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Ottilia Szives currently is working at the Department of Palaeontology in the Hungarian Natural History Museum, where she is the curator of the Paleogene Collection of micro- and macrofossils. She was graduated as a geologist at the Eötvös Loránd University, Budapest in 1996, in 2002 received the PhD degree. She is the member of the Lower Cretaceous Working Group "Kilian Group", and the Hungarian Palaeontological Society. Her main field of scientific interest is the Cretaceous ammonite stratigraphy, palaeogeography and palaeontology.

Aptian–Campanian ammonites of Hungary

A trangressive section of the Late Aptian Tata Limestone Formation covering the underlying Tithonian–Berriasian Szentivánhegy Limestone Formation at the Kálvária Hill of Tata

The Cretaceous ammonite record of present Hungary is very hectic considering both the numbers of collected specimens and the documentation as well. Researches on Cretaceous ammonites started in the mid XIXth century with the scientific discovery of the marvellous Late Albian fauna of "Schichten von Nána" (Hauer 1862). In the frame of this monographic study, the author collected and studied the most important surface and borehole Aptian–Campanian ammonite assemblages that contain approximately 7000 specimens.

Cretaceous sedimentation of the Carpathian Basin was determined by the Alpine orogeny and three sedimentary megacycles can be recognized in the present sediment record. Ammonite-bearing strata are abundant in Lower Cretaceous and getting more rare after the Albian due to the more intensive orogenic movements that caused environmental changes. Reef complexes, brackish-coal and subaerial environments dominated the sedimentation from the Cenomanian and this caused almost the complete lack of the ammonites in the area of present Hungary. A tectono-sedimental overview of the Hungarian Cretaceous is outlined by L. Csontos in the present monograph.

Fülöp (1975) have made collected fossils from Tata, from condensed basal "pockets" that lie between a Tithonian hardground and a massive Late Aptian – Early Albian crinoidal limestone. Fossils preserved as glauconitized and phosphatized internal moulds and show sorting by size — this also suggest the reworking and transportation of the assemblage. The great number of *Tetragonites, Silesitoides, Diadochoceras, Acanthohoplites* and *Hypacanthoplites* is remarkable. The ammonite assemblage contain Middle Aptian to Late Aptian species besides echinoids, gastropods and belemnites. Early Albian ammonites only known from boreholes and contain *Douvilleiceras, Brancoceras* and *Beudanticeras* species. There is no ammonite data from the Middle Albian due to the lack of the ammonite-bearing facies.

Late Albian ammonite assemblages are represented in great specimen number and high taxonomic diversity. Thanked to the impressive macrofauna, the fossils of the "Turrilitenmergel" (Böckh 1909) are in the mainstream of the Hungarian palaeontology, even H. Douvillé (1933) also published data about the Late Albian ammonites of Tilos Forest. The most accurate and well-known work about "Vracon" ammonites of the Bakony Mountains is of Scholz (1979). Fossils also collected from a condensed basal layer and recently from the above 2 metres as well. The assemblage is useless for biostratigraphic purposes but the presence of *Zuluscaphites, Engonoceras, Ficheuria* and the extreme diversity of *Salaziceras* makes the assemblage unique. From borehole materials the most important is Jásd J–42 section. This section was nominated as an Albian/Cenomanian Boundary Candidate but not have much support (Birkelund et al. 1984) because of the "boreal" affinity of the ammonite fauna. The decision is more understandable if we consider the lack of surely Cenomanian taxa. Other remarkable borehole section is Bóly B–1 which is known due to the first description of *Worthoceras pygmaeum* Bujtor, 1991. The Bóly B–1 subchapter is written with L. Bujtor.

Late Cretaceous, consecutively Santonian–Campanian ammonites are rare, due to the brackish water and reef environments that dominated the region by then. There is only a single Santonian ammonite is discovered by Partényi (1986) from a borehole. Campanian ammonite record contain two dozen specimens, mainly *Menabites* and *Pachydiscus* species, but *Glyptoxoceras, Scaphites hippocrepis II* (DeKay), and *Brahmaites* are also present. The Campanian chapter is written with I. Főzy.

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Editor:

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BUDAPEST, 2007

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Contents

Preface

Studies on the Cretaceous ammonites of Hungary had been started in the second half of the XIXth century with the finding of the impressive fossil assemblage of "Schichten von Nána" (HAUER 1862). Since then, Cretaceous ammonite studies are in the mainstream of the Hungarian palaeontology (HANTKEN 1868; LÓCZY 1906; BÖCKH 1909; KOCH 1909; SOMOGYI 1914; NOSZKY 1934, 1942; NAGY I. Z. 1973; SCHOLZ 1975, 1979; HORVÁTH, A. 1985, 1989; BUJTOR 1989, 1990a, 1990b, 1991; FŐZY 2001, 2004; FŐZY & FOGARASI 2002; FŐZY et al. 2002; FŐZY & JANSSEN 2005, 2006; COMPANY et al. 2006; SZIVES, 1996, 1999a, 1999b, 2002; SZIVES & MONKS 2002).

The present monograph of the Aptian–Campanian ammonites of Hungary is a summarising work of unpublished or partly published materials. The studied assemblages are mainly from the collections of the Hungarian Natural History Museum and the Geological Museum of Hungary. The well-known and fully published Vraconian assemblage from surface outcrops of the Bakony Mts is complemented with an unpublished, exceptionally beautiful collection of a qualified private collector, Zoltán Evanics.

Before starting to document the Hungarian ammonite record, an outline of the Cretaceous system and geodynamics of the Alp–Carpathian region can help to reconstruct the palaeogeographical situation. The book is divided into chapters according to certain ages as Aptian, Albian, Santonian and Campanian. Each chapter contains a historical outline, a stratigraphic, palaeobiogeographic, palaeoecologic–taphonomic and a systematic part. Both the Aptian and Albian ammonite assemblages from surface outcrops are known from condensed strata. A Late Aptian ammonite record is also documented here from a borehole as well. Fortunately several boreholes with continuous core sampling crossed Albian ammonite-bearing sequences. The Santonian ammonite record of Hungary includes a single specimen. A dozen of ammonites came from Campanian sediments but from a very restricted area.

Acknowledgments

The present monograph is based mainly on those materials, which were collected during decades by the Geological Institute of Hungary (GIH) and stored at the Geological Museum of Hungary (GMH). The author is grateful to the director of the Museum, and now the Institute as well, prof. László Kordos, who kindly let me to borrow thousands of specimens for the purpose of the present work. I am also very obligated to Zoltán Evanics, a highly qualified private collector, who spent 23 years collecting fossils from the Tilos Forest and had shown and lent me his exceptionally beautiful and unique specimens for this investigation.

I am indebted for the friendly cooperation of my colleague, dr. István Főzy, with whom we invented the idea of a monograph about the Hungarian Cretaceous ammonites and we started this work together, with the finding of "thought-to-be" disappeared materials.

I wish to record my admiration and thanks to three of my professors, prof. András Galácz (Eötvös Loránd University Budapest), prof. William James Kennedy (Oxford University Museum) and prof. Attila Vörös (Hungarian Natural History Museum). Their professional help and highly qualified knowledge of palaeontology, besides their exceptional personality took extreme influence on my work and my mentality. I am grateful to have the opportunity to study from them.

I am also very grateful for the professional help and friendship of dr. Neale Monks, dr. Ricardo Barragán-Manzo (Universidad de Mexico) and dr. László Bujtor. The professional help of dr. Zdenek Vasicek (Ostrava University of Mining and Metallurgy) and dr. Jean-Louis Latil (University of Bourgogne) is also appreciated very much.

All the laboratory work including specimen preparation and photography was carried out at the Magyar Természettudományi Múzeum (Hungarian Natural History Museum), Budapest. I acknowledge the support of the Palaeontological Department, especially the former and the present heads, prof. Attila Vörös and dr. János Szabó. Assistance of Eszter Hankó is kindly appreciated.

Handling, collecting, borrowing and transporting enormous amount of ammonites was taken with the help of Judit Baló-Lehmayer, Dezső Illés and Péter Papp, all from the Geological Institute of Hungary. Their enthusiastic and altruistic help is thanked very much.

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Finally, I would like to thank everything to my beloved mother.

October, 2007.

OTTILIA SZIVES

Introduction

(Ottilia Szives)

Source of the material

Most of the Cretaceous formations of Hungary have yielded valuable ammonoid faunas. Cretaceous deposits can be found on surface in the Transdanubian Range and the Mecsek and Villány Mountains. Collecting of fossils had been started in the second half of the 19th century, but organised ammonite collecting was done in the 1950's and 60's by the Magyar Állami Földtani Intézet (Geological Institute of Hungary, GIH) with the leadership of the late prof. József Fülöp. These materials were stored unregistered at different store houses of the GMH, now temporary housed at the Palaeontological Department of the Hungarian Natural History Museum (HNHM) for the purpose of the present work.

The Palaeontological Department of the Eötvös Loránd University of Budapest and the HNHM also organized short collectings at the Bakony and Villány Mts. These materials are registered and housed permanently at the HNHM.

The private collection of Zoltán Evanics from Tilos Forest (Bakony Mts) is also studied and partly figured here.

Approximately 15 000 ammonite specimens were collected from the Lower Cretaceous deposits as well, but these faunas will be described in a separate monograph. Present work focuses only the ammonite assemblages of the Aptian–Campanian period.

Abbreviations and depositories of material

The following abbreviations are used to indicate the source of the material:

GIH — Geological Institute of Hungary, Budapest, Hungary
GMH — Geological Museum of Hungary, Budapest, Hungary
HNHM — Palaeontological Department of the Hungarian Natural History Museum, Budapest, Hungary
EZPC — private collection of Zoltán Evanics, Hungary

Measurements are abbreviated as follows:

D = diameter, H = whorl height, W = whorl breadth, W/H = whorl breadth/whorl height, U = umbilicus. Numbers in brackets indicate percentages.

The systematics of ammonoid taxa basically follows the system of Wright et al. (1996). If other systematics is used it is indicated at the certain taxonomic group.

Tectonic evolution

A brief outline of the Aptian–Campanian sedimentary system of Hungary

From the Early Aptian until the Maastrichtian, the sedimentation is determined by the closure of oceanic ridges and compressive tectonics (HAAS 1984). There are three, basically similar sedimentation megacycles can be outlined during this period — the Albian–Cenomanian, the Turonian–Coniacian and the Santonian–Maastrichtian megacycles (Text-Figure 1).

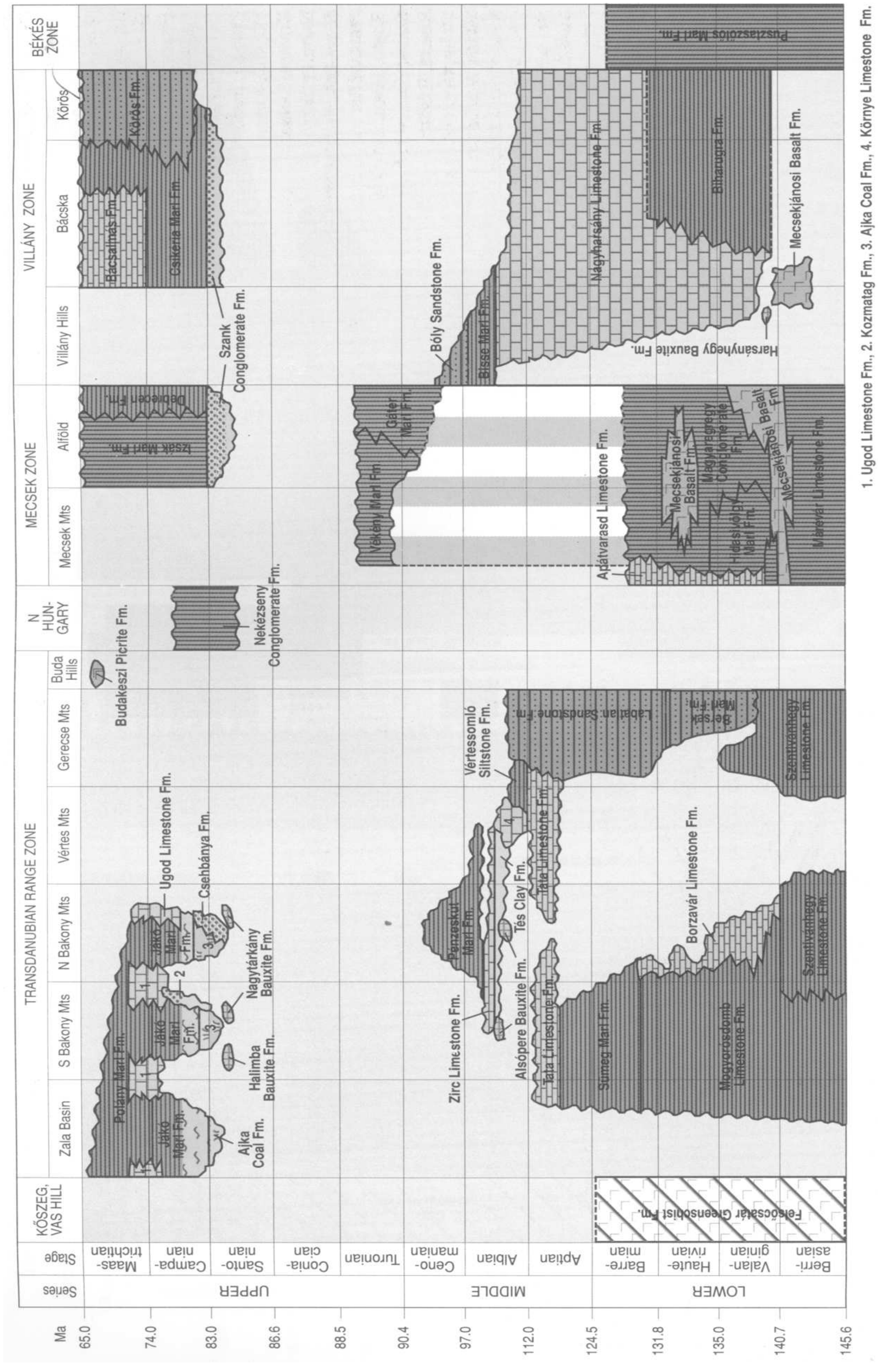
During the Late Aptian, shallow marine crinoidal sediment, the Tata Limestone Formation deposited discordantly onto the subaerial/submarine erosional hardground surface of Tithonian–Berriasian. In the Early Albian orogenic movements originated a transgression and the crinoidal sediment changed into deeper water basin sediment — the Vértessomló Aleurolite Formation. Both sedimentary units contain ammonites, which are documented here from Tata and the Tatabánya Ta–1462 borehole. As the transgression continued, pelagic, deep water sediment, the Pénzeskút Marl Formation deposited in the basins with a marvellous ammonite assemblage.

From the Cenomanian to Santonian subaerial circumstances dominated the region of the present Transdanubian Range. The Upper Cretaceous formations of Hungary compose a relatively complex sedimentary cycle begins with terrestrial bauxites, the dinosaur-bearing Csehbánya Formation or brackish water coal sediments, and ends with the deep water Jákó and Polány Marl Formations or the urgonian Ugod Limestone on the heights. HAAS (1999b) writes "as a combined effect of tectonics and subaerial erosion, an articulated basin came into being by the Santonian with elongated hights and depressions between them, roughly paralell by the structural strike of the Transdanubian Range." The depressions filled with fluvial–lacustrine–limnic sediments covered with marls. The most recent and accurate works on the Santonian sediment cycle is by HAAS (1983, 1999a, 1999b).

The only record of Santonian ammonites in Hungary (PARTÉNYI 1986) is a single specimen from a borehole (Csabrendek Cr–2). In the Late Santonian – Early Campanian freshwater, brackish and normal marine sediments indicates the new wave of the transgression. In between rudist platforms, a deeper water, pale coloured basin sediment, the Polány Marl Formation deposited which presented poor ammonite data. The upper part of this marly sediment changes into aleurolite and contains sandstone intercalations which suggest the slow orogenic rise of the denudation area. Eocene sediments deposited with huge hiatus onto the Campanian – Early Maastrichtian rock surface.

For more detailed studies see CSÁSZÁR & HAAS (1984); HAAS & CSÁSZÁR (1987); HAAS (1994); CSÁSZÁR & ÁRGYELÁN (1994) and CSONTOS & VÖRÖS (2004).

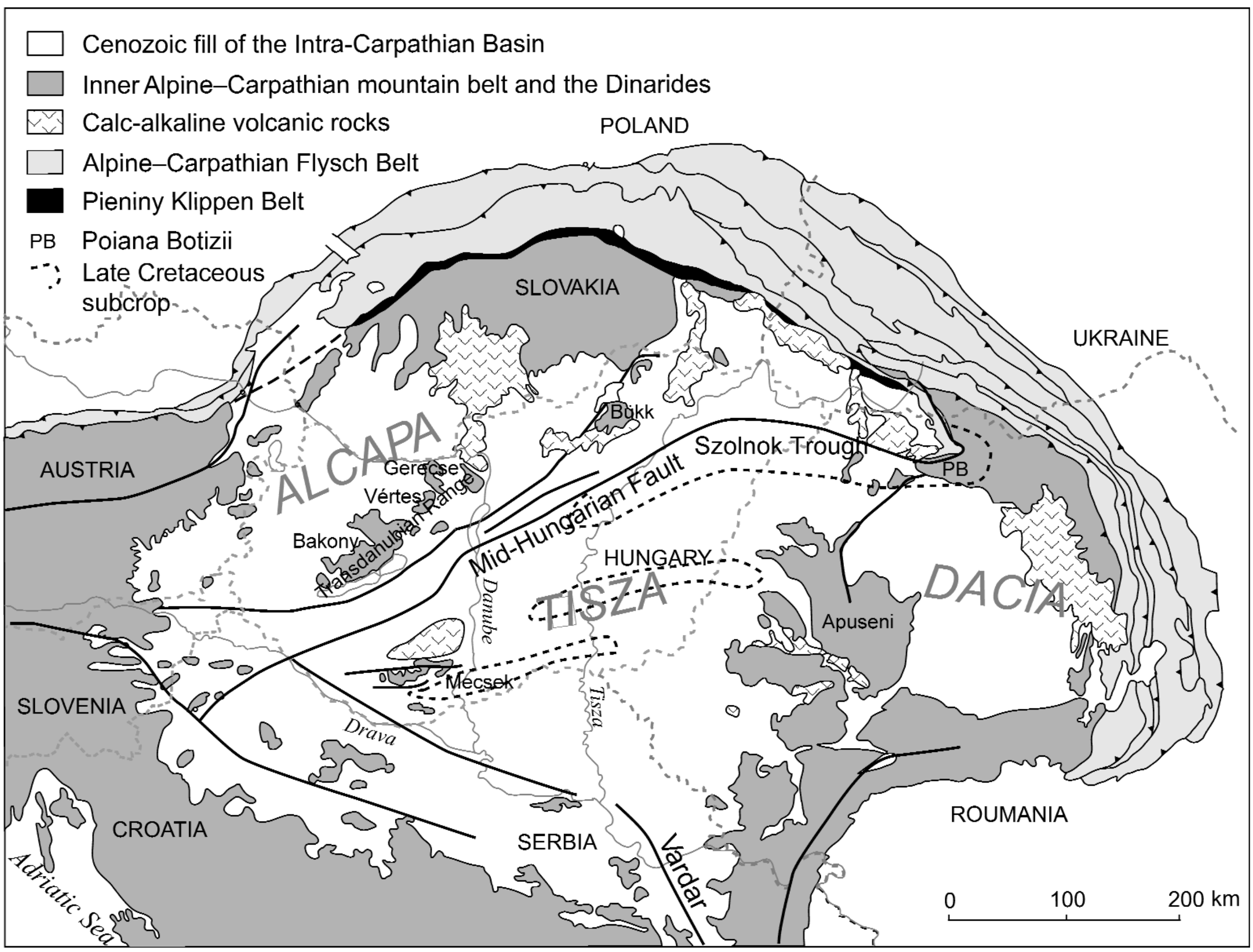
For better understanding of the Early Cretaceous basin evolution and sedimentation cycles of Hungary — which determined the ammonite distribution, the monograph continues with an outline of the Cretaceous sedimentary system and geodynamics of Hungary by L. Csontos.



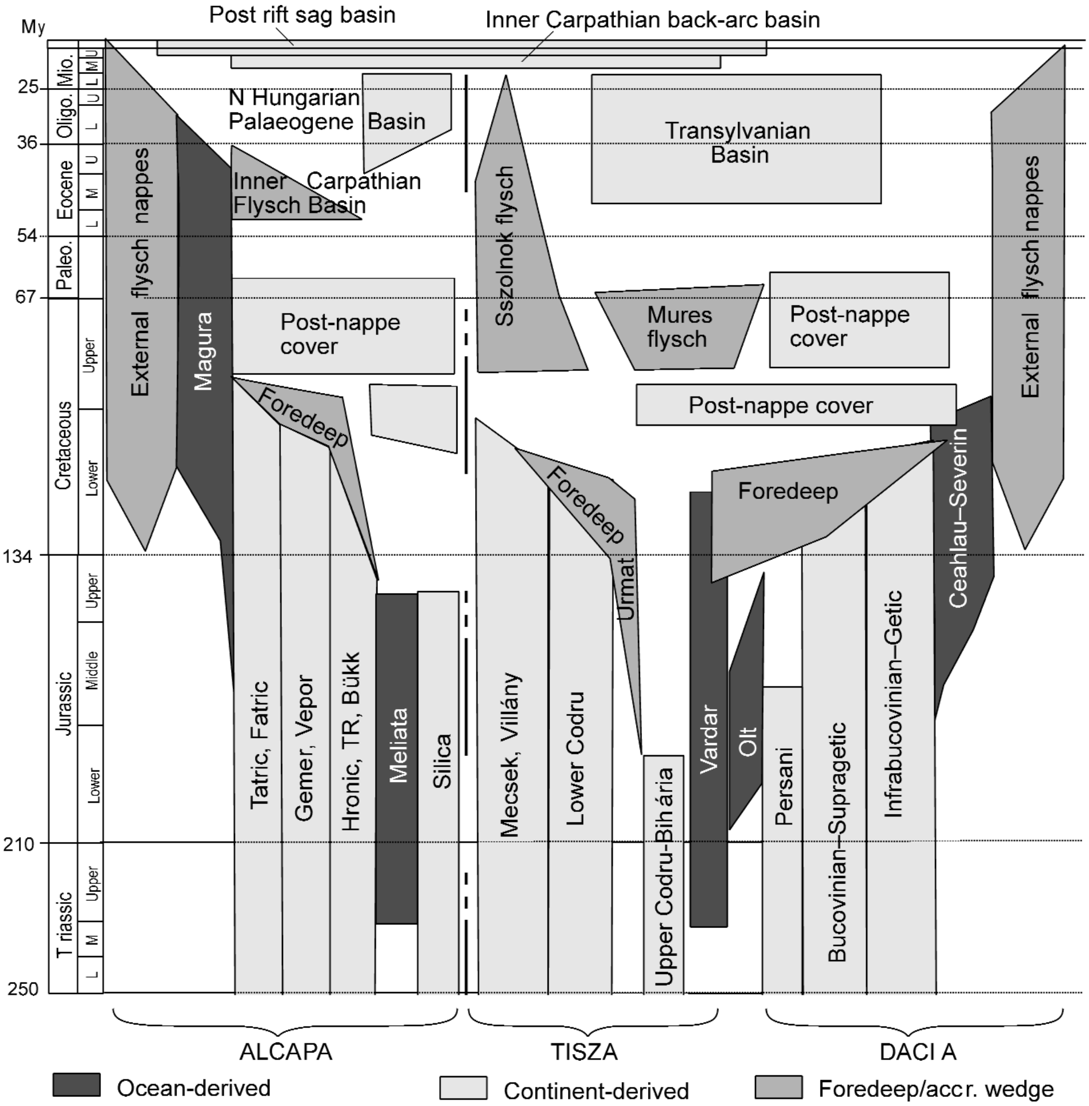
Text-Figure 1. Lithostratigraphic units of Cretaceous deposits of Hungary. From CSÁSZÁR et al. 1996

The Cretaceous system and geotectonic evolution of Hungary

From a Mesozoic palaeogeographic point of view, Hungary, or better to say the Intra-Carpathian area can be subdivided into two major terranes (HAAS et al. 1995, CSONTOS & VÖRÖS 2004). The northern one is called Alcapa (from Alps, Carpathians, Pannonian Basin), whereas the southern is called Tisza–Dacia (from the river Tisza and from the Roman province in southern Transylvania, now Romania) (Text-Figure 2). The northern terrane is a close relative of Austroalpine structural units in the Eastern Alps, while the southern shows close affinities to the European platform in the earlier part of Mesozoic. The Dacia terrane is not represented in Hungary.



Text-Figure 2. Major terranes of the Intra-Carpathian area and location names of mountains mentioned in the text. After CSONTOS & VÖRÖS 2004 (sources listed there)



Text-Figure 3. Stratigraphic summary chart of the Intra-Carpathian terranes. Simplified from CSONTOS & VÖRÖS 2004

Cretaceous strata occur in both major terranes. Characteristically, Early Cretaceous formations are the terminal members of a long stratigraphic cycle starting in Late Permian in both terranes (Text-Figure 3). There are signs of starting compressional tectonic activity during Early Cretaceous deposition. In Alcapa there is a clear and sharp change in the Albian, which is related to a major structural reorganization in the Alpine realm. Late Albian – Cenomanian strata form a second sedimentary cycle in the Alcapa Unit. In Tisza–Dacia one of the main tectonic events is of Early Turonian age, when there was strong compressional activity in Alcapa, too. (Late Turonian–)Senonian formations are widespread in both terranes. These formations post-tectonically cover Alpine nappes. In other words pre-(Turonian)–Senonian formations are present in individual nappes and hence are different, while Senonian seals these nappes and is more uniform. Except one basin (Szolnok Flysch), the Senonian sedimentary cycle is topped by an unconformity and its upper part is more or less eroded. Oldest formations covering the Cretaceous are Eocene or Neogene in age.

In the following the main terms of the Early Cretaceous deposits will be briefly listed following a subdivision of the Alpine nappes of the two major terranes. Senonian deposits of the two terranes will be described separately.

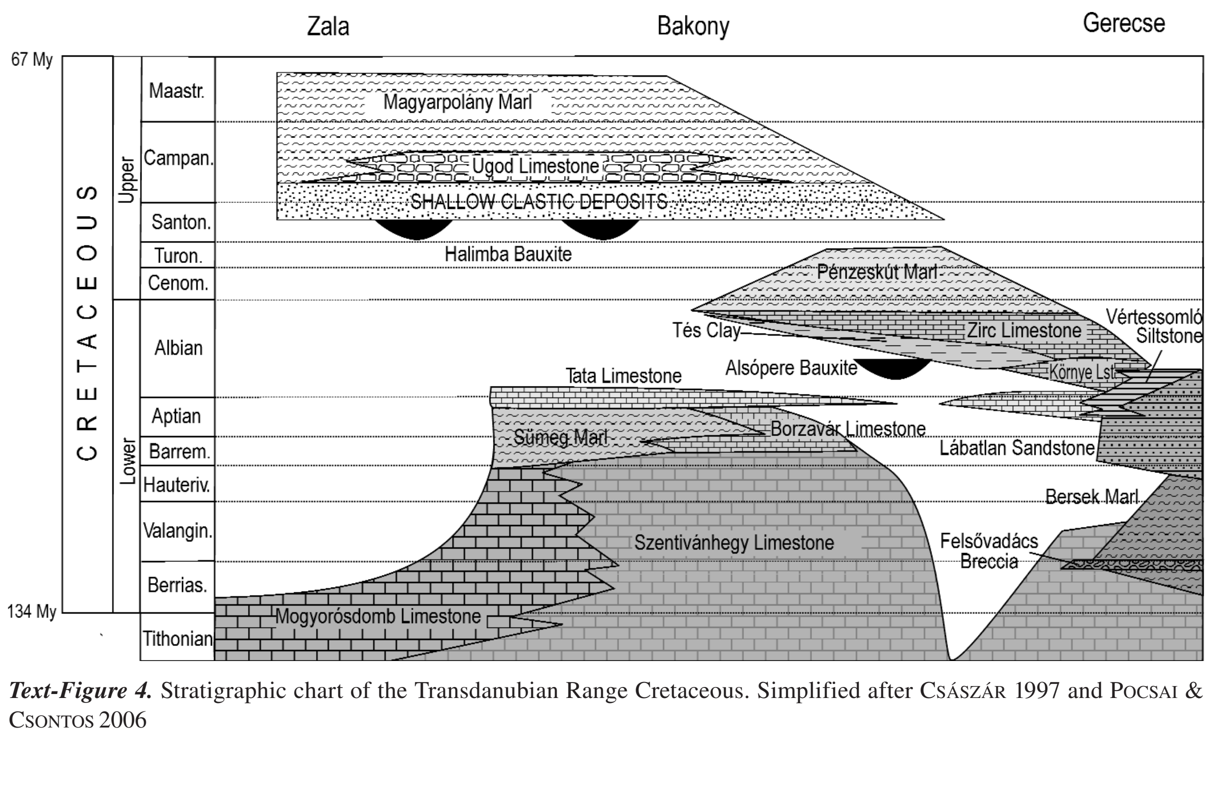
Pre-Gosau Cretaceous in Alpine nappes of Alcapa

The structurally lowest exposed nappe is the Penninic. This unit consists of metamorphic remains of an oceanic assemblage, the bulk of which is built of greenschists and calcschists (Felsőcsatár Formation). A characteristic deep marine conglomerate is found within the calcschists (Cák Conglomerate Formation). The deep marine assemblage was metamorphosed during Late Cretaceous – Palaeogene and was exhumed during (Senonian)–Miocene extensional tectonics (TARI 1994, DUNKL & DEMÉNY 1997).

The Lower and Middle Austroalpine nappes are only made of crystalline rocks of Variscan origin. The highest nappe of the structural pile is the Transdanubian nappe (TARI 1994, HORVÁTH, F. et al. 1987, FODOR et al. 2003). This long and NE–SW elongated range hosts Cretaceous pre-Gosau deposits in its SW (Bakony) and NE (Gerecse) portion (Text-Figure 4). There is a relatively large area (Vértes) between the two development sectors, which is practically devoid of Early Cretaceous. From facies studies it seems that the two development areas differ in depositional history and facies (FÜLÖP 1964a, b).

In the SW area the earliest Cretaceous deposits constitute a natural continuation of the latest Jurassic succession (Text-Figure 4). A thinly layered, often cherty micritic limestone (Mogyorósdomb Formation) occurs in pelagic facies. This formation persists until the Barremian. Further NE, the cherts disappear, but the matrix remains the same micrite (Szentivánhegy Limestone Formation). Even further NE thinner-thicker coarse grained crinoidal limestone lenses, interlayers are found in the vicinity of palaeo-highs (Borzavár Formation). The white micrites at the base of the Cretaceous (Szentivánhegy Limestone Formation) are found as far as the western part of the NE development area, in the Gerecse Mts (CSÁSZÁR & HAAS 1984). This can host redeposited carbonate elements derived from a nearby platform (BÁRÁNY 2004). Further NE, i.e. in the eastern part of Gerecse Mts, a peculiar lithologic assemblage is found. The Late Jurassic pelagic limestones are unconformably covered by a deep marine conglomerate/breccia (Felsővadács Breccia), which consists mostly of rounded clasts of Dachstein Limestone, but also contains pebbles of mafic rocks and radiolarites (CSÁSZÁR & ÁRGYELÁN 1994). This clastic formation interfingers with the white micrites of Szentivánhegy Formation. It announces the development of a WSW facing deep marine slope, on which a succession of rhythmic marls (Bersek Formation) and turbiditic glauconitic sandstone (Lábatlan Formation) is deposited (CSÁSZÁR & HAAS 1984, BÁRÁNY 2004). The westward prograding slope assemblage contains more and more hiatuses westward. The bulk of this succession is Valanginian-Hauterivian (Bersek Marl) and Barremian–Aptian (Lábatlan Sandstone) (FOGARASI 2001). This succession is interpreted to be formed in the foredeep of a SW-wards propagating ophiolitic nappe (TARI 1994, FOGARASI 1995, MINDSZENTY et al. 2001).

In the SW development area (Bakony Mts) the Barremian is generally represented by deep marine marls (Sümeg Formation), which develop from the white cherty micrites. The grey, pelagic marl contains at some places large deep marine breccia bodies, which indicate development of a palaeo-topography (POCSAI & CSONTOS 2006). These marls grade upwards continuously into Aptian – Lower Albian crinoidal Tata Limestone, which might also contain large breccia bodies. These breccias, like the Barremian ones, are always located on the footwall of local elevations, where a thin and shallow water facies crinoidal limestone is deposited. Towards the east a gentle erosional unconformity develops at the base of the Tata crinoidal limestone. The dual facies pattern in the Aptian – Early Albian can be followed to the western edge of the NE development area, at the western Gerecse Mts, where a black shale-silt (Vértessomlyó Silt Formation) interfingers with crinoidal limestones (Tata Formation) and rudist reef limestones (Környe Formation) (MINDSZENTY et al. 2001). In the eastern Gerecse Mts glauconitic Lábatlan sandstones are topped by a deep marine conglomerate fan (Köszörűkőbánya Conglomerate Formation; SZTANÓ 1990). This facies pattern is interpreted as strongly controlled by incipient Alpine thrusts of general NW–SE strike (POCSAI & CSONTOS 2006).



Text-Figure 4. Stratigraphic chart of the Transdanubian Range Cretaceous. Simplified after CSÁSZÁR 1997 and POCSAI & CSONTOS 2006

Late Albian always covers a strong angular unconformity. The erosional surface is covered by brackish water marl (Tés Formation), rudist reefs and back-reef lagoonal limestone (Zirc Formation; CSÁSZÁR 1986). Higher up these facies grade to glauconitic, deeper marine silt and marl (Pénzeskút Formation). In the NE development area this time interval is not represented by sediments.

The Bükk Mts is also a member of the Alcapa Unit. Here an anchimetamorphosed Mesozoic succession is found. The Late Jurassic is represented by radiolarites, followed by radiolarian-bearing black silt, shale (Lökvölgy Shale Formation) of distal turbiditic origin (CSONTOS 2000). Only Late Jurassic fossils are known so far from this formation, but it is not excluded, that the upper part of the thick black Lökvölgy shale was deposited in earliest Cretaceous.

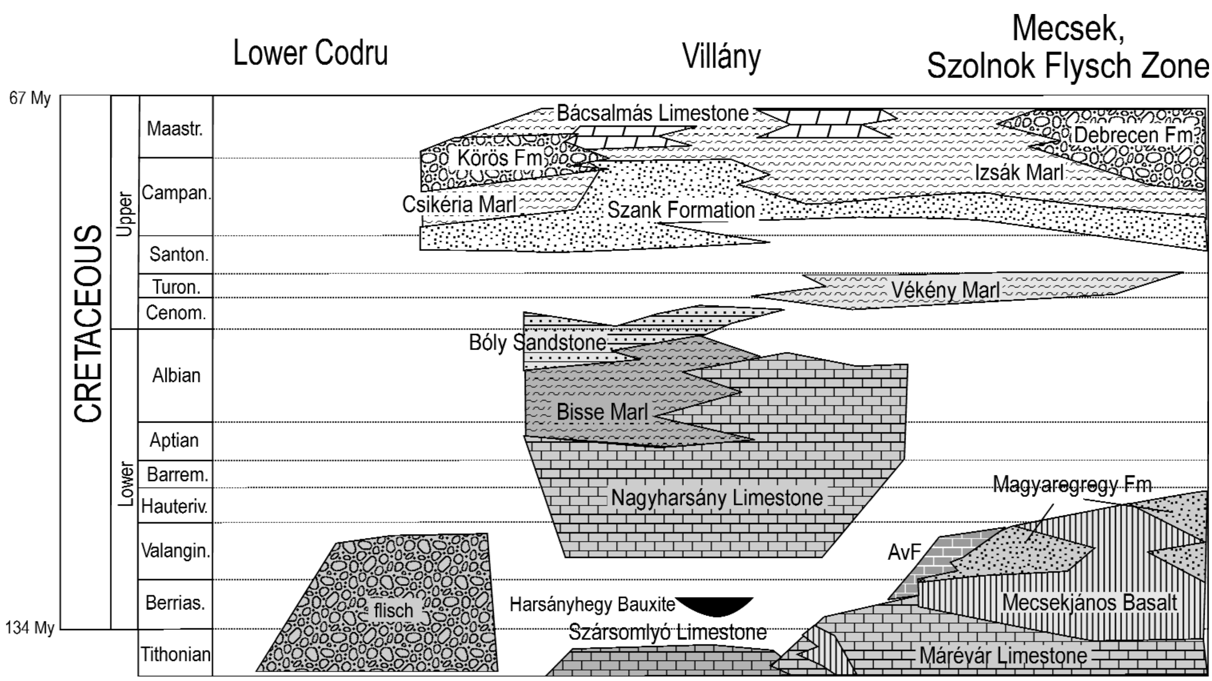
Senonian deposits of Alcapa

Gosau sediments of the Hungarian part of Alcapa are exposed in two localities: in the western part of the Bakony Mts and N of Bükk, just adjacent to the anchimetamorphic Palaeozoic Uppony massif. The Bakony exposures (on Text-Figure 4) and subcrop are part of a broad basin, which is introduced by continental formations: bauxites (Halimba Formation) and fluviatile deposits containing coal (Ajka Coal Formation, Csingervölgy Formation). This coaliferous succession grades upward into a carbonate platform with Hippurites reefs, platform limestone (Ugod Formation), slope breccia (Jákóhegy Member) and pelagic chalky marl (Jákó Marl grading to Magyarpolány Marl Formation) (HAAS et al. 1985). The Ugod reefs typically grow on the eroded fronts of thrust sheets, while more basinal deposits are found to the west (TARI 1994). This Gosau Basin is thought to be a continuation of the Kainach Basin, Austria (TARI 1994), or of the Cretaceous deposits of the same age in the Mura depression (FODOR et al. 2002). In both cases the opening of the basin was due to an extensional collapse and semi-brittle normal faulting (E–W extension) after the Turonian nappe formation. The present day picture is due to reactivation of this normal detachment fault in the Middle Miocene.

The small remnant exposures of Senonian rocks N of Bükk Mts are made of a coarse conglomerate, grading upwards to sandstone and marl (Nekézseny Formation). Large blocks of Hippurites reefs are embedded in the deep marine slope sediments (BREZSNYÁNSZKY & HAAS 1984). This part can be the sheared, transported portion of the vaster basin, which was described before.

Pre-Gosau deposits of Tisza

The pre-Gosau sediments of Tisza are exposed in the Mecsek and Villány Mts (on Text-Figure 2). Both exposures have subsurface continuation beneath the Great Hungarian Plain. The Late Jurassic of Mecsek Mts is represented by pelagic limestones, chalky limestones (Text-Figure 5). Radiolarite-chert is frequent in these deposits. This formation may grade to lowest Cretaceous (Márévár Formation). At the beginning of the Cretaceous, a voluminous alkali-mafic volcanism



Text-Figure 5. Stratigraphic chart of the Tisza unit Cretaceous. Simplified after CSÁSZÁR 1997 (sources listed there)

(Mecsekjános Basalt Formation) is installed (HARANGI 1994). It is quite probable that this volcanism began already during the Late Jurassic, but in the exposures appeared in the Berriasian. Although the original setting was deep marine, some of the volcanoes reached the surface and shallow water region, therefore a coarse clastic apron (Magyaregregy Conglomerate Formation) and some local biogenic carbonates (Apátvarasd Limestone) are occasionally found within the large amount of volcanic material (CSÁSZÁR & TURNŠEK 1996, BUJTOR 2006). The alkali-mafic volcanites are rift-related (HARANGI 1994). Higher parts of the Cretaceous succession are absent in the Mecsek Mts.

In Villány, the Late Jurassic is in shallow water facies (on Text-Figure 5). Platform oolithic limestones of Kimmeridgian–Tithonian age were exposed to local erosion and a bauxite/terrestrial red clay horizon (Harsányhegy Bauxite Formation) formed. The emersion happened at the beginning of Cretacecous. The bauxite horizon is then covered by Valanginian – Early Albian shallow water rudist limestone (Nagyharsány Formation). No reefs were found, but a well layered platform limestone was deposited. In the Albian the platform interfingered with a deeper marine marl (Bisse Marl Formation) and turbiditic sandstone of slope facies (Bóly Formation) (CSÁSZÁR 1996, 1997).

Senonian deposits of Tisza

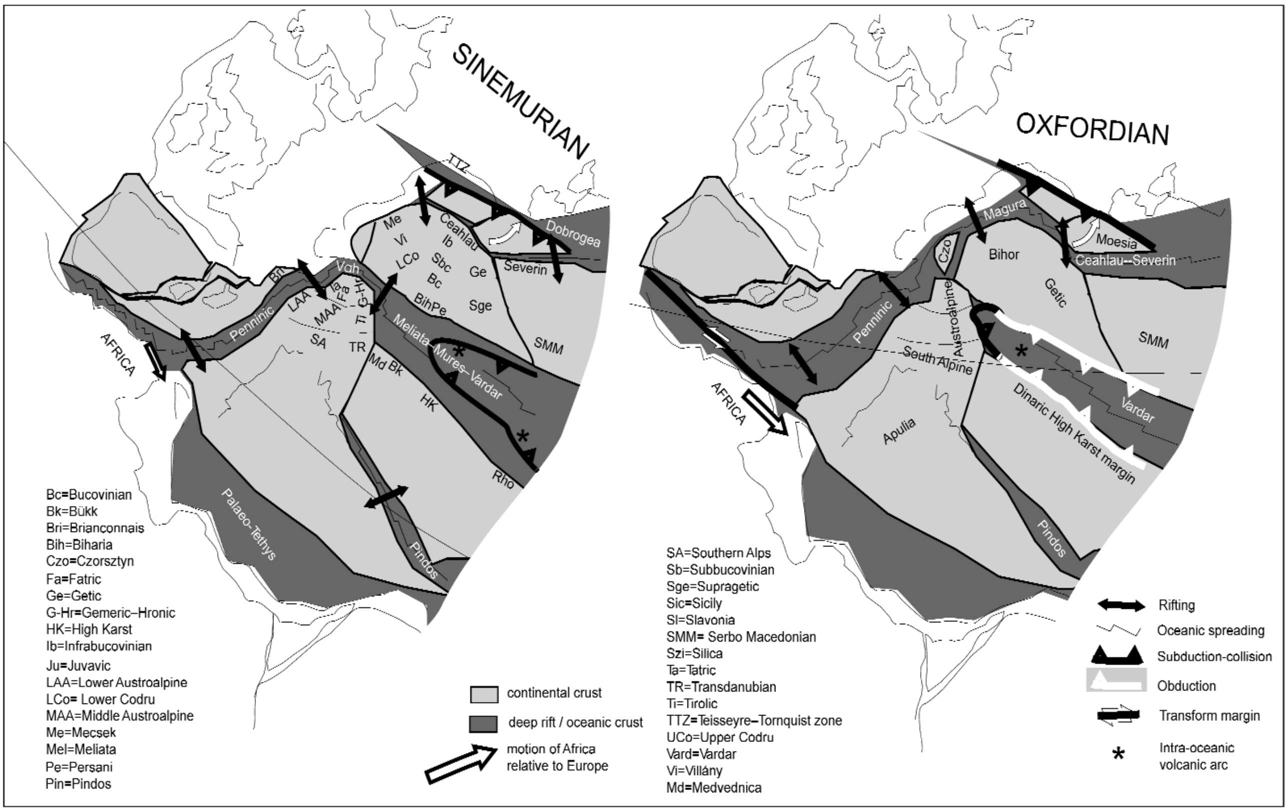
Except one tectonized outcrop in Mecsek Mts (Vékény) and a basaltic dyke in Villány Mts, no Late Cretaceous is found in exposures in the Tisza terrane. On the other hand, Turonian–Senonian is largely documented by industrial and scientific boreholes beneath the Great Hungarian Plain (SZENTGYÖRGYI 1989). These deposits occur in three parallel basins, elongated in ENE–WSW direction (on Text-Figure 2). The first is located above Mecsek-type Mesozoic and is found NE of Szolnok city. This basin is called the Szolnok flysch basin (SZEPESHÁZY 1973), because some parts of the stratigraphic succession are turbiditic. Deposition in the Szolnok flysch basin starts with red and grey marls (on Text-Figure 5; Gátér and Vékény Formations) of Cenomano–Turonian age (BALLA & BODROGI 1993). This reddish marl is a pelagic formation widespread in the internal Western Carpathians, too. This tectonized marl found in the northern part of Mecsek Mts. This is followed by Senonian deep marine marl (Izsák Marl Formation) interfingering with a sandy turbidite (Debrecen Formation) (SZENTGYÖRGYI 1989; CSÁSZÁR 1996, 1997). At the base locally a slope conglomerate is found (Szank Formation). Further parts of the turbidite basin consist of Palaeocene shale, Eocene turbidite (Nádudvar Flysch Formation), Oligocene clay and Early Miocene clastics (NAGYMAROSY & BÁLDI-BEKE 1993). The second trough covers the nappe contacts of Mecsek and Villány nappes, while the third basin is located above the contact of Villány and Codru nappes (BÉRCZI-MAKK 1986, SZENTGYÖRGYI 1989). The deposits of these basins begin with a coarse conglomerate (Szank Conglomerate Formation) and are followed by deep sea shales (Csikéria Marl Formation), turbidites and marls (Körös Formation — SZENTGYÖRGYI 1989). In the third basin the turbidites and marls (Csikéria Marl) interfinger with shallow water, or shallow basinal limestone (Bácsalmás Formation), which was deposited above the eroded thrust front (HAAS 1987). Further south, in Croatian and Serbian territory, deposition turns more and more turbiditic. There, large amounts of calcalkaline volcanites and mafic rocks are found interlayered or intruded in these sediments (ČANOVIĆ & KEMENCI 1988, PAMIĆ 1998). A Senonian basaltic dyke crossing Early Cretaceous carbonates is found in the Villány Mts (NÉDLI & M. TÓTH 2007).

Cretaceous geodynamics of the structural units in Hungary

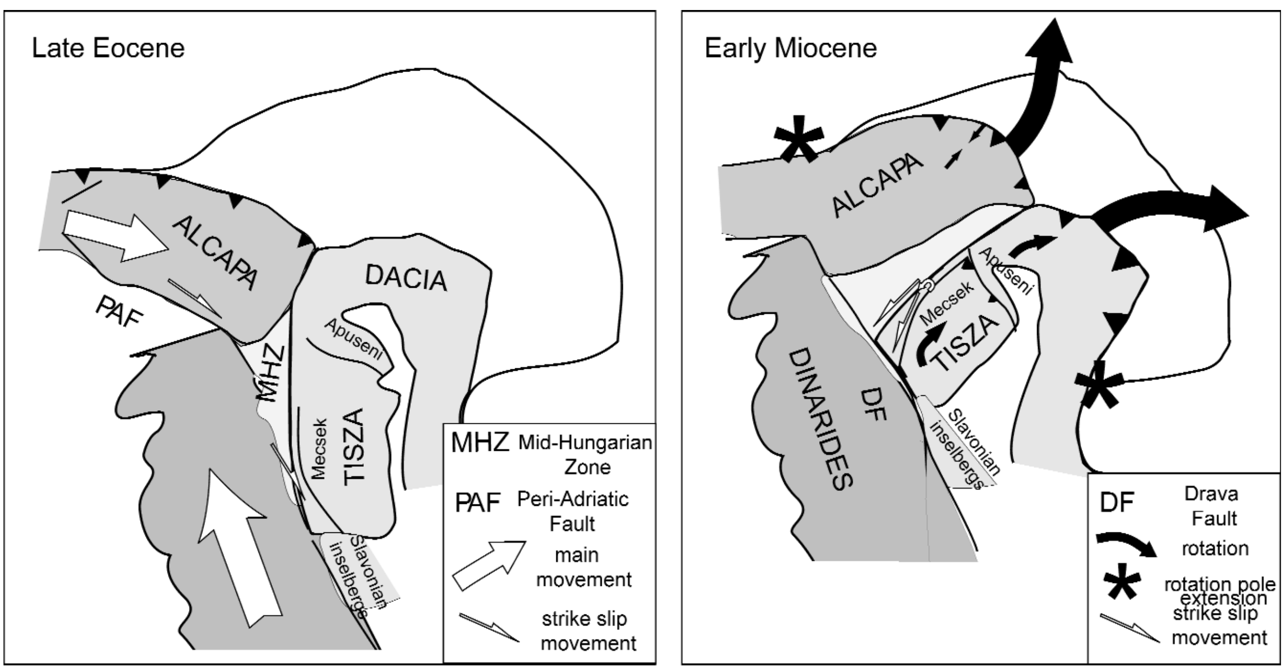
The Cretaceous is a very interesting period from tectonic point of view, since this is the time of major plate reorganizations, mountain building on the margin of the Meliata–Mures–Vardar Ocean and spreading, to full development of the Penninic–Piemont–Ligurian Ocean. Both oceans are dominant elements of the Alpine–Carpathian area. The former is a branch of the Tethys splitting the Austroalpine and Apulian area in the south, while the latter is an oceanic trough propagating from west to east in the northern part of the area (FRISCH 1979) (Text-Figure 6). Rifting in the Vardar–Meliata Ocean began in Permian and spreading occurred in Triassic (KÁZMÉR & KOVÁCS 1989, OBRADOVIĆ & GORICAN 1988), while rifting of the Piemont–Ligurian Ocean was initialized during Liassic (CSONTOS & VÖRÖS 2004), but was completed only in the Middle – Late Jurassic (STAMPFLI & BOREL 2002). This northern oceanic branch can be considered an extension of the Central Atlantic, since its opening is closely related to the opening of that ocean (FRISCH 1979).

As a rule, the southern parts of Alcapa and Tisza (–Dacia) are influenced by the development of Vardar–Meliata, while the development and tectonics of the northern regions of the same terranes are controlled by the Piemont–Ligurian Ocean. In this manner, the Transdanubian Range and Bükk region was mostly influenced by the Vardar–Meliata history, while Mecsek, Villány and Great Hungarian Plain structural units were controlled more by the Piemont–Ligurian Ocean.

To understand the Cretaceous geodynamic evolution of the area we have to set the Late Jurassic scene. To arrive at that point it is imperative to retro-deform and retro-rotate the elements of the Carpathian–Pannonian tectonic puzzle. As it is known long ago from palaeomagnetic measurements (MÁRTON, E. 1987; MÁRTON, E. & MÁRTON, P. 1978; MÁRTON, E. & FODOR 1995), Alcapa suffered important counterclockwise, and Tisza–Dacia suffered important clockwise rotations in the Tertiary. Therefore any Cretaceous or Tertiary geodynamic reconstruction must re-place them according to the observed

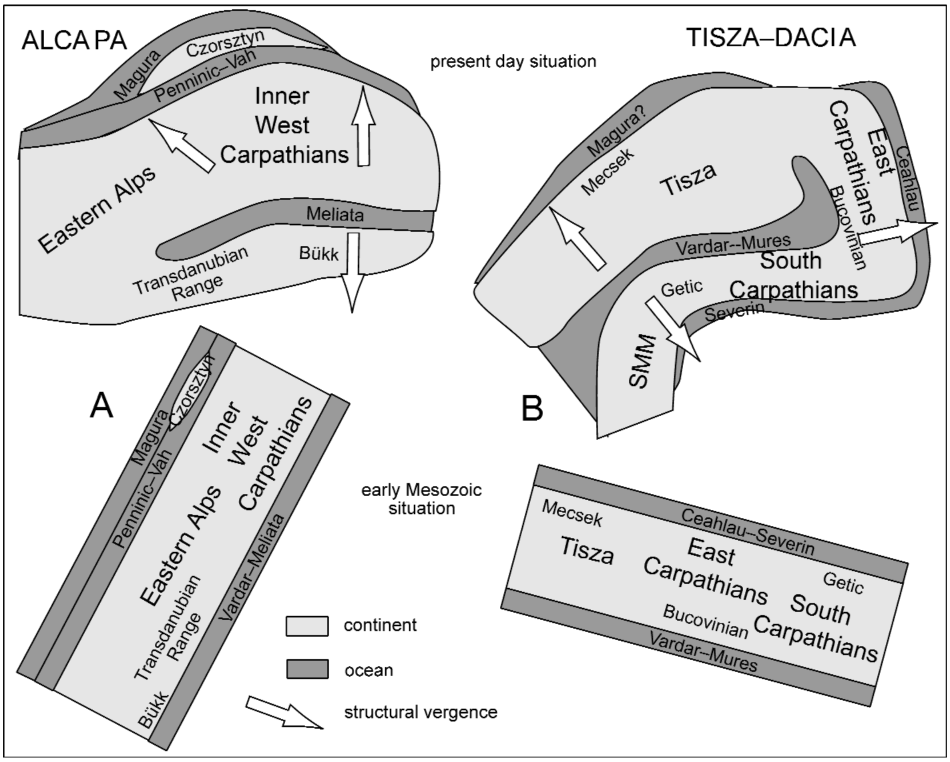


Text-Figure 6. Jurassic reconstructions of the Alpine Carpathian area. Simplified from CSONTOS & VÖRÖS 2004. Note the presence of two major oceanic domains: Meliata–Vardar in the central south and Penninic–Piemont in the north



Text-Figure 7. Reconstruction of Tertiary rotations, after BALLA 1987, MÁRTON 1987 and CSONTOS & VÖRÖS 2004

rotations (BALLA 1984, 1987a, b; CSONTOS & VÖRÖS 2004) (Text-Figure 7). Palaeomagnetic data on Mesozoic rotations (MÁRTON, E. 1993, 2000) suggest that there were important rotations in the Cretaceous as well. These rotations possibly affected different parts of each terrane. That means that Alcapa and Tisza–Dacia were both folded on themselves (CSONTOS & VÖRÖS 2004) (Text-Figure 8). Therefore, in the Late Jurassic, we may propose much more linear, long and narrow geodynamic elements in the Alpine–Carpathian area.



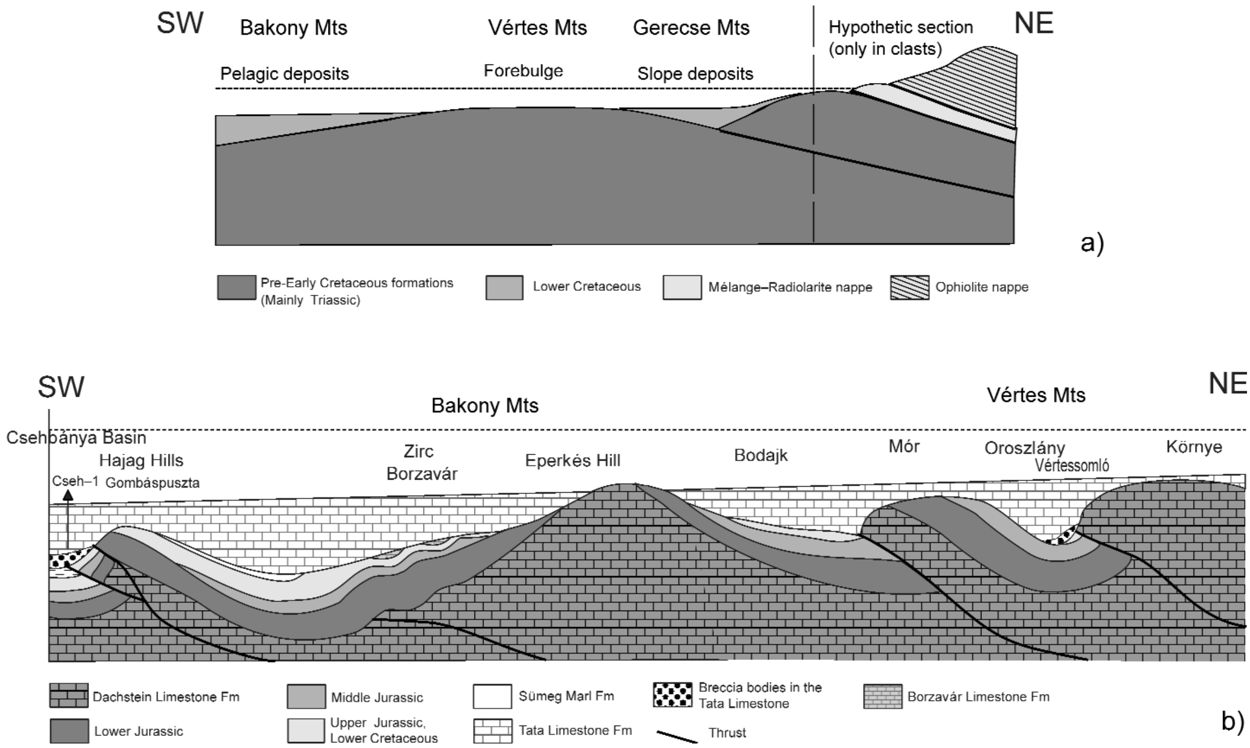
Text-Figure 8. Model of two major buckles of originally linear continental stripes. Simplified from CSONTOS & VÖRÖS 2004. Buckling of the continental stripes possibly occurred during mid-Cretaceous. a) model for Alcapa, b) model for Tisza–Dacia

According to the model of several research groups (KOVÁCS 1982, HAAS et al. 1995, CSONTOS & VÖRÖS 2004), the European continent was bordered in the south by the fully developed Piemont–Ligurian Ocean. This was a narrow branch of Tethys characterised by spreading very oblique to the margins (FRISCH 1979). This is tentatively continued in the Magura–Pieniny–Ceahlau–Severin oceanic domains of the West, East and South Carpathians, respectively (on Text-Figure 6). The western part of this ocean was flanked in the south by the Austroalpine microcontinent. This narrow continental stripe enclosed the later Austroalpine nappes of the Eastern Alps and of the West Carpathians. Another microcontinent was located south of the Piemont–Ligurian Ocean in the eastern continuation of this microcontinent. The Tisza–Bucovinian–Getic–Serbo-Macedonian continental stripe had a somewhat different rifting and later tectonic history from the Austroalpine, therefore it is taken as a separated microcontinent (KOVÁCS 1982). The southern margin of the Vardar–Meliata Ocean was formed by the Dinaridic microcontinent. This was a vast carbonate platform area which might have continued in the Austroalpine platform.

While there is a debate on the eastern continuation of the Piemont–Ligurian Ocean, there is another controversy on the western continuation of the Meliata–Vardar Ocean. For most researchers it seems that this ocean ended near Graz in a sphenochasm (Text-Figures 6, 8a). Therefore, the northern and southern margins of this ocean could carry identical formations and fauna (see geometric solution of HAAS et al. 1995). Palaeomagnetic measurements suggest that this margin or better to say, the shape of the termination of Meliata—Vardar could change with time. In the Late Jurassic, for instance, the Austroalpine and the Dinaridic parts could be aligned on a linear trend (see CSONTOS & VÖRÖS 2004; Text-Figure 4). There is yet another possibility, suggesting that the Vardar–Meliata Ocean could have continued along the Periadriatic Fault to join with Piemont–Liguria at the western Ivrea Zone.

Correlation of different mountain and development areas in the Pannonian Basin with other units in the Eastern Alps and the Carpathians is strongly dependent on the applied models. Most researchers suggest (HAAS et al. 1995, CSONTOS & VÖRÖS 2004) that the Transdanubian Range and Bükk Mts were located on the southern, Dinaridic part of the dead end of the Vardar–Meliata Ocean (Text-Figures 6, 8).

Part of the Vardar–Meliata Ocean was obducted in the Kimmeridgian–Oxfordian onto the Dinaric (N Transdanubian, Bükkian) margin (Text-Figures 6, 9). The obduction resulted in huge ophiolite sheets, travelling on a Mélange Nappe, now observed in the Internal Dinarides, Albanides and Hellenides. The process began as a result of intra-oceanic subduction, since most amphibolite sole datings indicate late Middle Jurassic ages (170–160 Ma — LANPHERE et al. 1975). However, the ophiolite sheet and the Mélange Nappe underneath soon reached the Dinaric margin, because Tithonian reefs and shallow water sediments are transgressive on the oceanic rocks (STRAJIN et al. 1977, DIMITRIJEVIĆ 1997, PAMIĆ & TOMLJENOVIĆ 2000). The landward progression of the ophiolite sheets did not stop, because a foredeep type basin: the Lower Bosnian



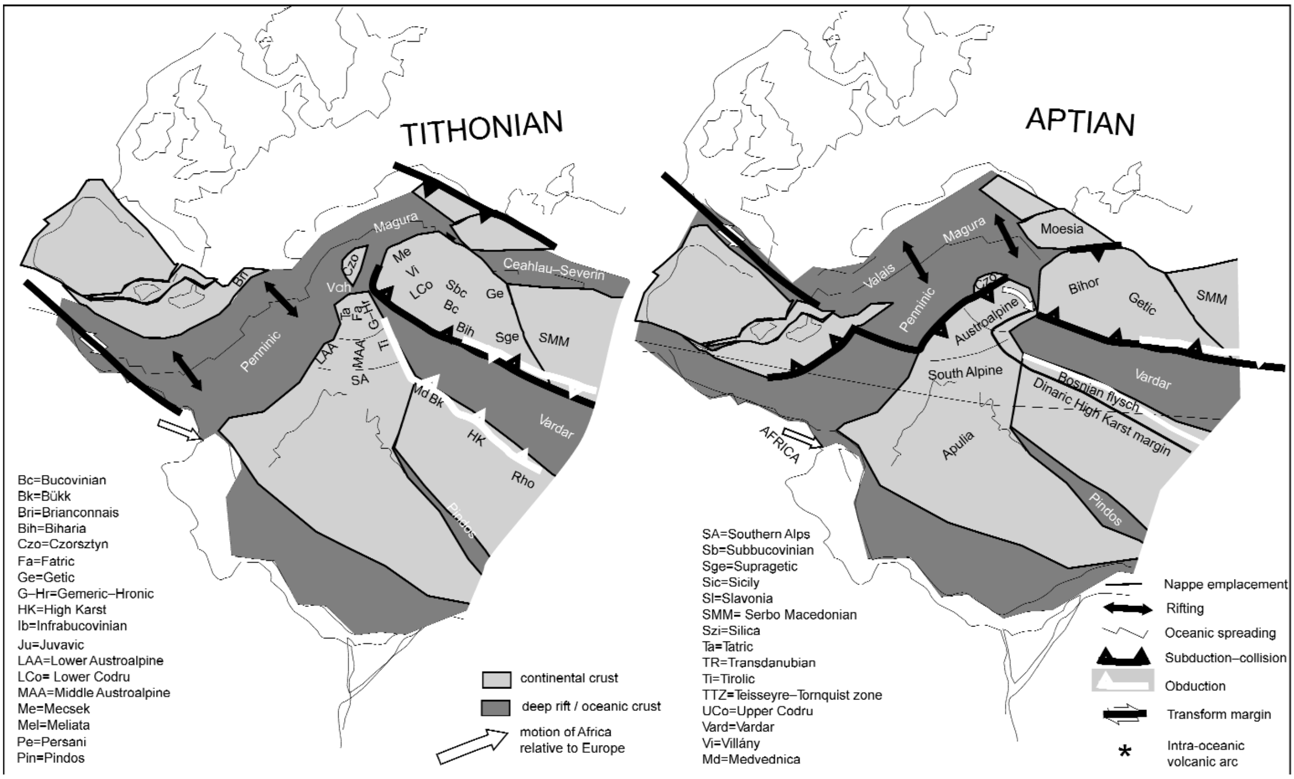
Text-Figure 9. Schematic sections through the central part of Alcapa. a) Schematic section from the Gerecse to the Bakony Mts region (early-middle Early Cretaceous), inspired by TARI 1994, MINDSZENTY et al. 2001, BÁRÁNY 2004 and own works. b) Constructed cross section through the Vértes and Bakony Mts (middle-late Early Cretaceous), redrawn from POCSAI & CSONTOS 2006. Note the presence of west-vergent blind thrust and ramp folds in both sections

(Vranduk) flysch basin (AUBOUIN et al. 1970, PAMIĆ & TOMLJENOVIĆ 2000) was developed ahead of the advancing ophiolite and mélange nappes. Medium-high pressure anchi-epimetamorphic transformations took place in the underthrust Dinaric margin (now forming the Internal Dinarides) at about 120 Ma ago (BELAK et al. 1995, MILOVANOVIĆ 1984, 1989, MILOVANOVIĆ et al. 1995).

Remains of the obducted ophiolite slab are not found in Hungary, but they are preserved in the South Apuseni Mts, in the southern and internal part of the Tisza–Dacia terrane. Smaller occurrences of serpentinites associated to this oceanic slab are also found in SE Slovakia (Dobsina). In N Hungary the remains of an oceanic shale unit (Szarvaskő Nappe) equivalent to the Mélange Nappe of the Dinarides are found in the Bükk region. There obduction also created Early Cretaceous anchi-epimetamorphic transformations (120 Ma — ÁRKAI et al. 1995). In the N Gerecse, but also in pelagic deposits of the whole Transdanubian Range, ophiolite-derived heavy minerals appear as early as Late Jurassic (CSÁSZÁR & ÁRGYELÁN 1994). In the earliest Cretaceous deposits of the Gerecse Mts (Felsővadács Conglomerate), ophiolite clasts are common. These clasts are derived from the present NE. Obduction created a foredeep, which was further developed in Early Cretaceous (Text-Figure 9a). This hosted deposits of the Bersek Marl and Lábatlan Sandstone. These sediments are strongly similar to the Rossfeld beds of similar age in Salzkammergut (HANTKEN 1868, FAUPL & WAGREICH 1992) and to the lower parts of the Bosnian Flysch (Vranduk Formation — RAMPNOUX 1970, HRVATOVIĆ in PAMIĆ & TOMLJENOVIĆ 2000). South of the foredeep, the non-depositional area is interpreted as a forebulge, while the deeper basin on the SW part of the Bakony Mts is interpreted as the antipodal slope of this forebulge (TARI 1994, MINDSZENTY et al. 2001). In the Hungarian part of Tisza, the only faint signal of the Late Jurassic – Early Cretaceous obduction event is the emersion period in Villány, leading to bauxite deposition (Text-Figure 5).

From Dinaric geology it appears that the Vardar–Meliata Ocean could have been closed by the Early Cretaceous (see arguments in CSONTOS & VÖRÖS 2004). Another alternative is an Eocene closure of the same ocean. Based on these alternatives the widespread Internal Dinaric 120 Ma old anchimetamorphism is explained in different ways. In the first hypothesis, the anchimetamorphism is due to burial and collision in the Early Cretaceous. This model suggests that the Dinaric margin was the lower plate and another microcontinent, very possibly the Tisza–Dacia was the upper one. Following the second hypothesis the 120 Ma metamorphic events was due to subduction of the Dinaric margin beneath the ophiolite nappe and the isostatic readjustment and uplift following the underthrusting.

In the Internal Dinarides, apart from the Bosnian Flysch trough area (Text-Figure 10), there is relatively few remains of Lower Cretaceous deposits. Some of these remains are transgressive formations over anchi-epimetamorphic units of the underthrust Dinaric margin (DIMITRIJEVIĆ 1997). In other words, the lower structural units suffered substantial uplift, doming and erosion very soon after the metamorphic peak was reached.

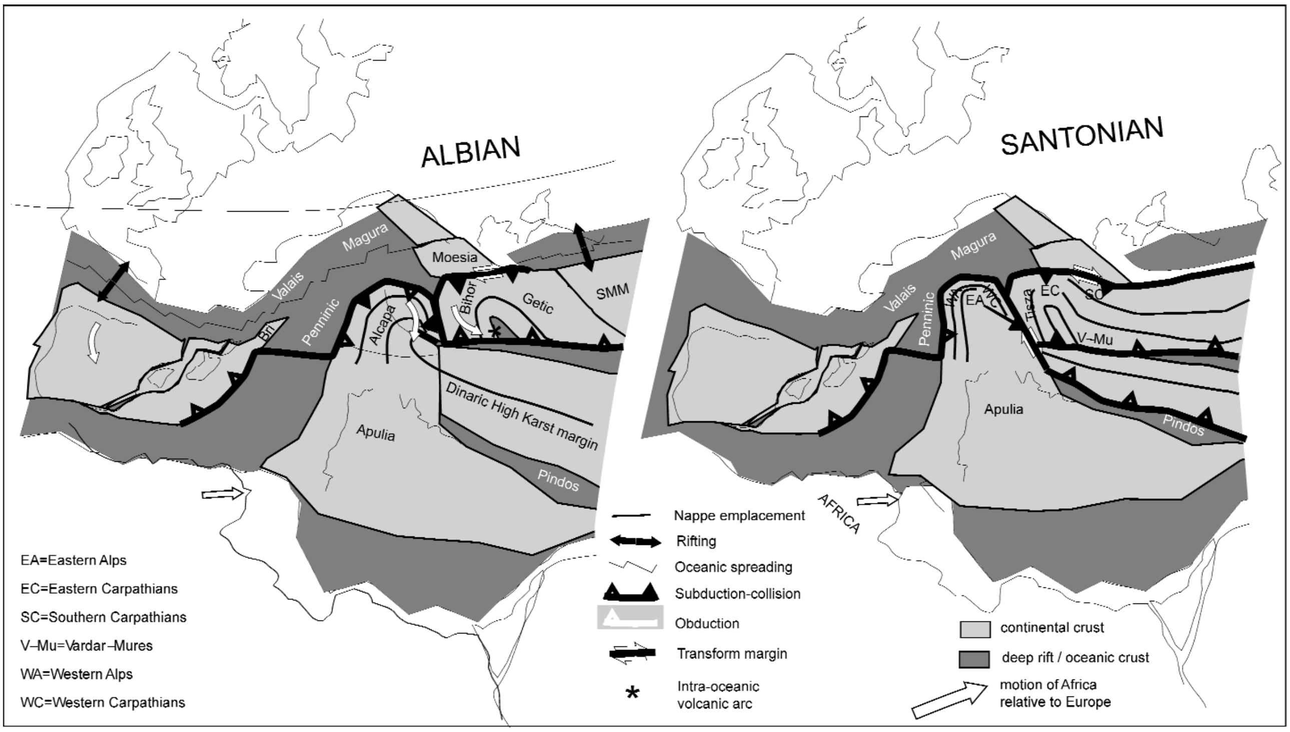


Text-Figure 10. Late Jurassic – Early Cretaceous reconstructions of the Alpine Carpathian area. Modified from CSONTOS & VÖRÖS 2004

In the Transdanubian Range the Early Cretaceous history of the Internal Dinarides seems to be better documented. The very variable Tata Formation of Aptian – Lower Albian age interfingers with the Vértessomló Siltstone and partly with the reef facies of Környe Limestone (GÖRÖG 1995, MINDSZENTY et al. 2001, POCSAI & CSONTOS 2006, Text-Figure 8b). The facies map suggests a deeper, flexural basin in the NE, which might be the successor of the Bersek–Lábatlan Basin. Shallower facies are interpreted to be located on top of advancing thrust sheets, while there are deeper basinal and deep marine coarse clastic facies in the local foredeeps of these thrust sheets (POCSAI & CSONTOS 2006, Text-Figure 8b). The thrusts are oriented NW–SE (present orientation), i.e. perpendicular to later structures. The progression of these thrust sheets towards the SW are interpreted to be driven by the south-westwards glide of the ophiolite sheet.

Late Albian is transgressive on the above mentioned formations (on Text-Figure 4). This transgression might be influenced by global sea level changes, but in this sector it is most probably linked to a rather sharp change in deformation. From that time onwards, shortening becomes NW–SE oriented, so major NE–SW striking folds; thrusts begin to form (TARI 1994). In the collision hypothesis this is explained by a change in the collision-directions (from transpressional to margin-perpendicular collision). In the no-collision hypothesis the Late Albian change might be also linked to the isostasy-driven uplift of Internal Dinaric (Bükkian) metamorphic formations. In SE Slovakia the earlier amalgamated nappe pile experienced ductile-brittle normal faulting and a metamorphic dome (Vepor Mts) was exhumed (HÓK et al. 1993). In a third hypothesis the change in deformation directions might be also related to large rotations within the Alcapa Terrane. That rotation could approach the more distant parts of the Dinaric and West Carpathian margins (Text-Figure 11).

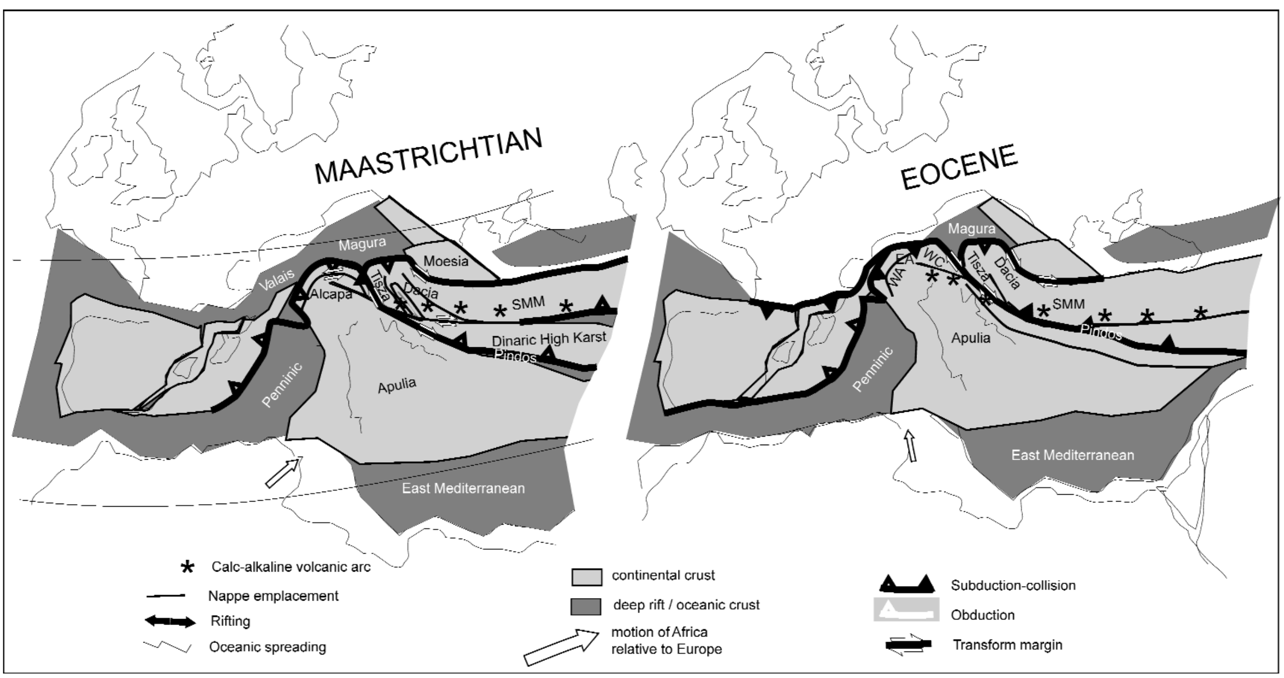
In the Hungarian part of Tisza, Aptian–Albian formations are very limited in extent. They are better developed in the Apuseni Mts and in the East and South Carpathians. In the Apuseni a platform and a basin were developed, while in the Southern Apuseni, on top of the ophiolites, a wildflysch was formed. It seems that the Southern Apuseni is the locus of major nappe movements. In the East Carpathians, Aptian and Lower Albian turbidites are followed by a thick, unconformable conglomerate of Late Albian age (LUPU 1983). This seals different nappes and defines the collision of the East Carpathians with a supposed “Coumanian cordillera” (SĂNDULESCU et al. 1981a, b). This cordillera might be the western edge of the Moesian promontory (CSONTOS & VÖRÖS 2004, Text-Figure 9). Due to this collision the Ceahlau–Severin Ocean vanishes. In the South Carpathians Albian is characterised by a terrestrial formation, which is lying unconformably on older members of the stratigraphic succession. Palaeomagnetic measurements (MÁRTON, E. 2000) suggest that the Aptian–Albian time interval might mark the beginning of a major rotation. The geodynamic reasons of this variable tectonic behaviour of the Tisza–Bucovinian–Getic ribbon-continent can be found in its particular position. Its eastern–southern parts (Bucovinina–Getic) are in collision with the Moesian promontory (Text-Figure 11). In the early collision hypothesis of the Vardar the southern interface of Tisza is already locked by the Dinaric continent, while in the north the vast Magura



Text-Figure 11. Albian–Santonian reconstructions of the Alpine Carpathian area. Modified from CSONTOS & VÖRÖS 2004

Ocean is still preserved. Therefore Tisza does not show the traces of collision in the Albian. In the late collision hypothesis Tisza is surrounded by oceans on its northern and southern peripheries. The internal rotation of the ribbon continent might be explained by the westward motion of it. This could have created a transpressive shear along the East–South Carpathian–Moesian interface and could have displaced Tisza towards the eastern ends of the Austroalpine microcontinent. When in contact, the two loose ends, i.e. the West Carpathian sector and the Tisza sector were able to bend and form two major internal folds within each ribbon-continent (Text-Figure 11). Major shortening in the internal side of the Tisza–Dacia fold could initiate shortening in the South Apuseni Mts.

Turonian seems to be a major nappe-emplacement age in both terranes. Based on seismic sections, TARI (1994) suggests a NW and SE directed thrusting, creating nappes or imbricate sheets. Nappe stacking is demonstrated in the Apuseni Mts



Text-Figure 12. Maastrichtian–Eocene reconstructions of the Alpine Carpathian area. Modified from CSONTOS & VÖRÖS 2004

(Transylvania, Romania) (BLEAHU et al. 1981). This tectonic episode might be related to the rotation of both terranes and to their compressional contact (CSONTOS & VÖRÖS 2004, Text Figure 11). The two internal folds in both ribbon-continents finish their formation and are pushed against each other. Because of the western advance of the Tisza–Bucovinian–Getic ribbon, the East Carpathian part leaves the Moesian margin and is now opposed to the still open Magura Ocean.

Nappes in both terranes are sealed by Late Turonian to Santonian deposits. The Senonian basins are either formed as flexural basins due to tectonic load, or are generated by post-nappe extensional collapse of the Cretaceous orogen (GYÖRFI & CSONTOS 1994). The latter solution is emphasized by Alpine studies (NEUBAUER et al. 1995, FROITZHEIM et al. 1997, TARI 1994). It is important to note, however, that the Senonian basins follow the trend of the earlier formed nappes. In case of the Alcapa Terrane the extensional activity is demonstrated by ductile fabric and exhumation-uplift studies (NEUBAUER et al. 1995, FODOR et al. 2003). In the case of Tisza, there is an ongoing compressional activity in the Southern Apuseni Mts, which has a peak in latest Cretaceous (Text-Figure 12). It is proposed that the formation of the Tisza–Getic internal fold was terminated in this time. Folding affected again the internal side of the fold. This deformation may have been emphasized by a transpressive contact with the western edge of Moesia (CSONTOS & VÖRÖS 2004). This event might have partially controlled the development of the Szolnok flysch basin.

In the Maastrichtian the two continental buckles were shifted northwards and were compressed into the Carpathian embayment. This generated lateral shear zones between the intervening parts (on Text-Figure 12). In Eocene the northwards shift of the two compressed buckles continued. South-directed subduction of the Penninic–Pieniny and Magura oceans consumed the space ahead of the northwards moving plates. The sedimentation terminated in most depositional areas and the Cretaceous cycle ended.

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Stratigraphy and palaeontology

Aptian stage

(Ottilia Szives)

Geology and stratigraphy

Historical background

The Aptian stage was defined by d'Orbigny in 1840, the type section is located in South-east France, near Apt, Vaucluse. By radiometric data Aptian lasts from 125.0±1 Ma to 112.2±1 Ma (Gradstein et al. 2004). Base of the stage is proposed to be defined by the beginning of M0 magnetic polarity chronozone, the end is potentially markered by the lowest occurrence of a calcareous nannofossil, *Praediscosphaera columnata* (Gradstein et al. 2004).

The Aptian stage was divided into substages (Table 1) — two or three, depending on the author and the studied area (Hoedemaeker et al. 1993, Cecca et al. 1999, Hoedemaeker & Rawson 2000, Hoedemaeker & Reboulet 2003, Reboulet & Hoedemaeker 2006). In France, from the second half of the XIXth century two substages were interpreted (Toucas 1888, Kilian 1888), but the position of the Clansayesian substage was uncertain as the part of the Aptian (Jacob

Table 1. Major differences in the Aptian ammonite biostratigraphy of the Western Tethyan — Boreal and Mediterranean — area

Stage	Substage	Tethys Mula Workshop, 1992 (in Erba 1996)	Kilian Group (Reboulet, Hoedemaeker 2006)	Substage	South England (Rawson 1983, Hancock 1991)	Kennedy et al. (2000)
ALBIAN	Lower	not discussed	*Douvilleiceras mammillatum*	Lower	*Douvilleiceras mammillatum*	*Leymeriella tardefurcata*
			Leymeriella tardefurcata		*Leymeriella tardefurcata*	*Leymeriella germanica*
		Leymeriella schrammeni				*Proleymeriella schrammeni*
112 My	Upper (Clansayesian)	*Hypacanthoplites jacobi*	*Hypacanthoplites jacobi*	Upper	*Hypacanthoplites jacobi*	*Hypacanthoplites jacobi*
		Acanthohoplites nolani	*Acanthohoplites nolani*			*Acanthohoplites nolani*
APTIAN	Middle (Gargasian)	*Parahoplites melchioris*	*Parahoplites melchioris*		*Parahoplites nutfieldensis*	Not mentioned
		Cheloniceras (Epicheloniceras) subnodosocostatum	*Cheloniceras (Epicheloniceras) subnodosocostatum*		*Cheloniceras (Epicheloniceras) martinoides*	
	Lower (Bedoulian)	*Dufrenoyia furcata*	*Dufrenoyia furcata*	Lower	*Tropaeum bowerbanki*	
		Deshayesites deshayesi	*Deshayesites deshayesi*		*Deshayesites deshayesi*	
		Deshayesites weissi	*Deshayesites weissi*		*Deshayesites forbesi*	
121 My		*Deshayesites tuarkyricus*	*Deshayesites oglanensis*		*Prodeshayesites fissicostatus*	

This figure is not a correlation chart. Double horizontal line indicates Aptian/Albian boundary. Bold horizontal lines indicate substage boundaries.

1905, PERVINQUIÉRE 1907, FALLOT 1920a). Finally, according to its stratigraphic position and fauna, BREISTROFFER (1947) concluded the Clansayesian substage as the upper part of the Aptian stage.

In the Mediterranean area, so far in Hungary as well, three substaged Aptian has been used since decades (FÜLÖP 1954, 1976; SZIVES 1999b, 2002, 2007). FÜLÖP (1976) in his monograph followed Russian terminology for the zonation, which placed *Diadochoceras nodosocostatum* Zone for the whole Clansayesian substage (Lyon Colloquium 1963 in RAWSON et al. (eds) 1996, BOGDANOVA & TOVBINA 1994, BOGDANOVA 1999). The position of the Barremian/Aptian boundary and the ammonite zonal scheme for the western Tethyan Aptian is discussed by BARABOSHKIN & MIKHAILOVA (2002), ROPOLO et al. (2000), ARKADIEV et al. (2000), BOGDANOVA & PROZOROVSKY (1999), BARABOSHKIN (1998), AGUADO et al. (1997), RAWSON et al. eds (1996), ERBA (1996). ATROPS & DUTOUR (2002, 2005) proposed to move the base of the Middle Aptian to the base of the *Dufrenoyia furcata* Zone according to a major faunal turnover that corresponds to a transgression (REBOULET & HOEDEMAEKER (reporters) 2006). CONTE (1994) and ROPOLO et al. (2000) are intended to keep the *Dufrenoyia furcata* Zone in the Lower Aptian because they documented the same faunal change at the top of the *Dufrenoyia furcata* Zone.

The supposed stratigraphic position of the Hungarian Aptian/?Lower Albian deposits and their fauna makes reasonable to pay special attention to the question of the Aptian/Albian boundary. The position of the boundary is a point of disagreement since decades (Brinkmann 1937, BREISTROFFER 1947, CASEY 1961a, KEMPER 1982, OWEN 1996a, b, CASEY 1999, KENNEDY et al. 2000, HANCOCK 2001, OWEN 2002). In the ammonite record a gap appears between the *Hypacanthoplites jacobi* Zone (Aptian) and the overlying *Leymeriella (L.) tardefurcata* Zone (Albian) which gap can be documented in many sequences (CASEY 1961a, AMÉDRO 1992, HART et al. 1996, KENNEDY et al. 2000). Ammonite assemblages of the Anglo–Parisien Basin, Northern Germany, South-eastern France and Russia cannot be correlated exactly because of different faunistic picture and a presumable hiatus in many sequences. In the question of the Aptian/Albian boundary there was no suggestion at the last meeting of the Kilian Group (REBOULET & HOEDEMAEKER [reporters] 2006), the decision is still pending on the Albian Working Group of the Subcomission on Cretaceous Stratigraphy. Hungarian ammonite record from the Aptian supports the idea of KENNEDY et al. (2000), that on the base of the absence of typical Lower Albian ammonite taxa it is better to attach the *Proleymeriella schrammeni* and *Leymeriella germanica* Zones to the Upper Aptian. A major faunal turnover marks the base of the Albian at the beginning of the *Leymeriella tardefurcata* Zone as the first occurence of typical Lower Albian taxa (see on Table 1).

Problems of the zonation of the Aptian/Albian boundary are summarized by KENNEDY et al. (2000). Definition for the Aptian/Albian boundary are currently undergoing active review HANCOCK (2001) proposed the base of *Lyelliceras lyelli* subzone of *Hoplites dentatus* Zone— which currently defines the base of the Middle Albian — for the base of the Albian.

In the present work, the standard Mediterranean ammonite zones of the Lower Cretaceous Working Group "Kilian Group" (REBOULET & HOEDEMAEKER [reporters] 2006) are accepted for the Early and Middle Aptian. For the Late Aptian/Early Albian, the ammonite biozonation of KENNEDY et al. (2000) is accepted and used.

The Aptian record in Hungary

Geological setting and stratigraphy

In the present Hungary, Aptian ammonite-bearing sections exposed on the surface in the Transdanubian Range (Text-Figure 13). Borehole sequences that yielded Aptian ammonites are also shown on Text-Figure 13. Bakony Mountains located in the south-western part of the Transdanubian Range (TR), Gerecse Mountains situated in the north-western part of the TR. The first Cretaceous megacycle that can be recognized in the deposits of Hungary ended up around the Late Aptian with a continuous trangression resulted deep water aleurolite at north in one hand (Vértessomló Aleurolite Formation), on the other hand in the southern part of the Transdanubian Range terrestrial circumstances existed with intensive deposition of strata, that later form bauxites.

Aptian formations are not widespread on the surface in Hungary; ammonite bearing sections are even more rare. The most important surface localities are in Tata, additional specimens were collected from the Bakony Mountains — at the Zirc, Márvány quarry and Olaszfalu, Eperkés Hill sections. Only few continuous core sampled boreholes drilled Aptian strata, and ammonites are known just from two of them. Unfortunately all the ammonites of the Neszmély N–1 borehole are mentioned and partly figured in FÜLÖP (1964, 1975) but have been disappeared. Ammonoid assemblage of Neszmély N–4 are under revision by I. Bodrogi.

From stratigraphical point of view The Hungarian Aptian is represented by the radiolaritic Sümeg Marl, crinoidal Tata Limestone and the siliciclastic Lábatlan Sandstone Formations in the Transdanubian Range, the marine Magyaregregy Conglomerate Formation in the Mecsek Mountains and the urgonian Nagyharsány Limestone Formation in the Villány Unit. All lithostratigraphic units indicate different environments of former Cretaceous seas. Aptian ammonites are only known from the Sümeg Marl Formation and the basal beds of the Tata Limestone Formation.

The Sümeg Marl Formation is a radiolaritic, glauconitic sandy marl, about 270 metres thick in the Southern Bakony Mountains — mainly known from boreholes. In the Northern Bakony area maximum thickness of the marl is 35 metres

Text-Figure 13. Map of Hungary. Position of sections and boreholes is numbered as follows: 1 — city of Tata; 2 — Tatabánya Ta–1462 borehole, Tatabánya Ta–1436 borehole, Oroszlány O–1881 borehole; 3 — Jásd 1 quarry; 4 — Jásd J–42 borehole; 5 — Jásd J–36 borehole; 6 — Pénzesgyőr, Tilos Forest; 7 — Zirc, Márvány Quarry; 8 — Olaszfalu, Eperkés Hill, Villó Hill; 9 — Sümeg, Sintérlap Quarry; 10 — Tapolcafő; 11 — Bóly B–1 borehole

(CSÁSZÁR [ed.] 1996) and have several outcrops. The name "Sümeg Marl" was originated from KNAUER (1969) although FÜLÖP (1964) determined this unit as a distinct formation, but without giving a certain name. Ammonites are abundant in the Sümeg Marl, aged from Hauterivien to Aptian and mainly from Neszmély N–1 borehole. FÜLÖP (1964) figured some of them, but the specimens seem to be disappeared.

The Lábatlan Sandstone Formation is graded sandstone with marl, siltstone and radiolarite intercalations. HANTKEN (1868) described first the "Lábatlan sandstone and conglomerate strata", and CSÁSZÁR & HAAS (1977) actualised this name and defined a distinct formation (CSÁSZÁR [ed.] 1996). The sequence can be well observed in the Eastern Gerecse Mountains in about 150 metres of thickness (CSÁSZÁR [ed.] 1996). According to recent studies (FŐZY et al. 2002; FŐZY & JANSSEN 2005, 2006) the age of the formation is Hauterivian – Late Barremian based on ammonites and nannofossils. Presence of Aptian strata is also proved without any ammonite evidence because orbitolinids (SCHLAGINTWEIT 1990) indicate Late Aptian – Early Albian age.

The last member of the Aptian sequence is the Tata Limestone Formation. Most of the Hungarian Aptian ammonite material came from this formation. The name as a distinct formation was derived from FÜLÖP (1975), although NOSZKY JR. (1934) mentioned it as brachiopod–crinoidal limestone. Tata Limestone is known from the axis of the Transdanubian Range from Sümeg to Tata, characterized by mass of crinoid fragments and a great percentage of terrigenous material. Brachiopods and bryozoans are also abundant, but no ammonite was found in prevalent, typical part of the formation itself yet. Cephalopods are only known from the heavily condensed basal beds of the formation which is very distinctinct from the rest above (Text-Figure 14). The age of the Tata Limestone Formation was first given by SOMOGYI (1914) as Valanginian– Aptian age on the basis of ammonites and brachiopods. KOCH (1909) described in details the "crinoidal limestone" and determined some ammonites that led him to Neocomian age. The most detailed work about Tata Limestone at its type locality, Kálvária Hill of Tata city was published by FÜLÖP (1975, 1976). He dedicated a whole chapter of the lithologic and palaeontologic analysis of the crinoidal limestone and pictured two plates of ammonites from the basal pockets as *Holcophylloceras (Salfeldiella) guettardi* (RASPAIL 1831), *Tetragonites duvalianus* (D'ORBIGNY 1841), *Tetragonites heterosulcatus* (ANTHULA 1899), *Ptychoceras* sp., *Hamites* sp. (later referred to *H. praegibbosus csaszari* SZIVES & MONKS, 2002), *Valdedorsella getulina* (COQUAND 1880), *Valdedorsella* sp., *Puzosiella minuta* EGOIAN 1965 [here referred to *Silesitoides* spp), *Puzosiella* div. sp. (later referred to *Silesitoides* spp. by SZIVES, *Uhligella* sp. (here referred to *U. rebouli*

Text-Figure 14. View of the top of Kálvária Hill

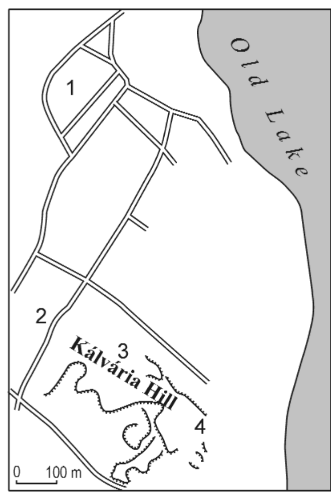
(JACOB 1908) and *U. balmensis* (JACOB 1908)], *Melchiorites* sp. [here referred to *M. melchioris* (TIETZE 1872)], *Acanthohoplites bigoureti* SEUNES 1887, *?Dufrenoyia* sp. (here referred to *Dufrenoyia katalinae* sp. nov.), *Colombiceras* sp., *Diadochoceras nodosocostatum* (D'ORBIGNY 1841), *Acanthohoplites nolani* (SEUNES 1887), *Parahoplites Uhligi* (ANTHULA 1899) (here referred to *?Parahoplites tenuicostatus* SINZOW 1907) which suggested to him Upper Aptian *Diadochoceras nodosocostatum* Zone as the age of the whole ammonite assemblage. Two decades later SZIVES (1996, 1999a, b, 2002) revised the ammonite fauna of the basal pockets and extended the age from Lower Aptian to Lower Albian. This opinion is fully discussed and corrected here.

Microfacies and microform studies led to different results. SIDÓ (1970, 1975) investigated the foraminifer assemblage of the sequence and concluded Upper Aptian age. GÖRÖG (1996) determined the age as Middle Aptian by orbitolinids while LEEREVELD (1992) dinocyst investigations suggested Albian age. LELKES (1990) studied the microfacies system of Tata Limestone and recognized three types which "mark the end of a long pelagic period in the history of the Bakony Mountains". CSÁSZÁR & ÁRGYELÁN (1994) analyzed relations and problems of Tata Limestone and the covering Vértessomló Aleurolite Formations in details.

Studied sections

Tata

The town of Tata is situated west of the Gerecse Mountains and hosts four former localities where Aptian ammonites were found (Text-Figure 15). Two of them, Kálvária Hill and Kékkő Quarry can still be visited as parts of an open-air geological museum but collecting fossils is forbidden. Other two localities of Tata, Fazekas street. and Vájáriskola were temporary outcrops and destructed since decades.



Text-Figure 15. Simplified map of Tata localities. Sections numbered as follows: 1 — Vájáriskola, 2 — Fazekas street 21, 3 — Kálvária Hill 4, — Kékkő

KÁLVÁRIA HILL GEOLOGICAL MUSEUM

The superbly excavated hill is a classical Mesozoic fossiliferous locality of Hungary. From the 1960's it runs as an open-air geological museum. The Kálvária Hill section starts with the Triassic Dachstein Limestone and ends with the Albian grey siltstone.

Geological investigation of the fossiliferous red Jurassic strata started in the early XIXth century (BEUDANT 1822) although TOWNSON (1797) also mentioned Tata as a city "built on red marble". In the early XXth century the best Hungarian geologists and palaeontologists worked on the Cretaceous grey crinoidal limestone, as LÓCZY Sen. (1906), LIFFA (1910), KOCH (1909), SOMOGYI (1914). KOCH (1909), in his essential work about the geological settings of the Kálvária Hill, described some ammonites as *Lytoceras (Tetragonites)* sp., *Hoplites (Parahoplites)* sp. and *Phylloceras* sp. among other fossils. After a long break FÜLÖP (1954) published a brief work on the geological settings of the area, but geological importance and curiosities of the locality led him to dedicate a monograph (FÜLÖP 1975, 1976) to the Kálvária Hill of Tata. In the 1950's, Fülöp József, the director of the Geological Institute of Hungary at that time, had the institute to start a gorgeous excavation on the Kálvária Hill of the town. Works led to one of the most spectacular and complete outcrop of the Mesozoic sequences of Hungary. During the excavation thousands of fossils were collected from different ages and strata. One of these collections is the so called "Aptian Fülöp Collection".

Ammonites known to be Aptian age were excavated in the geological museum from two sites — one on the top of the hill, named as Kálvária Hill by FÜLÖP (1975), and a second is opposite to the Fülöp Memorial House, named as Kékkő Quarry, also by FÜLÖP (1975).

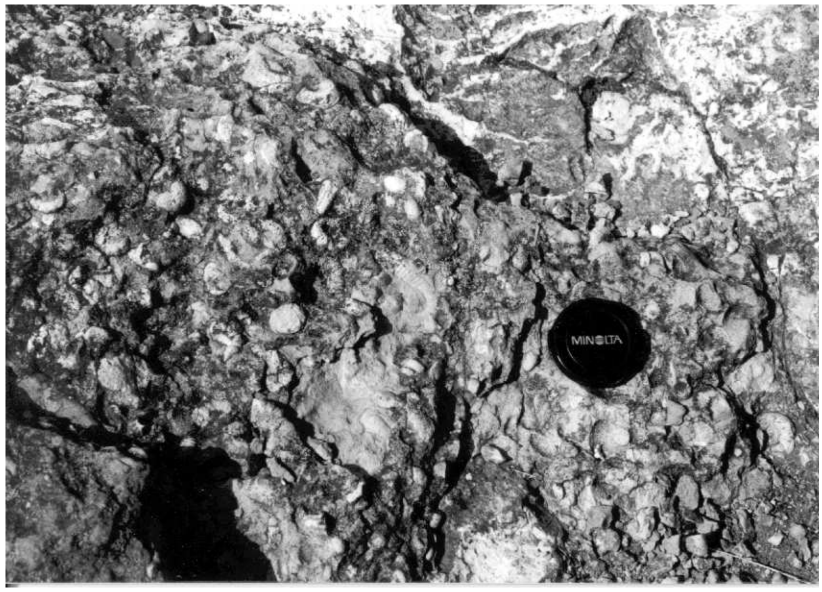
For more detailed description of the Kálvária Hill Geological Museum of Tata see FÜLÖP (1976) and HAAS & HÁMOR (2001).

All the material collected from the Kálvária Hill Geological Museum is the property of the Geological Institute of Hungary and housed in the same building at the Geological Museum of Hungary.

KÁLVÁRIA HILL SECTION

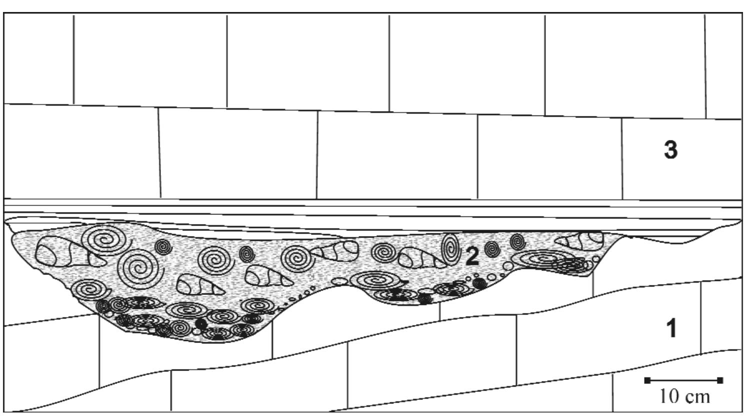
From the Kálvária Hill locality, almost a thousand ammonite internal moulds were collected by the Fülöp Team. Additional collecting was done by Szives. The full ammonite data for each locality is presented in the appendix. For the first sight it is a bit confusing that Fülöp used the same name for the exact locality and the whole site — Kálvária Hill — on his original designations of the fossils.

On the upper yard of the open-air geological museum section, the partly stromatolitized Tithonian limestone hardground is still can be observed. On the eroded, uneven surface of the Tithonian is followed by the greyish-blue, crinoidal Tata Limestone (Text-Figure 16). Between the underlying Tithonian limestone and the overlying crinoidal Tata Limestone, in some isolated, local deepenings of a hardground, a heavily condensed fossil assemblage can be found, called "Aptian fauna of Tata".



Text-Figure 16. Picture of the basal pockets of the Tata Limestone Formation at Tata, Kálvária Hill

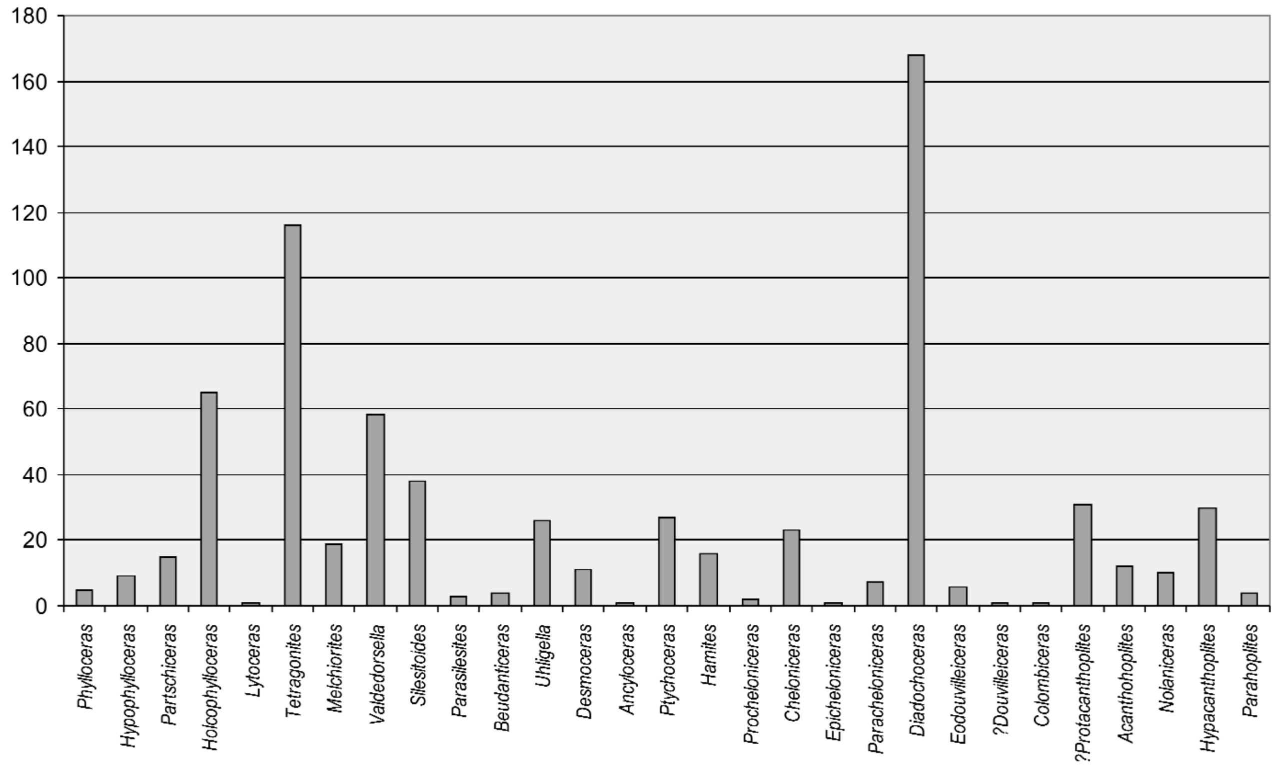
Fauna. The fauna was fossilized as a mass of internal moulds in heavily condensed srata, although "strata" is not a correct term for the situation (Text-Figure 17). All the assemblages were collected from surface outcrops — apart from Kékkő Quarry one —, are from heavily condensed fossiliferous masses which occur in isolated lenses between the overlying Tata Limestone and the underlying Tithonian limestone. Ammonites collected here show good example of sorting by size. Most of them are between 2–5 centimetres in diameter. Some bigger fragments or entire moulds also can be found as specimens belong to genus *Beudanticeras, ?Ancyloceras, Ephamulina, Eodouvilleiceras.* Internal moulds are made of a phosphatic, glauconitized marly grey limestone. Matrix between the moulds often contains a centimetre sized black pebbles and carbonized plant remains. In most cases moulds are entire, slightly eroded ones, without any sign of flattening or other marks of deformation.



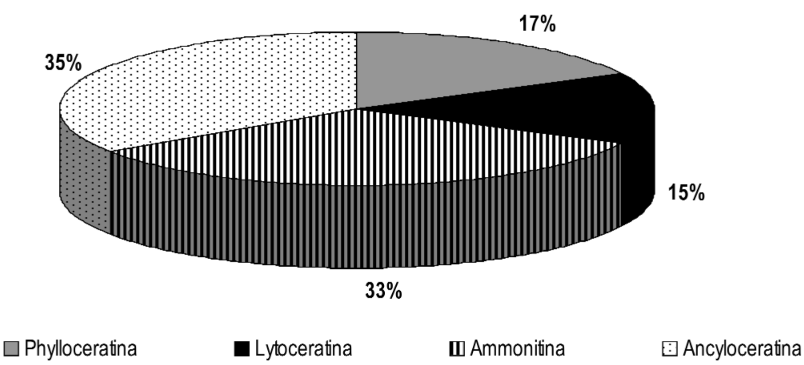
Text-Figure 17. Stratigraphic position of the basal pockets (2) which situated between the underlying Tithonian limestone (1) and the overlying crinoidal Tata Limestone Fm (3)

The accompanying fauna contains lots of echinoids, belemnites and gastropods. Bivalves are rare. A half dozen of nautilids also were found.

The ammonite assemblage of Kálvária Hill encompasses almost the entire spectrum of a Middle – Upper Aptian fauna together with its whole startigraphic range. Generic distribution of the collected specimens (Text-Figure 18) shows high dominance of the genera *Tetragonites* and *Diadochoceras*. *Holcophylloceras* and *Valdedorsella* species are also very common forms of the assemblage. *?Parahoplites* almost lacks here, in contrary *?Protacanthoplites* and *Silesitoides* are abundant. The remarkably great percentage of *Hamites* and *Ptychoceras* specimens within the



Text-Figure 18. Generic distribution of the collected specimens at Kálvária Hill section



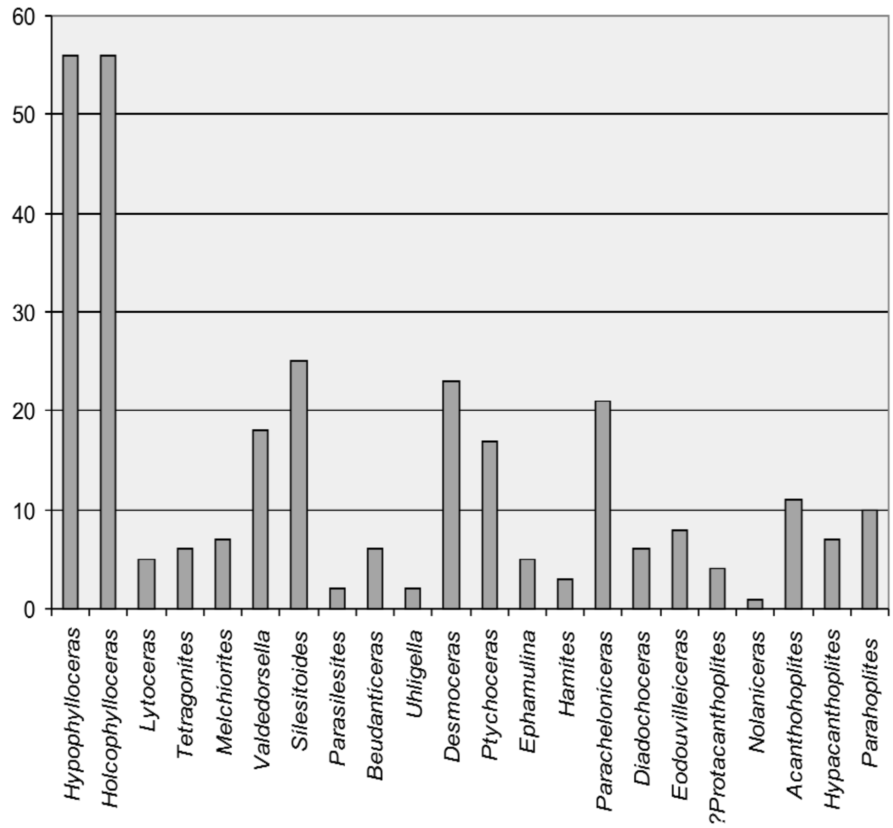
Text-Figure 19. Percentage diagram of the ammonite assemblage at Kálvária Hill by subordo level. Data chart belongs to the diagram is presented in the appendix

Ancyloceratina can be due to palaeoecological factors discussed later. Text-Figure 19 shows the percentage diagram by subordo level.

KÉKKŐ QUARRY SECTION

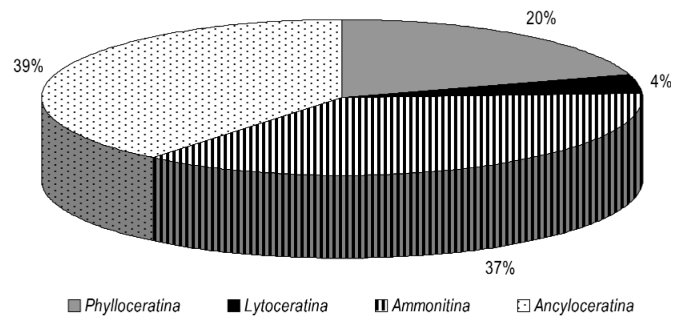
Kékkő Quarry was the original name of the entire site what was originally a quarry and now is called Kálvária Hill open-air Geological Museum. The quarry was named after the bluish-grey crinoidal Tata Limestone that was excavated here as building stone for the house constructions by the local people of Tata. The Kékkő Quarry section is also situated in the open-air geological museum of Kálvária Hill, just opposite the little Memorial House.

Contrary to the Kálvária Hill section, fossils from Kékkő Quarry locality were collected from exact beds, but two different names were used for the locality. Original designations by the late professor Fülöp are very confusing because he mentioned strata as "from the second faunal level on the bottom", "from the sandy level above the second faunal level", "from the strata above the first faunal level" without any numbering or stratigraphic chart. Trying to reconstruct the situation, it is supposed that during the several collecting phases in the 1950's and 60's, two different names were given to the same section as "Kékkő Quarry" and "Jewish Cemetery" by different collectors. The author of this chapter tried to find levels and strata mentioned in the original designations of the fossils but all efforts went on vain, not even a single ammonite was found. From Kékkő Quarry section the assemblage was collected, supposedly, bed-by-bed. Lack of the original documentation and the unsuccesful new collecting made the ammonite stratigraphic reconstruction impossible.



Text-Figure 20. Generic distribution of the collected specimens at Kékkő Quarry section

Fauna. Ammonites of the Kékkő Quarry section are different from others of Tata in many points of view. All the fossils, apart from belemnite rostra, are preserved as internal moulds, as in other Aptian surface localities, but here the internal moulds are made of grey, glauconitized-phosphatized marly limestone. Moulds are mostly big (5–15 cm), most cases heavily flattened and deformed. Sorting by size cannot be observed, while it is usual in other localities of the Aptian fauna. Generic distribution of the collected specimens (Text-Figure 20) shows the high dominance of the genus *Holcophylloceras* and the relative abundance of the genera *Silesitoides, Desmoceras* and *Cheloniceras (Paracheloniceras)* which are not common at other localities. From biostratigraphical point of view, this should have been the most interesting section; unfortunately the original documentation of the collecting is lost. Most ammonoid taxa, on the basis of the startigraphic distribution, are restricted to Middle to Late Aptian (sensu Kennedy et al. 2000). Most specimens of *Silesitoides, Ephamulina, Paracheloniceras* and *Eodouvilleiceras* were collected from this section. *Cheloniceras* lacks here although the genus is very abundant in other sites at Tata. Situation is the same for *Diadochoceras* which is represented here only by a few specimens. At subordo level (Text-Figure 21) the Ancyloceratina and Ammonitina dominate the fauna.



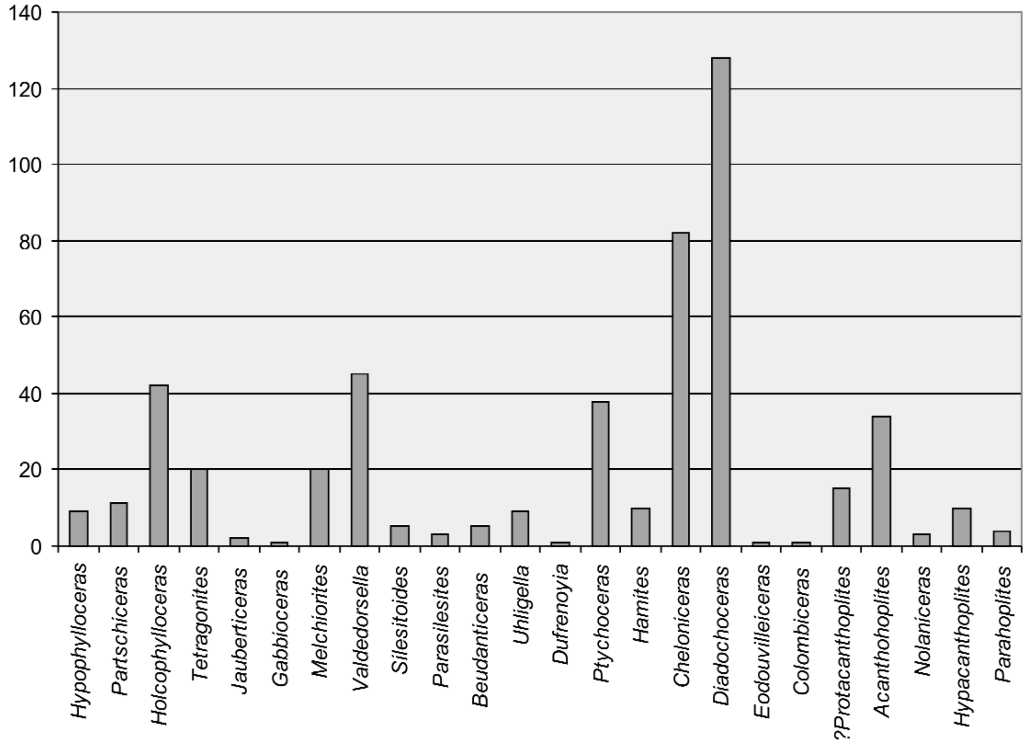
Text-Figure 21. Percentage diagram of the ammonite assemblage at Kékkő Quarry by subordo level

Accompanying fauna contains lots of echinoids, belemnites and gastropods, and some bivalves as well.

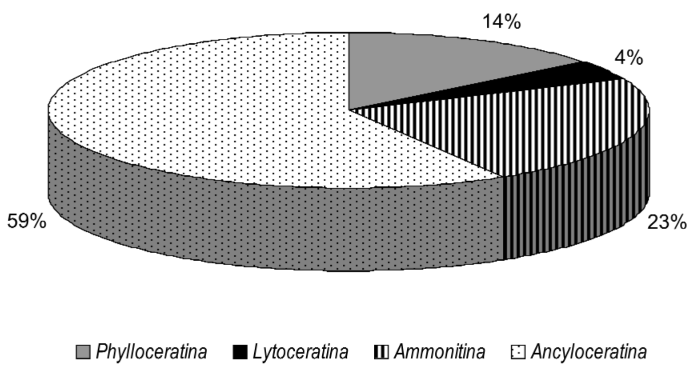
The state of preservation varies much, usually average. Suture lines were obliterated during the diagenesis. Moulds are homogenous from the inner whorls to the body chamber.

Fazekas street 21 section

On the original designations of the late professor Fülöp, one of the localities was called Fazekas street. It is also in the town of Tata. In 1953, a temporary sewage system construction started in front of the No. 21. Workers found some fossils and informed the geologist working on the Kálvária Hill. Fortunately, the hole crossed a fossiliferous pocket between Tithonian and Tata Limestone. Fülöp have collected the assemblage, the sewage system has been completed and the hole has been recultivated.



Text-Figure 22. Generic distribution of the collected specimens at Fazekas street section



Text-Figure 23. Percentage diagram of the ammonite assemblage at Fazekas street by subordo level

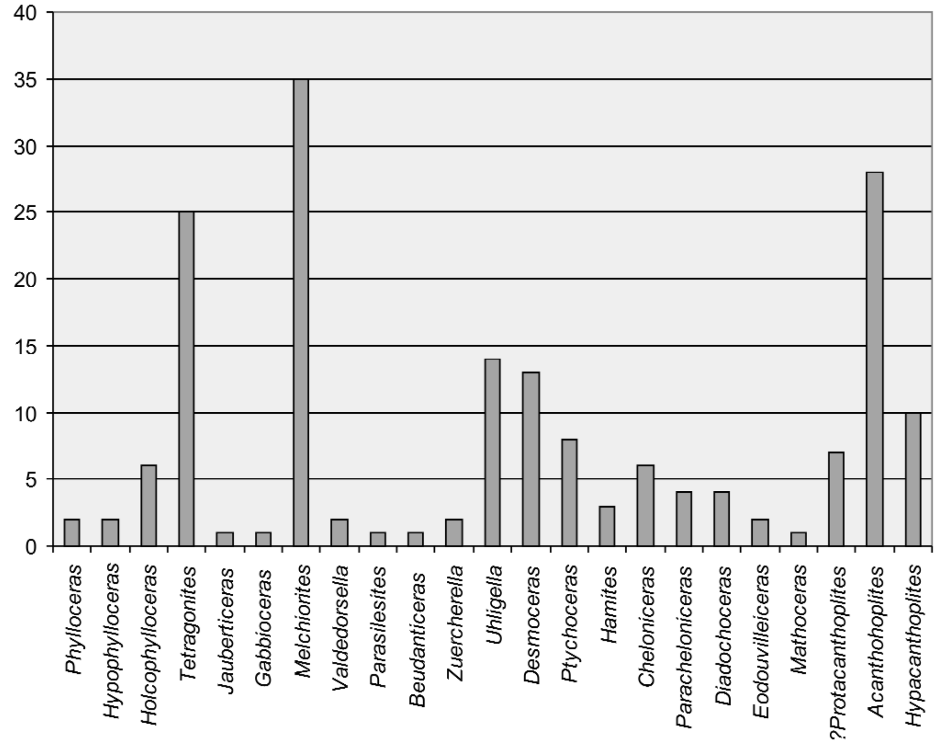
Fauna. From Fazekas street locality 504 specimens were determined, almost the total number of the collected ones. The fauna of Fazekas street is very similar to that from Kálvária Hill, not only in faunistic composition but in taphonomic features as well. Ammonites of Fazekas street locality are a good example of sorting by size. Most of the fossils are between 3 to 5 cm in diameters, bigger forms are missing. Fossils preserved as phosphatized and glauconitized internal moulds accompanied with small, black, oval pebbles and carbonated wooden material. State of preservation is good, many suture lines are visible. If we have a look on the generic distribution (Text-Figure 22), the high dominance of *Diadochoceras* and *Cheloniceras* is remarkable, *Holcophylloceras, Valdedorsella* and *Acanthohoplites* are also abundant here. The high dominance of subordo Ancyloceratina (Text-Figure 23) is also remarkable.

The accompanying fauna contains lots of echinoids, belemnites and gastropods, and some bivalves as well.

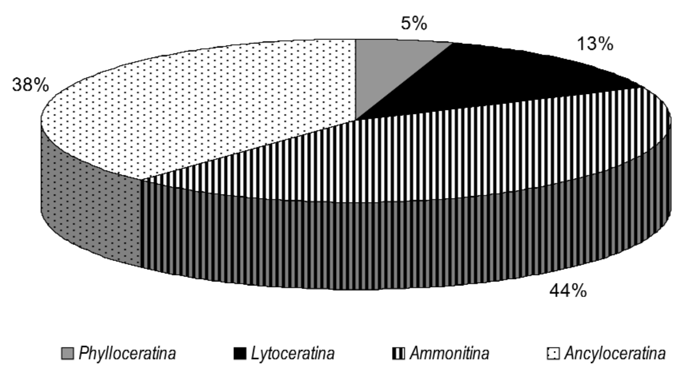
VÁJÁRISKOLA SECTION

On the original designations of the late professor Fülöp, one of the Tata localities is called Vájáriskola. Vájáriskola section was a temporary sewage constructing hole in the town of Tata, in front of a former Miners' School building. Nowadays the exact position of the hole cannot be reconstructed.

Fauna. Fossils collected from Vájáriskola locality are internal moulds as in all the Aptian sites of Tata, consist of purple red marly limestone which makes difference from fossils collected from other localities where the rocks are bluish grey. The inner material is not phosphatized and glauconitized so much as the specimens from Kálvária Hill or Fazekas street locali-



Text-Figure 24. Generic distribution of the collected specimens at Vájáriskola section



Text-Figure 25. Percentage diagram of the ammonite assemblage at Vájáriskola by subordo level

ties. The biggest Aptian ammonite specimens are from this locality, sorting by size cannot be visible. The ammonite assemblage is in poor state of preservation apart from some fortunate specimens. Analyzing the generic distribution (Text-Figure 24) of the specimens found at Vájáriskola locality, the high dominance of *Melchiorites* and *Acanthohoplites* is remarkable, besides the great number of *Tetragonites, ?Protacanthoplites, Hypacanthoplites* and *Desmoceras*. According to the percentage data (Text-Figure 25), subordo Ammonitina are more abundant in specimen number than the others.

The accompanying fauna contains lots of echinoids, belemnite rostra, gastropods and some bivalves as well.

Gerecse Mountains

Vértessomló Vs–8 borehole

There are only two *Holcophylloceras guettardi* (Raspail 1831) specimens and a *Beudanticeras* sp. specimen from unknown depth.

Tatabánya Ta–1423 borehole

The borehole drilled with continuous core sampling and penetrated the Vértessomló Aleurolite Formation. Only a single *Parasilesites* cf. *kilianiformis* (Fallot 1910) specimen was found at 292.4–295.0 m.

Table 2. Ammonite data of Tatabánya Ta–1462 borehole

Depth in metres	Ammonite record of Tatabánya Ta-1462 borehole
210.8	*Brancoceras* sp.
213.0-214.0	*Puzosia (P.) mayoriana* (D'ORBIGNY, 1841)
221,0-222.3	*Tetragonites (T.) duvalianus* (D'ORBIGNY, 1841)
223.0-223.4	*Parasilesites kilianiformis* (FALLOT, 1910)
230.0-232.0	*Holcophylloceras guettardi* (RASPAIL, 1831)
235.0-240.0	*Neosilesites nepos* (DOUVILLÉ, 1917)
253.0-255.0	*Neosilesites nepos* (DOUVILLÉ, 1917) (two specimens)
255.2-256.0	*Neosilesites nepos* (DOUVILLÉ, 1917)
260.0-261.0	*Hypacanthohoplites* sp.
264.0-266.0	*Neosilesites nepos* (DOUVILLÉ, 1917)
265.0	*Beudanticeras* sp.
268.0	*Neosilesites* sp.
277.8-278.2	*?Parahoplites* sp.
277.8-278.2	*Neosilesites nepos* (DOUVILLÉ, 1917)
277.8-278.2	*Nolaniceras nolani* (SEUNES, 1887)
300.5	*Brancoceras* sp.
303.5	*?Desmoceras* sp.
299.2-319.0	*Beudanticeras (B.) convergens* (JACOB, 1908)
326.8-327.5	*Ammonoidea*
330.5	*Paracheloniceras (Ch.) rerati* COLLIGNON, 1965

TATABÁNYA TA–1462 BOREHOLE

The borehole drilled with continuous core sampling and crossed the Vértessomló Aleurolite Formation. A representative Late Aptian ammonite fauna was found in the 120 metres long core. Cephalopods of the Tatabánya Ta–1462 borehole were determined by G. SCHOLZ in a manuscript, all the ammonite fauna is revised here (Table 2).

NESZMÉLY N–1 BOREHOLE

Ammonites of the Neszmély N–1 borehole are listed and partly figured by FÜLÖP (1975). The material is housed at the Geological Museum of Hungary.

NESZMÉLY N–4 BOREHOLE

The ammonite material of the borehole is currently under revision by I. Bodrogi and was not accessible for the purpose of the present work.

Bakony Mountains

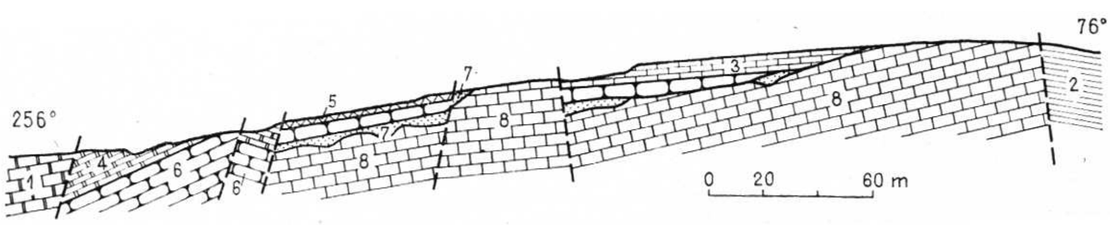
In the axis of the Transdanubian Range syncline, Tata Limestone Formation is present where it escaped the later erosion. Heading to the south-west from the Gerecse Mountains, Aptian crinoidal limestone sequence reaches 200 metres in thickness (in Pénzesgyőr Pgy–3 borehole).

EPERKÉS (EPERJES) HILL SECTION

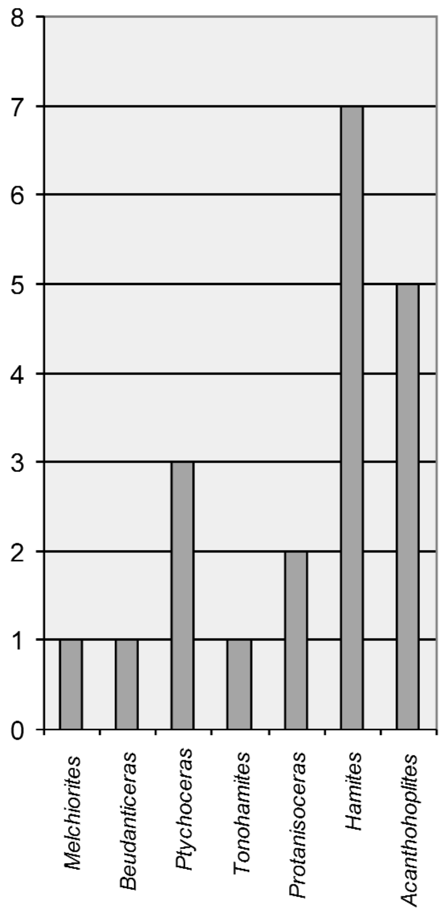
The section, named Eperkés Hill is nearby the village of Olaszfalu in the Northern Bakony Mts. Eperkés Hill is an important key-section (Text-Figure 26) of Jurassic and Lower Cretaceous sedimentary sequences of Hungary. Strata range from Lower Jurassic accross the Albian Tés Marl to Neogene (FÜLÖP 1964) (Text-Figure 27). In contrary to other localities, at Eperkés Hill no systematic ammonite collecting was done in the Aptian section, all the 18 specimens found here are fortunate findings. Most of the specimens were collected by A. Galácz, I. Főzy and I. Szente in 1995, some are from the collection of the Hungarian Natural History Museum and collection of Ágnes Somodi.

Text-Figure 26. The Aptian section of Eperkés Hill. The hammer indicates the lower boundary of the Tata Limestone Formation

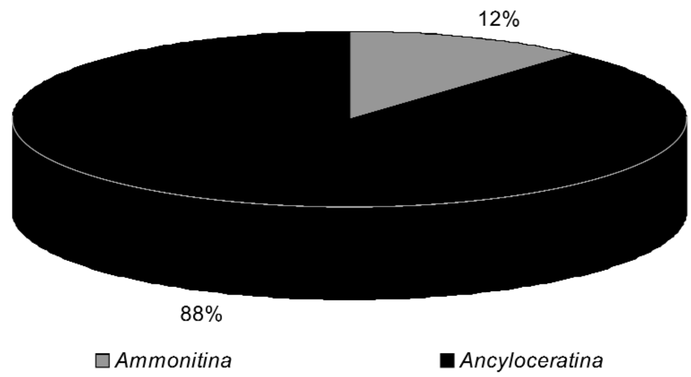
Both TAEGER (1909) and WEIN (1934) concluded the Tithonian to Neocomian age of the sequence. NOSZKY Jr. (1934) reported light red limestone "from the lower Early Cretaceous", p. 106). The Aptian crinoidal limestone at the Eperjes Hill is light orange-red coloured and discordantly deposited on the Upper Jurassic Szentivánhegy Limestone Formation. The



Text-Figure 27. Stratigraphic section of Eperkés Hill, after FÜLÖP (1964). 1 — Albian limestone, 2 — Aptian marl, 3 — Aptian crinoidal limestone, 4 — Tithonian limestone with calpionellids, 5 — Tithon Hierlatz Limestone, 6 — Kimmeridgeian limestone, 7 — Liassic Hierlatz Limestone, 8 — Liassic Kardosrét Limestone



Text-Figure 28. Generic distribution of the collected specimens at Eperkés Hill section



Text-Figure 29. Percentage diagram of the ammonite assemblage at Eperkés Hill by subordo level

most complete scientific work of the section was done by FÜLÖP (1964), revised recently by CSÁSZÁR [ed.] 2002). Both works contain detailed drawings of the section. SOMODI (1987) studied brachiopods of Aptian strata of the locality and she concluded that the sedimentary environment of the Aptian crinoidal limestone was connected to the top of a seamount characterized by heavy water movements.

Fauna. Fourteen specimens were determined. Half of them are heteromorphs which fact can be caused partly by palaeoecological reasons and partly by collecting bias. Generic distribution of the collected specimens at Eperkés Hill (Text-Figure 28) shows the dominance of *Acanthohoplites* and heteromorphs. Five species are represented with one specimen. No Phylloceratina and Lytoceratina were found. A new *Tonohamites* species is also found here (SZIVES & MONKS 2002). The subordo-level percentage distribution shows (Text-Figure 29) the high dominance of the Ancyloceratina but it is surely due to the limited specimen number.

The age of the ammonite fauna is determined as Uppermost Aptian (sensu KENNEDY et al. 2000) because of the appearance of *Hamites, Tonohamites* and *Protanisoceras*.

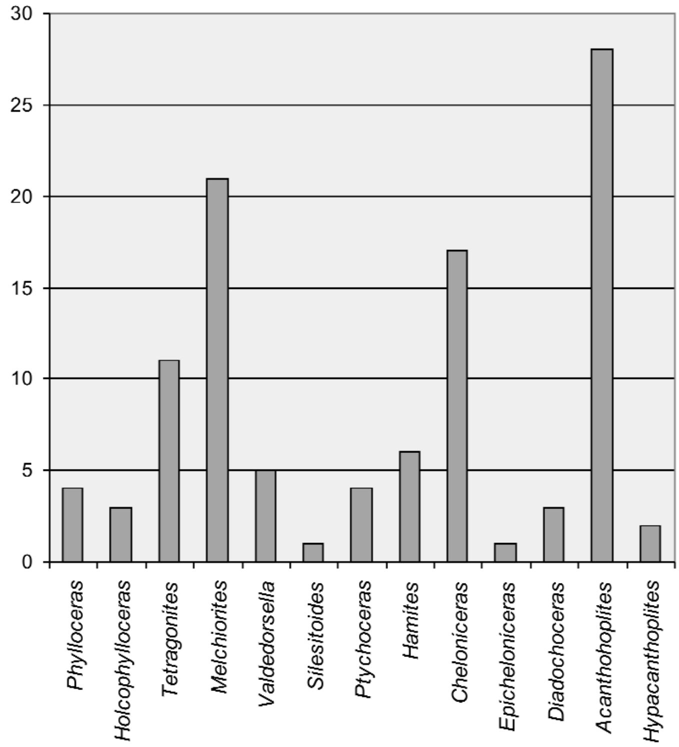
The state of preservation is excellent; most of the specimens are internal moulds with fragments of the original, calcitized shell. Suture lines are also well preserved. Internal moulds are not phosphatized or glauconitized as at other locaities. Accompanying fauna contains many brachiopods and some belemnite rostra.

ZIRC, MÁRVÁNY QUARRY SECTION

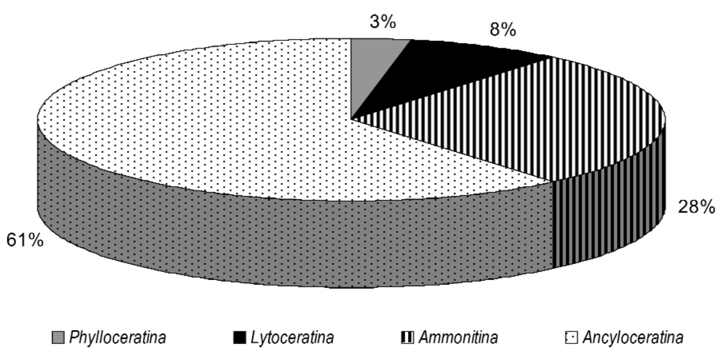
The Márvány Quarry locatity (Text-Figure 30) is situated in the northern Bakony Mountains, west from the town of Zirc, in the "Pintér-hegy" abbey forest. Its name was originated from the red limestone that was quarried here.

In the Márvány Quarry, the sequence (Text-Figure 31) starts with Tithonian white limestone, then discordantly follows an Upper Hauterivian cephalopod limestone. After a hiatus the Aptian crinoidal limestone rests on the top. For more detailed description of the locality see FŐZY & JANSSEN (2006). FÜLÖP (1964) was the first who recognized Aptian crinoidal limestone on the top of Márvány Quarry sequence. He wrote "…The Márvány Quarry section is a key section for better understanding of the Aptian crinoidal limestone. Besides Tata, this is the only locality where a fossil assemblage came out fom the

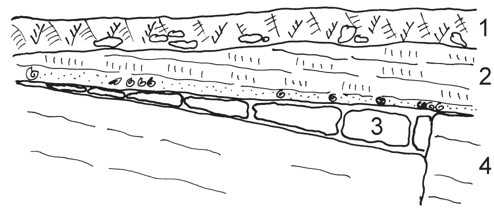
Text-Figure 30. View of Márvány Quarry section



Text-Figure 32. Generic distribution of the collected specimens at Márvány Quarry section



Text-Figure 33. Percentage diagram of the ammonite assemblage at Márvány Quarry by subordo level



Text-Figure 31. Sequence of Márvány Quarry, after FÜLÖP (1964). 1 — soil, 2 — Aptian crinoidal limestone, 3 — Barremian limestone, 4 — Tithonian limestone

base of the crinoidal limestone …., which has main importance to find out its stratigraphic position.". (By that time the 18 ammonite specimens of Eperkés Hill were not found yet.) Fülöp J. (loc. cit) ranged ammonites into 14 taxa and concluded that the age of the fauna was similar to that of Tata, is Aptian. Since his work no scientific studies held on the Aptian ammonite assemblage of Márvány Quarry except of SZIVES (2002).

Fauna. The Márvány Quarry assemblage is very similar to Kálvária Hill or Fazekas street already at the first glance. Ammonites are preserved as phosphatized and glauconitized internal moulds and show good example of sorting by size. Ammonites are mainly between 2–3 centimetres in diameter although bigger ones are also found in less numbers. Generic distribution of the collected specimens at Márvány Quarry (Text-Figure 32) shows the dominance of *Acanthohoplites*, *Cheloniceras* and *Melchiorites*. Low percentage of Phylloceratina is remarkable at subordo-level distribution (Text-Figure 33). The age of the fauna is determined as Late Aptian (sensu KENNEDY et al. 2000) because of the occurence of *Hamites praegibbosus* SPATH 1941. This is the oldest documented specimen of *Hamites* (SZIVES & MONKS 2002).

The state of preservation is average. Accompanying fauna includes echinoids, gastropods and belemnite rostra. Some brachiopods were also found.

Faunistic and biostratigraphic evaluation of Hungarian Aptian ammonites

The age of the basal ammonite fauna of the basal pockets and the overlying crinoidal Tata Limestone Formation was always a problematic question of the Hungarian palaeontology. The fossil-bearing pockets lay on a Tithonian hardground. The overlying Tata Limestone does not contain any ammonite evidence in spite of its great thickness; therefore its age can be approached only with the age of the basal fauna and the overlying Vértessomló Aleurolite Formation. Due to heavy condensation and the state of the preservation, the age of the fauna cannot be determined exactly.

FÜLÖP (1976) determined the age of the basal assemblage on the basis some well identifyable species in the Late Aptian *Cheloniceras (Epicheloniceras) subnodosocostatum* Zone (in the use of Lyon Colloquium 1963 in ERBA 1996), and "according to the more exact ammonite zonal scheme of Russian geologists…" (FÜLÖP 1975, p. 104 in Hungarian). Most of the fauna remained undetermined and out of focus. He was right at the point of the age but hundreds of older and younger specimens suggested a more complicated picture. His idea was that in the earlier Cretaceous the area was emerged, became a positive land area and sediments were eroded under subaerial circumstances then transgression flooded the territory in the Middle Aptian. This idea relies on the fact that no older forms could be found in the basal sediment (FÜLÖP 1976) but ignores for instance the stromatolite cover of the hardground that indicates submarine environment at least for a period of time. SZIVES (1996, 1999a, 2002) concluded that the Tithonian hardground was flooded in the late Early Aptian. During Aptian – Early Albian times the sedimentation was very slow but continuous, sometimes intermittent for short periods, that resulted in a heavily condensed assemblage of ammonoids of a various state of preservation. Microflora- and fauna is completely missing from the basal beds because they were swept away by the currents. Different preservational states are remarkable. It was also problematic that a condensed level of 10 centimetres contains ammonites of million years of the Late Aptian with continuous sedimentation. Of course, it might occur — as it is known at the Jurassic ammonitico rosso for example — but sedimentary features have to reflect that, which features are completely lack in this case. Because of the heavy condensation, there are no bedding in the basal sediment that can help us to define stratigraphic levels. Similar condensed glauconitic sequences are known from the Late Aptian of the Swiss Jura Mts (RENZ & JUNG 1978). Typical Early Albian ammonites as genera *Proleymeriella, Brancocears, Hysteroceras, Cleoniceras, Sonneratia* are missing (*Brancoceras* sp. is only known from Ta–1462 borehole) from the assemblages. Representatives of *Silesitoides, Beudanticeras, Uhligella, Puzosia, Hamites, Hypacanthoplites* are reported. This could be caused by ecological and palaeobiogeographical factors besides the significant age difference.

In the present work, following the thoughts of OWEN (1996b), the author proposed a different picture for the sedimentation of the Tata fauna. Thought-to-be Early Aptian forms as *?Ancyloceras matheroni* (D'ORBIGNY 1842) and *Procheloniceras albrechti austriae* (UHLIG 1883) are in the worst state of preservation that suggest heavy reworking. Most of the ammonites of surface localities are from the Late Aptian *Acanthohoplites nolani* and *Hypacanthoplites jacobi* Zones. OWEN (1996b, p. 471) writes the following: "In shallow seas, subject to tidal flow or of a depth in which storm waves can remobilise sea-floor sediment relatively frequent intervals, a bare rock surface stripped of all but mobile sediments normally exists. In the geological column, such as erosion surface might be deemed emergent, when in fact a seaway existed. …. pockets of sediment are preserved in cobble-scoured pot-holes in a hard rock surface." This is exactly the situation which can be outlined for the accumulation of the Tata fauna. Considering the fossil material and the state of preservation, it can be concluded that during the Early and Early – Middle Aptian continuous currents stripped the sea-floor leaving no fossil evidence behind. From the late Middle Aptian the sea-level emerged — as it is described and documented (LELKES 1990, CSÁSZÁR & ÁRGYELÁN 1994) —, sedimentation continued and the sediments were not swept away from time-to-time. Besides, several or at least two sediment-remobilizing events took place that left the consolidated sediment in the pockets. Bigger fragments did not reach the pockets, as well as microgranules and microfossils were swept away and the size-sorted material remained and accumulated in the pockets of the hardground.

Biostratigraphical problems of the Aptian/Albian boundary (KENNEDY et al. 2000) suggest that in most thought-to-be continuous boundary sections there is a gap between Upper Aptian and Lower Albian deposits therefore biostratigraphical ranges of many taxa may vary a little. The Hungarian Middle Aptian – Late Aptian reworked fauna is definately not suitable for boundary biostratigraphic studies. Youngest ammonites — *Hamites praegibbosus csaszari* SZIVES & MONKS (2002) and *Hamites* sp.— are both reported from the *Leymeriella (L.) tardefurcata* Zone of the Earliest Albian deposits of Europe (KEMPER 1964, 1971, 1982), Mangyshlak (SAVELIEV 1973) and Iran (SEYED-EMAMI 1980a, b). Considering that in every case when basal lenses are found below the Tata Limestone Formation, crinoidal Tata Limestone should be at the same age or younger than the basal assemblage. Therefore the age of Tata Limestone Formation both in the Bakony and Gerecse Mts is Late Aptian and younger. This doesn't mean automatically that other Tata Formation sections without the basal assemblage are at the same age.

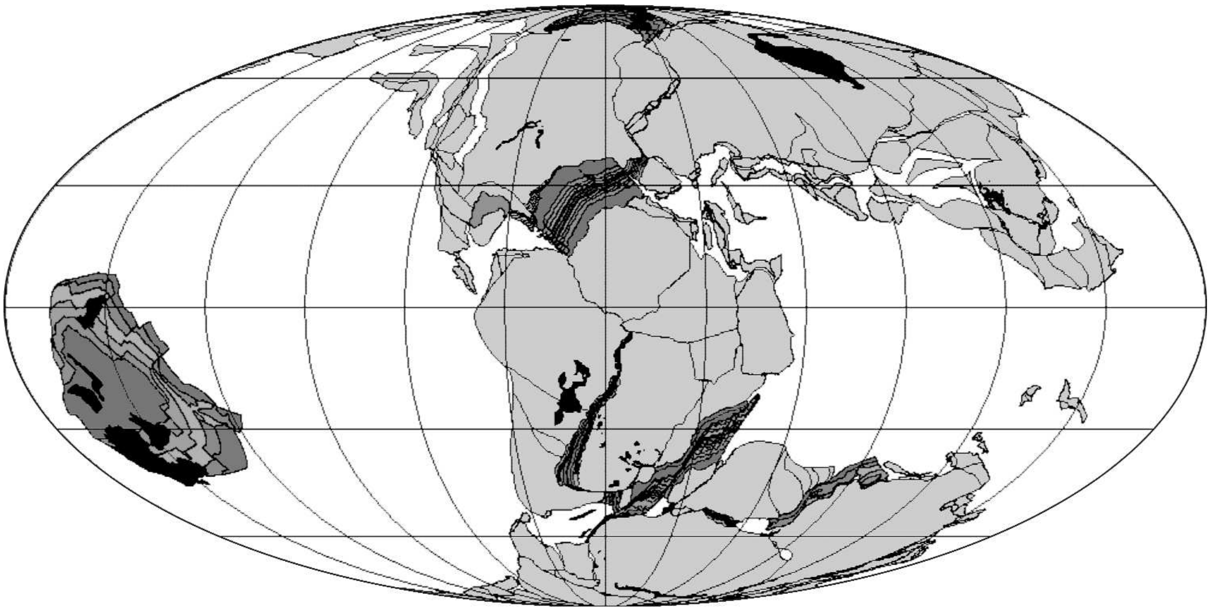
Summarizing the stratigraphical results of the Aptian chapter, we can point out that all sections from Gerecse Mts and Bakony Mts contain isochronous ammonite assemblages, namely of Middle to Late Aptian age.

35 taxa are described for the first time from Hungary.

Palaeobiogeography of Hungarian Aptian ammonites

According to the fossil record, there were several main biogeographic units — provinces — in the Aptian which are divided and named in different ways by different authors (KAUFMANN 1973; MUTTERLOSE 1992; OWEN 1988, 1996a, b; RAWSON 1994; KAKABADZE et al. 2004). These are the Arctic, Tethyan — including the Mediterranean-Himalayan (RAWSON 1981) or Indo-Mediterranean (KAUFMANN 1973) and Boreal subprovinces —, North American, Carribbean, South Atlantic, East Pacific, East Asiatic and Australian provinces.

During Aptian times the climate was well balanced (MUTTERLOSE 1992). Mesozoic palaeogeographical pattern was quite complicated in the Western Tethyan area, especially in the Carpathian region (CSONTOS & VÖRÖS 2004). Orogenic movements of future Alps and Carpathians started in the Aptian (Text-Figure 34) and caused transgression and faunistical boom later in the Albian. The Tethyan palaeobiogeographical unit "stretched from the western coastal region of northern South America and southern North America in the west to Australia in the east. It occupied much of the marine regions of



Text-Figure 34. Global palaeogeographical reconstruction of Early Aptian (120 My). Map is from the "Plate Tectonics On-Line Reconstruction Tool" website http://www.itis-molinari.mi.it/Intro-Reconstr.html, model after SCHETTINO & SCOTESE 2000. Continental crusts are light grey, opening oceanic trenches are coloured to dark grey, hotspot tracks are black

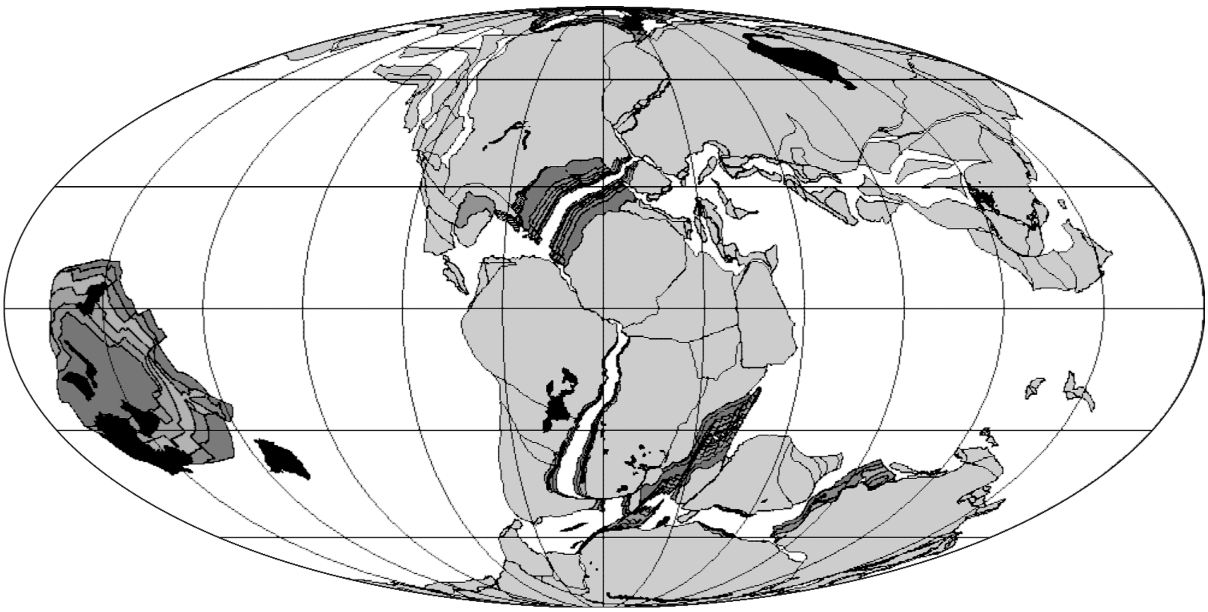
Gondwanaland..." (OWEN 1996b). This global connection of main marine environments caused that ammonite faunas, at least in generic level were more or less cosmopolitan from the westernmost end of the former Tethys to the shores of Eastern Africa, of course with additional occurences of endemic taxa. This is unique during the Cretaceous period which can be characterized with extreme faunal provincialism.

In the marine environments of the western Tethys two main palaeobiogeographic subprovinces can be recognized (MUTTERLOSE 1992, OWEN 1988, 1996b) during the Aptian: Boreal (North Temperate) and Mediterranean, but distinction between their ammonite record is not so clear than later in the Albian. Temperature conditions were equalized and a global eustatic rise resulted less differentiated provincialism between Boreal and Mediterranean realms (RAWSON 1994, BENGTSON & KAKABADZE 1999) during the Aptian. Boreal ammonite forms — as *Tropaeum* or *Hypacanthoplites* — dominated the high latidude seas, while "mediterranean" ammonites as *Diadochoceras, Cheloniceras, Colombiceras* and *Acanthohoplites* can be found in warmer, low latitude oceans. Faunal interchange was intensive between the two subprovinces which can be clearly demonstrated by the qualitative and quantitative comparison of ammonite assemblages. Connection between the two subprovinces was cut off later in the Albian which can be clearly demonstrated by the differences of Arctic, Boreal and Mediterranean ammonite assemblages.

Aptian ammonite assemblages of Ethiopia (ZEISS 1975), Mozambique (HENNIG 1939, HAUGHTON & BOSHOFF 1956, DA SILVA 1962), Madagascar (COLLIGNON 1962), Somalia (TAVANI 1949), South-East Africa (KRENKEL 1910), the Crimea and Caucasia (SINZOW 1907, 1909, 1913; KAZANSKY 1914; ROUCHADZE 1933, 1938a, 1938b; LUPPOV 1952; GLAZUNOVA 1953; DRUSCHICH & KUDRYAVTSEV 1960; EGOIAN 1965, 1969), Southern France (JACOB 1905, 1908; JACOB & TOBLER 1906; KILIAN 1913; KILIAN & REBOUL 1915) and Hungary (SZIVES 1999a, 2002) contain many Tethyan taxa, as *Cheloniceras, Paracheloniceras, Diadochoceras, Colombiceras, Acanthohoplites* and *Parahoplites* besides cosmopolitan phylloceratid, lytoceratid and desmoceratid genera.

At the easternmost shores of the Tethys, at least according to the ammonite data (BRUNNSCHWEILER 1959, WHITEHOUSE 1926, 1927, 1928) of Australia, endemic species dominated the region. Opening seaways between the African landmass and Madagascar, India and Australia produced small, partly separated marine environments, where probably palaeoecological factors controlled the faunal dispersal and made endemism stronger (BENGTSON & KAKABADZE 1999).

Opening of the Northern Atlantic during the Aptian (Text-Figure 35) let the communication active between the westernmost Tethyan Realm and the Carribean Subprovince. In Mexico, besides the dominance of genus *Dufrenoyia,* in the Lower to Middle Aptian, there were several endemic taxa in the Late Aptian (*Juandurhamiceras*, *Rhytidoplites*, *Riedelites*, *Burckhardtites*) which have clear regional biostratigraphic significance (BURCKHARDT 1925, HUMPHREY 1949, YOUNG 1974, BARRAGÁN-MANZO & MÉNDEZ-FRANCO 2005, BARRAGÁN-MANZO & SZIVES 2007) in the region. The Aptian ammonite assemblages of Venezuela, Colombia and Peru (SOMMERMEIER 1910, RIEDEL 1938, RENZ 1982, HOEDEMAEKER ed. 2004) also show good resemblance to the Tethyan ones in species level, with the dominated occurrence of endemic species in the region. More than half of the reported species from Colombia (KAKABADZE et al. 2004) are endemic, but naturally, it may vary genera by genera. Kakabadze (loc. cit.) concluded that „From the the middle



Text-Figure 35. Global palaeogeographical reconstruction of Late Aptian (112 My). Map is from the "Plate Tectonics On-Line Reconstruction Tool" website http://www.itis-molinari.mi.it/Intro-Reconstr.html, model after SCHETTINO & SCOTESE 2000. Continental crusts are light grey, opening oceanic trenches are coloured to dark grey, hotspot tracks are black

Aptian onward this area, together with the other areas of the Caribbean Subprovince, became an independent Province of the Tethyan Realm".

In the South Atlantic Province, strong endemism occured in the Aptian-Albian times (LEANZA 1970, FÖRSTER & SCHOLZ 1979; AGUIRRE-URRETA 1986; MEDINA & RICCARDI 2005), most of the ammonite species did not dispersed in great discances and not reported from Europe or the western Tethyan Realm.

Systematic descriptions

The systematics of Ancylocerataceae and Turrilitaceae superfamilies of Ancyloceratina subordo follow MONKS's (1999) system.

Ordo Ammonoidea ZITTEL, 1884
Subordo Phylloceratina ARKELL, 1950
Superfamily Phyllocerataceae ZITTEL, 1884
Family Phylloceratidae ZITTEL, 1884
Subfamily Phylloceratinae ZITTEL, 1884
Genus *Phylloceras* SUESS, 1865
Type species: *Ammonites heterophyllus* J. SOWERBY, 1820

Phylloceras **sp.**

Material. Six fragments in bad state of preservation.

Description. Eroded fragments with a typical phylloceratid sculpture, involute umbilicus and high whorl section.

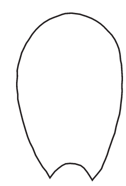
Discussion. Fragments are too eroded for specific identification.

Occurrence. The genus occurs in the condensed Late Aptian basal pockets of Tata Limestone Formation, otherwise the genus *Phylloceras* is known from the Berriasian to Maastrichtian with worldwide distribution.

Subgenus *Hypophylloceras* SALFELD, 1924
Type species: *Phylloceras onoense* STANTON, 1895

Phylloceras (Hypophylloceras) subseresitense **WIEDMANN, 1963**
Pl. I, Figure 1

*1963 *Phylloceras (Hypophylloceras) subseresitense* WIEDMANN, Pl. 14, Figure 9; Pl. 15, Figure 6; Text-Figures 41, 42, 43



Text-Figure 36. Whorl section of *Phylloceras (H.) subseresitense* WIEDMANN, 1963

Material. Well preserved internal moulds from three Tata localities, 14 specimens in total.

Description. Small and medium sized highly involute forms with paralell flattened lateral region. On the ventrolateral part slight striae can be observed. Whorl section is ellipticone (Text-Figure 36), suture cannot be observed.

Remarks. According to the diphylloid morphology of main saddles, WIEDMANN (1963) put the species into the *Phylloceras thetys* group.

Occurrence. The species occurs in the condensed Upper Aptian basal pockets of Tata Limestone Formation; otherwise WIEDMANN described the species from the Aptian of Mallorca.

Phylloceras (Hypophylloceras) **cf.** ***velledae*** **(MICHELIN, 1838)**
Pl. I, Figure 2

1841 *Ammonites Velledae* MICHELIN — D'ORBIGNY, p.280, Pl. 82, Figure 1–4
1872 *Ammonites velledae* MICHELIN — TIETZE, p. 134
non 1899 *Phylloceras Velledae* MICHELIN — ANTHULA, p. 95, Pl. 5, Figure 1
1902 *Amonites Velledae* MICHELIN — VON KOENEN, p. 37
1905 *Phylloceras velledae* MICHELIN — JACOB, p. 104
non 1907 *Phylloceras Velledae* MICHELIN — PERVINQUIÉRE, p. 52
1947 *Phylloceras velledae* MICHELIN in D'ORBIGNY — BREISTROFFER, p. 55
1957 *Phylloceras velledae* MICHELIN — ERISTAVI, p. 56, Pl. 2, Figure 21
non 1960 *Euphylloceras velledae* MICHELIN — DRUSCHICH & KUDRYAVTSEV, p. 252, Pl. 2, Figure 5
1961 *Phylloceras velledae* MICHELIN — ERISTAVI, p. 42, tab. 1, Figure 1
1963 *Ph. (H.) velledae* MICHELIN — WIEDMANN, p. 197, Text-Figures 48, 49, Pl. 11, Figure 1; Pl. 13, Figures 1, 2, 4; Pl. 19, Figure 1; Pl. 21, Figure 4
1967 *Euphylloceras velledae* MICHELIN — DIMITROVA, p. 22, Pl. 8, Figure 1
1968 *Ph. (H.) velledae* MICHELIN — WIEDMANN & DIENI, p. 25, Pl. 1, Figure 5
1987 *Ph. (H.) velledae* MICHELIN — IMMEL, p. 57, Pl. 1, Figure 3
1989 *Ph. (H.) velledae velledae* MICHELIN — FÖLLMI, p. 114, Pl. 1, Figure 10, 11
1995 *Ph. (H.) velledae* MICHELIN — VASICEK & RAKÚS, Pl. 22, Figure 1

Material. Four damaged internal moulds from Kálvária Hill and two well preserved specimens from Vájáriskola.

Measurement.

	D	H	W	U	W/H
1.	22	14.5(65)	8(36)	2(9)	0.55
2.	24	15(63)	10(42)	1.5(6)	0.66

Description. Small, involute forms with high aperture and deep umbilicus. Whorl section oval. On the ventral-ventrolateral sides of the moulds fine radial striae can be visible which apperently disappear towards the dorsal part. Suture lines cannot be observed.

Discussion. WIEDMANN (1963) created a *velledae*-group within the genus *Phylloceras* according to one diphylloid main saddle beside the other tetraphylloid ones. *Ph. (H.) velledae* can be easily confused with the adult specimens of *Ph. (H) cypris* FALLOT & TERMIER 1923. The separation of the two species is based on stronger involution and more differentiated suture of *Ph. (H.) velledae*. Hitherto in present material sutures cannot be studied and the author used open nomenclature. Hungarian specimens show great similarity to the subspecies of *Ph. morelianum* (D'ORBIGNY 1841) figured by WIEDMANN (1963).

Occurrence. The species occurs in the condensed Upper Aptian basal pockets of Tata Limestone Formation, otherwise known worldwide from Lower Albian – Cenomanian sediments.

Genus *Partschiceras* FUCINI, 1923
Type species: *Ammonites partschi* HAUER, 1854

Partschiceras baborense (COQUAND, 1880)
Pl. I, Figure 5, 6, 8

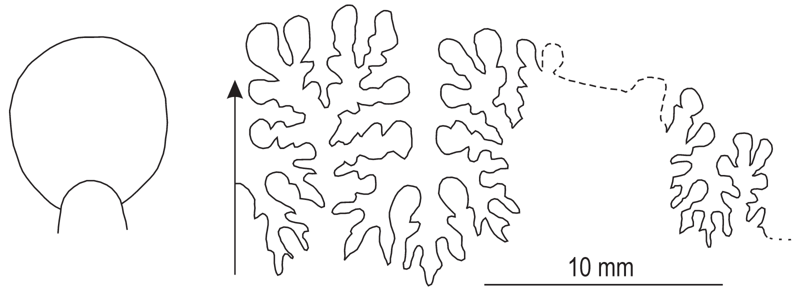
1842 *Ammonites rouyanus* D'ORBIGNY p. 362, Pl. 110, Figure 3–5
1872 *Ammonites rouyanus* D'ORBIGNY — TIETZE, p. 133, Pl. 9, Figure 7, 8
*1880 *Ammonites baborensis* COQUAND — p. 26
1899 *Phylloceras rouyanum* D'ORBIGNY — ANTHULA, p. 94
1907 *Phylloceras rouyanum* D'ORBIGNY — PERVINQUIERE, p. 56
1920b *Phylloceras baborense* COQUAND — FALLOT p. 17
1937 *Phylloceras baborense* COQUAND — COLLIGNON, Pl. 1, Figures 4, 5, 6
1962 *Phyllopachiceras baborense* COQUAND — COLLIGNON, p. 3, Figure 945
1963 *Partschiceras baborense* COQUAND — WIEDMANN, p. 243, Pl. 14, Figure 2, 4, 5; Pl. 16, Figure 1, 2; Pl. 21, Figure 5, 6; Text-Figure 59
1968 *Partschiceras baborense* COQUAND — WIEDMANN & DIENI, p. 27, Pl. 3, Figure 4; Pl. 4, Figure 11
1972 *Partschiceras baborense* COQUAND — VASICEK, Pl. 1, Figure 6
1977 *Phyllopachyceras baborense* COQUAND — KOTETISHVILI, p. 33, Pl. 7, Figure 4a, b
1979 *Partschiceras baborense* COQUAND — MARTINEZ, p. 243, Pl. 1, Figure 1a, b, c
1989 *Partschiceras baborense* COQUAND — FÖLLMI, p. 114, Pl. 1, Figure 14

Material. Well preserved internal moulds from all Tata localities, totally 26 fragments.
Measurement.
Kálvária Hill

	D	H	W	U	W/H
1.	30	16(53)	15(50)	–	0.94
2.	27	14(52)	13(48)	2(7)	0.93
3.	21	10(48)	10(48)	2(9)	1.00
4.	23	12(52)	12(52)	2(9)	1.00
5.	18	10(55)	10(55)	–	1.00

Description. Small, bubbled, rounded involute forms with narrow, deep umbilicus. The whorl section at adult stage is almost circular with maximun width at the mid-lateral side (Text-Figure 37). No ornamentation.

Discussion. The relation between *P. baborense* (COQUAND, 1880) and *P. rouyanum* (D'ORBIGNY, 1841) is full of confusions and misunderstandings. According to PERVINQUIÉRE (1907) and FALLOT (1910) the *baborense* and *rouyanum* are subspecies or variations of the same species, with slight differences of the whorl sections — maximum width at mid-lateral side at *baborense* and ventrolateral side at *rouyanum*. Later ERISTAVI (1957) rediscussed the question and put the two forms into two distinct species. Eristavi's separation was based on the height/width ratio of the whorl sections, which was between 0.87–0.98 at *P. baborense* but always above 1.0 at *P. rouyanum*. Later RENNGARTEN (1926) realised that the maximum width of the whorl section of the European specimens was at the dorsolateral side. This did not fit at all the distinctive parameters of the two species so instead he created a new subspecies (*baborense* var. *elliptica* RENNGARTEN 1926) for the European specimens.



Text-Figure 37. Whorl section and lobeline of *Partschiceras baborense* (COQUAND, 1880)

According to WIEDMANN (1963), the maximum height/width ratio seems to be changing during the ontogeny from the lateral part to the dorsolateral part, so the subspecies separation based on it is not correct. The specimens found in Hungary show good similarity to those described by WIEDMANN (1963).

Occurrence. The species occurs in the condensed Upper Aptian basal pockets of Tata Limestone Formation, otherwise known from the Upper Aptian deposits wordwide.

Subfamily Calliphylloceratinae SPATH, 1927b
Genus *Holcophylloceras* SPATH, 1927b
Type species: *Phylloceras mediterraneum* NEUMAYR, 1871

Holcophylloceras guettardi (RASPAIL, 1831)
Pl. I, Figures 3, 4, Pl. XIII, Figure 14

1841 *Ammonites Guettardi* RASPAIL — D'ORBIGNY, p. 169, Pl. 53, Figure 1–3
1872 *Ammonites guettardi* RASPAIL — TIETZE, p. 401
1899 *Phylloceras guettardi* RASPAIL — ANTHULA, Pl. 1, Figures 1–3
1907 *Phylloceras Guettardi* RASPAIL — PERVINQUIERE, p. 60
pars 1920b *Phylloceras guettardi* RASPAIL — FALLOT, p. 18, Pl. 1, Figure 1, 2
1937 *Phylloceras guettardi* (RASPAIL) — COLLIGNON, Pl. 1, Figure 1
1962 *Phylloceras (Salfeldiella) guettardi* (RASPAIL) — COLLIGNON, Figure 947
1971 *Salfeldiella guettardi* (RASPAIL) — KVANTALIANI, p. 13, Pl. 2, Figure 4
1975 *Holcophylloceras (Salfeldiella) guettardi* (RASPAIL) — FÜLÖP, p. 104
1989 *Sowerbyceras (Holcophylloceras) guettardi* RASPAIL — FÖLLMI, p. 114, Pl. 1. Figure 15

Material. 172 internal moulds in good preservation from all surface localities and a single specimen from Tatabánya Ta–1426 borehole at 230 m.

Measurement.

		D	H	W	U	W/H
Fazekas street						
	1.	23	11(47)	9(39)	–	0.81
	2.	23	10(43)	9(39)	3(13)	0.9
	3.	29	15(51)	11(37)	4(14)	0.74
Kálvária Hill						
	1.	33	17(51)	12(36)	4(13)	0.71
	2.	24	13(54)	10(41)	3(13)	0.77
Kékkő Quarry						
	1.	24	12(50)	–	3.8(15)	–
	2.	33	16(48)	–	4.5(13.5)	–
	3.	31	15(48)	–	5(16)	–
	4.	26	13(50)	–	4(15)	–

Description. Small, bubbled, involute forms with crater-like deep umbilicus. Whorl section slightly oval, maximum whorl height is at the lateral part. Characteristic S-shaped constrictions are well observed from the dorsal part towards the venter where they become slightly shallower. Sutureline is partly visible.

Occurrence. The species occurs in the condensed Upper Aptian basal pockets of Tata Limestone Formation, also reported from the Late Aptian – Early Albian sequence of the Vértessomló Siltstone Formation (Tatabánya Ta–1426 borehole). The species is known worldwide from Barremian to Cenomanian deposits.

Subordo Lytoceratina HYATT, 1889
Superfamily Lytocerataceae NEUMAYR, 1875b
Family Lytoceratidea NEUMAYR, 1875b
Genus *Lytoceras* SUESS, 1865
Type species: *Ammonites fimbriatus* J. SOWERBY, 1817a

Lytoceras sp.
Pl. I, Figure 7

Material. Six internal moulds from Kékkő Quarry and Fazekas street.

Description. Big and medium-sized specimens and fragments with characteristic evolute coiling and striae. Sutureline cannot be observed.

Occurrence. The genus occurs in the condensed Upper Aptian basal pockets of Tata Limestone Formation; otherwise *Lytoceras* was cosmopolitan from the Liassic to the Cenomanian times.

Superfamily Tetragonitaceae HYATT, 1900
Family Tetragonitidae HYATT, 1900
Genus *Tetragonites* KOSSMAT, 1895
Type species: *Ammonites timotheanus* PICTET, 1847
Subgenus *Tetragonites* KOSSMAT, 1895
Type species: *Ammonites timotheanus* PICTET, 1847

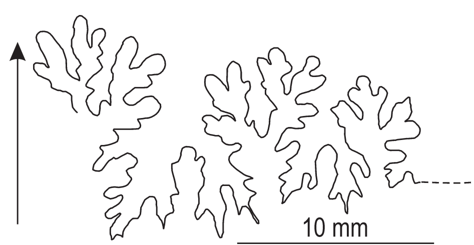
Tetragonites (Tetragonites) duvalianus (D'ORBIGNY, 1840)
Pl. I, Figure 11, Pl. XIII, Figure 7

*1840	*Ammonites Duvalianus* — D'ORBIGNY, p. 158, Pl. 50, Figures 4, 5
1899	*Ammonites duvalianus* D'ORBIGNY — ANTHULA, p. 99, Pl. 7, Figures 3 a, b
1905	*Tetragonites duvalianus* D'ORBIGNY — JACOB, p. 401
pars 1960	*Tetragonites duvalianus* D'ORBIGNY — DRUSCHICH & KUDRYAVTSEV, p. 261, Pl. 8, Figure 4 (= *T. heterosulcatum* ANTHULA, 1899), Figure 5, P1. 9, Figure 4 (= *Kossmatella agassiziana* (PICTET, 1847))
1967	*Tetragonites duvali* D'ORBIGNY — DIMITROVA, p. 32, Pl. 11, Figures 2, 2a
1967b	*Eotetragonites duvali* D'ORBIGNY — MURPHY, Pl. 1, Figures 2, 3
1975	*Eotetragonites duvalianus* D'ORBIGNY — FÜLÖP, p. 104, Pl. 49, Figures 4–8, 12–13
1988	*Eogaudryceras (Eotetragonites) duvalianum duvalianum* D'ORBIGNY — STOYKOVA & IVANOV, p. 8, Pl. 1, Figure 7

Material. One of the most abundant Aptian species in Hungary, with 121 internal moulds in various state of preservation from all localities. Also determined from Tatabánya Ta–1426 borehole at 221,3 m.

Measurement.		D	H	W	U	W/H
Fazekas street						
	1.	29	12(41)	–	11(38)	–
Vájáriskola						
	1.	27	10(37)	11(41)	11(41)	1.1
	2.	30	11(37)	13(43)	13(43)	1.18
Kálvária Hill						
	1.	46	–	24(52)	18(39)	–
	2.	40	15(37)	21(52)	-	1.4
	3.	33	13(39)	–	14(42)	–
	4.	36	–	–	14(39)	–
	5.	37	–	17(46)	15(41)	–
	6.	35	12.5(36)	–	15(43)	–

Description. Medium sized specimens with moderate involution. Ventral part wide, whorl section depressed, maximum whorl size at outer dorsolateral side, dorsal edge is almost horizontal. Strong, almost radial constrictions run from the dorsal towards the ventral part, they can be prorsiradiate on the venter. Lateral part between two constrictions could be slightly convex. The number of the constrictions on the last whorl is 9–11. Suture is well visible (Text-Figure 38).



Text-Figure 38. Part of the suture of *Tetragonites duvalianus* ANTHULA, 1899

Discussion. Specimens described in this paper are the most similar to those ones were described by ANTHULA (1899). *Tetragonites heterosulcatum* ANTHULA, 1899 has wider venter, less dense ribs and a higher angle of constrictions than of *T. duvalianus*, so the identification of fragmented specimens could be sure on the basis of these features.

Occurrence. The species occurs in the condensed Upper Aptian basal pockets of Tata Limestone Formation, otherwise *T. duvalianus* was abundant in Southern France, Switzerland, Georgia and the Caucasus and the Balkhan in the *Cheloniceras (Epicheloniceras) subnodosocostatum*, *Parahoplites melchioris* and *Nolaniceras nolani* Zones of Gargasian and Clansayesien.

Tetragonites (Tetragonites) heterosulcatum ANTHULA, 1899
Pl. I, Figures 9, 10

*1899 *Lytoceras (Tetragonites) heterosulcatum* ANTHULA, p. 99, Pl. 7, Figure 4a–c, 5a–b
1907 *Lytoceras (Tetragonites) heterosulcatum* ANTHULA — PERVINQUIERE, p. 73
1960 *Tetragonites heterosulcatus* ANTHULA — DRUSCHICH & KUDRYAVTSEV, Pl. 8, Figures 3a, b, 4
1967 *Tetragonites heterosulcatus* ANTHULA — DIMITROVA, p. 31, Pl. 11, Figures 1, 1a
1967b *Tetragonites heterosulcatus* ANTHULA — MURPHY, p. 32, Figure 14
1971 *Tetragonites heterosulcatus* ANTHULA — KVANTALIANI, p. 22, Pl. 3, Figure 4
1975 *Eotetragonites heterosulcatus* ANTHULA — FÜLÖP, p. 104, Pl. 49, Figure 14, 15
1977 *Tetragonites hetrosulcatus* ANTHULA — KOTETISHVILI, p. 35, Pl. 7, Figure 7
1977a *Tetragonites* (?) *heterosulcatus* ANTHULA — KENNEDY & KLINGER, p. 152, Figure 1 a–f

Material. 47 fragments and hollow internal moulds from Kálvária Hill, Vájáriskola and Márvány Quarry localities.
Measurements.

		D	H	W	U	W/H
Vájáriskola						
	1.	30	13(43)	14(46)	13(43)	1.08
	2.	–	–	–	12	–
Kálvária Hill						
	1.	29	11(38)	12(41)	11(38)	1.1
	2.	44	17.5(40)	23(52)	18(41)	1.35
	3.	25	9(36)	11(44)	10(40)	1.22

Description. Form and shape is similar to *T. duvalianus* (D'ORBIGNY 1840). Constrictions on *T. heterosulcatum* are steeper, straight and slightly prorsiradiate on the lateral region and very shallow on venter, if they cross it at all. The lateral part between the two constrictions is always flat. The number of the constrictions on last whorl is 7–10, juveniles can bear shallow constrictions.

Remarks. At some cases constrictions are do not cross the venter, as it could be observed on specimens figured by DRUSCHICH & KUDRYAVTSEV (1960).

Occurrence. The species occurs in the condensed Upper Aptian basal pockets of Tata Limestone Formation otherwise *T. heterosulcatum* is a characteristic fossil of the *Nolaniceras nolani* Zone distributed worldwide.

Subfamily Gabbioceratinae BREISTROFFER, 1953
Genus *Jauberticeras* JACOB, 1908
Type species: *Ammonites jaubertianus* D'ORBIGNY, 1850

Jauberticeras jaubertianum (D'ORBIGNY, 1850)
Pl. I, Figures 12, 13

1899 *Lytoceras latericarinatum* ANTHULA, p. 101, Pl. 7, Figures 2 a–c
1907 *Ammonites jaubertianus* D'ORBIGNY — PERVINQUIÉRE, p. 331.
1908 *Lytoceras (Jaubertella) Jaubertianum* D'ORBIGNY — JACOB, p. 17, Pl. 2, Figures 13, 14
non 1908 *Lytoceras (Jaubertella) Jaubertianum* D'ORBIGNY — JACOB, p. 17, Pl. 2, Figure 15 (=*Gabbioceras* sp.)
1908 *Lytoceras (Jaubertella) latericarinatum* ANTHULA — JACOB, p. 17, Pl. 2, Figure 17
1913 *Lytoceras (Jaubertella) jauberti* D'ORBIGNY — KILIAN, Pl. 12, Figure 7a, b
1920b *Jaubertella jaubertiana* D'ORBIGNY — FALLOT, p. 25
non 1960 *Jaubertella latericarinata* (D'ORBIGNY) — DRUSCHICH & KUDRYAVTSEV, p. 261, Pl. 9, Figures 1a, b
1962a *Jauberticeras jaubertianum* (D'ORBIGNY) — WIEDMANN, p. 25
1967a *Jauberticeras jaubertianum* (D'ORBIGNY) — MURPHY, p. 604, Pl. 64, Figure 20–24
1975 *Gabbioceras (Jauberticeras) latericarinatum* (ANTHULA) — FÜLÖP, p. 104
1977b *Jauberticeras jaubertianum* (D'ORBIGNY) — KENNEDY & KLINGER, p. 2, Figures 1a–g

Material. Three fragmented, but well preserved internal moulds from Fazekas street and Vájáriskola localities.

Description. Small, cadicone forms with deep, wide umbilicus and subtrapezoidal whorl section. The rounded venter and the slightly concave lateral part form sharp ventrolateral edge. On the ventral region slight striae can be visible. Suture cannot be observed.

Remarks. J. jaubertianum can be characterized with slight striae appearing mainly on the umbilical wall or on the ventral part of well preserved specimens. Hungarian specimens are well preserved but striae cannot visible. According to ANTHULA (1899), the presence of the ornamentation "is just partly depending on preservation state of the specimens", he interpreted the ornamentation as the effect of the ontogeny. During the ontogeny, the ventral part is also getting more rounded (MURPHY 1967a). Keep these two points in view, it should be pointed out the Hungarian specimens are not completely adults. The relationship of "*Ammonites jaubertianus* D'ORBIGNY 1851" and "*Lytoceras latericarinatum* ANTHULA 1899" was rather confused. WIEDMANN (1962a) accepted the separation of the two species based on the presence of ornamentation. MURPHY (1967a) rediscussed the relation of the two species and merged them on the basis of the similar sutures, and proposed the name of *A. jaubertianum* as the senior synonym. The present work follows MURPHY's (1967a) taxonomy on the description of Gabbioceratinae subfamily.

Occurrence. The species occurs in the condensed Upper Aptian basal pockets of Tata Limestone Formation, otherwise known from the Gargasian to Lower Albian of Europe, North Africa, Caucasus, Zululand and Madagascar.

Genus *Gabbioceras* HYATT, 1900
Type species: *Ammonites batesi* GABB, 1869

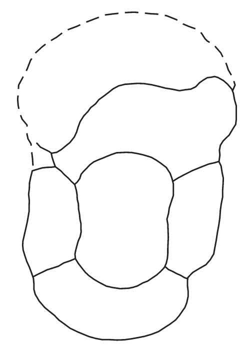
Gabbioceras michelianum (D'ORBIGNY, 1850)
Pl. I, Figure 14

1908 *Lytoceras (Jaubertella) micheliana* D'ORBIGNY — JACOB, p. 18, Pl. 2, Figure 19
1962a *Jauberticeras michelianum* D'ORBIGNY — WIEDMANN, p. 33
1967a *Gabbioceras michelianum* D'ORBIGNY — MURPHY, p. 602, Pl. 64, Figures 6, 7, 12, 13, 17, 18
1975 *Gabbioceras micheliana* D'ORBIGNY — FÜLÖP, p. 104

Material. Two internal moulds from Fazekas street and Vájáriskola localities.

Description. Small, cadicone forms with deep, wide umbilicus. The umbilicus, compared to *Jauberticeras*, is shallower and less wide. Ventral region is rounded just as the ventral edge (Text-Figure 39), which is the other well observed feature different from *Jauberticeras*. No ornamentation is visible, suture cannot be studied.

Occurrence. The species occurs in the condensed Upper Aptian basal pockets of Tata Limestone Formation. MURPHY (1967a) reported the species from the Gargasian of Texas, mentioning that exact stratigraphic position of the European specimens is unknown.



Text-Figure 39. Whorl section of *Gabbioceras michelianum* (D'ORBIGNY, 1850)

Subordo Ammonitina HYATT, 1889
Superfamily Desmocerataceae ZITTEL, 1895
Family Desmoceratidae ZITTEL, 1895
Subfamily Puzosiinae SPATH, 1922b
Genus *Valdedorsella* BREISTROFFER, 1947
Type species: *Desmoceras akuschaense* ANTHULA, 1899

Valdedorsella getulina (COQUAND, 1880)
Pl. I, Figure 15, 16, 17, Pl. III, Figure 24

*1880 *Ammonites getulinus* COQUAND, p. 18
1899 *Desmoceras akuschaense* ANTHULA, p. 104, Pl. 8, Figure 2a–c
1905 *Desmoceras akuschaense* ANTHULA — JACOB, p. 402, Pl. 12, Figure 1
1907 *Puzosia Getulina* COQUAND — PERVINQUIERE, p. 151, Pl. 6, Figure 16
1920a *Puzosia Getulina* COQUAND — FALLOT, p. 45, Pl. 2, Figure 7–10
1960 *Valdedorsella akuschaense* ANTHULA — DRUSCHICH & KUDRYAVTSEV, p. 301, Pl. 44, Figures 3a, b
1962 *Valdedorsella getulina* COQUAND — COLLIGNON, p. 33, Figure 977
1968 *Valdedorsella getulina* COQUAND — WIEDMANN & DIENI, p. 108
1975 *Valdedorsella getulina* (COQUAND) — FÜLÖP, p. 104, Pl. 49, Figure 1–5
1982 *Valdedorsella getulina* ANTHULA — RENZ, p. 22, Pl. 2, Figure 19a–c, Text-Figures 10a, b
1990 *Valdedorsella akuschaense* ANTHULA — STOYKOVA & IVANOV, p. 60, Pl. 1, Figure 7

Material. Huge amount of well preserved internal moulds from all localities, totally 128 specimens.

Measurement.	D	H	W	U	W/H
Kékkő Quarry					
1.	28	11(39)	13(46)	7(25)	1.18
2.	29	13(45)	14(48)	8(28)	1.07
3.	25	11(44)	13(52)	6(24)	1.18
Kálvária Hill					
4.	26	11(42)	14(53)	7(26)	1.27
5.	26	11(42)	14(53)	7(26)	1.27
6.	25	10(40)	13(52)	6(24)	1.30
7.	24	–	13(54)	–	–
8.	21	9(42)	13(62)	–	1.44
9.	18	8(44)	10(55)	4(22)	1.25
10.	16	7(44)	10(62)	4(25)	1.42
11.	16	–	10(62)	4(25)	–

Fazekas street					
12.	23	10(43)	14(61)	6(26)	1.40
13.	28	11(39)	15(54)	7(25)	1.36
14.	22	10(45)	14(63)	6(27)	1.40

Description. Bubbled, rounded involute forms with deep umbilicus and rounded umbilical edge. Whorl section highly depressed with maximum width at the outer part of the dorsolateral region. Venter is slighly rounded or flat, the species characterized by sinuous constrictions, numerically 5–6 on the last whorl. In between the constrictions, fine striae starts from the lateral region, these can be observed on the well preserved specimens, mainly from Kálvária Hill.

Discussion. Hungarian specimens show good similarity to those described by ANTHULA (1899), with the slight difference that on the Hungarian specimens' striae start at the lateral side. PERVINQUIERE (1907) pointed out that five constrictions per whorl are usual and the shape of constrictions is tending to be more sinuous during the ontogeny. This seem to fit the Hungarian specimens although some cases they have six constrictions per whorl.

Occurrence. The species occurs in the condensed Upper Aptian basal pockets of Tata Limestone Formation, otherwise the species was common in the Aptian sediments wordwide.

Genus *Melchiorites* SPATH, 1923
Type species: *Ammonites melchioris* TIETZE, 1872

Melchiorites sp. indet.

Material. Poorly preserved specimens in great number from all localities.

Description. Small, compressed slightly evolute specimens. Curling of the last whorl is irregular that gives ellipticoneic character to the form. Three to four sinuous constrictions per whorl can be poorly visible.

Discussion. Due to heavy reworking, the specific characters as the shape of the constrictions or other type of the ornamentation cannot be visible.

Occurrence. The genus occurs in the condensed Upper Aptian basal pockets of Tata Limestone Formation, otherwise it is known from Barremian to Albian of the Mediterranean region.

Melchiorites melchioris (TIETZE, 1872)
Pl. III, Figures 2, 3, 5, 6, Pl. XIII, Figure 3

*1872 *Ammonites melchioris* TIETZE, p. 135, Pl. 9, Figures 9, 10.
1907 *Puzosia (Latidorsella?) Melchioris* (TIETZE) — PERVINQUIERE, p. 147, Pl. 6, Figure 15
pars 1913 *Desmoceras melchioris* (TIETZE) — KILIAN, p. 335, Pl. 12, fig 5, non Pl. 10, Figure 2
1920a *Puzosia* cf. *melchioris* (TIETZE) — FALLOT, p. 49, Text-Figure 21
1920c *Puzosia melchioris* (TIETZE) — FALLOT, p. 254, Pl. 3, Figure 5
1920c *Puzosia melchioris* (TIETZE) var. alpina KILIAN — FALLOT, p. 256, Pl. 3, Figure 6
1962 *Melchiorites melchioris* (TIETZE) — COLLIGNON, p. 36, Figure 980
1968 *Melchiorites melchioris* (TIETZE) — WIEDMANN & DIENI, p. 109, Pl. 10, Figure 4
1975 *Melchiorites melchioris* (TIETZE) — FÜLÖP, p. 104, Pl. 49, Figure 13
pars 1982 *Melchiorites melchioris* (TIETZE) — BRAGA et al., p. 697, 699; Pl. 1, Figures 9, 12
1982 *Melchiorites melchioris* (TIETZE) — RENZ, p. 23, Pl. 2, Figures 20a, b

Material. 85 internal moulds in various states of preservation from all surface locality and a single specimen from Tatabánya Ta–1426 borehole at 265 m.

Measurement.	D	H	W	U	W/H
Fazekas street					
1.	–	14	14	7	1.00
2.	34	16(47)	13(38)	–	0.81
3.	24	9(38)	7(29)	8(33)	0.78
4.	19	7(38)	6(32)	6(32)	1.00
5.	38	18(47)	–	11(30)	–
Kálvária Hill					
6.	35	16(45)	11(31)	11(31)	0.69
7.	30	14(46)	10(33)	9(30)	0.90

Description. Small elliptical forms with wide umbilicus and oval whorl section. The species is characterized by the lack of ornamentation and by well visible radial, almost straight constrictions, 3–4 per whorl. Constrictions are absent or not visible on inner whorls. Suture cannot be observed.

Discussion. Some specimens have bullae in between constrictions, which derived from the umbilical edge and getting weaker at the lateral flank. The Hungarian specimens show good resemblance to the type specimen of TIETZE (1872). On the specimens of BRAGA et al. (1982) the shape of constictions are hardly visible.

Occurrence. The species occurs in the condensed Late Aptian basal pockets of Tata Limestone Formation, also reported from the Upper Aptian of the Vértessomló Siltstone Formation (Tatabánya Ta–1426), otherwise the species distributed worldwide in the Barremian and Aptian.

Melchiorites emerici (RASPAIL, 1831)
Pl. III, Figures 1, 4

1883 *Haploceras emerici* RASPAIL — UHLIG, p. 221, 224, 232, Pl. XVII, Figure 13
1920c *Puzosia emerici* RASPAIL — FALLOT, p. 247–251
1920c *Puzosia emerici* RASPAIL var. *strigosa* FALLOT — FALLOT, p. 251
1920c *Puzosia emerici* RASPAIL var. *alpina* KILIAN — FALLOT, p. 253

Material. 10 well preserved internal moulds from Márvány Quarry locality.

Description. Similar to *M. melchioris* (TIETZE, 1872) apart from the lateral sinuousity of the constrictions.

Occurrence. The species occurs in the condensed Upper Aptian basal pockets of Tata Limestone Formation, otherwise the species distributed worldwide in the Barremian and Aptian.

Subfamily Silesitoidinae BREISTROFFER, 1953
Genus *Silesitoides* SPATH, 1925d
Type species: *Silesites escragnollensis* JACOB, 1908

Silesitoides sp.

Material. 67 specimens and fragments from all Tata localities, mostly in poor state of preservation.

Description. Involute compressed forms, 5–6 centimetres in diameter. The ornamentation is hardly studied due to the poor preservation, but constrictions are slightly visible. No other elements or suture visible.

Remarks. The *Silesitoides* assemblage show different morphological features, but the state of preservation is poor for more exact identification.

Occurrence. The genus occurs in the condensed Upper Aptian basal pockets of Tata Limestone Formation, otherwise known from the Upper Aptian to Middle Albian deposits of Poland, England, France, the Baleares and North Africa.

Silesitoides superstes (JACOB, 1908)
Pl. II, Figures 4, 10, Pl. IV, Figure 2

*1908 *Silesites superstes* JACOB, p. 42, Pl. II, Figures 23a, b
2000 *Silesitoides superstes* (JACOB, 1908) — KENNEDY et al., p. 664, Figures 43 i, j, m (refigured holotype)

Material. Six poorly preserved internal moulds from Kékkő Quarry and Fazekas street localities.

Description. The two figured specimens are small, serpenticone, evolutee forms with shallow umbilicus and slightly compressed whorl section. Constrictions are widely separated, 4–5 per whorl. At specimen No. 10, delicate ribs start from the outer flank and cross the venter straight but the ornamentation is getting weaker during the ontogeny. On specimen No. 4, no ornamentation is visible at any stage of growth apart from the constrictions.

Remarks. KENNEDY (2000) re-illustarted the holotype of JACOB (1908) and there is no visible ornamentation apart from the constrictions.

Occurrence. The species occurs in the condensed Upper Aptian basal pockets of the Tata Limestone Formation, otherwise known from Lower – Middle Albian deposits of Poland, North Arfica, the Baleares and France.

Silesitoides escragnollensis (JACOB, 1908)
Pl. II, Figures 6, 7, 8, 9, 11, 12, 13

*1908 *Silesites escragnollensis* JACOB, p. 43, Pl. II, Figures 20a, b, 21a, b
1975 *Puzosiella* sp. — FÜLÖP, p. 104, Pl. 50, Figure 9
2000 *Silesitoides escragnollensis* (JACOB, 1908) — KENNEDY et al., p. 664, Figures 43 o, p

Material. 59 specimens from Kálvária Hill, Kékkő Quarry and Márvány Quarry localities.

Measurement.	D	H	W	U	W/H
1.	50	15(30)	10(20)	26(52)	0.38
2.	62	17(27)	14(22)	35(56)	0.4
3.	52	15(29)	12(23)	28(54)	0.42

Description. Five to six centimetres big, serpenticone, evolute forms with shallow umbilicus and rounded umbilical wall. Whorl section is slightly compressed. Presence of strong, collared constrictions is characteristic feature of the genus. Constrictions, 10–12 on the last whorl, are straight in the lateral region and tending to be prorsiradiate on the venter. In between the constrictions, there are bullae that are flat on the dorsolateral region and getting stronger on the outer lateral part without reaching the ventral region. Suture cannot be observed.

Discussion. The Hungarian specimens show greater resemblance to *S. escragnollensis* (JACOB 1908). There are other five described species (*S. sulcobifurcatus* REYNES 1876, *S. thos* PERVINQUIERE 1907, *S. superstes* JACOB 1908, *S. palmensis* FALLOT & TERMIER 1923, *S. tatricus* PASSENDORFER 1930). *S. tatricus* (PASSENDORFER 1930) differs from *escragnollensis* only in the more rounded whorl section as MARCINOWSKI & WIEDMANN (1990) emphasized it.

Occurrence. Apart from the Eperkés Hill, the species is known from each surface locality of the condensed Upper Aptian basal pockets of Tata Limestone, Hungary. Otherwise the species is known from France and England.

Genus *Parasilesites* IMLAY, 1959
Type species: *Parasilesites bullatus* IMLAY, 1959

***Parasilesites kilianiformis* (FALLOT, 1910)**
Pl. II, Figures 2, 3, 5, Pl. XIII, Figure 6, Pl. XXV, Figure 4

*1910 *Puzosia nolani* var. *kilianiformis* — FALLOT, p. 26, Pl. 1, Figure 5
1920a *Puzosia nolani* var. *kilianiformis* — FALLOT, p. 46, Pl. 3, Figure 3
1968 *Parasilesites kilianiformis* FALLOT — WIEDMANN & DIENI, p. 124, Pl. 10, Figure 7
1969 *Puzosiella minuta* gen. et sp. nov. — EGOIAN, p. 174, Pl. 16, Figures 8, 9, 10
1975 *Puzosiella minuta* EGOIAN — FÜLÖP, p. 104, Pl. 50, Figure 8
1982 *Parasilesites kilianiformis* (FALLOT) — RENZ, p. 37, Pl.5, Figure 10 a, b
1990 *Parasilesites kilianiformis* FALLOT — MARCINOWSKI & WIEDMANN, p. 58, Pl. 7, Figure 4

Material. 10 specimens from Tata localities and a single specimen is from Tatabánya Ta–1426 borehole at 223.3 m.

Description. Small, slightly ellipticone, evolutee forms characterized with prorsiradiate constrictions and dense, slight ventrolateral ribs, which start on the mid lateral region and crosses the venter prorsiradiately.

Discussion. According to the first description, it is difficult to separate *P. kilianiformis* FALLOT, 1910 from *Parasilesites kiliani* FALLOT, 1910. FALLOT (1920a) figured a *P. kilianiformis* (*Puzosia Nolani* var. *Kilianiformis*) which is, according to the first description, shows good morphological similarity to *Silesitoides superstes* (JACOB, 1908).

Occurrence. The species is known from each surface locality of the condensed Upper Aptian basal pockets of the Tata Limestone Formation, reported from the Upper Aptian – Lower Albian of the Vértessomló Siltstone Formation (Tatabánya Ta–1426), otherwise it is known from the Lower Albian of Mallorca and Middle Albian of the "Mediterranean" region.

Subfamily Beudanticeratinae BREISTROFFER, 1953
Genus *Beudanticeras* HITZEL, 1902
Type species: *Ammonites beudanti* BRONGNIART, 1822
Subgenus: *Beudanticeras* HITZEL, 1902
Type species: *Ammonites beudanti* BRONGNIART, 1822

***Beudanticeras (Beudanticeras) beudanti* (BRONGNIART, 1822)**
Pl. III, Figures 9, 10, 11, 12, 13, Pl. XIV, Figure 8; Pl. XIX, Figure 1, Pl. XXI, Figure 1, Pl. XXV, Figures 2, 6

1968 *Beudanticeras beudanti* (BRONGNIART, 1822) — WIEDMANN & DIENI, p. 128, Pl. 11, Figure 10
1979 *B. beudanti* (BRONGNIART, 1822) — SCHOLZ, p. 68, Pl. 13, Figures 1, 6
1990 *Beudanticeras beudanti* (BRONGNIART, 1822) — MARCINOWSKI & WIEDMANN, p. 59, Pl. 7, Figure 1
1993 *Beudanticeras beudanti* (BRONGNIART, 1822) — KENNEDY, p. 235–238, Figure 1, 2 (refigured lectotype)

Material. A dozen of poorly preserved specimens from all surface localities of Tata. Also reported from the Upper Albian of Tilos Forest (see the Albian chapter).

Description. Rather involute, big, compressed, ellipticone specimens with narrow umbilicus and high, flattened flanks. The outer lateral whorl is plicate, with the alternation of longer and shorter ones, which both cross the venter.

Discussion. The species differs from *B. (B.) convergens* (JACOB, 1908) in the presence of ornamentation.

Occurrence. The species occurs in the condensed Upper Aptian basal pockets of the Tata Limestone Formation, also documented from the Upper Albian condensed basal beds of the Pénzeskút Marl Formation; otherwise it is reported from Europe.

Beudanticeras(Beudanticeras) convergens **(JACOB, 1908)**
Pl. III, Figures 7, 8, Pl. XIII, Figure 5

*1908 *Desmoceras (Uhligella) convergens* JACOB, p. 29, Pl. 2, Figure 24, 25, 26
1961 *Pseudorbulites convergens* JACOB — CASEY, p. 145, 146; Pl. 46d, g
1968 *Beudanticeras convergens* JACOB — WIEDMANN & DIENI, p. 126–127
1989 *Beudanticeras convergens* JACOB — FÖLLMI, p. 138, Pl. 9, Figures 10, 11
2000 *Beudanticeras convergens* JACOB — KENNEDY et al, p. 665, Figures 37j, 41j–l, 42w–h', 43a–h, 47p, q, 48a

Material. 11, poorly preserved internal moulds from Vájáriskola locality, and a single specimen from Tatabánya Ta–1426 borehole at 299.2 — 319.0 m.

Measurements.	D	H	W	U	W/H
Vájáriskola					
7.	25	12(48%)	10(40)	6(24)	0.83
8.	22.5	–	–	5(22)	–
16.	50	24(48)	15(30)	12(24)	0.63
17.	40	19(48)	–	18(45)	–

Description. Characteristically ellipticone very involute forms, with high compressed whorl section and flattened, subparallel flanks. The internal mould is smooth, no ornamentation is visible. No suture is visible.

Discussion. Specimens found in Hungary are show good similarity to the first description of JACOB (1908) and specimens described by FÖLLMI (1989) from Vorarlberg.

Occurrence. The species occurs in the condensed upper Late Aptian basal pockets of the Tata Limestone Formation, reported from the Upper Aptian – Lower Albian of the Vértessomló Siltstone Formation (Tatabánya Ta–1426), otherwise reported from the Upper Aptian – Lower Albian deposits of Vorarlberg, France and Poland.

Genus *Zuercherella* CASEY, 1954

Type species: *Desmoceras zuercheri* JACOB & TOBLER, 1906

Zuercherella zuercheri **JACOB & TOBLER, 1906**
Pl. III, Figures 21, 22, 23.

*1906 *Desmoceras zuercheri* JACOB & TOBLER, 1906, p. 9, Pl. 2, Figure 2
1920a *Uhligella zürcheri* JACOB & TOBLER — FALLOT, p. 261, Pl. 3, Figure 7
1954 *Zürcherella zürcheri* JACOB & TOBLER — CASEY, p. 112
1968 *Zürcherella zürcheri* JACOB & TOBLER — WIEDMANN & DIENI, p. 130, Pl. 12, Figure 1
1982 *Beudanticeras (Zuercherella) zuercheri* JACOB & TOBLER — RENZ, Pl. 1, Figure 20

Material. Three specimens from Tata.

Description. Discoidal, involute forms with slight, sinuous ribs running from the umbilical edge towards to the rounded venter. Some ribs tend to be wider and stronger on the outer flank and at the venter. Slight intercalated ribs also appear.

Discussion. The shape of the conch is similar to Uhligella, but *Zuercherella* has weaker ribbing with smooth intercalated ribs.

Occurrence. The species occurs in the condensed Upper Aptian basal pockets of the Tata Limestone Formation, otherwise the species known from Upper Aptian deposits worldwide.

Genus *Uhligella* JACOB, 1908

Type species: *Desmoceras clansayense* JACOB, 1905

Uhligella clansayensis **(JACOB, 1905)**
Pl. III, Figures 15, 19

*1905 *Desmoceras clansayense* JACOB, p. 403, Pl. XII, Figures 2a, 2b; 3a, 3b
1975 *Uhligella* sp. — FÜLÖP, p. 104, Pl. 50, Figure 12

Material. 21 poorly preserved internal moulds from all Tata localities.

Measurements.

	D	H	W	U	W/H
Fazekas street					
2.	21	9(43)	7(33)	6(29)	0.78
4.	32	16(50)	11(34)	8(25)	0.69
13.	46	22(48)	15(33)	10(22)	0.68
14.	30	14(47)	11(37)	8(27)	0.78

Description. Involute, more or less circular forms with high aperture, which has the maximum width at the dorsolateral side. Very slight, sinuous ribs start at the ventrolateral part and cross the venter continuously. On the lateral side there is no ornamentation at all.

Discussion. The species can be determined by the lack of lateral ornamentation and ellipticone coiling, although already FALLOT (1920b) remarked that apart from the different stratigraphical range, almost nothing suggests the separation of *Uhligella boussaci* FALLOT (Lower Albian) and *Uhligella clansayensis* JACOB (Upper Aptian), because their sutures are almost identical. The present author accepts FALLOT's opinion and handles *U. clansayensis* JACOB and *U. boussaci* FALLOT as the same species and for the reason of priority keeps *clansayensis* as the valid specific name. The species also resembles to *Beudanticeras (B.) beudanti* (BRONGNIART 1822) on the basis of the ornamentation, but the smaller diameter, the less ellipticone sculpture and the more involution makes difference, although WIEDMANN & DIENI (1968) proposed to include genus *Uhligella* JACOB, 1908 in *Beudanticeras* HITZEL, 1902. SCHOLZ (1979) and MARCINOWSKI & WIEDMANN (1990) also discussed the problem and concluded that the two genera are separated.

Occurrence. The species occurs in the condensed Upper Aptian basal pockets of the Tata Limestone Formation, otherwise it is known from Upper Aptian deposits of Europe and North Africa.

Uhligella balmensis JACOB, 1908

Pl. III, 14, 16, 17, 18, 20.

*1908 *Desmoceras (Uhligella) balmensis* JACOB, p. 33, Figure 20, Pl. 3, Figures 6–9
1963 *Uhligella balmensis* JACOB — COLLIGNON, p. 71, Pl. 267, Figure 1162
1963 *Uhligella balmensis* JACOB var. pingus COLLIGNON — COLLIGNON, p. 74, Pl. 268, Figure 1168
1990 *Uhligella balmensis* JACOB — MARCINOWSKI & WIEDMANN, p. 61, Pl. 6, Figure 8

Material. 5 well preserved internal moulds from Tata.

Description. Discoidal or slightly ellipticone forms with very stong bullae, 6–8 per whorl. Bullae start from the umbilical edge and crosses over the venter continuously. Intercalated ribs appear; they are strong and also pass the venter. Suture cannot be observed.

Discussion. The specimens show good resemblance to JACOB's (1908) first description except that the bullae are not sinuous. A little stronger ornamentation makes difference from the similar form of *U. rebouli* JACOB, 1908, although JACOB (1908) mentioned similarities between "*U. rebouli* JACOB, 1908 and *U. walleranti* JACOB, 1908 besides *U. balmense* JACOB, 1908 and *Pachydiscus* spp.". According to the same stratigraphic position and morphology, *U. balmensis* and *U. rebouli* can be interpreted as intraspecific variations of one species but without further studies of the holotypes it cannot be proved.

Occurrence. The species occurs in the condensed Upper Aptian basal pockets of the Tata Limestone Formation, otherwise known from the Lower Albian of France, Switzerland, Poland and the Middle Albian of Madagascar.

Subfamily Desmoceratinae ZITTEL, 1895
Genus *Desmoceras* ZITTEL, 1884
Type species: *Ammonites latidorsatus* MICHELIN, 1838
Subgenus *Desmoceras* ZITTEL, 1885
Type species: *Ammonites latidorsatus* MICHELIN, 1838

Desmoceras (Desmoceras) latidorsatum (MICHELIN, 1838)

Pl. III, Figure 25, Pl. XIV, Figure 10, Pl. XIX, Figure 3, 4, Pl. XXVIII, Figure 6, Pl. XXVI, Figure 1, 2

1908 *Desmoceras (Latidorsella) latidorsatum* MICHELIN — JACOB, Pl. 4, Figure 10, 11, 13; Pl. 5, Figure 1
1908 *Desmoceras (Latidorsella) latidorsatum* MICHELIN var. *aplatie* JACOB — JACOB, Pl. 5, Figure 2
1963 *Desmoceras latidorsatum* MICHELIN — COLLIGNON, p. 84, Pl. 273, Figure 1176, 1178, 1179
1963 *Desmoceras latidorsatum* MICHELIN var. *inflata* BREISTROFFER — COLLIGNON, p. 84, Figure 1177
1963 *Desmoceras latidorsatum* MICHELIN var. *medida* JACOB — COLLIGNON, p. 84, Pl. 273, Figure 1180
1975 *Desmoceras falcistriatum* (ANTHULA) — FÜLÖP, p. 104
1979 *Desmoceras latidorsatum* MICHELIN — SCHOLZ, p. 61–62
1989 *Desmoceras latidorsatum* MICHELIN — FÖLLMI, p. 135, Pl. 8, Figure 2, 3, 4
1990 *Desmoceras (Desmoceras) latidorsatum latidorsatum* (MICHELIN) — MARCINOWSKI & WIEDMANN, Pl. 7, Figure 2
1990 *Desmoceras (Desmoceras) latidorsatum inflatum* BREISTROFFER — MARCINOWSKI & WIEDMANN, Pl. 7, Figure 3

Material. 13 poorly preserved internal moulds and fragments from Tata, and several specimens from Tilos Forest as well.

Description. Bubbled specimens with deep umbilicus and depressed whorl section with moderate involution. Sinuous constrictions start from the umbilical edge and cross the venter straight. No other ornamentation or the suture is visible.

Discussion. The specimens, despite the bad state of preservation, can be identified quite well on the basis of the bubbled shape and the well visible constrictions although the high variability of the species is well known (WIEDMANN & DIENI 1968; MARCINOWSKI & WIEDMANN 1990).

Occurrence. In Hungary the species occurs in the condensed basal pockets of the Upper Aptian Tata Limestone Formation and also reported from the Upper Albian – Lower Cenomanian Pénzeskút Marl Formation, from surface localities and boreholes as well. Otherwise the species was a cosmopolitan taxon of the Early Albian – Cenomanian times.

Family Silesitidae HYATT, 1900
Genus *Neosilesites* BREISTROFFER, 1951a
Type species: *Silesites Seranonis* D'ORBIGNY var. *balearensis* FALLOT, 1920a

Neosilesites nepos (H. DOUVILLÉ, 1917)
Pl. XIII, Figures 2, 10, 12, 13

*1917 *Silesites nepos* H. DOUVILLÉ, p. 109, Pl. XV, Figure 8, 9

Material. Four specimens from the Tatabánya Ta–1426 borehole at 265, 258, 255.5 and 253 metres.

Description. Small, evolutee, discoidal forms with dense, narrow, strong ribs, rib index is around 40 but exactly cannot be determined due to the lack of a complete specimen. Ribs bifurcate at the ventral edge, secondary ribs cross the venter continuously. Whorl section is circular, which is characteristic of the genus.

Remarks. H. DOUVILLÉ (1917) described *Silesites nepos* from Moghara. It resembles *S. seranonis* (D'ORBIGNY, 1841), a former index fossil of the Barremian. FALLOT (1920a) also described a *Silesites* species, but according to the different stratigraphical occurrence and a bit different ornamentation, separated the new form as a new subspecies of *seranonis* called *balearensis* (FALLOT, 1920a). It differs from nepos in the mode of ribbing — primary ribs end at midflank and do not bifurcate. BREISTROFFER (1951a) created a new genus (*Neosilesites*) for the specimens of *S. seranonis* var. *balearensis* FALLOT, 1920a (p. 55, Pl. III, Figure 5), which stratigraphic position is much younger as of *S. seranonis*, Upper Aptian – Lower Albian.

Occurrence. The species is known from the Upper Aptian – Lower Albian deposits of France, the Balearic Islands, Poland and North Africa, a rather rare fossil. In Hungary the species is known from the Upper Aptian – Lower Albian sequence of the Tatabánya Ta–1426 borehole, 253 m, 255.5 m, 258 m and 265 m.

Superfamily Acanthocerataceae GROSSOUVRE, 1894
Family Brancoceratidae SPATH, 1933
Subfamily Brancoceratinae SPATH, 1934
Genus *Brancoceras* STEINMANN, 1881
Type species: *Ammonites senequieri* D'ORBIGNY, 1841

Brancoceras senequieri (D'ORBIGNY, 1841)
Pl. XIII, Figure 1

*1841 A*mmonites senequieri* D'ORBIGNY, p. 292, Pl. 86, Figure 3–5
2004b *Brancoceras senequieri* (D'ORBIGNY, 1841) — KENNEDY, p. 256, Pl. 4, Figs 1–3, 14–15; Pl. 5, Figures 20–28; Pl. 6, Figs 1–12; Text-Figures 6E, j, 7F (with synonymy).

Material. A single, flattened, fragmented specimen from Tatabánya Ta–1462 borehole from 210.8 metres.

Description. A flattened third whorl of a small, evolute specimen with prominent ribs that start from the umbilical edge, flattening across the venter and become fan-like on the ventral edge. The ventral region is not visible.

Discussion. The small size and the shape of the ribs make the specific identification clear.

Occurrence. The species co-occurs with typical Upper Aptian assemblage in the Upper Aptian – Lower Albian sequence of Tatabánya Ta–1462 borehole. Otherwise the genus was cosmopolitan and reported from Lower Albian – Middle Albian deposits.

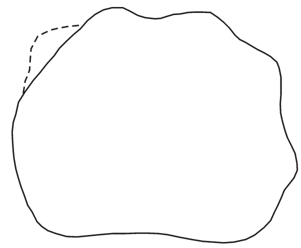
Subordo Ancyloceratina WIEDMANN, 1966
Superfamily Ancylocerataceae GILL, 1871
Family Ancyloceratidae GILL, 1871
Subfamily Ancyloceratinae GILL, 1871
Genus *Ancyloceras* D'ORBIGNY, 1842
Type species: *Ancyloceras Matheronianus* D'ORBIGNY, 1842

?Ancyloceras matheroni D'ORBIGNY, 1842
Pl. IV, Figure 6

*1842 *Ancyloceras Matheronianus* D'ORBIGNY, p. 497, Pl. 122

Material. A 7 centimetres long fragment of an internal mould from Kálvária Hill locality.

Description. A slightly curved fragment with an almost same sized, suboctogonal whorl section (Text-Figure 40) at the two ends (34 vs. 36 mm in diameter). The dorsal side is smooth with light striae. Ribs start at the lower lateral part and become tuberculated. Umbilical tubercle is the smallest and other are getting bigger towards the venter. In the interspaces there are secondaries with no tubercles. Suture cannot be observed.



Text-Figure 40. Whorl section of *Ancyloceras matheroni* D'ORBIGNY, 1842 M: 1×

Discussion. At the genera *Ancyloceras* and *Toxoceratoides*, the ornamentation of the phragmocone is almost similar. The only difference between the two forms is in the body chamber and the size of the conch. Due to the fragmentation of the present specimen, body chamber cannot be observed. The specimens of the genus Ancyloceras are rather large, although specimens of Toxoceratoides are few centimetres long apart from *Toxoceras honnoratum* (D'ORBIGNY 1841). Neither KLINGER & KENNEDY (1977) nor AGUIRRE–URRETA (1986) identifies *T. honnoratum* as a member of genus *Toxoceratoides*, so the position of the species is uncertain. According to the rather large size of the Hungarian specimen, and on the basis of the ornamentation, the author prefers to identify the fragment as an ?*Ancyloceras* species.

Occurrence. In Hungary the species is reported from the condensed Upper Aptian basal pockets of Tata Limestone Formation at Kálvária Hill, otherwise the species was cosmopolitan in the Barremian – Early Aptian times worldwide.

Genus *Tonohamites* SPATH, 1924
Type species: *Tonohamites decurrens* SPATH, 1924

Tonohamites boldii SZIVES & MONKS, 2002
Pl. IV, Figure 10

Material. A single specimen from Eperkés Hill locality.

Description. A hook-shaped conch with a dorso-ventrally compressed whorl section. The conch is slightly twisting. Strong ribs start from the dorsal part and wear three bullate tubercles. The ribs slightly rursiradiate, completely effaced dorsally and partially effaced between the ventarl nodes. Ventral tubercles are less distinct near the aperture but they occur on most ribs. Ventrolateral spines are irregularly distributed. Suture is unknown.

Remarks. The specimen resembles to *Protanisoceras (Torquistylus)* in the twisting body chamber, but the rounded ribs and the single pair of tubercles make clear difference between the two taxa.

Occurrence. The species was described from Hungary, from the condensed Upper Aptian section of Tata Limestone Formation of Eperkés Hill.

Superfamily Turrilitaceae GILL, 1871
Family Ptychoceratidae GILL, 1871
Genus *Ptychoceras* D'ORBIGNY, 1841
Type species: *Ptychoceras Emericianum* D'ORBIGNY, 1841

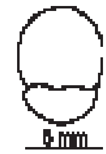
Ptychoceras laeve MATHERON, 1842
Pl. IV, Figures 3, 4, 5

*1842 *Ptychoceras laevis* MATHERON, p. 266, Pl. 41, Figure 3
1897 *Ptychoceras adpressum* (J. SOWERBY) — PARONA & BONARELLI, p. 105
1907 *Ptychoceras laeve* MATHERON var. *Hamaimensis* — PERVINQUIERE, p. 90, Pl. 4, Figure 5, 6
1907 *Ptychoceras laeve* MATHERON — PERVINQUIERE, p. 90
1920a *Ptychoceras laeve* MATHERON — FALLOT, p. 16
1933 *Ptychoceras minimum* ROUCHADZÉ, p. 180, Pl. 1, Figure 8
1960 *Ptychoceras minimum* ROUCHADZÉ — DRUSCHICH & KUDRYAVTSEV, p. 265, Pl. 11, Figure 5
1962b *Ptychoceras laeve* laeve MATHERON — WIEDMANN, p. 90, Pl. 7, Figure 1, Text-Figures 31, 32
1975 *Ptychoceras minimum* ROUCHADZE — FÜLÖP, p. 104, Pl. 49, Figure 110
1987 *Ptychoceras laeve* MATHERON — IMMEL, p. 127, Pl. 4, Figures 5, 6
1989 *Ptychoceras minimus* ROUCHADZÉ — DOGUZHAEVA & MUTVEI, p. 94, Pls. 3, 4
1989 *Ptychoceras laeve laeve* MATHERON — FÖLLMI p. 120, Pl. 3, Figure 17
1992 *Ptychoceras minimus* ROUCHADZÉ — WIEDMANN & KAKABADZE, p. 396, Text-Figure 3

Material. Almost 50 fragments of internal moulds from all localities.

Description. Small, 1–2 centimetres long fragments of ptychocon forms. Whorl section is more or less circular (Text-Figure 41). Shafts are adpressed, usually smooth, but on some specimens there is a corrugation just before the hook. Hook is rounded or slightly conical. Older shaft always adpressed with the younger ones at any stage of growth, which is a generic character. Suture cannot be observed.

Discussion. P. laeve could be easily confused with *P. adpressum* (J. SOWERBY, 1814), which is a bit smaller (MONKS 1999). Ontogenetic evolution of the genus was carefully studied by WIEDMANN & KAKABADZE (1992). PERVINQUIÉRE (1907) mentioned that in MATHERON's (1842) first description the shafts are absolutely smooth, while his own specimens have rugae before the knees, which characterize a new subspecies. The roundness of the knee is changing according to the stratigraphic position, (MONKS, pers. comm.), the youngest forms (from about the Early Albian) have the more conical shape in contrast to the rounded-kneed older forms. The genus *Ptychoceras* can be easily separated from the Barremian genus *Euptychoceras* by the continuously adpressed shafts.



Text-Figure 41. Shaft section of *Ptychoceras laeve* MATHERON, 1842

The systematic position of the genus is quite uncertain. Some authors put genus *Ptychoceras* into the Turrilitaceae superfamily (ARKELL 1957; WIEDMANN & DIENI 1968), while others put the genus into the Ancyloceratаceae superfamily (WRIGHT et al. 1996). In a short communication BREISTROFFER (1951b) cleared up the relation with the family Hamitidae. The most recent paper on the topic is from MONKS (1999). After a detailed cladistic analysis pointed out that Ptychoceratidae should be place into Turrilitaceae superfamily together with the Hamitidae, Anisoceratidae, Baculitidae and Turrilitidae families. Within the Ptychoceratidae, MONKS splitted the Ptychoceratinae and the Worthoceratinae subfamilies.

Occurrence. In Hungary the species is known from the condensed Upper Aptian basal pockets of Tata Limestone Formation. From the Upper Aptian the species is known from France, Spain, North Africa and Georgia. It is also known from the Lower Albian of Escragnolles.

Family Anisoceratidae HYATT, 1900
Genus *Protanisoceras* SPATH, 1923
Type species: *Hamites raulinianus* D'ORBIGNY, 1842

Protanisoceras acteon (D'ORBIGNY, 1850)
Pl. IV, Figures 7, 8, Pl. V, Figure 5

*1850 *Hamites acteon* D'ORBIGNY, p. 126
1908 *Hamites* nov. sp. cf. *virgulatus* PICTET — JACOB, p. 315
non 1940 *Hamites acteon* D'ORBIGNY — BREISTROFFER, p. 134
1953 *Protanisoceras blanchet* PICTET & CAMPICHE — BREISTROFFER & VILLOUTREYS, p. 70
1961b *Protanisoceras (Protanisoceras) acteon* D'ORBIGNY — CASEY, p. 109, Pl. 24, Figure 1–4; Text-Figure 36d
1977 *Protanisoceras acteon* D'ORBIGNY — PHILLIPS, p. 152
1989 *Protanisoceras acteon* D'ORBIGNY — FÖLLMI, p. 126, Pl. 5, Figure 1

Material. Two fragments from Eperkés Hill.

Description. Medium-sized fragment of a shaft and a hooked shaft. Whorl section is oval and dorso-ventrally compressed. Ribs are broad and rounded, wearing ventral tubercles that weaken near the aperture. Ribs are slightly rectiradiate and effaced dorsally.

Discussion. A pair of tubercles on the ribs at both side of the sulca is a generic character which is well visible on the specimen.

Occurrence. From Hungary the species is known from the condensed Upper Aptian basal pockets of the Tata Limestone Formation. The species is known from the Upper Aptian — Middle Albian sequences of Western Europe, Madagascar, Peru and India.

Genus *Ephamulina* COLLIGNON, 1963
Type species: *Anisoceras trituberculatum* COLLIGNON, 1949

Ephamulina arcuata (COLLIGNON, 1962)
Pl. V, Figures 1, 2

*1962 *Pictetia arcuata* COLLIGNON, Pl. 221, Figure 958
1963 *Ephamulina arcuata* COLLIGNON — COLLIGNON, Pl. 252, Figure 1083
2000 *Ephamulina* cf. *arcuata* COLLIGNON — KENNEDY et al., p. 684, Figure 50e, j, k
2002 *Ephamulina* cf. *arcuata* COLLIGNON — SZIVES & MONKS, p. 1142, Text-Figure 5e, f

Material. Six huge, heavily eroded fragments of internal moulds and some smaller ones from Kékkő Quarry locality.

Description. Criocone, huge, fragmented internal moulds with circular whorl section. Huge specimens lack ornamentation. Suture is florid, with wide, bifid lobes and saddles.

Discussion. Despite the bad state of preservation, on the basis of the specific morphology and the suture, the fragment can be identified quite well. Small specimens are trituberculated and resemble to *Ephamulina trituberculata* (COLLIGNON 1949), but due to the lack of a complete specimen we cannot decide if trituberculation characterizes just an early ontogenetic stage or marks a distinct species.

Occurrence. In Hungary, all specimens are from the condensed Upper Aptian basal pockets of Tata Limestone Formation from Kékkő Quarry locality. Otherwise, the genus is known from the Upper Aptian – Middle Albian deposits of Madagascar, France and Georgia.

Family Hamitidae GILL, 1871
Genus *Hamites* PARKINSON, 1811
Type species: *Hamites attenuatus* J. SOWERBY, 1814

Hamites praegibbosus SPATH, 1941
Pl. IV, Figure 9

1939 *Hamites* sp. nov. SPATH, p. 563
*1941 *Hamites praegibbosus* SPATH, p. 627, Pl. 70, Figures 13–15; Text-Figure 227a–f
1947 *Hamites praegibbosus* SPATH — BREISTROFFER, p. 24, 40
1949 *Hamites praegibbosus* SPATH — COLLIGNON, p. 124
1951 *Hamites praegibbosus* SPATH — CASEY, p. 97
1961 *Hamites praegibbosus* SPATH — CASEY, p. 94, Pl. 22, Figures 4 (a, b), 5 (a–c), Text-Figure 33 (a, b)
1961 *Hamites dixoni* CASEY, p. 97, Pl. 22, figs 6 (a–c), Text-Figure 33c
1960 *Hamites praegibbosus* SPATH — OWEN, p. 369
1975 *Hamites* div. sp. — FÜLÖP, p. 104, Pl. 49, Figures 9, 11
1977 *Hamites praegibbosus* SPATH — PHILLIPS, p. 82
2002 *Hamites praegibbosus* SPATH — SZIVES & MONKS, p. 1143, Text-Figures 4b, c; 5c, d

Material. Four, slightly flattened internal moulds from Eperkés Hill and Márvány Quarry localities.

Description. Ancylocone forms with oval whorl section. Dorsal part smooth, weak ribs tending to appear and getting stronger towards the venter. Ribs sharp and narrow, equal in width to the interspaces.

Discussion. The tight body chamber and sharp, equally spaced ribs characterize the species.

Occurrence. According to WRIGHT et al. (1996), the genus appeared in the lower part of the *Douvilleiceras mammillatum* Superzone, and shows the same stratigraphic range in India, Madagascar, England and France. In the Vocontian Basin the species occurs on the top of the *Leymeriella (L.) tardefurcata* Zone (KENNEDY, pers. comm) already. From Hungary, all specimens are from the condensed Upper Aptian basal pockets of Tata Limestone Formation from Eperkés Hill and Márvány Quarry localities.

Hamites csaszari SZIVES & MONKS, 2002

*2002 *Hamites csaszari* SZIVES & MONKS, p.1145, Text-Figure 6b, c

Material. A unique specimen numbered as Kv77 from Kálvária Hill locality.

Description. A small fragment with laterally compressed whorl section. Weak, blunt, straight or slightly prorsiradiate ribs start at midflank, widening on the venter. Rib index is 4. Dorsal region is smooth.

Discussion. Although the fragment is very tiny, it is different from any other Hamites species and has such a distinctive ornamentation with the weak, very wide and blunt ribs.

Occurrence. Species known only from the Upper Aptian condensed basal pockets of Tata Limestone Formation at Kálvária Hill locality.

Hamites fueloepi SZIVES & MONKS, 2002
Pl. IV, Figures 11, 12

1975 *Hamites* sp. — FÜLÖP, Pl. 49, Figure 9
*2002 *Hamites fueloepi* SZIVES & MONKS, p. 114, Text-Figures 6f, g, h, i

Material. Two fragments of internal moulds from Kékkő Quarry locality.

Description. Two fragments of an ancylocone specimen with circular whorl section. Ribs blunt, rursiradiate on the descending shaft, rib index around 7, decreasing near the aperture. Ribs are qually distanced as the interspaces between them. Suture is partly visible on the holotype with small internal lobe and trifid, small umbilical lobe.

Discussion. Specimens of the new taxon suggest this form was more tightly folded and larger than other *Hamites* taxa, though resembles to Middle Albian *Hamites gibbosus* J. SOWERBY, 1812, it is better to separate the two forms due to the different stratigraphic range.

Occurrence. The species is known only from the Upper Aptian condensed basal pockets of Tata Limestone Formation at Kékkő Quarry locality.

Hamites kalvariensis SZIVES & MONKS, 2002
Pl. V, Figures 3, 4, 6

*2002 *Hamites kalvariensis* SZIVES & MONKS, p.1145, Text-Figures d, e

Material. Two specimens from Kálvária Hill locality.

Description. Ancylocone form with subcircular whorl section. Ribs dense, straight, rectiradiate, very sharp and effaced on the dorsal surface. Rib index around 10.

Discussion. The form resembles to the Middle Albian *Hamites tenuicostatus* SPATH, 1941, but the new species has sharper and much straight ribs.

Occurrence. In Hungary it is from the condensed Upper Aptian basal pockets of Tata Limestone Formation.

Superfamily Douvilleicerataceae PARONA & BONARELLI, 1897
Family Douvilleiceratidae PARONA & BONARELLI, 1897
Subfamily Cheloniceratinae SPATH, 1923
Genus *Procheloniceras* SPATH, 1923
Type species: *Ammonites stobieckii* D'ORBIGNY, 1850

Procheloniceras albrechti austriae (UHLIG, 1883)
Pl. V, Figure 7, Pl. VI, Figure 1

*1883 *Acanthoceras Albrechti Austriae* UHLIG, p. 129, Pl. 22; Pl. 20, Figure 13; Pl. 23, Figure 1
1960 *Procheloniceras albrechti-austriae* (UHLIG — DRUSCHICH & KUDRYAVTSEV, p. 335, Pl. 16, Figure 1

Material. Two specimens from Kálvária Hill locality.

Description. Big, slightly flattened forms with wide umbilicus. Ribs are strong, heavily rectiradiate, on the dorsal side wearing two or three light tubercles or bullae. Intercalated ribs present. Ventral region and the suture cannot be observed due to the compression.

Discussion. Despite the poor preservation, the specimens are well identified according to the wide umbilicus and the rectiradiate, tubercled ribs.

Occurrence. From Hungary the species is from the condensed Upper Aptian basal pockets of the Tata Limestone Formation at Kékkő Quarry locality, otherwise it is known from the Lower Aptian deposits of the "Mediterranean" region and Mangyshlak.

Genus *Cheloniceras* HYATT, 1903
Type species: *Ammonites Cornuelianus* D'ORBIGNY, 1840

The genus *Cheloniceras*, from stratigraphical and evolutionary point of view, is one of the most important taxa in the Early Aptian. It contains more than 70 species which number is too much for correct and useful taxonomic and stratigraphic interpretation. Generic characters and the description of the different ontogenetic stages of the type species are fully discussed by CASEY (1961b, p. 194–198). Accordig to the lack, presence or the size of ventral tubercles, the genus divided into three subgenera (WRIGHT et al. 1996):

— *Cheloniceras* HYATT, 1903 — lack of ventral tubercles.
— *Epicheloniceras* CASEY, 1954 — presence of "normal" sized ventral tubercles.
— *Paracheloniceras* COLLIGNON, 1962 — presence of big, ear-shaped ventral tubercles.

Lots of the systematic descriptions of *Cheloniceras* species are from the early 20th century and, even the later ones, completely lack the idea of intraspecific variation which became common when later documented among the ammonites (KENNEDY & COBBAN 1976). Further investigation needed for making clear the problem of sexual dimorphism, intraspecific variation and a possible merge of present *Cheloniceras* species.

Subgenus *Cheloniceras* HYATT, 1903
Type species: *Ammonites Cornuelianus* D'ORBIGNY, 1840

Cheloniceras (Cheloniceras) cornuelianum (D'ORBIGNY, 1840)
Pl. VI, Figures 2, 3, 7, 8, 9, 12

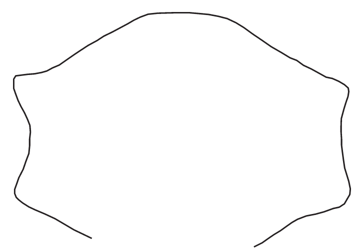
*1841 *Ammonites Cornuelianus* D'ORBIGNY, p. 364, Pl. 112, Figure 1, 2
1955 *Cheloniceras cornueli* D'ORBIGNY — ERISTAVI, p. 145
1955 *Cheloniceras cornueli* D'ORBIGNY var. pygmea NIKSCHITSCH — ERISTAVI, p. 145
1960 *Cheloniceras cornuelianum* D'ORBIGNY — DRUSCHICH & KUDRYAVTSEV, p. 336, Pl. 18, Figures 1a–c, 2a–c, 3

1960 *Cheloniceras cornueli pygmaea* NIKSCHITSCH — DRUSCHICH & KUDRYAVTSEV, p. 337, Pl. 18, Figures 4a, b
non 1960 *Cheloniceras cornuelianum sinzowi* LUPPOV — DRUSCHICH & KUDRYAVTSEV, p. 338, Pl. 18, Figures 5a, b
1961b *Cheloniceras (Ch.) cornuelianum* D'ORBIGNY — CASEY, p. 509, 510, 520, 522, 548, 571, 609
1965 *Cheloniceras (Ch.) cornuelianum* D'ORBIGNY — CASEY, p. 198, Pl. 33, Figures 7a, b; Pl. 34, Figures 1a, b; 9a, b; Pl. 35, Figures 1a, b, 2, 3; Text-Figures 60a–c, 61, 62, 67e–f
1967 *Cheloniceras (Ch.) cornuellianum* D'ORBIGNY — DIMITROVA, p. 170, Pl. 82, Figure 3
1977 *Cheloniceras cornuelianum* D'ORBIGNY — KOTETISHVILI, p. 98, Pl. 19, Figure 3a–c
1994 *Cheloniceras* cf. *cornuelianum* D'ORBIGNY — VASICEK et al., p. 68, Pl. 21, Figure 5

Material. More than a hundred internal moulds and fragments at various state of preservation from all surface localities.
Measurement.

	D	H	W	U	W/H
Fazekas street					
1.	23	8(35)	10(44)	9(39)	1.25
2.	19	9(47)	10(53)	8(42)	1.11
3.	21	9(43)	10(48)	8(38)	1.11
4.	21	9(43)	10(48)	8(38)	1.11
5.	17	6(35)	8(47)	6(35)	1.33

Description. Small and medium-sized, moderately evolutee forms with coronate-polygonal, compressed whorl section (Text-Figure 42). Ribs start from the umbilical edge then wear a bulla at the lateral side. Bullate ribs wear tubercle on the midflank. Primary ribs split after the tubercle and together with the secondaries cross the well rounded venter straight.



Text-Figure 42. Whorl section of *Cheloniceras (Ch.) cornuelianum* (D'ORBIGNY, 1840). M: 3×

Discussion. Almost a half century after the description the *Ammonites Cornuelianus* and *Ammonites Martini* by D'ORBIGNY (1841), opinions about the two species were different about the separation of the two species. According to NEUMAYR & UHLIG (1881), the two species represent two different ontogenetic stages of the same form: "*martini*" is the juvenile; the "*cornuelianum*" is the adult one. ANTHULA (1899) also shared their opinion but discovered that the number of the secondary ribs is also changing: on the early whorls he found 1–4, later only one rib. Despite of them, KILIAN's (1913) view was to separate the two clear, distinct species. According to CASEY's (1961b) opinion, the two forms are different and he accepted the *martini* and the *cornuelianum* as two distinct species. Besides this, OWEN (1996a) pointed out that different stratigraphic position also makes difference between the two species. The only statement we can add, that Hungarian *cornuelianum* assemblage do not have tuberculated venter at any visible stage of growth. Considering the heavily condensed Hungarian material, none of the opinions can be endorsed.

Occurrence. The species was cosmopolitan between the Early to Late Aptian, and known from the Hungary from the Upper Aptian condensed basal pockets of Tata Limestone Formation from all surface localities.

Subgenus *Epicheloniceras* CASEY, 1954
Type species: *Douvilleiceras tschernyischewi* SINZOW, 1906

The stratigraphic position of subgenera *Cheloniceras*–*Epicheloniceras* was always a point of disagreement. CASEY (1961a) reported that "appearance of the Subgenus *Cheloniceras* (*Epicheloniceras*) forms a well definable lower limit to the Upper Aptian (Gargasian) in Europe...". OWEN (1996a) mentiones the opinion of DELAMETTE (1988), that *Epicheloniceras* persist from the *Cheloniceras (Epicheloniceras) buxtorfi* subzone of the *Cheloniceras (Epicheloniceras) martinioides* Zone (OWEN 1996a) together with the genus *Parahoplites*, then *Parahoplites* is replaced by its descendant *Eodouvilleiceras* in the *Hypacanthoplites jacobi* Zone (OWEN 1996a). *Parahoplites* species still known from the lower *Hypacanthoplites jacobi* Zone together with *Acanthohoplites*. The condensed Hungarian material is not eligible for stratigraphic investigations.

***Cheloniceras (Epicheloniceras)* sp.**

Pl. VI, Figures 10, 11

Material. Two fragments from Kálvária Hill locality.
Description. Two fragments of a ventral part of two internal moulds. Primary ribs start from a ventrolateral tubercle, then bifurcate and cross the venter straight.
Occurrence. In Hungary it is from the condensed Upper Aptian basal pockets of the Tata Limestone Formation.

Subgenus *Paracheloniceras* COLLIGNON, 1962
Type species: *Epicheloniceras (Paracheloniceras) wrighti*, COLLIGNON 1962

***Cheloniceras (Paracheloniceras) rerati* COLLIGNON, 1965**
Pl. V. Figures 8, 9, 10, 11, 12, Pl. XIII. Figure 11

1962 *Epicheloniceras (Paracheloniceras) wrighti* COLLIGNON, p. 42, Figure 994
1965 *Cheloniceras (Paracheloniceras) guenoti* COLLIGNON, p. 49, Pl. 1, Figures 1, 2
*1965 *Cheloniceras (Paracheloniceras) rerati* COLLIGNON, p .49, Pl. 1, Figures 3, 4
2000 *Paracheloniceras rerati* COLLIGNON — KENNEDY et al., p. 690, Figures 58d–g, j–m

Material. 32 poorly preserved specimens from the Vájáriskola, Kálvária Hill and Kékkő Quarry localities.

Description. Strongly flattened, discoidal specimens with moderate evolution. Ribs start at the umbilical edge with strong bullae which flatten and widen across the lateral region. At the ventral edge ribs end in ear-shaped bullae forming a sulcus at the ventral region. Some specimen has tubercles at the outer part of the lateral region as well.

Discussion. COLLIGNON separated three species (*wrighti* 1962; *rerati* 1965 and *guenoti* 1965) from Madagascar. KENNEDY (2000), as the first revising author, merged *rerati* and *guenoti* species with chosen the name of *rerati*, and described it from France.

Occurrence. The species is known from the Upper Aptian of Madagascar, the *Hypacanthoplites jacobi* Zone of South France. From Hungary, the species is documented from the Upper Aptian condensed basal pockets of the Tata Limestone Formation at Kálvária Hill and Kékkő Quarry localities.

Genus *Diadochoceras* HYATT, 1900
Type species: *Ammonites Nodosocostatus* D'ORBIGNY, 1841

***Diadochoceras nodosocostatum* (D'ORBIGNY, 1841)**
Pl. VI, Figures 4, 5, 6; Pl. VII, Figures 1, 2, 3, 6

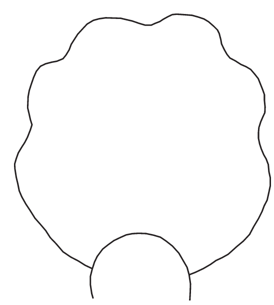
*1841 *Ammonites Nodosocostatus* D'ORBIGNY, p. 258, Pl. 75, Figure 1–4
1955 *Cheloniceras* cf. *nodosocostatum* D'ORBIGNY — ERISTAVI, p. 150
1962 *Diadochoceras nodosocostatum* D'ORBIGNY — COLLIGNON, p. 43, Figure 996
1965 *Diadochoceras nodosocostatum* D'ORBIGNY — EGOIAN, p. 137, Pl. 9, Figure 6, 7; Pl. 10, Figures 1, 2
1963 *Diadochoceras nodosocostatum* D'ORBIGNY — MIKHAILOVA, p. 68, Pl. 7, Figures 3–4
1975 *Diadochoceras nodosocostatum* (D'ORBIGNY) — FÜLÖP, p. 104, Pl. 50, Figure 18
1982 *Diadochoceras* aff. *nodosocostatum* D'ORBIGNY — RENZ, p. 27, Pl. 2, Figures 7a, b; 8a, b; 9a, b; Text-Figure 16a.

Material. More than two hundred specimens from all localities in variable state of preservation.

Measurement.	D	H	W	U	W/H
Fazekas street					
1.	23	9(39)	9(39)	8(35)	1.00
2.	22	8(36)	8(36)	8(36)	1.00
3.	28	10(36)	11(39)	11(39)	1.10
4.	22	9(41)	9(41)	8(36)	1.00
5.	20	9(45)	8(40)	7(35)	0.88
6.	25	8(32)	8(32)	10(40)	1.00
Kálvária Hill					
8.	22	9(41)	10(45)	8(36)	1.11
9.	20	8(40)	8(40)	7(35)	1.00

Description. Small, evolute forms with deep umbilicus. Whorl section is very characteristic, coronate-polygonal (Text-Figure 43), with rounded outline. Primary ribs running straigt from the umbilicus through the venter, having two lateral and a ventral tubercles. In between the tubercled primaries there are two or three untubercled intermediate ribs, they start from the mid-lateral region. Venter rounded. Suture cannot be observed.

Discussion. The genus *Diadochoceras* can be easily separated from *Cheloniceras* on the basis of the round whorl section and the two lateral tubercles. MIKHAILOVA (1963) pointed out that the ontogenetical suture differentiation of *Diadochoceras* resembles most to the *Acanthohoplites* and *Hypacanthoplites*, therefore the genus *Diadochoceras* is adviced to be placed into the family Parahoplitidae (SCHINDEWOLF 1966; BOGDANOVA, MIKHAILOVA 2004) in contrast to the opinion of WRIGHT et al. (1996), who put *Diadochoceras* not even into a different family (Douvilleiceratidae) but into a different superfamily (Douvilleicerataceae). Here I follow the classification of WRIGHT et al. (1996). The extreme richness of *Diadochoceras* in the Hungarian material is very unusual. MIKHAILOVA (1963) reported five species from Mangyshlak, the only area apart from Hungary, where *Diadochoceras* also very abundant.



Text-Figure 43. Whorl section of *Diadochoceras nodosocostatum* (D'ORBIGNY, 1841). M: 3×

Occurrence. The genus was cosmopolitan in the Upper Aptian and can be used as an index fossil for the lower part of it. In Hungary it is found in the Upper Aptian condensed basal pockets of Tata Limestone Formation.

Diadochoceras margariti MIKHAILOVA, 1963

Pl. VI, Figures 13, 15, 16, 19

*1963 *Diadochoceras margariti* MIKHAILOVA, p. 73, Tab. 7, Figure 8a, b
Pars 1965 *Nodosohoplites subplanatus* EGOIAN — p. 145, Tab. XI, Figures 7, 8 only

Material. Sixteen fragmented internal moulds from Kálvária Hill and Fazekas street localities.

Description. Whorl section is higher than that of the *nodosocostatum*. The ornamentation of the phragmocone is the same as for *nodosocostatum*, apart from the last whorl and the body chamber of an adult specimen. On the last whorl of the *margariti*, tubercles weaken until they disappear, the interspace between the ribs getting wider and the ribs themselves getting sharp, thinner and sinuous. Intercalated ribs are present at any visible stage of growth.

Discussion. The author believes — on the basis of the size and the ornamentational resemblance — that sexual dimorphism is present in the genus *Diadochoceras*, *nodosocostatum* (D'ORBIGNY, 1841) – *margariti* MIKHAILOVA (1963) are micro- and macroconch pairs, and *hokodzense* MIKHAILOVA (1963) is also a macroconch. *D. crebicostatum* MIKHAILOVA (1963) is look like a *Nolaniceras nolani* (SEUNES, 1887).

Occurrence. In Hungary it is from the condensed Upper Aptian basal pockets of Tata Limestone Formation, otherwise known from the Upper Aptian *Nolaniceras nolani* Zone deposits of North Caucasus.

Diadochoceras hokodzense MIKHAILOVA, 1963

Pl. VII, Figures 4, 5

*1963 *Diadochoceras hokodzense* MIKHAILOVA, p. 69, tab. 7, Figure 5–7
Pars 1965 *Diadochoceras mutabilis* EGOIAN — p. 144, Tab. X, Figures 4, 5, 6, 7, 8

Material. Eleven fragments of internal moulds from Kálvária Hill and Fazekas street localities.

Description. Evolute, small to medium sized forms with coronate-polygonal whorl section. Primary ribs are mostly untubercled and start from an umbilical bulla. Ribs are strong and straight; tend to be prorsiradiate on the venter. On the last whorl, the interspace between two ribs is getting wider, ribs tend to be stronger, intermediate ribs appear.

Discussion. Differs from *D. margariti* MIKHAILOVA (1963) with the stronger and straighter ribbing, lack of tubercles and presence of umbilical bullae.

Occurrence. The species was described from the Upper Aptian *Nolaniceras nolani* Zone of North Caucasus. In Hungary it is from the condensed Upper Aptian basal pockets of Tata Limestone Formation.

Diadochoceras spinosum MIKHAILOVA, 1963

Pl. VI, Figures 14, 17, 18, 20; Pl. VII, Figure 7

*1963 *Diadochoceras spinosum* MIKHAILOVA, p. 69, Tab. 7, Figure 5–7
Pars 1965 *Nodosohoplites subplanatus* EGOIAN, p. 145, Tab. 11, Figure 9 (only)
Non 1975 *Diadochoceras nodosocostatum* (D'ORBIGNY) — FÜLÖP, Pl. 50, Figure 18

Material. 30 fragments and complete internal moulds from Kálvária Hill and Fazekas street localities.

Description. Evolute, highly ornamented forms with coronate-polygonal whorl section. The primary ribs are straight or slightly prorsiradiate on the venter and almost disappear under the heavy tubercles. Each rib has two laterals and one ventral tubercle. Between two tuberculated ribs there is only one intermediate rib, usually starting also from the umbilical edge. Intermediates are sharp, thin and never wear tubercles nor bullae.

Discussion. D. spinosum differs from other *Diadochoceras* species in the stronger tuberculation, the disappearance of the tuberculated ribs and the presence of a single, narrow intermediate rib between two tuberculated one. Besides small fragments, some quite big internal moulds also found compared to the average size of the genus. This is opposite to EGOIAN's (1965) opinion, who reported the strong tuberculation as connected to a certain ontogenetic stage. According to the extremely rich Hungarian material we have to disclaim his opinion.

Occurrence. The species is knows the Clansayesian deposits of Georgia and Mangyshlak. In Hungary it is from the condensed Upper Aptian basal pockets of Tata Limestone Formation.

Subfamily Douvilleiceratinae PARONA & BONARELLI, 1897
Genus *Eodouvilleiceras* CASEY, 1961b
Type species: *Douvilleiceras horridum* RIEDEL, 1938

Eodouvilleiceras sp.
Pl. VIII, Figure 1

Material. A heavily eroded single internal mould from Kékkő Quarry.

Description. Massive, huge fragment with wide umbilicus and compressed-polygonal whorl section. Outer whorls are heavily eroded, but the presence of multituberculated ribs is visible.

Discussion. Due to the bad state of preservation specific characters are not visible.

Occurrence. In Hungary the species is known from the condensed Upper Aptian basal pockets of the Tata Limestone Formation from Kékkő Quarry locality.

Eodouvilleiceras clansayense (Jacob, 1905)
Pl. VII, Figures 8, 9, 10, 11

*1905 *Douvilleiceras clansayense* Jacob, p. 413, Pl. 13, Figure 4
1965 *Epicheloniceras clansayense* (Jacob) — Egoian, p. 156, Tab. 13, Figure 6; Tab. 14, Figures 1–3
1971 *Epicheloniceras clansayense* (Jacob) — Kvantaliani, p. 108, Pl. 16, Figure 3
1975 *Epicheloniceras apanashevi* Egoian — Fülöp, p. 104

Material. 17 fragments of internal moulds from all Tata localities.

Description. Evolute, large fragments with compressed, hexagonal whorl section. Strong primary ribs are multituberculated. Slight, untuberculated intermediate ribs appear. Ribs wear divided tubercles on both sides of the ventral sulcus, while lateral tubercles lack bifurcation. Secondary ribs disappear later during the ontogeny.

Discussion. Fragments are well identifiable on the basis of the compressed hexagonal whorl section, presence of multituberculate ribs and the heavy sculpture.

Occurrence. In Hungary, the species is known from the condensed Upper Aptian basal pockets of Tata Limestone Formation. The species is described from the Clansayesian of Southern France. The genus was desribed from Colombia (Riedel 1938), also known from Turkmenia, Georgia, Japan and California.

Genus *Douvilleiceras* Grossuvre, 1894
Type species: *Ammonites Mammillatus* Schlotheim, 1813

?Douvilleiceras sp.
Pl. VIII, Figure 2

Material. A plaster cast of an imprinted fragment from Kálvária Hill locality.

Description. The plaster cast shows the ventral region of a large form with wide venter and characteristically wide ventral sulcus. On both side of the ventral sulcus mammillated tubercles appear.

Discussion. Douvilleiceras is one of the most easily identifiable ammonoid genera in the Cretaceous. Due to the presence of the unique mammillate tubercles, a tiny fragment is enough for the identification of the genus. Hitherto, the question marked generic identification seems to be unlikely if considering the Late Aptian age. First certain representatives of the genus are known from Southern England, from the *Leymeriella (L.) tardefurcata* Zone of the Early Albian (Casey 1962). *Douvilleiceras* specimens reported from older deposits as well (Pictet & Renevier 1854, Jacob 1905), but these records are revised (Breistroffer 1947, Casey 1962) or due to the lack of an adequate description meant to be unidentifiable (Anderson 1938).

Occurrence. Considering the palaeogeographical distribution, the genus was cosmopolitan and from stratigraphical point of view known from the Lower Albian deposits of Venezuela, Colombia, USA, Europe, Russia, Caucasia, Madagascar and India. In Hungary it is from the condensed Upper Aptian basal pockets of Tata Limestone Formation at Kálvária Hill.

Superfamily Deshayesitaceae Stoyanow, 1949
Family Deshayesitidae Stoyanow, 1949
Subfamily Deshayesitinae Stoyanow, 1949
Genus *Dufrenoyia* Kilian & Reboul, 1915
Type species: *Ammonites Furcatus* J. de C. Sowerby in Fitton, 1836

Dufrenoyia katalinae sp. nov.
Pl. IV., Figure 1

1975 *?Dufrenoyia* sp. — Fülöp, p. 104, Pl. 50, Figure 16
1999b cf. *Leymeriella recticostata* Saveliev, 1973 — Szives, p. 404, Pl. II, Figure 7
2002 *?Leymeriella (Leymeriella) recticostata* Saveliev, 1973 — Szives, p. 84, Pl. II, Figure 33

Material. A single quarter whorl of a big specimen from the Fazekas street locality, Tata.

Derivation of name. The species is named atfer my mother.

Location. The holotype is housed in the Palaeontological Department of the Hungarian Natural History Museum, repository number is 2007.103.1.

Dimensions.

	D	H	W	W/H	U
2007.103.1.	–	22	17	0.77	18

Description. Compressed fragment with high whorl section. Very strong, straight, flat topped ribs start at the umbilical shoulder and broaden continuously towards the ventral edge. No intercalated ribs occur between the primaries, only the deep interspaces. Ribs end in peaks which overhang the ventral edge. During the ontogeny, ribs tend to be tuberculated on the lower and outer lateral region, and the ventral nodes getting more prominent and high. Ribs are in pairs at the two sides of the ventral sulcus, do not alternate.

Discussion. There are some morphological similarities between the present form and the first description of *Dufrenoyia lurensis* KILIAN (1913). But most *Dufrenoyia* species are small sized, in many cases intercalated ribs are present and ribs alternating, zigzagging on the two sides of the venter. BARABOSHKIN (pers. comm., 2007) pointed out that *Dufrenoyia* specimens from the Russian Platform are bigger and much coarsely ornamented than the European ones.

There is also a significant morphologic similarity between the present form and *Leymeriella (Leymeriella) recticostata* SAVELIEV (1973). *Dufrenoyia lurensis* KILIAN (1913) is known from the Gargasian, while *Leymeriella (L.) recticostata* SAVELIEV is reported from the mid Early Albian of Mangyshlak and represent the second morphological trend of the genus *Leymeriella* which is marked with the appearance of the ventral nodes. This in contrast to the opinion of CASEY (1957), who noted nodded forms as an ancestral form of *Leymeriella*. His opinion is that the appearance of the ventral node of the ribs is an evolutionary tendency of the genus which is in contradiction with his conclusion. According to Saveliev's stratigraphical interpretation of *L. (L.) recticostata*, it is very unlikely that a well developed neoleymerielliid form appears in Aptian deposits. The first occurrence of a primitive form of genus *Leymeriella* in the Hungarian Early Albian deposits is reported from the overlying siltstone deposits, but only from boreholes. It is also less likely, that after the appearance of a well developed, neoleymeriellid form, a more primitive lineage occure in younger deposit.

The fragment is considered to be a homeomorph of *L. (L.) recticostata* and on the basis of its startigraphic range and referred into a new species of *Dufrenoyia*. This new species represent a late morphological stage of the genus — which is mostly known from Early Aptian deposits — and characterized by the size development and the evolvation of coarse ribbing together with the reduction of secondary and intercalated ribs.

Occurrence. From Hungary, the specimen was found from the condensed Middle Aptian – Upper Aptian basal pockets of Tata Limestone Formation at Fazekas street locality. Otherwise the genus is known from the Early Aptian deposits of Europe, and Middle to Late Aptian deposits of texas, Mexico, Colombia, Venezuela and Japan.

Subfamily Mathoceratinae CASEY, 1964
Genus *Mathoceras* CASEY, 1964
Type species: *Hoplites (Kilianella?) matho* PERVINQUIERE, 1907

Mathoceras sumerensis (STOYKOVA, 1990)
Pl. VIII, Figure 3

*1990 *Venezuella sumerensis* STOYKOVA, p. 26, Pl. 1., Figure 6; Pl. 2., Figure 4
2007 *Mathoceras sumerensis* STOYKOVA, 1990 — BARRAGÁN & SZIVES, p. 27, Figure 4 (6)

Material. A unique, slightly deformed specimen from Vájáriskola, repository number K15033. (Locality was misgiven in BARRAGÁN & SZIVES (2007), corrected here.)

Description. Moderately evolute, medium sized, circular specimen with high whorl section. Strong, slightly prorsiradiate ribs start from the umbilical edge, form bullae on the inner flank and strong tubercles appear on outer flank. Ribs do not cross the venter until the diameter reaches 45–50 mm. When ribs cross the venter, they form strong clavi on the ventrolateral edge. After 50 mm diameter, the ornamentation became less prominent. No secondary ribs visible.

Discussion. Mathoceras can be well identifiable with the three rows of tubercles. The suture is less florid than that of *Dufrenoyia* (CASEY 1964) which it can be mixed with. The specimens resemble *M. venezolanum* RENZ, apart from the presence of secondaries.

Occurrence. The genus is reported from the Upper Aptian deposits of Venezuela, Tunisia, the Baleares and Bulgaria. In Mexico, *Mathoceras*-bearing sections are from the Middle Aptian *Cheloniceras* spp. Zone (BARRAGÁN-MANZO 2000; BARRAGÁN-MANZO & MÉNDEZ-FRANCO 2005) which probably can be correlated with the *Cheloniceras (Epicheloniceras) subnodosocostatum* of the Mediterranean standard (BARRAGÁN & SZIVES, 2007). In Hungary the species is came from the condensed Upper Aptian basal pockets of Tata Limestone Formation at Vájáriskola locality.

?Family Parahoplitidae SPATH, 1922a
Subfamily Acanthohoplitinae STOYANOW, 1949
Genus *Colombiceras* SPATH, 1923
Type species: *Parahoplites Tobleri* JACOB in JACOB & TOBLER, 1906

Colombiceras tobleri (JACOB in JACOB & TOBLER, 1906)

Pl. IX., Figures 1, 4

*1906 *Parahoplites tobleri* JACOB in JACOB & TOBLER 1906, Pl. 2, Figure 4
1907 *Acanthohoplites tobleri* (JACOB) — SINZOW, p. 486, Pl. 5, Figures 14, 15
1913 *Acanthohoplites tobleri* JACOB — SINZOW, p. 113, Pl. 6, Figure 2
1938 *Colombiceras* aff. *tobleri* JACOB — RIEDEL, p. 51, Pl. 8, Figures 23, 24
1953 *Colombiceras tobleri* JACOB — GLAZUNOVA, p. 47, Pl. 9, Figures 1–4
1960 *Colombiceras tobleri* JACOB — DRUSCHICH & KUDRYAVTSEV, p. 328, Pl. 14, Figures 1, 2
1968 *Colombiceras tobleri* JACOB — WIEDMANN & DIENI, p. 92, Pl. 9, Figure 14

Material. Two fragments of internal moulds from Fazekas street and Kálvária Hill localities.
Description. Fragments characterized by circular whorl section and rounded venter, evolution of the conch cannot be observed. Ribs are strong, wide and getting flat-topped on the venter. Intercalated ribs appear between primaries. Suture cannot be visible.
Remarks. The species is well characterized by the flat-topped, wide, coarse ribs and the circular whorl section.
Occurrence. The species was cosmopolitan in the Middle to Late Aptian times. In Hungary it was collected from the condensed Upper Aptian basal pockets of Tata Limestone Formation at Fazekas street and Kálvária Hill localities.

?Genus *Protacanthoplites* TOVBINA, 1970
Type species: *Parahoplites abichi* ANTHULA, 1899

According to the opinion of WRIGHT et al. (1996), genus *Protacanthoplites* TOVBINA, 1970 is sorted as a synonym of genus *Acanthohoplites* SINZOW, 1907. I use the name of ?*Protacanthoplites originalis* SHARIKADZE et al. (2004) temporary for the specimens figured and described here. On the basis of the Hungarian material, a description of a new genus is in process in a separate paper.

?Protacanthoplites originalis SHARIKADZE et al., 2004

Pl. VIII, Figures 4–15

*2004 *Protacanthoplites? originalis* SHARIKADZE et al., p. 393, Pl. 81., Figures 3–5
1999b cf. *Neosilesites* n. sp. SZIVES, Pl. 1, Figure 3
2002 *?Callizoniceras* n. sp. SZIVES, p. 75, Pl. II, Figures 6–10, 13

Material. Totally 57 specimens and fragments of internal moulds from three Tata localities.
Measurement.

	D	H	W	U	W/H
1.	43	16(37)	16(37)	20(46)	1
2.	19	6(31)	6(32)	9(47)	1
3.	28	9(32)	10(36)	10(36)	1.1
4.	32	11(34)	10(31)	12(38)	0.9

Description. Small circular forms with rounded whorl section. There are 4–6 deep, sometimes collared constrictions running through from one side of the dorsal part to the other, straightly crossing the venter. Two-three straight, strong ribs appear at the umbilical edge between the constrictions. Suture cannot be observed.
Remarks. The identification is with question mark, because the generic characters as the presence of strong constrictions, the evolute and circular conch are not perfectly fit to any described genera.
Occurrence. The species known from the Middle Aptian of Colombia and from the condensed Upper Aptian deposits of Hungary, from Kálvária Hill, Fazekas street and Vájáriskola localities.

Genus *Acanthohoplites* SINZOW, 1907
Type species: *Parahoplites aschiltaensis* ANTHULA, 1899

Acanthohoplites spp.

Pl. IX, Figures 7, 19, Pl. X, Figure 2

Material. Several fragments from all surface localities.
Description. Fragments are characterized with circular whorl section. Ribs start from the umbilical edge and cross the

lateral side and the venter straight, without any sign of bifurcation. Intercalated ribs sometime occur. No tubercles or bullae. No suture is visible.

Discussion. Considering the ornamentation, some fragments resembles to *Colombiceras crassicostatum* (D'ORBIGNY 1842) but the whorl section is circular which is not corresponds.

Occurrence. The genus known worldwide from the Middle to Upper Aptian deposits. In Hungary it is described from the condensed Upper Aptian basal pockets of Tata Limestone Formation of all surface localities.

Acanthohoplites bigoureti (SEUNES, 1887)

Pl. IX, Figure 5; Pl. X, Figures 1, 7

*1887 *Acanthoceras Bigoureti* SEUNES, p. 566, Pl. 14, Figures 3, 4
1899 *Parahoplites Bigoureti* (SEUNES) — ANTHULA, p. 117, Pl. 13, Figures 2a–c
1907 *Douvilleiceras bigoureti* (SEUNES) — PERVINQUIÉRE, p. 195, Pl. 8, Figure 37
1938 *Acanthohoplites bigoureti* SEUNES — RIEDEL, p. 45, Pl. 8, Figure 7
1955 *Acanthoplites bigoreti* (SEUNES) — ERISTAVI, p. 101, Pl. 4, Figure 1
1960 *Acanthohoplites bigoureti* (SEUNES) — DRUSCHICH & KUDRYAVTSEV, p. 321, Pl. 8, Figures 1a, b; 2a, b.
1961 *Cheloniceras bigoureti* (SEUNES) — ERISTAVI, Tab. 4, Figure 1
non 1971 *Acanthohoplites bigoureti* (SEUNES) — KVANTALIANI, p. 42, Pl. 4, Figure 3
1975 *Acanthohoplites bigoureti* SEUNES — FÜLÖP, p. 104
1987 *Acanthohoplites* aff. *bigoureti* (SEUNES) — IMMEL, p. 123, Pl. 13, Figure 5
2006 *Acanthohoplites bigoureti* (SEUNES, 1887) — RAISOSSADAT, p. 921, Figure 5A, B

Material. Twelve fragments of internal moulds from Tata localities.

Description. Specimens are fragmented show characteristically coarse ornamentation. Strong ribs start from the umbilical edge and sometimes form tubercles on the midflank. Intercalated ribs also appear. Constrictions also present, every three-four ribs are followed by one. No tubercles are visible. Suture cannot be observed.

Discussion. Rounded venter and gibbose flanks are generic characters against the flat-ventered and flattened *Hypacanthoplites*. The coarse ornamentation and the rounded venter make the species well identifiable.

Occurrence. The species is one of the significant Clansayesian ammonites of the Mediterranean region. In Hungary it is from the condensed Upper Aptian basal pockets of Tata Limestone Formation.

Acanthohoplites aschiltaensis (ANTHULA, 1899)

Pl. IX, Figures 12, 13, 14, 16, 17, 18, 20

*1899 *Parahoplites aschiltaensis* ANTHULA, p. 117, Pl. 10, Figures 2a, b, 3a,b, 4
1955 *Acanthohoplites aschiltaensis* (ANTHULA) — ERISTAVI, p. 97
1960 *Acanthohoplites aschiltaensis* (ANTHULA) — DRUSCHICH & KUDRYAVTSEV, p. 319, Pl. 7, Figures 2a, b, 3a, b
1967 *Acanthohoplites aschiltaensis* (ANTHULA) — DIMITROVA, p. 185, Pl. 89, Figure 4
1975 *Acanthohoplites aschiltaensis* (ANTHULA) — FÜLÖP, p. 104
1982 *Acanthohoplites aschiltaensis* (ANTHULA) — KEMPER, Pl. 3, Figures 3a, c
1987 *Acanthohoplites aschiltaensis* (ANTHULA) — AUTRAN & DELANOY, Pl. 1, Figure 4
2006 *Acanthohoplites aschiltaensis* (ANTHULA, 1899) — RAISOSSADAT, p. 921, Figure 5D

Material. 76 specimens from all surface localities.

Measurement.

	D	H	W	U	W/H
1.	–	8	7	7	0.87
2.	25	11(44)	10(40)	9(36)	0.90
3.	22	9(41)	9(41)	8(36)	1.00
4.	18	7(21)	6(33)	6(33)	0.86
5.	25	11(44)	9(36)	10(40)	0.81
6.	19	9(47)	7(36)	7(36)	0.77

Description. Small, discoidal evolute specimens. Whorl section compressed, venter well rounded. Ribs narrow, dense and slightly sinuous, RI = 40–44 on the last whorl. Primary ribs are sometimes branching from the umbilical bullae, otherwise intercalated ribs present. Sometimes tubercles may appear on the outer lateral part but not on the body chamber. Suture is not visible.

Discussion. Relationship is close with *A. bigoureti* (SEUNES, 1887) which has stronger and coarser ornamentation that makes difference, probably these species are the intraspecific variations of the same species but without examining the holotypes it is impossible to decide.

Occurrence. Known from the Clansayesian strata worldwide. In Hungary it is documented from the condensed Upper Aptian basal pockets of Tata Limestone Formation.

Acanthohoplites abichi **(Anthula, 1899)**
Pl. IX, Figures 2, 3, 6, 8, 15; Pl. X, Figure 5

*1899 *Parahoplites abichi* Anthula, p. 118, Pl. 9, Figure 2
1938 *Acanthohoplites* aff. *abichi* Anthula — Riedel, p. 46, Pl. 12, Figure 8
1955 *Acanthohoplites abichi* (Anthula) — Eristavi, p. 1, Pl. 4, Figure 5
1960 *Acanthohoplites abichi* (Anthula) — Druschich & Kudryavtsev, p. 321, Text-Figure 110, Pl. 8, Figure 3
1961 *Cheloniceras abichi* (Anthula) — Eristavi, tab. 4, Figure 2
1967 *Acanthohplites abichi* (Anthula) — Dimitrova, p. 187, Pl. 89, Figures 6, 6a
1968 *Acanthohoplites abichi* (Anthula) — Wiedmann & Dieni, p. 88
1975 *Acanthohoplites abichi* (Anthula) — Fülöp, p. 104

Material. 29 specimens from all Tata localities in good state of preservation.
Measurement.

	D	H	W	U	W/H
1.	20	9(45)	8(40)	8(40)	0.88

Description. Specimens are small, slightly bubbled with wide umbilicus. Whorl height increases slowly, whorl section is circular. Ribs dense, narrow and appear on the umbilical edge, RI = 34 on the las whorl. Primary ribs wear tubercles on the outer side of the flank; branching, secondary rib starts from the tubercle. Intercalated ribs are without tubercle. Suture cannot be observed.

Discussion. The species is related to the group of *A. bigoureti* (Seunes, 1887) but has lower flanks and less coarse ornamentation. *A. aschiltaensis* (Anthula, 1899) has similar fine ribbing but whorl section is oval, in contrary to the circular whorl section of *A. abichi*.

Occurrence. Characteristic ammonite of the Mediterranean Clansayesian. In Hungary it is known from the condensed Upper Aptian basal pockets of Tata Limestone Formation.

Acanthohoplites andranomenensis **Besaire, 1936**
Pl. IX, Figures 9, 10, 11

1947 *Acanthohoplites andranomenensis* Besaire — Breistroffer, p. 67
1962 *Acanthohoplites andranomenensis* Besaire — Collignon, p. 51, Pl. 235, Figure 1017
1968 *Acanthohoplites andranomenensis* Besaire — Wiedmann & Dieni, p. 86, Pl. 9, Figure 6, Text-Figure 61

Material. Three specimens from Kálvária Hill locality.

Description. Small, oval specimens with shallow and narrow umbilicus. Very fine ribs start at the umbilical edge and wear tubercles on the midflank. Ribs are branching after the tubercle, secondary ribs crossing the outer flank and the venter slightly rectiradiate. Intermediate ribs are also present. The venter is rounded. Between the primaries, 2–3 intercalated ribs appear, wearing no tubercles. Suture cannot be observed.

Discussion. The species is well identifiable on the basis of its fine, small sculpture — dense, fine ribbing and tuberculated primaries.

Occurrence. The species is known from the Clansayesian of the Mediterranean region. In Hungary it is from the condensed Upper Aptian basal pockets of Tata Limestone Formation.

Genus *Nolaniceras* Casey, 1961a
Type species: *Hoplites nolani* Seunes, 1887

Nolaniceras nolani **(Seunes, 1887)**
Pl. X, Figures 4, 20, 21, Pl. XIII, Figure 8

*1887 *Hoplites Nolani* Seunes, p. 564, Pl. 13, Figure 4
1905 *Parahoplites Nolani* (Seunes) — Jacob, p. 408, Figure 3
1955 *Hypacanthoplites nolani* (Seunes) — Eristavi, p. 104, Pl. 4, Figure 8
1961 *Acanthohoplites nolani* (Seunes) — Eristavi, p. 56, Tab. 2, Figure 8
1960 *Acanthoplites nolani* (Seunes) — Druschich & Kudryavtsev, p. 326, Pl. 13, Figures 1–4
1968 *Acanthohoplites nolani* (Seunes) — Wiedmann & Dieni, p. 88, Pl. 9, Figures 10, 17
non 1975 *Acanthohoplites nolani* (Seunes) — Fülöp, p. 104, Pl. 19
1982 *Acanthohoplites nolani* (Seunes) — Renz, p. 29, Pl. 2, Figures 5a, b; Text-Figures 18a, b

Material. Fourteen specimens from Kálvária Hill and Fazekas street localities.
Measurement.

	D	H	W	U	W/H
1.	30	11(37)	8(27)	10(33)	0.72
2.	24	10(42)	8(33)	7(29)	0.8

3.	23	10(43)	6.5(26)	8 (35)	0.6
4.	28	11(40)	9(32)	11(40)	0.81

Description. Small, compressed, ellipticone specimens with wide and shallow umbilicus. Fine ribs bifurcate from the umbilical bullae; the number of the bullae on the last whorl is 19–21. Intercalated ribs start from the inner flank which results in very dense ribbing, RI = 46 on the last whorl. Ribs are tending to be more sinuous and prorsiradiate towards the aperture and cross the venter. The venter is rounded. Suture cannot be observed.

Discussion. Fine, dense and sinuous ribbing and rounded venter resembles to *A. andranomenensis* BESAIRE (1936) but *nolani* lack tubercles.

Occurrence. The species is an index fossil of the Late Aptian *Nolaniceras nolani* Zone, known worldwide. In Hungary it is from the condensed Upper Aptian basal pockets of Tata Limestone Formation.

Genus *Hypacanthoplites* SPATH, 1923
Type species: *Acanthoceras Milletianum* D'ORBIGNY var. *plesiotypica* FRITEL, 1906

***Hypacanthoplites* spp.**
Pl. X, Figures 3, 14, 22, Pl. XIII, Figure 4

Material. Great numbers of internal moulds in various state of preservation from all Tata localities.

Description. Discoidal forms with moderate involution. Primary ribs start from the umbilical edge, if it is visible.

Occurrence. The genus *Hypacanthoplites* is known from Upper Aptian – Lower Albian deposits, worldwide. In Hungary the genus is reported from the Upper Aptian basal pockets of Tata Limestone Formation.

***Hypacanthoplites* cf. *milletianus* (D'ORBIGNY, 1841)**
Pl. X, Figures 6, 17

*1841 *Ammonites Milletianus* D'ORBIGNY, p. 263, Pl. 77, Figures 1, 2
1947 *Hypacanthoplites Milletianus* (D'ORBIGNY) — BREISTROFFER, p. 40
pars 1965 *Hypacanthoplites milletianus* (D'ORBIGNY) — CASEY, p. 433, Pl. 73, Figures 7a, b, c, Text-Figure 160

Material. Five specimens from Fazekas street and Kálvária Hill localities.

Measurement.

	D	H	W	U	W/H
1.	–	36	16	–	0.44

Description. Big fragments with coarse ornamentation. Wide primary ribs start from the umbilical edge; intercalated ones appear on midflank and cross the flattened venter rectiradiate. Early whorls can have small tubercles on the umbilical edge which disappear during the ontogeny.

Discussion. Ventral region of CASEY's (1965) specimen is rounded which makes the generic identification questionnable. Pl. X, Figure 17 specimen resembles to *H. trivialis* BREISTROFFER (1947) but the ribbing of *milletianus* is coarser and tubercles are present at young stage.

Occurrence. The species known from Clansayesian of England, France and Georgia. In Hungary it is from the condensed Upper Aptian basal pockets of Tata Limestone Formation.

***Hypacanthoplites plesiotypicus* (FRITEL, 1906)**
(= *Hypacanthoplites jacobi* COLLET, 1907)
Pl. X, Figures 10, 16, 18, 19, 23

*1906 *Acanthoceras Milletianum* D'ORBIGNY sp. var. *plesiotypica* FRITEL, p. 245, 246, Text-Figure 2
1907 *Parahoplites jacobi* COLLET, p. 520, Pl. 8, Figures 1–3
1947 *Hypacanthoplites jacobi* sp. var. *obsoleta* (COLLET) — BREISTROFFER, p. 31, 83
1955 *Hypacanthoplites jacobi* SEUNES — ERISTAVI, p. 107
1960 *Hypacanthoplites jacobi* (COLLET) — DRUSCHICH & KUDRYAVTSEV, p. 331, Pl. 15, Figures 1a, b
1961 *Hypacanthoplites jacobi* (COLLET) — ERISTAVI, p. 60, Pl. 3, Figure 1
1961b *Hypacanthoplites jacobi* (COLLET) — CASEY, p. 529, 560, 609
1965 *Hypacanthoplites jacobi* (COLLET) — CASEY, p. 424, Pl. 72, Figures 5a, b, Text-Figures 156, 162a, f
1982 *Hypacanthoplites jacobi* (COLLET) — KEMPER, Pl. 3, Figures 4, 7, 8, 10, 11, 12
1982 *Hypacanthoplites 'plesiotypicus'* (FRITEL) — KEMPER, Pl. 3, Figures 6, 9
2000 *Hypacanthoplites plesiotypicus* (FRITEL) — KENNEDY et al., Figures 56a–k, 57j, r

Material. Five fragmented specimens from Fazekas street and Kálvária Hill localities.

Measurement.

	D	H	W	U	W/H
1.	52	24(46)	15(28)	20(38)	0.625

Description. Medium sized compressed forms with subrectangular whorl section, with medium wide and shallow umbilicus. Ribs start at the umbilical edge, slightly sinuously cross the flanks and cross the venter prorsiradiate or rectiradiate. Intercalated ribs start at the outer flank, RI= 20–22 on the last whorl. The venter is flat, the ventrolateral edge is sharp.

Discussion. Kennedy (Kennedy et al. 2000) discussed the species and pointed out: "...the types of *plesiotypicus* Fritel, 1906 and *jacobi* of Collet, 1907 are conspecific, with the former name having priority. For clarity of communication, the term *jacobi* Zone has been retained here, however.". Here his opinion is followed.

Occurrence. Hypacanthoplites jacobi is the index fossil of the Late Aptian *Hypacanthoplites jacobi* Zone, is known from the Western Tethyan region. In Hungary the species is reported from the condensed Upper Aptian basal pockets of Tata Limestone Formation.

***Hypacanthoplites elegans* (Fritel, 1906) (= *Hypacanthoplites elegans* (Fritel, 1906), *Hypacanthoplites hannovrensis* (Collet, 1907) and *Hypacanthoplites spathi* Dutertre, 1938)**
Pl. X, Figures 8, 11, 12

*1906 *Acanthoceras Milletianum* d'Orbigny var. *elegans* Fritel, p. 246, Figure 3
1947 *Hypacanthoplites elegans* (Fritel) — Breistroffer, p. 8
1955 *Hypacanthoplites hannovrensis* Collet var. *elegans* (Fritel) — Eristavi, p. 106, Pl. 5, Figure 4
1961b *Hypacanthoplites elegans* (Fritel) — Casey, p. 529, 560, 609
1965 *Hypacanthoplites elegans* (Fritel) — Casey, p. 439, Pl. 71, Figures 1a, b; Pl. 72, Figure 3, Pl. 74, Figures 10a, b, Text-Figures 163a–c
1971 *Hypacanthoplites elegans* (Fritel) — Kemper, Pl. 28, Figure 2; Pl. 29, Figures 5a, b
2006 *Hypacanthoplites* cf. *elegans* (Fritel, 1906) — Raisossadat, p. 915, Figures 4J, K

Material. Three specimens from Vájáriskola and Kálvária Hill localities.

Measurements.

	D	H	W	U	W/H
1.	–	12	7	–	0.58
2.	39	–	–	11(28)	–

Description. Moderately evolute specimens with compressed whorl section, with high flanks and flat topped venter. Feeble bullae or tubercles are present on the umbilical edge. Ribs are branching from bullae on the lower flank. Ribs are fine, dense and narrow. Sometimes intercalated ribs are also present.

Discussion. Dense, fine ribbing and slight tubercles are specific characters. Kennedy (in Kennedy et al. 2000) considered *H. elegans* (Fritel, 1906), *H. hannovrensis* (Collet, 1907) and *H. spathi* Dutertre (1938) as the same species and keep the name of *elegans* due to the reason of priority.

Occurrence. The species is known from the Late Aptian *Hypacanthoplites jacobi* Zone of France, England, Germany and Iran. In Hungary it is reported from the condensed Upper Aptian basal pockets of Tata Limestone Formation.

***Hypacanthohoplites acutecostum* (Riedel, 1938)**
Pl. X, Figures 9, 13, 15

*1938 *Acanthohoplites acutecosta* Riedel, p. 42, Pl. 8, Figures 1–6; Pl. 14, Figure 23

Material. Three specimens from Vájáriskola locality.

Description. Medium sized form with moderate involution. The primary ribs start at the umbilical edge from bullae then bifurcate. Intercalated ribs are also present. Ribs are fine and cross the lateral part sinuously. On the ventral edge, sometimes weak tubercles present. The venter is flattened, ribs goes straight on it.

Discussion. The flattened venter makes the generic specification clear. The specimens resemble to *H. elegans* (Fritel, 1906) but the ribbing is coarser and more rigid. According to Riedel's opinion (1938, p. 43) the species is resembles to *Gargasiceras interiectus* (Riedel, 1938).

Occurrence. Riedel (1938) reported the specimen from the Upper Aptian deposits of Colombia. In Hungary it is reported from the condensed Upper Aptian basal pockets of Tata Limestone Formation at Vájáriskola locality.

Subfamily Parahoplitinae Spath, 1922a
Genus *Parahoplites* Anthula, 1899
Type species: *Parahoplites melchioris* Anthula, 1899

?Parahoplites melchioris ANTHULA, 1899
Pl. XI., Figures 1, 4, 5

*1899 *Parahoplites melchioris* ANTHULA, p. 111, Pl. 8, Figures 4a, b, c; 5a, b
1907 *Parahoplites melchioris* ANTHULA, 1899 — SINZOW, p. 462, Pl. 2, Figures 1–4
1971 *Parahoplites melchioris* ANTHULA, 1899 — KEMPER, Pl. 24, Figure 4, Pl. 26, Figures 5a, b; Pl. 28, Figures 5a, b

Material. Seven specimens from various Tata localities.

Description. Specimens are slightly flattened; the shape of the conch is almost rounded. Lateral side is flat, the venter is well rounded and the umbilicus is medium deep. At the umbilical edge bullae appear and then primary ribs start and cross the lateral side straight. During the ontogeny ribs tend to be sinous with a slight prorsiradiation on the venter. Secondary ribs appear on the midflank, neither them nor the primaries wear tubercles. Suture cannot visible.

Discussion. The sharp ribs and the circular shape of the conch characterize the species, but the flattened preservation does not let us to examine the venter, therefore the generic status is questionnable. The lateral side ornamentation of *Acanthohoplites aschiltaensis* (ANTHULA, 1899) is very similar, but on the basis of the rather big size it is more likely that the specimens belong to *Parahoplites*.

Occurrence. The species is reported from the condensed Upper Aptian basal pockets of Tata Limestone Formation from Tata localities, otherwise known from Germany, the Kaukasus and Mangyshlak.

Parahoplites multicostatus SINZOW, 1907
Pl. XII, Figures 2, 3

*1907 *Parahoplites multicostatus* SINZOW, p. 463, Pl. 2, Figures 5, 7, 9, 11
1971 *Parahoplites multicostatus* SINZOW — KEMPER, Pl. 26, Figures 3a, b; Pl. 27, Figures 3a, b

Material. Two well preserved specimens from Kékkő Quarry, Tata.

Description. Bubbled fragment of an internal mould with well rounded wide venter and slightly flattened flanks. Ribs are narrow, dense, arise from an umbilical bullae; primaries bifurcate but intercalated ribs appear as well. Both ribs are getting equal in width at the outer flank and cross the venter straight.

Discussion. The generic identification is clear due to the excellent preservation. The dense and fine ribbing and the lack of ventrolateral tubercles characterize the species.

Occurrence. The species known from Hungary from the condensed Upper Aptian basal pockets of Tata Limestone Formation at Kékkő Quarry locality, otherwise known from Switzerland, Germany, Russia and Mangyshlak.

?Parahoplites tenuicostatus (SINZOW, 1907)
Pl. XI. Figures 2, 3, 6

*1907 *Acanthohoplites multispinatus* ANTHULA var. *tenuicostata* SINZOW — Pl. 7, Figures 1, 2, 3

Material. Seven internal moulds and fragmens from Tata localities, mainly from Kékkő Quarry.

Description. Relatively huge specimens with characteristically high whorl section and narrow umbilicus. Ribs arise from strong umbilical bullae, than cross the lateral side sinuously. Intercalated ribs appear on the midflank. Venter and sutures cannot be observed.

Discussion. The generic identification is uncertain because of the flattening and the unobservable venter, but on the basis of the big size is is more likely, that the specimens belong to *Parahoplites* rather than *Acanthohoplites*. The species can be identifyable with the high whorl section and the sinuous ribs start from umbilical bullae. The Hungarian specimens resemble very much to *Deshayesites* but the Early Aptian age seems to be unlikely considering the whole ammonite assemblage. Unfortunately the ventral area cannot be observed; therefore the generic name is with question mark. The species is also resembles to *Neodeshayesites* RIEDEL, 1938 but this genus is reported only from the Early Albian of Venezuela and Colombia.

The stratigraphical distribution of *Parahoplites*, and also the co-occurence with *Acanthohoplites* and *Hypacanthoplites* is problematic. According to the opinion of OWEN (1996a), the last members of genus *Parahoplites* co-occur with *Hypacanthoplites* in the Late Aptian *Nolaniceras nolani* Zone and *Parahoplites* also co-occur with *Cheloniceras* with the whole stratigraphic range of the two genera. CASEY (1996) refused both statements. In the Kopet Dagh Basin (RAISSOSADAT 2006), genera *Acanthohoplites, Hypacanthoplites* and *Parahoplites* are partly co-occur together.

Distribution. The species is known from the Upper Aptian deposits of Russia, the Caucasus and Mangyshlak, in Hungary the species is reported from the condensed Upper Aptian basal pockets of Tata Limestone Formation from Tata localities.

?Parahoplites robustus (SINZOW, 1907)

Pl. XII, Figures 1, 4; Pl. XIII, Figure 15

*1907 *Acanthohoplites multispinatus* ANTHULA var. *robusta* SINZOW — Pl. 7, Figure 7, 8

Material. Three specimens from Kékkő Quarry, Fazekas street and the Tatabánya Ta–1426 borehole at 277.8 m.

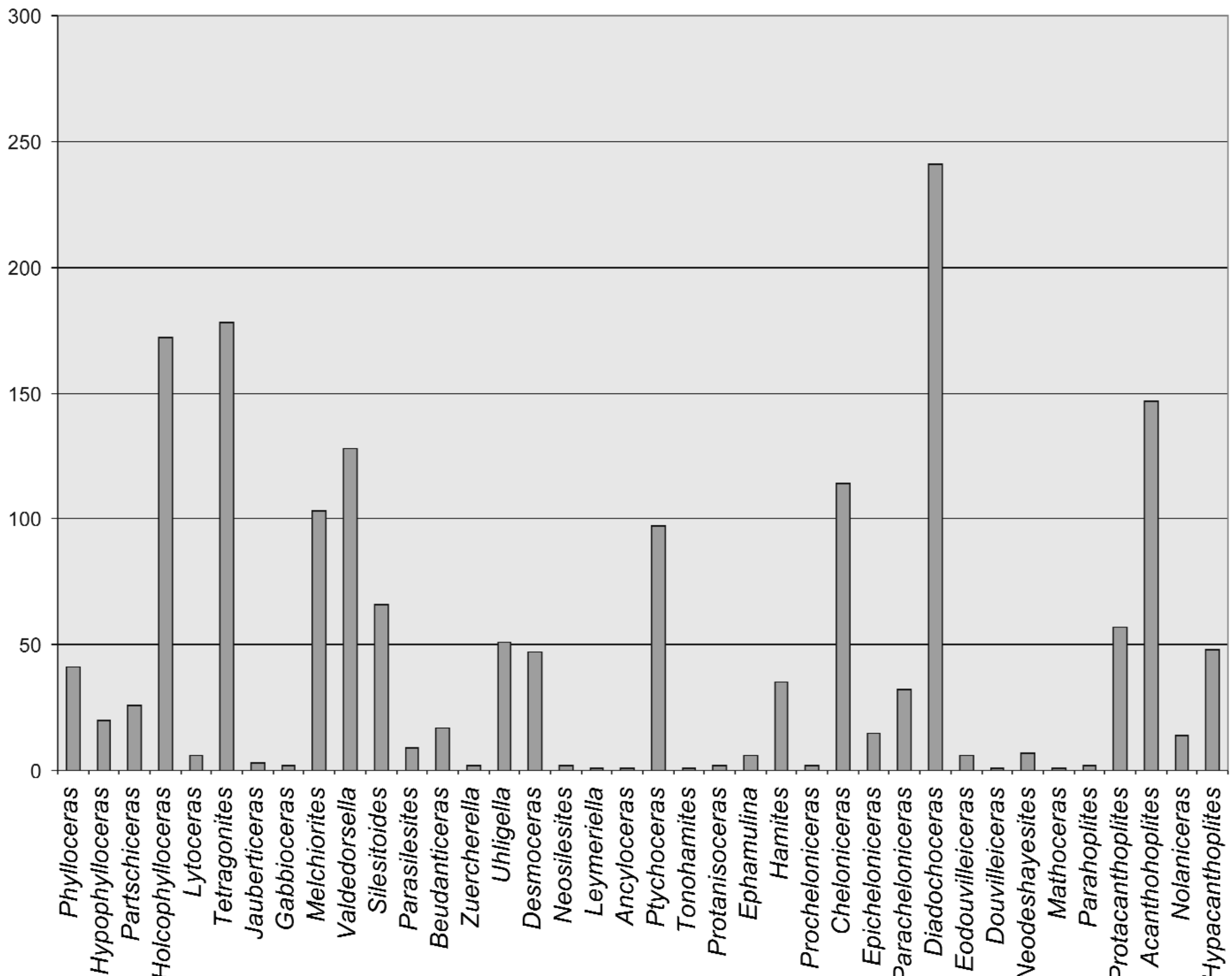
Description. Specimens are flattened. Fragments are huge, moderately involute. Primary ribs arise from umbilical bullae, then getting slighter on the midflank with a delicate sinuous. Intercalated ribs appear on the outer third of the flank and both with the primaries getting broader and blunter when crossing the venter.

Discussion. The ornamentation of the specimens show close resemblance to *P. multispinatus* (ANTHULA, 1899) var. *robusta* (SINZOW, 1907) but the flattened preservation does not let us to examine if ventral tubercles are present.

Occurrence. The species known from Hungary from the condensed Upper Aptian basal pockets of Tata Limestone Formation at Kékkő Quarry locality, otherwise known from Russia and Mangyshlak.

Appendix of the systematic description of Aptian

The summarized generic data (Text-Figure 44) for all Tata localities is presented here, as well as the numerical data of the Hungarian Late Aptian ammonite assemblages (Table 3).



Text-Figure 44. Generic distribution of the collected specimens of the basal lenses from all Tata localities

Table 3. Total number of identified specimens for all localities. Full specimen number data for each locality

Ammonite data of all localities	1	2	3	4	5	6
	Number of specimens					
Subordo Phylloceratina Arkell, **1950**						
Phylloceratidae gen. et. sp. indet.	35					
Phylloceras sp.				2		4
Phylloceras (Hypophylloceras) subseresitense Wiedmann, 1963	5		9			
Phylloceras (Hypophylloceras) velledae (Michelin, 1834)	4			2		
Partschiceras baborense (Coquand, 1880)	15		11			
Holcophylloceras guettardi (Raspail, 1831)*	65	56	42	6		3
Subordo Lytoceratina Hyatt, **1889**						
Lytoceras sp.	1	5				
Tetragonitidae gen. et. sp. indet.	52					
Tetragonites sp.		1		4		5
Tetragonites (Tetragonites) duvalianus (d´Orbigny, 1840)	78	5	20	13		5
Tetragonites (Tetragonites) heterosulcatum Anthula, 1899	38			8		1
Jauberticeras jaubertianum (d´Orbigny, 1851)			2	1		
Gabbioceras michelianum (d'Orbigny 1850)			1	1		
Subordo Ammonitina Hyatt, **1889**						
Melchiorites sp.						8
Melchiorites melchioris (Tietze, 1872)	19	7	20	35	1	3
Melchiorites emerici (Raspail, 1831)						10
Valdedorsella getulina (Coquand, 1880)	58	18	45	2		5
Silesitoides escragnollensis (Jacob, 1908)	38	21				1
Silesitoides superstes (Jacob, 1908)		4	2			
Parasilesites kilianiformis (Fallot, 1920)*	3	2	3	1		
Beudanticeras sp.*	(2*)					
Beudanticeras (Beudanticeras) beudanti (Brogniart, 1824)	3	-	4	-	-	-
Beudanticeras (Beudanticeras) cf. *convergens* (Jacob, 1908)*	1	6	1	1	1	
Zuercherella zuercheri (Jacob & Tobler, 1906)				2		
Uhligella sp.				14		
Uhligella balmensis (Jacob, 1908)	10	1	5	-	-	-
Uhligella clansayensis (Jacob, 1905)	16	1	4			
Desmoceras sp.		23		8		
Desmoceras (Desmoceras) latidorsatum (Michelin, 1838)	11			5		
Neosilesites nepos (Fallot, 1910)*	(6 *)					
Brancoceras sp.*	(2*)					
Subordo Ancyloceratina Wiedmann, **1966**						
?Ancyloceras matheroni (d'Orbigny, 1842)	1					
Tonohamites boldii Szives & Monks, 2002					1	
Ptychoceras laeve Matheron, 1842	27	17	38	8	3	4
Protanisoceras acteon (d'Orbigny, 1850)					2	
Ephamulina arcuata Collignon, 1962		6				
Hamites sp.	16	4	9	3	5	3
Hamites praegibbosus Spath, 1939					2	3
Hamites csaszari Szives & Monks, 2002	1					
Hamites fazekasensis Szives & Monks, 2002			1			
Hamites kalvariensis Szives & Monks, 2002	2					
Hamites fueloepi Szives & Monks, 2002		1				
Douvilleiceratidae gen. et. sp. indet.	26					
Procheloniceras albrechti austriae (Uhlig, 1883)	2					
Cheloniceras sp.			15			
Cheloniceras (Cheloniceras) cornuelianum (d´Orbigny, 1841)	23		65	6		18
Cheloniceras (Epicheloniceras) sp.	2					
Cheloniceras (Paracheloniceras) rerati Collignon, 1962*	7	21		4		
Diadochoceras sp.			11			
Diadochoceras nodosocostatum (d´Orbigny, 1840)	134	4	98	3		2
Diadochoceras hokodzense Mikhailova 1963			11			
Diadochoceras spinosum Mikhailova 1963	26	2	1	1		
Diadochoceras margariti Mikhailova 1963	8		7			1
Eodouvilleiceras clansayense (Jacob, 1908)	6	8	1	2		
?Douvilleiceras sp.	1					
Dufrenoyia katalinae sp. nov			1			
Mathoceras sumerensis (Stoykova, 1990)				1		
Colombiceras tobleri (Jacob & Tobler, 1906)	1		1			
?Protacanthoplites originalis Sharikadze et al., 2004	31	4	15	7		
Acanthohoplites sp.	4	2	3	5	1	6
Acanthohoplites bigoureti (Seunes, 1887)	2			3		7
Acanthohoplites aschiltaensis (Anthula, 1899)	3	9	23	20	1	
Acanthohoplites abichi (Seunes, 1887)			8		3	14
Acanthohoplites bigoti (Seunes, 1887)	1					
Acanthohoplites andranomenensis (Besaire, 1936)	2					1
Nolaniceras nolani (Seunes, 1887)*	10	1	3			
Hypacanthoplites sp.	29	4	6	5		2
Hypacanthoplites acutecostum (Riedel, 1938)				3		
Hypacanthoplites plesiotypicus (Fritel, 1906)	1		4			
Hypacanthoplites cf. *milletianus* (d´Orbigny, 1841)		3		2		
Hypacanthoplites elegans (Fritel, 1906)				2		
?Parahoplites sp.*	(1*)					
?Parahoplites melchioris Anthula, 1899	3	2	2			
?Parahoplites tenuicostatus (Sinzow, 1907)	1	5	1			
?Parahoplites multicostatus Sinzow, 1907		2				
?Parahoplites robustus (Sinzow, 1907)		1	1			
Total	822	247	493	182	20	106
Total number of determined specimens	1870					

Abbreviations: 1 — Kálvária Hill, ,2 — Kékkő Quarry, 3 — Fazekas street, 4 — Vájáriskola, 5 — Eperkés Hill, 6 — Márvány Quarry. Taxa found in boreholes are marked with *.

Albian stage

(OTTILIA SZIVES)

Geology and stratigraphy

Historical background

The Albian stage was introduced by D'ORBIGNY (1842) and named after the Roman name, Alba of Aube. The present type section is located at Aube in the Paris Basin, France. The base of the Albian stage is defined by the first occurrence of a calacareous nannofossil *Prediscosphaera columnata*, the end is defined by the first occurence of a planktonic foraminifer *Rotalipora grobotruncanoides* (GRADSTEIN et al. 2004). According to the latest studies, the Albian stage lasts from 112±1 to 99.6±0.9 Ma (GRADSTEIN et al. 2004).

In present monograph the latest report on the suggested standard ammonite zonal sheme for the Albian stage is followed (REBOULET & HOEDEMAEKER, 2006), apart from the Lowermost Albian and the subzonation of the *Stoliczkaia (Stoliczkaia) dispar* Zone.

Table 4. Biozonation of the Albian in the European faunal province after OWEN (1999) and KENNEDY et al. (2000)

		Zones (KENNEDY et al. 2000)	Zones (OWEN 1999b)	Subzones (OWEN 1999b; AMÉDRO 2002 in KENNEDY et al. 2008)
ALBIAN	Upper Albian (Vraconnian)	Not mentioned	*Stoliczkaia (Stoliczkaia) dispar*	*Arrhaphoceras (Praeschloenbachia) briacensis* *Mortoniceras (Subschloenbachia) perinflatum* *Mortoniceras (Subschoenbachia) rostratum* *Mortoniceras (Mortoniceras) fallax*
			Mortoniceras (Mortoniceras) inflatum	*Callihoplites auritus* *Hysteroceras varicosum* *Hysteroceras orbignyi* *Dipoloceras cristatum*
	Middle Albian		*Euhoplites lautus*	*Anahoplites daviesi* *Euhoplites nitidus*
			Euhoplites loricatus	*Euhoplites meandrinus* *Dipoloceroides subdelaruei* *Dimorphoplites niobe* *Anahoplites intermedius*
			Hoplites dentatus	*Hoplites spathi* *Lyelliceras lyelli*
	Lower Albian		*Otohoplites auritiformis*	*Pseudosonneratia (Isohoplites) steinmanni* *Otohoplites bulliensis* *Protohoplites (Hemisonneratia) puzosianus* *Otohoplites raulinianus*
			Sonneratia chalensis	*Cleoniceras floridum* *Sonneratia kitchini* *Sonneratia (Globosonneratia) perinflata*
		Leymeriella (E.) regularis	*Leymeriella tardefurcata*	*Leymeriella regularis*
		Leymeriella (L.) tardefurcata		*Leymeriella acuticostata*
		Leymeriella (L.) germanica		
		Proleymeriella schrammeni		*Leymeriella schrammeni*

This table is not a correlation chart. Note that KENNEDY merged two Leymeriella subzones to the Aptian.

Zonal schemes for the Albian of the European faunal province were published by OWEN (1984; 1999a, b, c; 2002) and by KENNEDY et al. (2000) for the Latest Aptian/Lowermost Albian of the Tethyan province (Table 4). For historical and practical reasons, the Aptian/Albian boundary on the basis of ammonites, is defined by the first appearance of genus *Leymeriella (Proleymeriella)* by BREISTROFFER (1947). Recent investigations (KENNEDY et al. 2000; HANCOCK 2001) made clear that genus *Leymeriella* is not an eligible marker to determine the exact position of the boundary. A detailed history of the zonal schemes for the Albian is studied by CASEY (1961a), KEMPER (1982), KENNEDY et al. (2000) and OWEN (2002).

BREISTROFFER (1947) merged the Clansayesian substage — JACOB's (1908) original Zone of *Douvilleiceras (Diadochoceras) nodosocostatum* and *Douvilleiceras (Acanthohoplites) bigoureti* — to the Aptian. Ammonite standard zonal scheme for the Albian stage is under a current discussion (REBOULET & HOEDEMAEKER 2006), but the position of the Aptian/Albian boundary is still an outstanding problem. According to the ammonite record, KENNEDY (KENNEDY in KENNEDY et al. 2000) suggested to mark the Aptian/Albian boundary between *Leymeriella germanica* and *Leymeriella tardefurcata* Zones. Here I follow his zonation for the latest Aptian/Lowermost Albian. The most recent study (HANCOCK 2001) proposed the base of *Lyelliceras lyelli* Zone as the base of the Albian — the lower boundary of this subzone currently marks the basal Middle Albian. OWEN (2002) also supported this idea and agreed that the position of the Clansayesian and the Aptian/Albian boundary is problematic since BREISTROFFER (1947). The Aptian/Albian boundary problems are also discussed in the Aptian chapter.

The subdivisions of the *Stoliczkaia (S.) dispar* Zone follows AMÉDRO's (2002) zonation who rise *Mortoniceras (Mortoniceras) fallax* BREISTROFFER as the oldest subzone of the *Stoliczkaia (S.) dispar* Zone (LATIL 1994a, b; AMÉDRO 2002 in KENNEDY et al. 2008).

The Albian/Cenomanian boundary is fully discussed in the last decade (TRÖGER et al. 1996; GALE et al. 1996; KENNEDY et al. 2004) and a Global Boundary Stratotype Section and Point (GSSP) is marked at Mont Risou, France (GALE et al. 1996; KENNEDY et al. 2004; GRADSTEIN et al. 2004) on the base of the first occurence of *Rotalipora globotruncanoides*, a plancton foraminifer. The historical ammonite markers of the basal Cenomanian as genera *Mantelliceras* HYATT, 1903 or *Neostlingoceras* KLINGER & KENNEDY 1978, are not widespread enough or rare (HANCOCK 2001) to mark the base correctly (GALE et al. 1996, KENNEDY et al. 2004).

Albian record in Hungary

Geological setting and stratigraphy

The Albian age was a stirring period in the history of the future Alps. First movements of Austrian orogeny started in the Early Aptian and culminated around the Aptian/Albian boundary (HAAS 1994) so Late Aptian – Middle Albian strata are often disturbed or even absent in the Western Tethyan area, even as in Hungary. In the Cretaceous, the second huge sedimentary megacycle had been started in the Early Albian and a slow, continuous deepening of the sedimentary basin can be recognized. Albian formations are relatively rare on the surface of Hungary. In the present Pannonian Basin most of the pre-Neogene basement is covered with hundreds, or even thousand metres of Neogene deposits. Mesozoic, consequently Albian sediments are exposed on surface and in boreholes in two areas — in the Transdanubian Range and the Villány Mountains. Hungarian Albian sediments from stratigraphic point of view are represented by several lithostratigraphic units. Albian ammonite bearing sequences listed here from south to north.

VILLÁNY MOUNTAINS

In the Villány Mountains Albian ammonites are known only from two sedimentary units, a dark grey aleurolite-marl-sandstone sequence known as Bóly Sandstone and the Bisse Marl Formations. Their geographical position can be seen on.

Cretaceous sediments of the Villány Mountains were first mentioned by PETERS (1863, p. 6) in the Hungarian geological literature. Detailed geological mapping of the area was done by HOFMANN (1876) for the first time. FÜLÖP (1966) realized the Albian age of previously thought-to-be Neocomian dark grey marl on the basis of ammonite evidences.

Bisse Marl Formation is dark grey marl with turbiditic sandstone intercalations, which overlaps the NAGYharsány Limestone or older Jurassic sediments. LÓCZY jr. (1912) published a monograph about the Villányi Cretaceous and he mentioned first a "[…when wet it is a bluish grey, at dry state a yellow coloured marl…]". This deposit was named later as Bisse Marl Formation (HORVÁTH in FÜLÖP 1978, p. 104). It is restricted to the Villány Zone, and known from a single surface outcrop of Tenkes Hill and from several boreholes — the most important are Bóly B–1, Vokány V–4, NAGYbaracska B–28. The marl is hemipelagic sediment (CSÁSZÁR [ed] 1996) with a rich ammonite assemblage of Late Albian age that was found in the Bóly B–1 borehole.

The Bóly Sandstone Formation is poorly known flysch sediment. The only sure record of the Bóly Sandstone is from the upper part of the Bóly B–1 borehole. BODROGI (1998) sutdied the foraminifer assemblage of the Bóly B–1 borehole. A borehole near to Nagybaracska B–28 crossed similar sediment without any ammonite evidence. BUJTOR (1989, 1991) studied intensively the macrofossil assemblage of the borehole, with a special focus on the abundant ammonites. According to the hereby revised ammonite data of the Bóly B–1 borehole, the age of the Bóly Sandstone Formation is restricted in the Late Albian *Stoliczkaia (S.) dispar* Zone.

TRANSDANUBIAN RANGE

Heading to north to the Transdanubian Range, Albian sediments are the Vértessomló Aleurolite, Zirc Limestone and Pénzeskút Marl formations that yield rich ammonite assemblages of Early and Latest Albian.

The Vértessomló Aleurolite is restricted to the Vértessomló Basin, the Tatabánya Basin, the western Gerecse foreland and supposedly it appears in the Western Gerecse Mountains (CSÁSZÁR [ed.] 1996). Early Albian ammonites are known from several boreholes and preserved mostly in pyritic state. In the Vértessomló Vs–8 continuous core sampled borehole the transition between crinoidal, underlying Tata Limestone and the covering, dark grey Vértessomló Aleurolite could be well observed with an excellent example of a fault as well.

Zirc Limestone is a rudistid, biogenic limestone which underlies the Pénzeskút Marl sequence. Due to its facies, ammonites are rare in the sediment, hitherto HORVÁTH (1985) mentioned a "*Stoliczkaia dispar"* specimen from the upper part of the Zirc Limestone. According to her data the age of the limestone, or at least the upper part, is Late Albian. Foraminifer data is presented by BODROGI (1993) and supported the Late Albian age of the formation.

The glauconitic Pénzeskút Marl is one of the most extensively studied Cretaceous sedimentary units of Hungary since centuries. The greyish yellow dolomitic marl with an impressive thickness of 350–500 metres, can be interpreted as the closure of the "Mid"-Cretaceous (Aptian–Cenomanian) sedimentary circle (CSÁSZÁR [ed.] 1996). According to its sedimentary features, the marl is divided vertically into three parts. Ammonites occur in all three subunits. Brief summary of the research history of Pénzeskút Marl given below is based on the work of NAGY (1973).

Although RÓMER (1858) mentioned a *Hippurites* from the Bakony Mts, HAUER (1862) made palaeontological interpretation for the first time. Thanks to its impressive macrofauna — ammonites, belemnite rostra, bivalves and gastropods in great abundance —, the age of "Schichten von Pénzeskút" and "Schichten von Nána" (HAUER 1862) was well determinable as "Gaultien" by HAUER (1858, 1862). The Pénzeskút Marl contains two sedimentary units: "Turritenmergel" (STACHE 1862, 1867), a light coloured glauconitic, marly sediment is followed — continuously or more frquently with a gap — by a more dolomitic marl. Since HAUER (1862), the Vraconnian of Hungary was named as "strata of Nána" and "strata of Pénzeskút". "Strata of Nána" can be described as an Upper Albian glauconitic sequence that overlaps, sometimes discordantly to other Albian sediments. "Strata of Pénzeskút" are concordantly overlain by the Nána beds. Separation of the two units was based on mainly lithological characters and could not be well observed according to faunistical peculiarities.

The possible presence of Cenomanian strata was suggested by BÖCKH (1909) "…considering the presence of *Acanthoceras mantelli* and *Discoidea cylindrica*.". TAEGER (1909, 1911, 1914, 1915, 1936) also extensively studied the Bakony area, and considered "Turrilitenmergel" and "Gault limestone" as the "youngest Cretaceous strata of the Bakony". He sent fossils to Henri Douvillé, who also attributed Vraconnian age to the upper turrilitic marl (H. DOUVILLÉ 1933). According to Taeger's ammonite data, TELEGDI ROTH (1935) also accepted the Vraconnian age of the glauconitic and turrilitic marl. NOSZKY JR. (1934) suggested the "Vracconnien glauconitic marl" is very alike to the glauconitic marls of the Tatras and supported the presence of Cenomanian sequences. After HAUER (1858, 1862) and H. DOUVILLÉ (1933), studies on ammonite assemblages were abandoned for a while. SZÖRÉNYI (1955) described echinoids, CZABALAY (1964, 1965) was working on the rich gastropod fauna of the "Turrilitenmergel", both of them regarded the age of the sequence as Late Albian to Mid? Cenomanian. In the meantime, two researchers started working on the ammonite assemblages of the Hungarian Upper Albian. Anna HORVÁTH (1985, 1989) studied extensively borehole faunas, while SCHOLZ (1975, 1979, 1997) was working on surface locality materials — as Bakonynána, Pénzesgyőr Tilos Forest. Horváth especially focussed on Jásd J–36 and Jásd J–42 boreholes, results were summarized in two papers (HORVÁTH 1985, 1989) the rest was left in manuscripts. However, Horváth determined ammonites for the late Prof. FÜLÖP what he used for his monographs (1961, 1964, 1975). NAGY I. Z. (1963, 1971, 1982, 1986) studied the cephalopods from the collection of the Hungarian Natural History Museum of surface localities and concluded "on the basis of the (ammonite) faunal elements that both the *Dispar* and *Substuderi* Zones are represented" and "the presence of the Cenomanian….cannot be justified by the ammonite fauna". NAGY I. Z. (1973) presented a list of 44 taxa and made an accurate historical outline of the "Vraconnian". Previous (ammonite HORVÁTH [1985, 1989], foraminifer [SIDÓ 1966, 1971; CSÁSZÁR et al. 1987], ostracod [MONOSTORI 2000]) studies supported the Late Albian – Middle Cenomanian age determination.

According to the ammonite data presented here, specimens surely known from the Late Albian *Stoliczkaia (S.) dispar* Zone and no Cenomanian taxa are recorded. Ammonite taxa determined previously as Cenomanian (HORVÁTH 1985, 1989) from the Jásd J–42 borehole, are revised here as Late Albian ones.

Studied sections

Ammonites from the Early Albian are from the *Leymeriella (L.) tardefurcata* Zone and cannot be found in surface outcrops but in continuous core sampled boreholes. There is no ammonite evidence from the Middle Albian in Hungary, in contrast to the abundant and rich Late Albian faunas.

Vértes foreland

OROSZLÁNY O–1881 BOREHOLE

The borehole, drilled with continuous core sampling, penetrated the Vértessomló Aleurolite Formation. A representative Early Albian ammonite fauna was found in the core (Table 5) from the *Douvilleiceras mammillatum* Superzone. The cephalopods of the O–1881 borehole, presumably with the designations of SCHOLZ, revised by O. SZIVES.

Table 5. Ammonite data of Oroszlány O–1881 borehole

Depth	Ammonite data of Oroszlány O–1881 borehole
292.0	*Beudanticeras beudanti* (BRONGNIART, 1822)
295.5	*Beudanticeras* sp.
295.5	*Beudanticeras beudanti* (BRONGNIART, 1822)
321.4	*Cleoniceras* cf. *cleon* (D'ORBIGNY, 1841)
338.4	*Douvilleiceras mammillatum* (SCHLOTHEIM, 1813)
338.8	*Beudanticeras* sp.

TATABÁNYA TA–1383 BOREHOLE

The borehole was drilled with continuous core sampling and penetrated the Vértessomló Aleurolite Formation. Only two specimens of *Beudanticeras beudanti* (BRONGNIART, 1822) were found between 230.0–256.0 metres.

TATABÁNYA TA–1423 BOREHOLE

A single specimen of *Parasilesites* sp. were found at 292.4 m depth. Figured at Pl. XXV, Figure 4.

TATABÁNYA TA–1428 BOREHOLE

The borehole, drilled with continuous core sampling, crossed Vértessomló Aleurolite Formation. Only a single *Beudanticeras walleranti* (JACOB, 1908) was found in the core at 319.0 metres depth.

PUSZTAVÁM PV–980 BOREHOLE

In the Fülöp József Memorial Book (HAAS [ed.] 1997) there is an unfinished manuscript of the Cretaceous sequences of Vértes Foreland and contains a list and photographs of ammonite assemblages of boreholes drilled around Pusztavám. The work was abandoned because of the death of Fülöp. The ammonite material was determined by SCHOLZ, the specimens are housed in the Geological Museum of Hungary. The assemblage of 63 specimens is from the Upper Albian "Turrilitenmergel" and published by HAAS [ed.] (1997).

VARIOUS AMMONITE ASSEMBLAGES FROM BOREHOLES

Some ammonites were described by SCHOLZ in manuscripts as *Hamites* sp., *Puzosia* sp. and *Leymeriella (Proleymeriella) revili* JACOB from Tata TVG–55 borehole that penetrated the Vértessomló Aleurolite Formation. The material is at the Geological Museum of Hungary.

VARIOUS, APPARENTLY LOST BUT PREVIOUSLY PUBLISHED BOREHOLE MATERIALS

FÜLÖP (1975) mentions several ammonites from borehole sequences as *Leymeriella (Proleymeriella) revili* JACOB, *Kossmatella jacobi* WIEDMANN and *Leymeriella (Proleymeriella) romana* JACOB from Tata TVG–45, Hamites sp. and *Leymeriella (Proleymeriella)* sp. from Tata TVG–59 and *Protanisoceras* sp. from Tata T–15, but we did not reach the track of the specimens.

Bakony Mountains

JÁSD 1 QUARRY

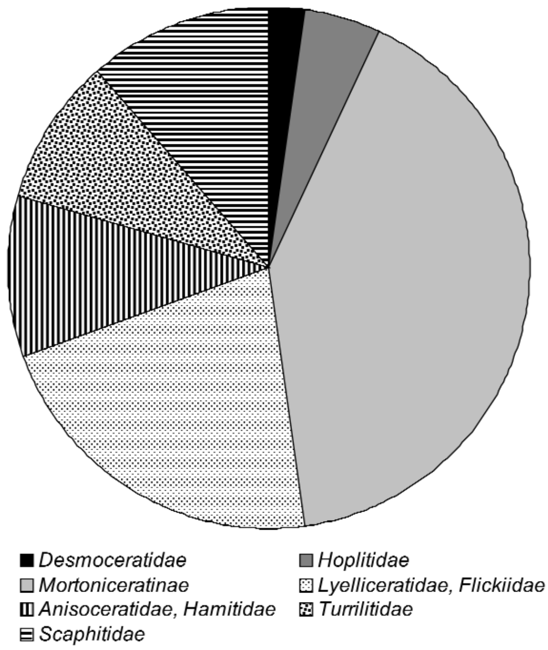
Jásd 1 quarry (Text-Figure 45) is nearby the village of Jásd in the Bakony Mts. There are two quarries in one yard; ammonite material is collected from the smaller one. On account of the oxidation, the originally grey coloured marl became yellowish, with massive marly limestone banks on the base. There is no sign of the condensed basal pockets, so presumably ammonites were not accumulated in pockets at the base but found in the section and collected bed-by-bed.

A brief outline of the section and the ammonite assemblage was given by HORVÁTH (1985, 1989). The exact collecting strata of the fossils cannot be reconstructed according to the original designations; therefore just the numerical and taxonomically revised ammonite data is presented here (Table 6).

Text-Figure 45. View of Jásd 1 quarry with G. Császár. The hammer indicates the lower boundary of the Late Albian “Turrilitenmergel”

Table 6. Ammonite data of Jásd 1 quarry

Ammonite data	Number of specimens
Puzosia (Puzosia) mayoriana (D'ORBIGNY, 1841)	1
Puzosia (Puzosia) planulata (J. de C. SOWERBY, 1827)	1
Discohoplites sp.	3
Hyphoplites sp.	1
Mortoniceras sp.	2
Cantabrigites cantabrigense SPATH, 1933	34
Graysonites horvathi n. sp.	1
Stoliczkaia sp.	3
Stoliczkaia (Stoliczkaia) dispar (D'ORBIGNY, 1841)	10
Anisoceras armatum (J. SOWERBY, 1817)	6
Stomohamites subvirgulatus (SPATH, 1941)	2
Stomohamites virgulatus (BRONGNIART, 1822)	1
Lechites (Lechites) gaudini (PICTET & CAMPICHE, 1859)	4
Mariella sp.	5
Turrilitoides sp.	3
Scaphites sp.	4
Scaphites hugardianus (D'ORBIGNY, 1841)	6



Text-Figure 46. Faunistic composition at family and subfamily level of the ammonite assemblage of Jásd 1 quarry

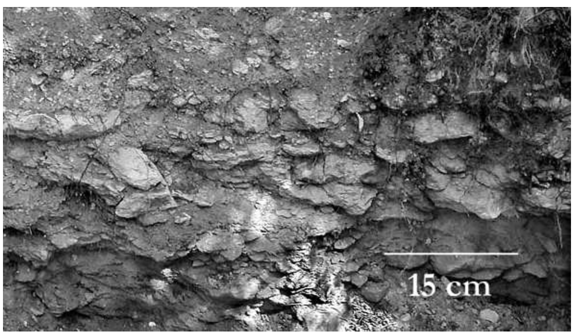
The faunistic composition of the ammonite assemblage (Text-Figure 46) suggests Late Albian age, with typical *Stoliczkaia (S.) dispar* Zone forms. The composition of the assemblage does not let us to determine the exact subzonal age.

TILOS FOREST

The Tilos Forest (Text-Figure 47) is one of the richest fossil collecting outcrop of Hungary, located nearby the village of Pénzesgyőr. Centuries ago, the surroundings of Tilos Forest were the part of the church forests and got its name after the forbidden entry for the locals. The fossiliferous locality is known since one and a half century (RÓMER 1858, 1860). The most accurate and well-known systematic work of the Hungarian Late Albian condensed sequence without giving any stratigraphic data is SCHOLZ's (1979), although his material is from various localities besides the Tilos Forest, and restricted in the basal pockets. In 2003, Főzy and Szives made a bed-by-bed collection which provided useful data not just from the basal pockets but from the overlying sedimentary unit that belongs to the lower subdivision of the Pénzeskút Marl.

The bed-by-bed collecting (Text-Figure 48) made clear that besides the well-documented condensed basal bed, the excavated 1.5 metres thick section (Text-Figure 49) above is also belongs to the *Stoliczkaia (S.) dispar* Zone with the high domi-

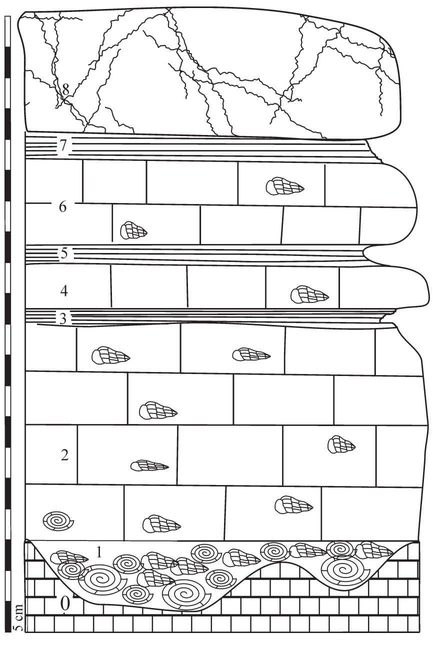
Text-Figure 47. View of Tilos Forest locality. Small pits are the collecting holes of the condensed basal pockets digged by private collectors



Text-Figure 48. The upper part of the bed-by-bed collected section at Tilos Forest

Table 7. Ammonite data of Tilos Forest section sorted bed-by-bed

Ammonite record of Tilos Forest	Number of specimens of Tilos Forest bed-by-bed							
	Base (1)	Bed no.						
		2	3	4	5	6	7	8
Phylloceras seresitense PERVINQUIÉRE, 1907	2							
Tetragonites sp.	2					1	2	
Tetragonites timotheanus (PICTET, 1847)	2							
Puzosia sp.	14		1	1	2	6		
Puzosia (P.) mayoriana (D'ORBIGNY, 1841)	15							
Beudanticeras sp.	11							
Beudanticeras beudanti (BRONGNIART, 1822)	9							
Desmoceras sp.	45							
Desmoceras latidorsatum (MICHELIN, 1838)	2							
Discohoplites sp.	6							1
Hyphoplites sp.								2
Engonoceras duboisi LATIL, 1989	3							
Mortoniceras sp.	3							
Hysteroceras binum (J. SOWERBY, 1815)	3							
Cantabrigites sp.	5					1		
Cantabrigites cantabrigense SPATH, 1933	5							
Neophlycticeras blancheti (PICTET & CAMPICHE, 1861)	13							
Stoliczkaia sp.	23			2		4		
Stoliczkaia (Stoliczkaia) dispar (D'ORBIGNY, 1841)	10							
Stoliczkaia (Stoliczkaia) notha (SEELEY, 1865)	10							
Stoliczkaia (Stoliczkaia) clavigera (NEUMAYR, 1875)	16							
Stoliczkaia (Stoliczkaia) tenuis RENZ, 1968	3							
Salaziceras (Salaziceras) salazacense (HÉBERT & MUNIER-CHALMAS, 1875)	11							
Zuluscaphites orycteropusi VAN HOEPEN, 1955	7							
Zuluscaphites helveticus, KENNEDY & DELAMETTE, 1994	2							
Salaziceras (Noskytes) bakonyense SCHOLZ,	6							
Ficheuria kiliani PERVINQUIÉRE, 1910	1							
Anisoceras armatum (J. SOWERBY, 1817)	25						1	
Anisoceras pseudo-elegans PICTET & CAMPICHE, 1861	5							
Stomohamites virgulatus (BRONGNIART, 1822)	8							2
Stomohamites subvirgulatus (SPATH, 1941)	6							
Helicohamites duplicatus (PICTET & CAMPICHE, 1861)	2							
Ostlingoceras puzosianum (D'ORBIGNY, 1842)		9	3	2	7	1		1
Mariella (Mariella) bergeri (BRONGNIART,	12						1	
Paraturrilites sp.	7							
Turrilitoides hugardianus (D'ORBIGNY, 1841)	14			1		3	1	1
Lechites (Lechites) gaudini (PICTET & CAMPICHE, 1859)	12		5	7	2	1	2	3
Lechites (L.) moreti BREISTROFFER, 1936	2							
Lechites (L.) communis SPATH, 1941	1							
Sciponoceras sp.			2			2		
Scaphites hugardianus (D'ORBIGNY, 1841)	31						3	



Text-Figure 49. Sequence of Tilos Forest. Thick black line indicates the lower boundary of the Late Albian "Turrilitenmergel". 0 — Zirc Limestone Formation; 1 — condensed basal pockets; 2, 4, 6 — limy marl; 3, 5, 7 — loose aleuritic marl

Text-Figure 50. Palaeosurface on the top of the Zirc Limestone Formation, just below the condensed basal pockets of the Pénzeskút Marl Formation. Hammer shows the place of a gigantic *?Puzosia* specimen

Text-Figure 51. A huge *?Puzosia* sp. found on the base of the "Turrilitenmergel"

nance of genus *Ostlingoceras* and *Stoliczkaia* species. The bed-by-bed ammonite data (Table 7) of the ammonite assemblage suggest Late Albian age, with typical *Stoliczkaia (S.) dispar* Zone forms in the basal bed and the overlying two metres as well. The composition of the assemblage does not let us to determine the exact subzonal age.

The faunistic composition of the sequence can be divided into two parts. The upper 150 cm is the yellowish grey marl contain mostly turriliticone ammonites, sometimes aleurolitic intercalations can be detected. It is characterized by the monospecific dominance of *Ostlingoceras puzosianum* (D'ORBIGNY, 1841) which can be caused mainly by palaeoecologic reasons. The other part is the basal bed that shows the dominance of genera *Stoliczkaia, Desmoceras, Puzosia* and *Scaphites*. The recent collection also made clear that the condensed basal "bed" is restricted to local deepenings of the palaeosurface (Text-Figure 50) and not exist as a distinct strata or layer. On the very base, a gigantic ?*Puzosia* specimen was found (Text-Figure 51) which is presumably belonged to the underlying zirc Limestone Formation of the same Late Albian age.

EVANICS COLLECTION

Zoltán Evanics, an amateur fossil hunter, spent 23 years with collecting a marvellous fossil assemblage from the basal pockets of the Pénzeskút Marl from Tilos Forest. His collection contains unique forms: three of *Engonoceras*, from which two are published by BUJTOR (1990a), and beautiful *Salaziceras, Zuluscaphites, Scaphites* and *Ficheuria* specimens. The best of his material is partly documented and photographed here; designations follow the collector's originals. Due to the collecting method, the material is sorted according to rarity, beauty etc. and therefore not an appropriate basis neither for qualitative nor for quantitative analisys.

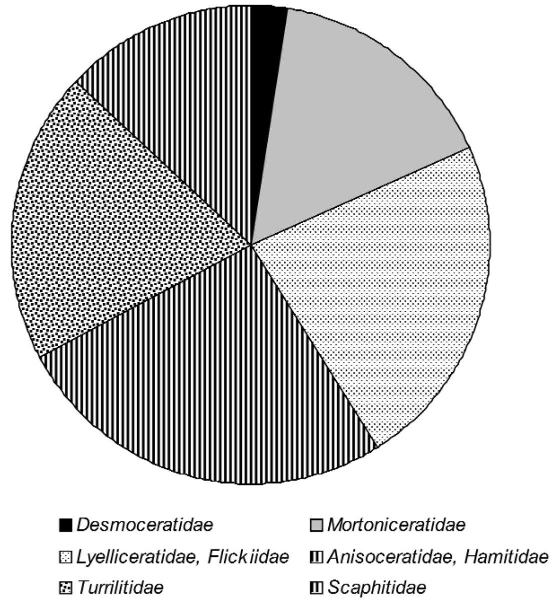
Text-Figure 52. Section of Bakonynána, Zsidó Hill. Hammer indicates the boundary between the massive Albian Zirc Limestone Formation and the overlying Late Albian Pénzeskút Marl "Turrilitenmergel" Formation

BAKONYNÁNA — ZSIDÓ HILL

A classic locality of the Late Albian "Turrilitenmergel" called Zsidó Hill or Gaja Valley road section (Text-Figure 52) is near to Bakonynána. This is the reference section of the lower boundary of the Pénzeskút Marl Formation (CSÁSZÁR [ed.] 1996). In this section the basal condensed pockets were cannot been detected, probably this indicate more equalized palaeosurface. The rock is yellowish grey massive marl with siltstone intercalations. A

Table 8. Ammonite data of Bakonynána, Zsidó Hill section

Ammonite record of Bakonynána, Zsidó Hill	Number of specimens of Bakonynána, Zsidó Hill bed-by-bed								
	9	10	11	12	13	14	15	16	above
Kossmatella muhlenbecki (FALLOT, 1885)							1		
Puzosia sp.				1	1				
Puzosia (Puzosia) mayoriana (D'ORBIGNY, 1841)					1				
Beudanticeras sp.				3	2				
Desmoceras latidorsatum (MICHELIN, 1838)			14		5		3		
Dipoloceras sp.		1							
Mortoniceras (M.) sp.	1			20	1		7		
Mortoniceras (M.) cf. *inflatum* (J. SOWERBY, 1817)								1	
Mortoniceras (M.) cf. *rostratum* (J. SOWERBY, 1817)				1					
Cantabrigites cantabrigense SPATH, 1933		7	9	7	8				
Stoliczkaia (Stoliczkaia) dispar (D'ORBIGNY, 1841)				11	5		2	1	
Stoliczkaia notha (SEELEY, 1865)				4				1	
Neophlycticeras blancheti (PICTET & CAMPICHE, 1859)			3	23	4			1	
Ficheuria kiliani PERVINQUIÉRE, 1910					1				
Anisoceras sp.				1					
Anisoceras armatum (J. SOWERBY, 1817)		5	8	28	15		1	1	
Anisoceras pseudo-elegans PICTET & CAMPICHE, 1859				10					
Hamites sp.				2					
Stomohamites virgulatus (BRONGNIART, 1822)		1		3	2	3			
Stomohamites subvirgulatus (SPATH, 1941)				5	4				
Mariella (M.) sp.				2	1				
Mariella (Mariella) bergeri (BRONGNIART, 1822)		2	2	27	2		1		
Turrilitoides hugardianus (D'ORBIGNY, 1842)			2	4	15				
Lechites (Lechites) gaudini (PICTET & CAMPICHE, 1861)			14		1		2		1
Lechites (L.) communis SPATH, 1941									1
Scaphites hugardianus (D'ORBIGNY, 1841)			11	22	12				



Text-Figure 53. Faunistic composition at family and subfamily level of the ammonite assemblage of Bakonynána

brief description of the section is given by MONOSTORI et al. (1989), which focusses on micropalaeontological data.

The well exposed fossiliferous strata are just beside the forest road and provided dozens of ammonites (Table 8) that are from the Upper Albian *Mortoniceras (M.) inflatum* and *Stoliczkaia (S.) dispar* Zones. The dominance of Family Anisoceratidae (mainly genus *Anisoceras*) and Family Lyelliceratidae (mainly the numerous *Stoliczkaia* species) is obvious (Text-Figure 53); but Mortoniceratidae and Turrilitidae are also present in great number. The material was collected bed-by-bed in the 70's but unfortunatelly the absence of the documentation cannot let to reconstruct the exact bed location. Ammonites occur from the bed no. 9 to bed no. 18–25. The richest fossiliferous stratum is the no. 12. The age of the assemblage can be placed into the *Stoliczkaia (S.) dispar* Zone but two fragments of *Mortoniceras (Mortoniceras)* cf. *inflatum* (J. SOWERBY 1817) from bed no. 12, 16 and a fragment of a *Dipoloceras* sp. (bed no. 9) possibly indicates older, *Mortoniceras (M.) inflatum* Zone age.

Text-Figure 54. View of the section of Olaszfalu, Villó Hill. Hammer indicates the boundary between the massive Albian Zirc Limestone Formation and the overying Late Albian Pénzeskút Marl "Turrilitenmergel" Formation

OLASZFALU, VILLÓ HILL

The Albian outcrop of Villó Hill (Text-Figure 54) is nearby to Olaszfalu, situated eastward of Eperkés Hill. The site is recently fenced around and closed for the public. Only two dozens of fossils found here (Table 9), the ammonite data suggest Late Albian age with the presence of typical *Stoliczkaia (S.) dispar* Zone taxa.

JÁSD J–36 BOREHOLE

The Jásd J–36 borehole was drilled near the village of Jásd, with continuous core sampling that contain an assemblage of fossils between 227.8–9.6 metres depth. Cephalopods are flattened and preserved mostly with shells in the grey siltstone and listed below (Table 10).

Table 9. Ammonite data of Olaszfalu, Villó Hill

Ammonite record	Number of specimens from Villó Hill
Cantabrigites cantabrigense SPATH, 1933	15
Neophlycticeras blancheti (PICTET & CAMPICHE, 1859)	2
Anisoceras armatum (J. SOWERBY, 1817)	5
Stomohamites subvirgulatus (SPATH, 1941)	3
Lechites sp.	5
Mariella sp.	1
Mariella (Mariella) bergeri (BRONGNIART, 1822)	2
Turrilitoides hugardianus (D'ORBIGNY, 1841)	17
Scaphites hugardianus (D'ORBIGNY, 1841)	8

Table 10. Ammonite data of Jásd J–36 borehole

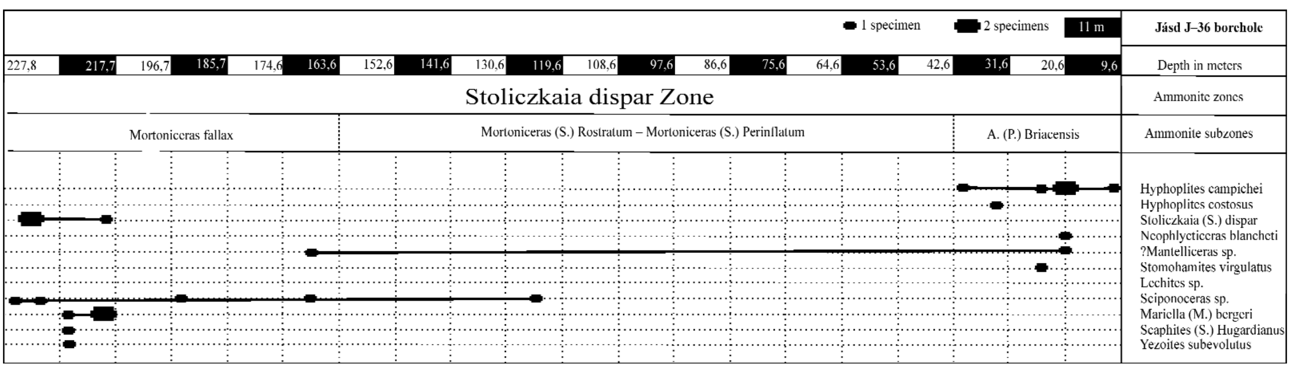
Depth (m)	Ammonite data of Jásd J–36 borehole
9.6–12.2	*Hyphoplites campichei* SPATH, 1925
15.2–16.9	*Mantelliceras* sp.
15.2–19.9	*Neophlycticeras* sp.
16.9–21.0	*Hyphoplites campichei* SPATH, 1925
16.9–21.0	*Hyphoplites campichei* SPATH, 1925
21.0–25.2	*Hyphoplites campichei* SPATH, 1925 *Hamites virgulatus* BRONGNIART, 1822
30.0–35.0	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
35.0–39.5	*Hyphoplites campichei* SPATH, 1925
112.6–115.0	*Hyphoplites campichei* SPATH, 1925
116.0–117.0	*Sciponoceras* sp.
129.1–137.9	Ammonoidea sp.
146.9–152.0	*Lechites* sp.
152.0–157.0	*Mantelliceras* sp.
152.0–157.0	*Sciponoceras* sp.
152.0–157.0	*Desmoceras* sp.
175.7–178.7	*Sciponoceras* sp.
198.2–201.8	*Stoliczkaia (Stoliczkaia) dispar* (D'ORBIGNY, 1841)
198.2–201.8	*Mariella (Mariella) bergeri* (BRONGNIART, 1822)
198.2–201.8	*Mariella (Mariella)* sp.
207.0–209.0	*Yezoites subevolutus* (BÖSE, 1928)
207.0–209.0	*Hyphoplites* sp.
207.0–209.0	*Mariella (Mariella)* sp.
207.0–209.8	*Scaphites (Scaphites) hugardianus* (D'ORBIGNY, 1841)
221.6–224.7	*Sciponoceras* sp.
224.7–227.8	*Stoliczkaia (Stoliczkaia) dispar* (D'ORBIGNY, 1841)
224.7–227.8	*Stoliczkaia (Stoliczkaia) dispar* (D'ORBIGNY, 1841)
224.7–227.8	*Sciponoceras* sp.

Ammonite taxa were originally determined and partly published by HORVÁTH (1985, 1989). In this monograph the whole material is revised.

The ammonite occurrences (Table 11) in the borehole show the presence of the Late Albian *Mortoniceras (M.) fallax* and *Arrhaphoceras (Praeschloenbachia) briacensis* subzones of the *Stoliczkaia (S) dispar* Zone.

The ammonite assemblage contains typical Late Albian forms at the full length of the fossiliferous sequence. The presence of *Stoliczkaia (Stoliczkaia) dispar* (D'ORBIGNY 1841), *Mariella (Mariella) bergeri* (BRONGNIART 1822) and *Scaphites (S.) hugardianus* (D'ORBIGNY 1841) clearly place the age of the material into the Late Albian *Stoliczkaia (S.) dispar* Zone. The *Yezoites subevolutus* (BÖSE 1928) and *Hyphoplites campichei* SPATH, 1925a characterize the *Arrhaphoceras (Praeschloenbachia) briacensis* subzone of the *Stoliczkaia (S.) dispar* Zone (KENNEDY et al. 2004).

Table 11. Ammonite occurences on the sequence of Jásd J–36 borehole



Summarizing the stratigraphic results of the ammonoid assemblage of Jásd J–36 borehole, we can assure that the whole ammonite assemblage can be placed into the Late Albian *Stoliczkaia (S.) dispar* Zone, and most likely indicates its youngest, *Arrhaphoceras (Praeschloenbachia) briacensis* subzone.

JÁSD J–42 BOREHOLE

The Jásd J–42 borehole was drilled in 1978 with continuous core sampling near the village of Jásd. This grey aleurolitic marly section is the reference section of the Pénzeskút Marl Formation. The ammonite bearing sequence is from 474.5 m to 30.2 m, the cephalopods of the Jásd J–42 borehole are listed below (Table 12). The ammonoid specimens are originally determined and partly published by HORVÁTH (1985, 1989), here the assemblage is fully revised.

Since decades, the Jásd J–42 borehole was interpreted as an Upper Albian – Middle Cenomanian sequence (JUHÁSZ 1979; HORVÁTH 1985, 1989; BODROGI 1989). According to the present ammonite occurrence data, the presence of Late Albian *Arrhaphoceras (Praeschloenbachia) briacensis* subzone is documented (Table 13).

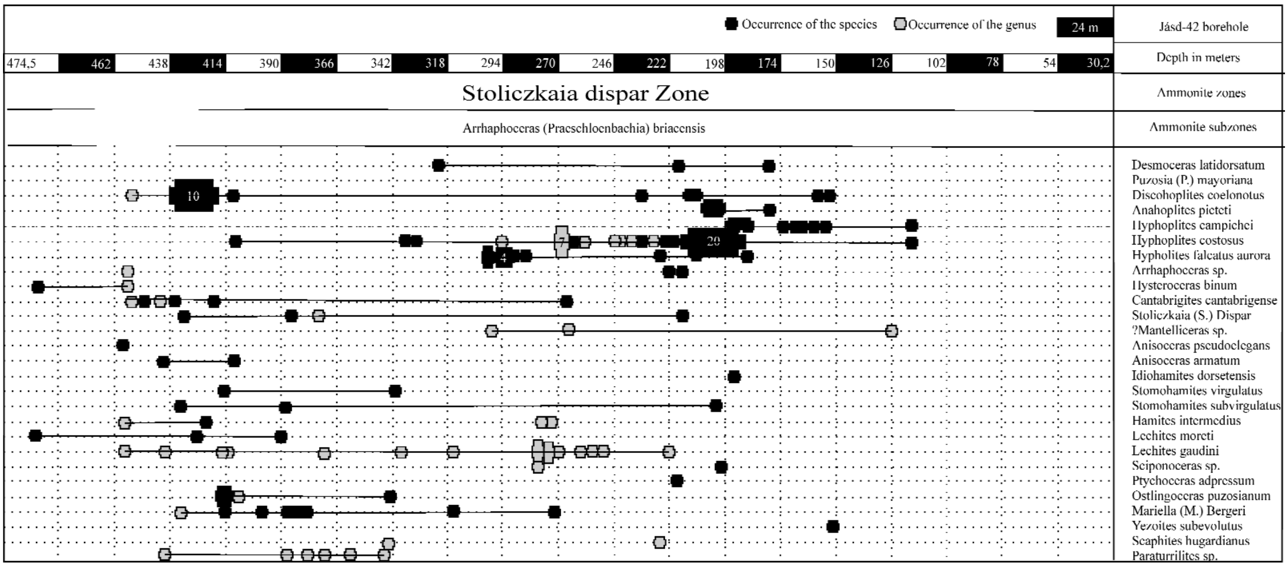
Table 12. Ammonite data of Jásd J–42 borehole

Depth (m)	Ammonite data of Jásd J-42 borehole
30.2	*?Mantelliceras* sp.
75.5	*Lechites* sp.
114.7	Ammonites indet.
114.7	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
116.0	*Lechites* sp.
119.2	*Hyphoplites campichei* SPATH, 1925
120.2	*Mariella* sp. juv.
125.8	*?Mantelliceras* sp.
129.1–137.9	*Hyphoplites* sp.
133.4	*Lechites* sp.
149.64	*Sciponoceras* sp.
151.7	*Idiohamites* sp.
152.3	*Yezoites subevolutus* (BÖSE, 1928)
152.3	*Mariella* sp.
152.7	*Hyphoplites* sp.
153.5	*Hyphoplites* sp.
155.2	*Hyphoplites campichei* SPATH, 1925
157.2	*Discohoplites coelonotus* (SEELEY, 1865)
158.3–158.7	*Hyphoplites* sp.
158.3–158.7	*Hyphoplites* sp.
158.3–158.7	*Sciponoceras* sp.
158.3–158.7	*Hyphoplites campichei* SPATH, 1925
158.3–158.7	*Lechites* sp.
159.2	*Discohoplites coelonotus* (SEELEY, 1865)
159.2	*Hyphoplites* sp.
170.0–170.3	*Hyphoplites campichei* SPATH, 1925
171.3	*Lechites* sp.
172.9	*Hyphoplites campichei* SPATH, 1925
175.4	*Hyphoplites campichei* SPATH, 1925
175.5	*Desmoceras latidorsatum* (MICHELIN, 1838)
176.7	*Anahoplites picteti* SPATH, 1925
183.9	*Hyphoplites falcatus aurora* WRIGHT & WRIGHT, 1949
184.3	*Hyphoplites campichei* SPATH, 1925
187.4	*Lechites* sp.
192.0	*Idiohamites* sp.
192.1	*Hyphoplites campichei* SPATH, 1925
196.7	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
196.9 2x	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
197.2	*Hyphoplites* sp.
197.5	*Hyphoplites* sp.
198.0	*Hyphoplites* cfr. *costosus* WRIGHT & WRIGHT, 1949
200.7–201.0	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
200.7–201.0	*Lechites* sp.
201.4	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
201.7	*Sciponoceras* sp.
202.2	*Hyphoplites* sp. juv.
203.2	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
203.4	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
203.5	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949 (3 specimens)
204.3	*Stomohamites subvirgulatus* (SPATH, 1941)
204.3	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
204.6	*Hyphoplites* sp. juv.
205.5	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
205.95	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949 (2 specimens)
206.0	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
206.3	Ammonites indet.
206.3	*Hyphoplites* sp.
206.4	*Hyphoplites* sp.
206.4	*Hyphoplites* sp.
206.4	Ammonoidea
207.3	*Hyphoplites* sp.
207.6	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
208.6	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
208.7	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
209.0	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
209.6	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
209.6	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
210.4	*Hyphoplites* sp.
210.5	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
211.7	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
212.0	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
212.7–212.9	*Hyphoplites costosus* WRIGHT & WRIGHT, 1949
212.7–212.9	*Discohoplites coelonotus* (SEELEY, 1865)
212.7–212.9	*Hyphoplites falcatus aurora* WRIGHT & WRIGHT, 1949
213.9	*Discohoplites* sp.
215.7	*Hyphoplites* sp. juv.
216.6	*Hyphoplites* sp. ind.
216.9	*Arrhaphoceras* (Praeschloenbachia) sp.
216.9	*Stoliczkaia* sp.
218.7	*Gaudryceras* sp.
219.4	*Ptychoceras adpressum* (PICTET, 1847)
221.5–221.7	*Hyphoplites falcatus aurora* WRIGHT & WRIGHT, 1949
221.5–221.7	*Lechites* sp.
221.5–221.7	*Hyphoplites campichei* SPATH, 1925
223.45	*Hyphoplites campichei* SPATH, 1925
225.3	*Hyphoplites* sp.
225.3	*Lechites* sp.
225.3	*Hyphoplites* sp.
228.0	*Hyphoplites falcatus aurora* WRIGHT & WRIGHT, 1949
228.7	*Scaphites* sp.
234.1	*Discohoplites coelonotus* (SEELEY, 1865)
234.1	Ammonites sp. ind.
234.7	*Hyphoplites campichei* SPATH. 1925
237.2–237.4	*Hyphoplites* sp.
237.2–237.4	Ammonites
242.9	*Lechites* sp.
256.0	Ammonoidea
256.8	Ammonoidea
258.4	*Idiohamites dorsetensis* SPATH, 1939
258.4	*Hyphoplites* sp.
258.4–258.7	*Hyphoplites* sp.
258.4–258.7	*Lechites* sp.
259.8–260.0	*Lechites* sp.
260.0–260.1	*Lechites* sp.
260.3	*Hyphoplites* sp.
260.8	*?Mantelliceras* sp.
261.9–262.0	*Hyphoplites campichei* SPATH, 1925
262.4	*Hyphoplites* sp.
262.6–262.8	*Hyphoplites* sp.
262.6–262.8	*Hyphoplites* sp.
263.0	*Hyphoplites* sp.
264.4–264.9	*?Hyphoplites* sp.

Continuation of Table 12

264.4–264.9	*Hyphoplites campichei* Spath, 1925
264.4–264.9	*Hyphoplites* sp. juv.
265.1	*Cantabrigites cantabrigense* Spath, 1933
265.1	*?Discohoplites* sp.
270.8	*Lechites* sp.
276.2–276.5	*Lechites* sp.
276.2–276.5	*Mariella (Mariella) bergeri* (Brongniart, 1822)
276.2–276.5	*Hamites* sp.
276.2–276.5	*Lechites* sp.
278.6	*Lechites* sp.
280.0–280.1	*?Stoliczkaia* sp.
281.0–281.3	*Hamites (Idiohamites?)* sp.
281.0–281.3	*Lechites* sp.
281.3	*Sciponoceras* sp.
281.3	*Hyphoplites* sp.
281.7	*Puzosia (Puzosia) mayoriana* (d'Orbigny, 1841)
285.3	Turrilitidae
287.05	*Hyphoplites* sp.
288.5	*Hyphoplites costosus* Wright & Wright, 1949
288.6	*Hyphoplites costosus* Wright & Wright, 1949
291.9	*Hyphoplites costosus* Wright & Wright, 1949
292.95	*Hyphoplites* sp.
292.95	Turrilitidae
294.4	*Hyphoplites costosus* Wright & Wright, 1949
297.8	*?Mantelliceras* sp.
298.7	*Hyphoplites costosus* Wright & Wright, 1949
299.3–299.5	*Hyphoplites costosus* Wright & Wright, 1949
304.6	*Democeras latidorsatum* (Michelin, 1838)
316.0	*Mariella (Mariella) bergeri* (Brongniart, 1822)
316.0	*Lechites* sp.
321.4	*Desmoceras latidorsatum* (Michelin, 1838)
331.6	*Hyphplites campichei* Spath, 1925
333.5	*?Anisoceras* sp.
333.5	*Hyphoplites campichei* Spath, 1925
335.4	*Lechites* sp.
340.5	*Stomohamites* cf. *virgulatus* (Brongniart, 1822)
345.4	*Ostlingoceras puzosianum* (d'Orbigny, 1842)
345.4	*Paraturrilites* sp.
345.4	*Scaphites* sp.
358.9	*Paraturrilites* sp.
361.7	*Lechites* sp.
376.2	*Paraturrilites* sp.
377.2	*Paraturrilites* sp.
377.3	*Stoliczkaia* sp.
382.0	*Mariella (Mariella) bergeri* (Brongniart, 1822)
388.55	*Mariella (Mariella) bergeri* (Brongniart, 1822)
388.6	*Stoliczkaia (Stoliczkaia) dispar* (d'Orbigny, 1841)
388.6	*Mariella (Mariella) bergeri* (Brongniart, 1822)
389.0	*Stomohamites subvirgulatus* (Spath, 1941)
391.25	*Paraturrilites* sp.
394.6	*Lechites (Lechites) moreti* Breistoffer, 1936
408.7	*Mariella (Mariella) bergeri* (Brongniart, 1822)
411.25	Ammonites sp. juv.
411.5–411.6	*Discophoplites coelonotus* (Seeley, 1865)
411.5–411.6	*Hyphoplites costosus* Wright & Wright, 1949
411.5–411.6	*Anisoceras armatum* (J. Sowerby, 1817)
413.0	*Ostlingoceras* sp.
414.05	*Ostlingoceras puzosianum* (d'Orbigny, 1842)
414.25	*Lechites* sp.
414.25	*Stomohamites virgulatus* (Brongniart, 1822)
414.25	*Lechites* sp.
414.25	*Lechites* sp.
416.9	*Mariella (Mariella) bergeri* (Brongniart, 1822)
417.6	*Ostlingoceras puzosianum* (d'Orbigny, 1842)
418.45	*Discohoplites coelonotus* (Seeley, 1865)
418.8	*Hamites cfr. intermedius* J. Sowerby, 1814
419.7	*Cantabrigites cantabrigense* Spath, 1933
420.8	*Lechites (Lechites) moreti* Breistroffer, 1936 (K 13754)
423.6	*Discohoplites coelonotus* (Seeley, 1865)
424.7	*Discohoplites coelonotus* (Seeley, 1865)
424.7	*Discohoplites coelonotus* (Seeley, 1865)
424.95	*Discohoplites coelonotus* (Seeley, 1865)
428.5	*Discohoplites coelonotus* (Seeley, 1865)
428.5	*Discohoplites coelonotus* (Seeley, 1865)
428.6	*Discohoplites coelonotus* (Seeley, 1865)
429.15	*Discohoplites coelonotus* (Seeley, 1865)
429.3	*Stoliczkaia (Stoliczkaia) dispar* (d'Orbigny, 1842)
430.6	*Mariella* sp.
430.95	*Stomohamites subvirgulatus* (Spath, 1941)
434.45	*Discohoplites coelonotus* (Seeley, 1865)
437.65	Hoplitidae
439.7	*Cantabrigites cantabrigense* Spath, 1933
441.0–441.15	*Cantabrigites* sp.
441.25	*Lechites (Lechites) communis* Spath, 1937
441.4	*Paraturrilites* sp.
442.35	*Anisoceras armatum* (J. Sowerby, 1817)
446.2	*Cantabrigites* sp.
446.5	*Cantabrigites cantabrigense* Spath, 1936
448.4	*Discohoplites* sp.
449.3	Ammonoidea
449.3	*Hamites* sp.
449.3	*Lechites* sp.
449.3	*?Arrhaphoceras (Praeschloenbachia)* sp.
455.45	Ammonoidea
456.4	*Hysteroceras* sp.
456.5	*Anisoceras pseudoelegans* (Pictet & Campiche, 1861)
471.8	*Hysteroceras binum* (J. Sowerby, 1815)
474.5	*Lechites (Lechites) moreti* Breistroffer, 1936

Table 13. Ammonite occurences on the sequence of Jásd J–42 borehole



In 1983, Anna Horváth proposed the section as an Albian/Cenomanian Boundary Stratotype nominee but "did not received much support…[because] the section belongs to the Boreal faunal province. The boundary would have to be defined on the appearance of a particular species of *Hyphoplites*, which was regarded unsuitable." (BIRKELUND et al. 1984). It is remarkable that BIRKELUND, on the base of the great abundance of Hoplitidae, referred the assemblage to the Boreal faunal province. Surface outcrops of the same age do not show any sign of this northern affinity, which is very strange considering that all the boreholes and surface outcrops both containing *Stoliczkaia (S.) dispar* Zone assemblages and are within a square kilometre in the present geographic position. However, according to the present investigation, the Jásd J–42 borehole does not reach Cenomanian strata on the basis of recent ammonite studies.

A great abundance of *Ostlingoceras, Mariella, Anisoceras* and *Discohoplites* dominates the ammonoid fauna of the Jásd J–42 borehole, with additional occurrence of *Hamites, Cantabrigites, Mortoniceras, Salaziceras* and *Stoliczkaia.* The ammonite assemblage defines the Late Albian *Stoliczkaia (S.) dispar* Zone. However, HORVÁTH (1985) mentions a *Tegoceras* sp. from 167.8 m which is much older and currently not found. The last surely *Stoliczkaia* species is found at 429.3 m in the borehole.

At 333.5 m a *Hyphoplites campichei* SPATH occurs for the first time, while the first *Mantelliceras* (?) sp. is at 297.8 m. There are several questionable specimens of *Mantelliceras* (?) sp. (30.2 m; 125.8 m; 260.8 m; 280.1 m; 297.8 m) which resembles none of the *Stoliczkaia* species as far as I know. However, LÓPEZ-HORGUE et al. (1999) published similar sculptured forms from the *Arrhaphoceras (Praeschloenbachia) briacensis* subzone of Northern Spain. Supposedly these heavily sculptured forms are transitions between genera *Stoliczkaia* and *Mantelliceras*. These forms can be determined as *Mantelliceras* on the basis of *Mantelliceras couloni* (D'ORBIGNY 1850) – like sculpture, but if considering the startigraphic range it would be better to refer them into the genus *Stoliczkaia.* Here I prefer the first option. At 125.8 m a *Mantelliceras* (?) sp. occurs with well visible ventral and ventrolateral tubercles.

At 152.3m, a *Yezoites subevolutus* (BÖSE 1928) was found. The same species occurs 10 metres below the A/C boundary at the Mont Risou section (KENNEDY et al. 2004; GALE et al. 2006) as the Global Boundary Stratotype Section (KENNEDY et al. 2004) but the species mostly reported from the *Mantelliceras mantelli* Zone.

There are also two fragments of *Arrhaphoceras (Praeschloenbachia)* sp. (449.5 and 216.9 m) which genus occurs in the topmost Late Albian.

According to the overall faunistic composition, the sequence of Jásd J–42 borehole contain ammonites of the dispar Zone, precisely from *Arrhaphoceras (Praeschloenbachia) briacensis* subzone. The typical ammonite assemblage of the Cenomanian is not present; however, even the Albian/Cenomanian boundary doesn't penetrate.

Villány Mountains

BÓLY B–1 BOREHOLE (OTTILIA SZIVES & LÁSZLÓ BUJTOR)

The ammonite data of Bóly B–1 borehole is based on the unpublished MSc thesis of L. BUJTOR (1989), the ammonite data and the conclusions are revised.

The Bóly B–1 borehole was drilled in 1983 with continuous core sampling from 1204.9 m to 582.9 m. The lowermost penetrated sediment is a grey marly siltstone (Bisse Marl Formation) which gradually changes upward into a pale, yellowish grey sandstone, the transition is between 828–987 metres (Bóly Sandstone Formation). A representative Late

Albian ammonite fauna was found (Table 14) in the 540 metres long part of the core, besides gastropods, bivalves and trace fossils. Fossiliferous section is between 570.4–1211.0 metres. The detailed stratigraphic and faunistic description was given by Bujtor (1989) in Hungarian. According to the ammonite assemblage of the Bóly B–1 borehole, Bujtor (loc. cit) placed the age of the fauna from the early Late Albian to late Early Cenomanian, exactly from the older,

Table 14. Ammonite data of Bóly B–1 borehole

Depth (m)	Ammonite record of Bóly B-1 borehole
582.9	–
596.5	Baculitidae sp.
604.5	Ancyloceratina sp.
611.8	Ancyloceratina sp.
612.0	Ancyloceratina sp.
620.4	Ammonoidea
850.0	*Tetragonites* sp.
858.7	Desmoceratidae sp.
859.5	Ancyloceratina sp.
861.8	*Sciponoceras* sp.
872.2	Desmoceratidae sp.
878.5	Desmoceratidae sp.
907.2	*Stoliczkaia* sp.
919.5	*Kossmatella* sp.
943	?Ancyloceratina sp.
948.4	?Ammonoidea sp.
961.7	Ammonoidea sp.
962.7	*Ostlingoceras puzosianum* (d'Orbigny, 1842)
962.7	*Puzosia (Puzosia)* sp.
971.4	*Puzosia (Puzosia)* sp.
973.3	Ammonoidea sp.
975.1	Ammonitina juv. sp.
975.4	Ammonitina juv. sp.
975.4	Ancyloceratina sp.
976.7	Turrilitinae sp.
977.0	Ammonitina juv. sp.
977.0	Ammonoidea fragment
977.0	Ancyloceratina sp.
977.0	Turrilitinae sp.
977.2	Ammonitina juv. sp. Ancyloceratina juv. sp.
977.9	Baculitidae sp.
982.1	Ancyloceratina sp.
982.3	Turrilitinae sp.
983.1	*Tetragonites* sp.
983.9	Plant remain
984.4	*Desmoceras* cf. *latidorsatum* (Michelin, 1838)
984.6	Desmoceratidae sp.
984.9	?Ammonitina sp.
987.4	*Lytoceratina* sp.
988.35	Turrilitinae sp.
988.4	*Puzosia (Puzosia) mayoriana* (d'Orbigny, 1841)
988.7	Turrilitinae sp.
989.2	Desmoceratidae sp.
990.6	*Puzosia* sp.
992.1	? Ancyloceratina sp.
992.3	Ammonoidea sp.
992.5	*?* Phylloceratina sp.
992.5	*Scaphites* sp.
993.1	*Puzosia (Puzosia) mayoriana* (d'Orbigny, 1841)
995.5	? Ammonitina sp.
995.5	Ammonitina juv. sp.
996.5	*Desmoceras* cf. *latidorsatum* (Michelin, 1838)
997.5	Ammonitina sp.
997.5	*Ostlingoceras* cf. *puzosianum* (d'Orbigny, 1842)
997.5	*Ostlingoceras puzosianum* (d'Orbigny, 1842)
997.6	Ammonitina juv. sp.
997.6	Ammonoidea sp. juv.
997.6	*Anagaudryceras* sp.
997.9	Ammonoidea juv. sp.
998.0	*Kossmatella romana* Wiedmann, 1962
998.0	*Lechites* sp.
998.0	*Scaphites simplex* (Jukes-Browne, 1875)
998.1	Ammonitina juv. sp.
998.2	*Helicohamites* cf. *duplicatus* (Pictet & Campiche, 1861)
998.2	*Scaphites hugardianus* (d'Orbigny, 1841)
998.4	Ammonitina juv. sp.
998.45	*Scaphites* sp. Turrilitinae sp. Ammonitina sp.
999.8	*Phylloceras (Hypophylloceras)* sp.
1000.3	*Anahoplites gracilis* Spath, 1926
1001.2	*Ostlingoceras puzosianum* (d'Orbigny, 1842)
1001.4	Turrilitinae sp.
1001.5	Ammonitina juv. sp.
1001.5	Turrilitinae sp.
1001.65	*Kossmatella* sp.
1001.8	*Aucellina* sp.
1001.8	*Kossmatella romana* Wiedmann, 1962
1002.0	*Lechites* sp.
1004.15	*Lechites* sp.
1005.3	Turrilitinae sp.
1005.7	*Mariella (Mariella)* sp.
1006.2	*Puzosia (P.) mayoriana* (d'Orbigny, 1841)
1008.4	*Ostlingoceras puzosianum* (d'Orbigny, 1842)
1010.2	*Puzosia (Puzosia)* sp.
1013.6	*? Puzosia (Puzosia)* sp.
1017.7	Cephalopoda
1021.8	*Lechites* sp.
1021.8	*Lechites* sp.
1022.2	*Lechites* sp.
1030.3	*Puzosia (Puzosia)* sp.
1030.5	*Mortoniceras* sp.
1030.7	Ammonoidea sp.
1030–1040	*Lechites gaudini* Pictet & Campiche, 1861
1030–1040	*Lechites* sp.
1031.0	? Lytoceratina

Continuation of Table 14

1031.8	*Puzosia (Puzosia)* sp.
1032.3	*Puzosia (Puzosia)* sp.
1032.8	*Puzosia (Puzosia)* sp.
1033.3	Ancyloceratina sp.
1033.5	*Cantabrigites cantabrigense* SPATH, 1933
1034.6	*Scaphites (Scaphites)* sp.
1034.7	*Lechites* sp.
1035.2	Ancyloceratina
1035.7	Baculitidae sp.
1035.9	*Helicohamites* cf. *duplicatus* (PICTET & CAMPICHE, 1861)
1038.7	Acanthocerataceae sp. juv.
1038.7	Ancyloceratina
1038.7	*Helicohamites* cf. *duplicatus* (PICTET & CAMPICHE, 1861)
1039.4	*Puzosia (Puzosia)* sp.
1039.8	Ammonoidea
1044.4	*Lechites* sp.
1044.5	Ammonitina
1044.5	Ammonoidea
1044.8	*Lechites* sp.
1046.1	*Idiohamites spiniger* (J. SOWERBY, 1818)
1050–1100	Ancyloceratina
1050–1100	*Puzosia (Puzosia)* sp.
1053.9	*Puzosia (Puzosia)* sp.
1056.8	Ammonitina sp. juv.
1056.9	Ammonitina juv. sp.
1057.0	Ancyloceratina
1057.2	Acanthocerataceae sp. juv.
1057.6	*Idiohamites* juv. sp. Ammonitina juv. sp.
1057.7	Ammonitina juv. sp.
1060.4	*Hemiptychoceras gaultinum* (PICTET, 1847)
1060.4	Phylloceratina juv. sp.
1060.5	Ammonitina juv. sp.
1060.8	Ammonitina juv. sp.
1060.9	*Lechites gaudini* PICTET & CAMPICHE, 1861
1060.9	Mortoniceras sp. Ammonitina juv. sp.
1060.9	*Worthoceras pygmaeum* BUJTOR, 1989
1067.9	Ancyloceratina
1071.7	*Idiohamites spiniger* (J. SOWERBY, 1818)
1071.9	*Mortoniceras* sp.
1072.0	*Helicohamites* cf. *ibex* (SPATH, 1941)
1072.4	*Idiohamites* sp.
1072.5	Ammonoidea
1072.7	*Helicohamites duplicatus* (PICTET & CAMPICHE, 1861)
1073.3	Ammonitina juv. sp.
1073.4	Brancoceratidae juv. sp.
1073.4	*Stomohamites virgulatus* (BRONGNIART, 1822)
1080.8	Baculitidae sp. *Sciponoceras* sp.
1081.3	? *Puzosia* sp.
1083.4	? Phylloceratina
1083.4	*Puzosia (Puzosia)* sp.
1083.5	*Puzosia (Puzosia)* sp.
1084.0	*Lechites gaudini* PICTET & CAMPICHE, 1861
1084.0	Phylloceratidae sp.
1089.7	Ancyloceratina sp.
1092.8	*Cantabrigites cantabrigense* SPATH, 1933
1094.0	Ancyloceratina
1094.4	*Puzosia (Puzosia)* sp.
1096.0	*Eogaudryceras* sp.
1096.3	*Mortoniceras* sp.
1096.7	*Puzosia (Puzosia)* sp.
1097.0	*Puzosia (Puzosia)* sp.
1097.5	? Ancyloceratina sp.
1099.6	*Eogaudryceras* sp.
1099.9	*Puzosia* sp.
1101.6	Ammonoidea
1106.9	Ammonoidea juv. sp.
1107.2	*Anagaudryceras* cf. *buddha* (FORBES, 1846)
1107.2	*Puzosia (Puzosia)* sp.
1108.3	Ancyloceratina
1108.9	Ammonitina Ancyloceratina
1112.3	Ancyloceratina
1113.8	Ancyloceratina Ammonoidea sp. juv.
1113.8	*Helicohamites duplicatus* (PICTET & CAMPICHE, 1861)
1113.9	Ammonitina sp. juv.
1114	*Lechites gaudini* PICTET & CAMPICHE, 1861
1115.2	Ammonitina *Stoliczkaia* sp.
1116.3	Ammonoidea
1116.3	*Hypophylloceras* sp.
1116.3	*Lechites* sp.
1117.3	*Kossmatella* cf. *uhlenbecki* (FALLOT, 1885)
1117.5	Ammonitina juv. sp.
1124.3	*Aucellina* sp.
1126.1	*Neohibolites* sp.
1136.6	Ammonitina juv. sp.
1137.7	? Nautiloidea
1159.6	*Puzosia (Puzosia)* sp.
1163.9	*Puzosia (Puzosia)* sp.
1168.9	*Kossmatella (Kossmatella)* cf. *agassiziana* (PICTET, 1848)
1169.8	*Neohibolites* sp.
1171.6	*Lechites* sp.
1171.6	*Puzosia (Puzosia) mayoriana* (D'ORBIGNY, 1841)
1171.7	*Kossmatella (Kossmatella)* cf. *agassiziana* (PICTET, 1848)
1171.8	Ancyloceratina
1171.8	*Kossmatella* sp. juv.
1171.9 lost	*Kossmatella* cf. *agassiziana* (PICTET, 1848)
1172.3	Ammonitina sp.
1173.0	*Neohibolites* sp.
1173.7	Ammonoidea
1173.7	*Puzosia* sp.
1175.8	*? Aucellina* sp.
1180.7	Ancyloceratina
1181.3	*Neohibolites* sp.
1188.9	*Lechites gaudini* PICTET & CAMPICHE, 1861
1197.0	Ancyloceratina
1200.9	*Puzosia (Puzosia)* sp.
1204.9	Ancyloceratina

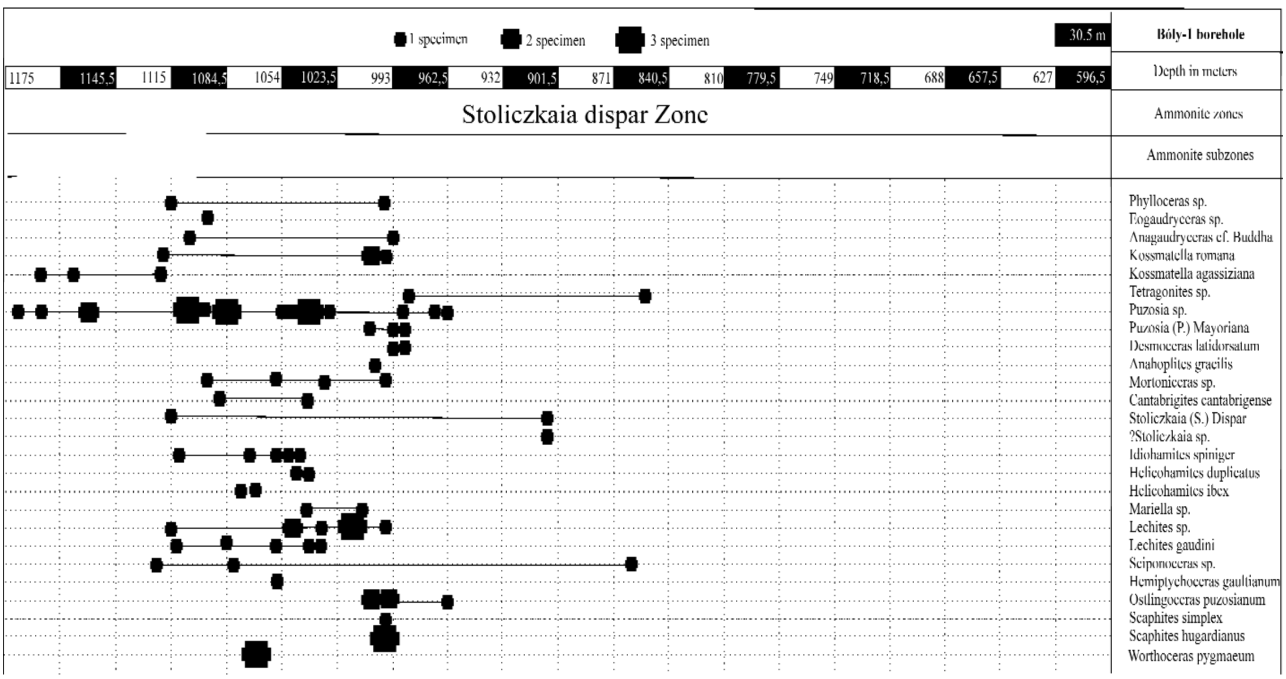
Dipoloceras cristatum subzone of the *Mortoniceras (M.) inflatum* Zone to the upper *Mantelliceras mantelli* Zone. Here his data is revised.

Despite that the borehole is more than 600 metres long, there are only a sixteen taxa which can be identified in species level due to the poor state of preservation. Most of the specimens are flattened and heavily phosphatized but shells were preserved in most cases.

The borehole, on the basis of the ammonite assemblage, can be divided into two parts. Below 1000 metres, the assemblage is characterized by the presence of *Mariella, Cantabrigites, Lechites, Hamites, Mortoniceras, Hemiptychoceras* and *Worthoceras*, beside some specimens of *Ostlingoceras* and *Scaphites*. Above 1000 metres the fauna tends to be changing with the appearance of *Ostlingoceras*, *Anahoplites* and *Stoliczkaia* species. This composition suggests that both faunistical "units" belong to the *Stoliczkaia (S.) dispar* Zone, the difference could be explained with stratigraphic and palaeoecological reasons. The sequence of Bóly B–1 borehole should be sedimented in deeper pelagic palaeoenvironment than the borehole sequences of Jásd J–36 and Jásd J–42, as their faunistic picture suggest.

The general composition of the ammonite assemblage (Table 15) suggests Late Albian age. The lack of the typical Uppermost Albian species as *Yezoites, Arrhaphoceras (Praeschloenbachia)* or *Hyphoplites* indicates that the sequence older than the uppermost Albian. None of the typical Early Cenomanian species as *Neostlingoceras, Schloenbachia* or *Mantelliceras* were found. The presence of the *Stoliczkaia (S.) dispar* Zone can be pointed out in the whole length of the sequence, presumably not from the youngest, *Arrhaphoceras (Praeschloenbachia) briacensis* subzone.

Table 15. Ammonite occurences on the sequence of Bóly B–1 borehole



Faunistic and biostratigraphic evaluation of Hungarian Albian ammonites

As it was demonstrated above, ammonite assemblages of Early Albian *Douvilleiceras mammillatum* Superzone are known only from a single borehole, while ammonites of the Late Albian *Stoliczkaia (S.) dispar* Zone were found from surface outcrops and boreholes as well.

Classic *Douvilleiceras mammillatum* Zone forms as *Douvilleiceras mammillatum* (Schlotheim 1813), *Cleoniceras* sp., *Brancoceras* sp., and several *Beudanticeras* species are documented from the Transdanubian Range. The restricted occurrence of the genus *Leymeriella* can be due mainly to palaeobiogeographical and palaeoecological reasons. Two species of genus — *Leymeriella (Proleymeriella) revili* (Jacob 1908) and *L. (Proleymeriella) romani* (Jacob 1908) — are mentioned by Scholz from the Tata TVG–55 borehole in manuscripts (mentioned in Fülöp 1975, p. 116) and from various other boreholes (Tata TVG–45, Tata TVG–59) but without any figure and the ammonites are apparently seem to be lost. No ammonite data were found from the Early Albian in the area of the southern Mecsek–Villány region.

From the late Early Albian to early Upper Albian, intensive orogenic movements of the future Alps uplifted the area, so sediments were eroded under subaerial circumstances or deposited in shallow water and brackish environments what explains the complete lack or destruction of Middle Albian ammonite assemblages. In the Late Albian, pelagic basin sediment, the "Turrilitenmergel" was accumulated mainly in the Northern Bakony area. The approximately 500 metres thick marly sequences yield impressive ammonite assemblages besides other macrofossils, which indicate Late Albian age. At the same time, in the Villány region fine grained, dark aleuritic sediment deposited in deeper water circumstances and produced a sequence that penetrated with the Bóly B–1 borehole.

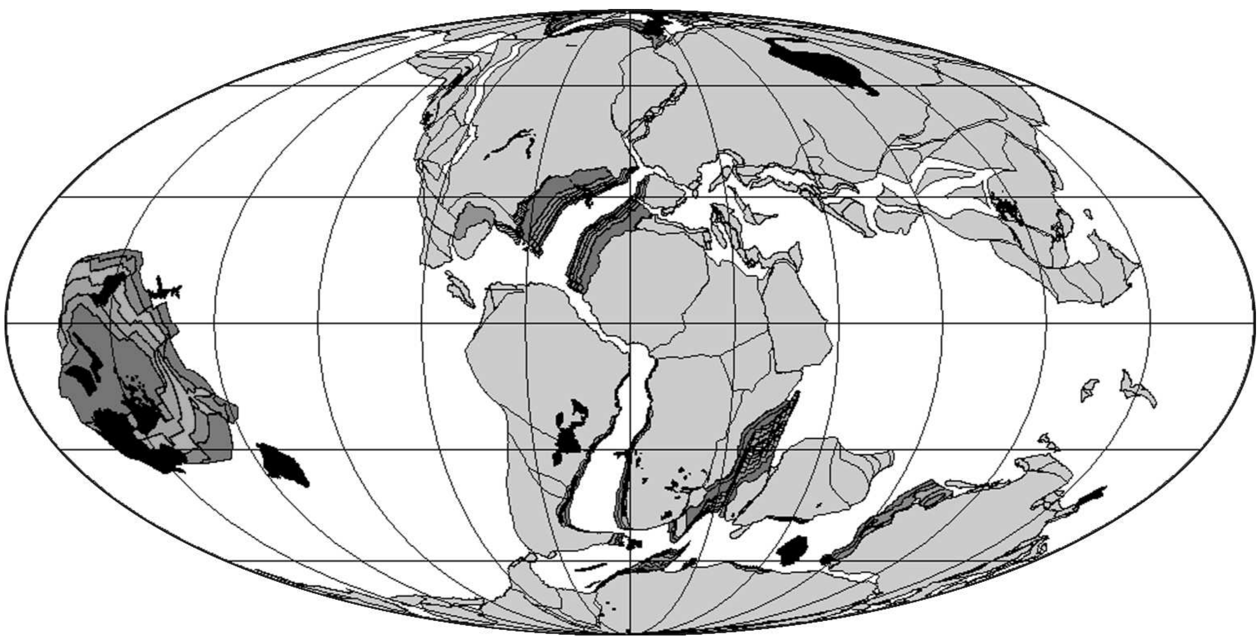
Summarizing the ammonite biostratigraphic results of the most recent ammonite record of the Hungarian Upper Albian sediments, the ammonite data of Tilos Forest, Bakonynána: Zsidó-hegy and Jásd 1 quarry sections indicate the presence of the Late Albian *Mortoniceras (M.) inflatum* and *Stoliczkaia (S.) dispar* Zones. On the basis of the Jásd J–42 and Jásd J–36 boreholes, the age of the ammonite assemblage is younger, can be placed into the Late Albian *Arrhaphoceras (Praeschloenbachia) briacensis* subzone of *Stoliczkaia (S.) dispar* Zone. Bóly B–1 borehole yielded a rich ammonite assemblage of the older subzones of the Late Albian *Stoliczkaia (S.) dispar* Zone.

26 ammonite taxa are described for the first time from Hungary.

Palaeobiogeographic interpretation of the Hungarian Late Albian ammonite record

In contrary to the well balanced climate and more or less cosmopolitan ammonite taxa of the Aptian, in the Albian certain ammonite provinces can be demonstrated not just in the north-western hemisphere, but in the rest of the marine environments. Palaeobiogeography of the Western Tethys was determined by the opening of the Northern Atlantic and the closure of the Tethys (Text-Figure 55). The Early Albian palaeobiogeographic evaluation is presented at the end of the Aptian chapter because of the faunistic composition of Late Aptian – Early Albian condensed ammonite assemblage.

OWEN (1999) distinguished three Albian faunal provinces in the north-western hemisphere. The first one is the Arctic province, which contains Korjak–Kamchatka, Alaska, Canadian Arctic, Greenland and the Spitzbergen. The second one is the European province with England, France, NW Germany, Austria, Bulgaria and Mangyshlak. The third is the Tethyan province that included the Southern Caucasus, North Africa, Iran and Madagascar. According to faunal and geographical similarities discussed later, the present area of Hungary contains sequences of both European and Tethyan palaeogeographic provinces.



Text-Figure 55. Global palaeogeographical reconstruction of Late Albian (100 My). Map is from the "Plate Tectonics On-Line Reconstruction Tool" website http://www.itis-molinari.mi.it/Intro-Reconstr.html, model after SCHETTINO & SCOTESE 2000. Continental crusts are light grey, opening oceanic trenches are coloured to dark grey, hotspot tracks are black

Despite the great abundance of the collected specimens and their researchers, nobody provided a proper palaeobiogeographic implication for the Albian assemblages of Hungary. Recent workers as SCHOLZ (1975, 1979), NAGY I. Z. (1963, 1971 1973, 1982, 1986) and HORVÁTH (1985, 1989) paid most of their attention to the systematic and stratigraphic problems of the ammonite material. BUJTOR (1990b) was the first researcher, who, after an extensive study of the Upper Albian – Cenomanian ammonites of Hungary, dedicated a paper to the palaeobiogeographic evaluation of Albian–Cenomanian ammonoids of Hungary. He concluded that "ammonite faunas [of Bakony and Villány Mts] indicate different palaeogeographic connections and diverse origin of these tectonic units. Bakony Mts shows southern, while Villány Mts shows northern affinities" (BUJTOR 1990b).

Bakony Mts

According to my opinion, "borehole" and "surface" assemblages of the Bakony Mts are basically different from each other considering their facies and both qualitative and quantitative faunistical parameters.

At present, the Bakony Mts are the part of the Transdanubian Range, situated along a SW–NE mountain chain. Sequences of the Pénzeskút Marl Formation are consist a dolomitic yellow marl with aleurolite and sandstone intercalations. The dominance of genera *Stoliczkaia, Cantabrigites, Salaziceras* and *Mortoniceras* — with the additional presence of *Engonoceras* and *Ficheuria* that restricted to the Mediterranean southern shore of the former Tethys — clearly show the southern affinity of surface ammonite assemblages. MORTONiceratinae (genera *Cantabrigites* and *Mortoniceras*) and Lyelliceratidae–Flickiidae (genera *Stoliczkaia, Neophlycticeras, Ficheuria, Zuluscaphites* and *Salaziceras*) give the 63% of the total ammonite taxa at Jásd 1 quarry 15% at Tilos Forest and 16% at Bakonynána. These heavily ornamented forms preferred warmer, shallower water conditions. The extreme richness of *Ostlingoceras* and other heteromorphs in the upper part of the Tilos Forest sequence is unique. This high monospecific diversity can be explained with the possibly more distal and specific palaeoenvironment (REBOULET et al. 2005). But I have no idea exactly what caused this.

At borehole faunas, the "boreal" domination of ammonoid taxa is obvious as BIRKELUND (BIRKELUND et al. 1984) also pointed out in the case of the Jásd J–42 borehole. Besides the cosmopolitan Albian taxa as *Puzosia* or *Beudanticeras*, the dominance of Hoplitidae (48% at Jásd J–42 borehole and 32% at Jásd J–36 borehole) and the ancillary position of genera *Stoliczkaia, Scaphites, Zuluscaphites* and *Kossmatella* and especially the complete lack of *Engonoceras, Ficheuria* and *Salaziceras* (as the representatives of dominantly Tethyan ammonite assemblages) are the markers of the higher Boreal/European affinity.

But in this case, these "boreal" taxa inhabited the deeper basin environments of cold water and indicate more the basin facies than the different palaeogeographic position. The facies of borehole sequences is a muddy, fine-grained, grey marly siltstone which also support the presence of deeper water conditions.

Villány Mts

Villány Mts are situated in southern Hungary. The boreal affinity and position of Villány fauna is not questionnable, although the poor state of preservation makes the high level faunistic evaluation difficult. The faunistic composition of Bóly B–1 borehole is presented on Table 14. The genus *Kossmatella* is the only true "Tethyan" element, while *Stoliczkaia, Salaziceras, Ficheuria, Engonoceras, Neophlycticeras* are missing. The genus *Anaholpites* is a boreal form, while the abundancy of genera *Puzosia, Desmoceras, Tetragonites* and *Phylloceras* indicate open, pelagic palaeoenvironment. These are cosmopolitan taxa and in this case indicate palaeobathymetry rather than palaeogeography.

So, in my point of view, the assemblage of Bóly B–1 borehole indicates the deepest, pelagic palaeoenvironment of all Late Albian ammonoid-bearing environments of Hungary, which idea can be supported by the occurence (FREY & SEILACHER 1980) of the trace fossil *Palaeodictyon*.

Palaeoecology and taphonomy

Surface outcrops

As it was mentioned previously, the Hungarian Late Albian ammonite assemblages are basically different from surface outcrops and boreholes.

The recent bed-by-bed collecting is used for palaeoecological investigation that was done only at Tilos Forest locality. The upper part of the sequence which is light beige coloured marly limestone with marly intercalations. The fauna is dominated by torticone ammonites with the appearence of *Stoliczkaia*. Specimens are generally huge and slightly phosphatized. Sorting by size cannot be observed. The accompanying fauna is dominated by gastropods and echinoids which may imply a shallow neritic palaeoenvironment. REBOULET et al. (2005) interpreted Late Albian torticone ammonites as "inhabited mainly more distalm, neritic palaeoenvironments...". Hungarian material supports this idea.

The condensed basal sediment is different from the overlying fauna at Tilos Forest, the situation might have been similar to the Late Aptian depositional process of the basal pockets of the Tata Limestone Formation. As OWEN (1996b) pointed out, in shallow seas these kinds of erosional surfaces could be swept by tidal flows as it could happened in the case of Tilos Forest. In the local deepenings of the palaeorelief a size-sorted, pyritized fauna accumulated, which was documented by SCHOLZ (1979) and in this present paper. Similar condensed sections are known from the Late Aptian and the Vraconnian sequences of the Swiss Jura Mts (RENZ & JUNG 1978). The ammonite assemblage is dominated by planispirals as *Stoliczkaia, Salaziceras* and *Puzosia* which refer to neritic palaeoenvironment (REBOULET et al. 2005).

Besides them, a great number of torticones is remarkable. Relative abundance of *Scaphites*, which "inhabited more proximal palaeoenvironments… and could have lived near the sea bottom" (REBOULET et al. 2005) correlates well, with the relative abundance of echinoids in the basal bed. It is remarkable as *Stoliczkaia* is interpreted as "neritic environment" preferring form could have lived in more proximal environment in contrast to the others are "oceanic or deep water" taxa of distal environment (REBOULET et al. 2005). REBOULET et al. (2005) has interpreted *Scaphites* as a "vertical migrant" as it was previously proposed by WESTERMANN (1996). They concluded that "*Scaphites* could have lived near the sea bottom… and possible had nektobenthic mode of life". Genera *Stoliczkaia, Desmoceras* and *Puzosia* probably had a "deep-nektonic rather than nektobenthic mode of life" (REBOULET et al. 2005). The change of the faunistic composition upward is remarkable: in the upper non-condensed six beds the dominance of genus *Ostlingoceras* is clear. This high abundance could be controlled by ecological factors. According to MONKS (1998), "turriliticone ammonites have approximately zero rotation angles… and oriented aperture downwards." He concluded that orientation of high spired turriliticones (*Turrilites, Ostlingoceras*) changed less than the low spired forms (*Turrilitoides, Mariella, Proturrilitoides*) when the body moved within the shell. Turriliticones are non-tilters (MONKS 1998) and possibly lived in distal environments and were planktonic animals.

Summarizing the palaeoecological and taphonomical investigations of surface outcrops, the facies of the sediment, the accompanying fauna and the composition of the ammonite assemblage suggest neritic palaeoenvironment. Transgression took place during the sedimentation which can be deduced from the composition of the ammonite fauna.

Borehole assemblages

Late Albian sediments crossed with Jásd J–42 and Jásd J–36 boreholes in the Transdanubian Range and Bóly B–1 borehole in the Villány Mts are fine-grained, dark grey marly aleurolites. This facies is considered to indicate deep water palaeoenvironment (CSÁSZÁR [ed.] 1996). Late Albian assemblage of Jásd J–42 borehole is dominated by Hoplitidae (48%), together with a great number of torticones and orthocones. Planispiral forms as *Stoliczkaia*, *Puzosia, Cantabrigites* and *Salaziceras* are just additional elements of the assemblage. REBOULET et al. (2005) mentiones *Lechites* as "common or abundant in deeper palaeoenvironments of the Vocontian Basin", while "...torticones…inhabited neritic palaeoenvironments". So, these assemblages are considered to be neritic faunas that indicate deeper palaeoenvironment than assemblages of the surface outcrops.

The ammonoid fauna of Bóly B–1 borehole is dominated by the Ancyloceratina subordo. Members of subordo Phylloceratina, Lytoceratina and Desmoceratidae consist of almost 40% of the ammonite specimens which suggest deeper, possibly pelagic palaeoenvironment in contrast of the neritic ammonite assemblage of Jásd J–36 and Jásd J–42 boreholes. Great abundance of orthocones (20%) and torticones (13.18%) suggest deeper epipelagic palaeoenvironment. Other planispiral forms as Hoplitidae and Brancoceratidae are ancillary elements with almost 7% of all. The accompanying fauna is highly dominated by gastropods and the bivalve genera *Aucellina* and *Inoceramus*. A trace fossil *Palaeodictyon* and some specimens of ?*Neohibolites* were also found (BUJTOR 1989). *Palaeodictyon* is a member of "Nereites" ichnofacies (FREY & SEILACHER 1980) which characterizes bathyal environments and is abundant in flysch or flysch-like sediments (FREY & SEILACHER, loc. cit) and mainly in pelagic fine-grained sediments.

In summary, fossil record of boreholes consist on ammonite assemblages that indicate deeper water palaeoenvironment than in the case of surface outcrops. The supposed palaeoenvironment was somewhat deep neritic in the fauna of Jásd J–42 and Jásd J–36 boreholes and pelagic of Bóly B–1 borehole. Numerous specimens of benthic bivalves could have been transported by turbiditic flows.

Systematic descriptions

For the classification of subordo Ancyloceratina, MONKS's (1998, 1999, 2000, 2002) systematics used here.

Ordo Ammonoidea ZITTEL, 1884
Subordo Phylloceratina ARKELL, 1950
Family Phylloceratidae ZITTEL, 1884

MURPHY & RODDA (2006) discussed the Phylloceratidae and proposed new systematics for the family. Here I follow the systematics of WRIGHT et al. (1996).

Genus *Phylloceras* SUESS, 1865
Type species: *Ammonites heterophyllus*, J. SOWERBY, 1820

Phylloceras seresitense PERVINQUIÉRE, 1907
Pl. XIV, Figure 1, 2

*1907 *Phylloceras seresitense*, PERVINQUIÉRE, p. 52
1963 *Phylloceras (Hypophylloceras) seresitense* PERVINQUIÉRE, 1907 — WIEDMANN, p. 213, Pl. 15, Figures 4a, b; Pl. 21, Figures 1a, b (with synonymy)
2006 *Neophylloceras seresitense* PERVINQUIÉRE, 1907 — MURPHY & RODDA, p. 41, Pl. 5, Figures 5–7, 10–14

Material. Three specimens from Tilos Forest.

Description. Involute forms with shallow umbilicus and slightly bubbled appearence. The umbilical edge and the lower flank is the widest point of the conch. Flanks are convex, no ornamentation is visible and apart from the prorsiradiate lirae appear on the outer flank.

Discussion. The Albian Phylloceratidae contains several specimens, the present one resembles to *Ph. (H) velledae* (MICHELIN 1838) and *Ph. (H) moreti* (MAHMOUD 1956), but the shallower umbilicus and the wide lower flank (in ventral view) characterize the species.

Occurrence. The species is known from the condensed basal pockets of the Upper Albian of Tilos Forest, otherwise reported from the Albian deposits of the Mediterranean region.

Genus *Hypophylloceras* SALFELD, 1924
Type species: *Phylloceras onoense* STANTON, 1895

Hypophylloceras sp.

Material. Two poorly preserved, flattened, shelled specimens from Bóly B–1 borehole from 999.8 m and 1116.3 m.

Description. Small, involute form with very narrow umbilicus. As it is characteristic for the subgenus, on the venter fine, radial ribs can be detected which disappear on the lateral region. Suture cannot be observed.

Discussion. The poor preservation and the heavy flattening destroyed the features necessary for the identification at species level.

Occurrence. The subgenus was cosmopolitan from the Valanginian to Maastrichtian.

Subordo Lytoceratina HYATT, 1889
Superfamily Tetragonitaceae HYATT, 1900
Family Gaudryceratidae SPATH, 1927b
Subfamily Gaudryceratinae SPATH, 1927b
Genus *Eogaudryceras* SPATH, 1927b
Type species: *Ammonites numidus* COQUAND, 1880

Eogaudryceras sp. indet.
Pl. XXVIII, Figure 1, 2

Material. Bóly B–1 borehole two flattened, shelled specimens from 1096.0 m and 1099.6 m.

Description. Moderately evolute, small forms with wide umbilicus. Ornamentation is from S–shaped fine ribs. Aperture not ornamented, follows the S-shape of the ribbing. Suture cannot be observed.

Discussion. The whorl section and the umbilical region are necessary for the species level identification (KENNEDY & KLINGER 1979) but these characters cannot be visible because of the heavy flattening.

Occurrence. The genus is reported from the *Stoliczkaia (S.) dispar* Zone sequence of Bóly B–1 borehole; otherwise it is known from the Upper Aptian to Upper Albian, from the Western Tethyan region, but from North America, South-Africa and California as well.

Genus *Anagaudryceras* SHIMIZU, 1934
Type species: *Ammonites sacya* FORBES, 1846

***Anagaudryceras* cf. *buddha* (FORBES, 1846)**

1979 *Anagaudryceras buddha* (FORBES) — KENNEDY & KLINGER, p.146, Pl. 8, Figures 1–3; Pl. 10, Figures 1–6; Pl. 11, Figures 1, 2.

Material. A poorly preserved shelled specimen from 997.6 m and an impression from 1107.2 m from Bóly B–1 borehole.

Description. Slightly depressed evolute forms. Umbilicus is wide and deep but hardly visible. Shell is ornamented with fine, radial ribs. In every 2–5 millimetres, collared ribs follow the fine, uncollared ones which only visible over 8 mm in diameter. Suture cannot be visible.

Discussion. Intraspecific variation is very common and high (KENNEDY & KLINGER 1979) at this species, therefore taxonomic problems also occur. Herein the author accepts the opinion of KENNEDY & KLINGER (1979) that *Ammonites sacya* FORBES (1846) represents the young ontogenetic stage of *Ammonites buddha* FORBES (1846).

Occurrence. The species is known from the Late Albian sequence of Bóly B–1 borehole; otherwise reported from the Middle Albian to Coniacian strata of the Western Tethys, Madagascar, Alaska, Japan and the Antarktica.

Genus *Zelandites* MARSHALL, 1926
Type species: *Zelandites kaiparaensis* MARSHALL, 1926

***Zelandites dozei* (E. FALLOT, 1885)**
Pl. XIV, Figure 3

*1885 *Ammonites dozei* FALLOT, p. 235, Pl. 4, Figure 3
1979 *Gaudryceras (Zelandites) dozei dozei* (FALLOT) — SCHOLZ, p. 51, Pl. 10, Figures 3, 4, Text-Figure 14
1996 *Zelandites dozei dozei* (FALLOT) — KENNEDY in GALE et al., p. 549, Figures 13a–c, g, i, j, l, m, 26c, 29p

Material. A single specimen from Tilos Forest.

Description. The specimen is 30 mm in diameter, highly compressed, with an oval whorl section. The cast is smooth with hardly visible constrictions which are slightly sinuous on the flanks and prorsiradiate on the venter.

Discussion. The specimen resembles to the one figured by KENNEDY (KENNEDY in GALE et al. 1996).

Occurrence. The species is known from the condensed basal pockets of the Upper Albian sequence of Tilos Forest; otherwise reported from the *Stoliczkaia (S.) dispar* and *Mantelliceras mantelli* Zones of France, Switzerland and Algeria.

Subfamily Kossmatellinae BREISTROFFER, 1953
Genus *Kossmatella* JACOB, 1908
Type species: *Ammonites agassizianus* PICTET, 1847

***Kossmatella* sp. indet.**
Pl. XXVI, Figure 14, Pl. XXVIII, Figure 5

Material. Three poorly preserved, shelled specimens from 919.5 m and 1001.65 m, and a juvenile one from 1171.8 m Bóly B–1 borehole.

Description. Small, involute forms. The only visible part is the last whorl. There are bubbles starting on the umbilical edge and gradually disappearing on the lateral region interspaced with lateral sulci. From the umbilical edge fine radiate ribs cross the lateral part and become prorsiradiate on the venter. Suture cannot be observed.

Discussion. The poor preservation only allows the generic level identification.

Occurrence. The genus is known from the Late Albian sequence of Bóly B–1 borehole; otherwise reported from the Lower Albian to Middle Cenomanian wordwide, considered as a typical Mediterranean taxon.

***Kossmatella agassiziana* (PICTET, 1847)**

1910 *Kossmatella agassiziana* PICTET — FALLOT, P., p.67, Pl. 3, Figure 2
1930 *Kossmatella agassiziana* PICTET — PASSENDORFER, p. 462 (112)
1967 *Kossmatella agassiziana* PICTET — DIMITROVA, p. 30, Pl. 10, Figure 4
1979 *Kossmatella agassiziana* PICTET — SCHOLZ, p. 54, Pl. 10, Figures 7, 9

Material. Two shelled specimens from Bóly B–1 borehole (1171.7 m and 1171.9 m) and an impression from 1168.9 m.

Description. The involution of the shells and the umbilical region cannot be observed because of the fragmented preservation. A fragment is characterized by the constrictions that start from the umbilical edge and cross the lateral part sinuously, finally prorsiradiate on the ventral edge. The constriction is shallow and moderately wide. In between them, fine lirae can be observed, strat from the midflank and well visible on the outer flank. The interspace between the constrictions is flat.

Discussion. The species differs from *K. (K) muhlenbecki* (E. FALLOT, 1885) from the shallower constrictions, also differs from *K. (K) romana* (WIEDMANN, 1962c) from the absence of umbilical bullae.

Occurrence. The species is known from the condensed basal pockets of the Upper Albian of Tilos Forest and the Late Albian sequence of Bóly B–1 borehole; otherwise reported from the Upper Albian to Lower Cenomanian deposits of the Mediterranean region and North America.

***Kossmatella* cf. *muhlenbecki* (E. FALLOT, 1885)**
Pl. XIV, Figure 4

1908 *Kossmatella muhlenbecki* (FALLOT) — JACOB, p. 23, Pl. 2, Figure 7
1930 *Kossmatella muhlenbecki* (FALLOT) — PASSENDORFER, p. 461 (111), Pl. 2, Figure 40
1968 *Kossmatella muhlenbecki* (FALLOT) — WIEDMANN & DIENI, p. 39, Pl. 2, Figure 9, Pl. 3, Figures 9, 11, 12
1979 *Kossmatella muhlenbecki* (FALLOT) — SCHOLZ, p. 53, Pl. 10, Figures 5, 6, 8

Material. A fragmented, shelled specimen from Bóly B–1 borehole at 1117.3 m and one specimen is from Bakonynána from bed no. 15.

Description. A piece of a small specimen where the umbilical region and the inner phragmocone cannot be visible. The trapezoidal whorl section is characteristic for the species. There are three, deep constrictions on the fragment which start on the umbilical edge, run radially on the lateral region, become prorsiradiate on the ventrolateral part and finally disappear on the venter. Fine, slight lirae are also observed which follow the shape of the constrictions and also disappear on the venter. Suture cannot be studied.

Discussion. Even the best preserved fragment is in poor state, which justifies the use of the open nomenclature.

Occurrence. The species is known from the condensed basal pockets of the Upper Albian of Tilos Forest and the Upper Albian sequence of Bóly B–1 borehole and Bakonynána; otherwise reported from the Albian deposits of the Mediterranean region.

***Kossmatella romana* WIEDMANN, 1962c**
Pl. XIV, Figure 5, Pl. XXVIII, Figures 3, 9, 14

*1962c *Kossmatella (Kossmatella) romana* n. sp. WIEDMANN, p. 164, Pl. 8, Figures 6, 7, Pl. 13, Figure 12, Abb. 21–24
1968 *Kossmatella (Kossmatella) romana* WIEDMANN — WIEDMANN & DIENI, p. 38, Pl. 1, Figures 10, 11, Pl. 3, Figure 10
1979 *Kossmatella (Kossmatella) romana* WIEDMANN — SCHOLZ, p. 53
1990 *Kossmatella (Kossmatella) romana* WIEDMANN — MARCINOWSKI & WIEDMANN, p. 28, Pl. 2, Figure 7

Material. Two shelled specimens from Bóly B–1 borehole at 988.0 m and 1001. 8 m.

Description. Small, slightly ellipsoidal forms. Bullae appear on the umbilical edge and flatten on the mid-lateral region and finally disappear on the venter. Fine lirae can be observed on the lateral region and disappear on the outer flank. In between the bullae, very shallow constrictions appear which getting wider on the outer flank. Suture cannot be detected.

Discussion. On the morphology of this species — in contrast to the previously described *Kossmatella* species —, the bullae characterize the appearence and not the constrictions.

Occurrence. The species is known from the condensed Upper Albian basal pockets of Tilos Forest and the Upper Albian sequence of Bóly B–1 borehole, otherwise reported from the Lower to Upper Albian deposits of the Western Tethyan region and Zululand.

Family Tetragonitidae HYATT, 1900
Genus *Tetragonites* KOSSMAT, 1895

***Tetragonites* sp.**
Pl. XXVIII, Figure 7

Material. Fragments of shelled specimens from Bóly B–1 borehole (850.0 m and 983.1 m) and two internal moulds from Tilos Forest.

Description. Small, evolute forms, whorl section and umbilical region cannot be observed. Ornamentation consists of 3–5 constrictions on each fragment, no ribs are present. Suture cannot be seen.

Discussion. Characters necessary for the species level identification as whorl section and the shape of the constrictions (WIEDMANN 1973) cannot be observed therefore identification of the fragments remained at generic level.

Occurrence. The species is known from the condensed Upper Albian basal pockets of Tilos Forest and the Upper Albian sequence of Bóly B–1 borehole; otherwise the genus was cosmopolitan and reported from the Upper Aptian to Maastrichtian.

Subgenus *Tetragonites* KOSSMAT, 1895
Type species: *Ammonites timotheanus* PICTET, 1847

Tetragonites (Tetragonites) timotheanus (PICTET, 1847)
Pl. XIV, Figure 16; Pl. XIX, Figure 2

1923 *Tetragonites timotheanus* (PICTET) — SPATH, p. 25, Pl. I, Figures 5, 6; Text-Figure 6
1967b *T. timotheanus* (PICTET) — MURPHY, p. 19, Text-Figures 8, 9a–d, f–k; Pl. 1, Figures 10–19
1973 *Tetragonites timotheanus* (PICTET) — WIEDMANN, p. 605, Pl. 7, Figures 5–7
1979 *Tetragonites timotheanus* (PICTET, 1847) — SCHOLZ, p. 56, Taf. 10, Figures 10–12; Taf. 11, Figures 1–8; Abb. 16, 17

Material. Two specimens from Tilos Forest.

Description. Medium sized specimens with medium involution, umbilicus is broad compared to other species of the genus. Whorl section is subquadrate. Umbilical edge is rounded, the lateral side is flattened. The only visible ornamentation are the constrictions, which almost straight with a strong prorsiradiation on the outer flank. Venter smooth apart, from the constrictions and flattened.

Discussion. The species is already reported from the Tilos Forest (SCHOLZ 1979). The broad umbilicus and the deep, straigt constrictions are specific characters.

Occurrence. The species is known from the condensed Upper Albian basal pockets of Tilos Forest; otherwise the species was distributed worldwide in the Late Albian.

Subordo Ammonitina HYATT, 1889
Superfamily Desmocerataceae ZITTEL, 1895
Family Desmoceratidae ZITTEL, 1895

Desmoceratidae gen. et. sp. indet

Material. Several crushed specimens from Bóly B–1 borehole (858.7 m; 872.2 m; 878.5 m; 984.6 m and 989.2 m).

Description. Small, smooth specimens with narrow umbilicus and depressed whorl section. No sutures are visible.

Discussion. Probably juveniles or nuclei remained; no generic characters are visible on the crushed specimens.

Occurrence. The family is known from the Upper Valanginian to the Upper Maastrichtian (WRIGHT et al. 1996).

Subfamily Puzosiinae SPATH, 1922b
Genus *Puzosia* BAYLE, 1878

Puzosia sp. indet.

Material. 26 fragments of shelled specimens and internal moulds from various localities and boreholes.

Description. Small and medium sized specimens. Umbilical region and the whorl section are poorly preserved. Deep and wide constrictions ornamenting the shells, crossing the venter with a convex sinuos. In between them 10–17 fine ribs can be recognized. Suture cannot be observed.

Discussion. Distinctive features that characterize each species are cannot be seen therefore the identification at species level is not possible.

Occurrence. The genus is known from the condensed Upper Albian basal pockets of all surface outcrops and the Upper Albian sequence of Bóly B–1 borehole; otherwise the genus was cosmopolitan from the Early Albian to the Late Turonian.

Subgenus *Puzosia* BAYLE, 1878
Type species: *Ammonites planulatus* J. de C. SOWERBY, 1827

Puzosia (Puzosia) mayoriana (D'ORBIGNY, 1841)
Pl. XIII, Figure 9, Pl. XIV, Figure 7; Pl. XIX, Figure 8, Pl. XXVIII, Figures 8, 10, 13

*1841 *Ammonites Mayorianus* D'ORBIGNY, p. 267, Pl. 79, Figures 10, 11
1862 *Ammonites Mayorianus* D'ORBIGNY — HAUER, p. 654
1899 *Desmoceras (Puzosia) Mayorianum* D'ORBIGNY — ANTHULA, p. 106
1923 *Puzosia mayoriana* (D'ORBIGNY) — SPATH, p. 42, Pl. I, Figures 9a, b; 10a, b; Text-Figure 10
1979 *Puzosia mayoriana* (D'ORBIGNY) — SCHOLZ, p. 66
1984 *Puzosia (Puzosia) mayoriana* (D'ORBIGNY, 1841) — WRIGHT & KENNEDY, p. 55, Pl. 3, Figures 1, 2, 4, 6, 9–12; Pl. 4, Figures 1, 2, 5–7; Text-Figures 1A, B; 2C, H, M; 3N–R; 4A–E (with synonymy of Upper Albian and Cenomanian references)
1996 *Puzosia (Puzosia) mayoriana* (D'ORBIGNY, 1841) — KENNEDY in GALE et al., p. 552, Figures 10f; 11k, l; 14h–n

Material. Three specimens from Bóly B–1 borehole (988.4 m; 993.1 m; 1171.6 m), one from Jásd J–42 (281.7m), one is from Jásd 1 quarry from bed no. 13, and 15 specimens from Tilos Forest.

Description. Generally the species is characterized by huge specimens; however the specimens known from Bóly B–1 borehole are quite small. Whorl section is compressed, the umbilicus is shallow and the umbilical edge is rounded. The lateral side is flattened. Fragments are well identified on the basis of the constrictions and the light, dense (10–15) ribs between them, start at the outer lateral region. Constrictions cross the venter with sinuous and the ribs follow them. Suture cannot be observed.

Discussion. The species is fully discussed by SPATH (1923), WRIGHT & KENNEDY (1984) and COOPER & KENNEDY (1987).

Occurrence. The species is known from the condensed Upper Albian basal pockets of various Hungarian localities and boreholes; otherwise reported from the Middle Albian to Upper Cenomanian and considered as a "Tethyan" species described from Europe, Africa, Madagascar, Japan and India.

Subfamily Beudanticeratinae BREISTROFFER, 1953
Genus *Beudanticeras* HITZEL, 1902
Type species: *Ammonites beudanti* BRONGNIART in CUVIER & BRONGNIART, 1822

Beudanticeras sp.
Pl. II, Figure 1

Material. 7 fragments from Tilos Forest, 5 is from Bakonynána.

Description. Huge discoidal specimens, but too poorly preserved for specific identification.

Subgenus *Beudanticeras* HITZEL, 1902
Type species: *Ammonites beudanti* BRONGNIART in CUVIER & BRONGNIART, 1822

Beudanticeras (Beudanticeras) beudanti (BRONGNIART, 1822)
Pl. III, Figures 9–13, Pl. XIV, Figure 8, Pl. XIX, Figure 1, Pl. XXI, Figure 1, Pl. XXV, Figures 2, 6

For synonymy see the Aptian chapter.

Material. Two specimens are documented from the Tatabánya Ta–1383 borehole between 230.0–256.0 metres; twoneo other specimen is reported from the Oroszlány O–1881 borehole at 295.5 m. 9 huge specimens were collected from Tilos Forest.

Description. See the Aptian chapter.

Discussion. The Early Albian specimens are smaller, and have stronger ornamentation, while Late Albian ones are bigger and smooth. This change of the ornamentation also appeared during the ontogeny and not only considered as an evolutionary tendency.

Occurrence. The species is known from the condensed Upper Albian basal pockets of Tilos Forest. Also reported from the Early Albian sequences of *Douvilleiceras mammillatum* Zone of Tatabánya Ta–1383 and Oroszlány O–1881 boreholes; otherwise the species documented from Upper Aptian to Upper Albian deposits and considered as a "Tethyan" species described from Europe and Angola.

Beudanticeras (Beudanticeras) dupinianum (D'ORBIGNY, 1841)
Pl. XXV, Figure 5

*1841 *Ammonites Dupinianus* D'ORBIGNY, p. 276, Pl. 81, Figures 6, 7, 8
1923 *Beudanticeras dupinianum* (D'ORBIGNY, 1841) — SPATH, p. 60–62, Pl. 4, Figures 1a–d; Text–Figure 14
1961b *Beudanticeras dupinianum* (D'ORBIGNY, 1841) — CASEY, p. 152, Pl. XXVI, Figure 11; Pl. XXVII, Figures 6–8; Pl. XXVIII, Figures 5a, b; Text-Figures 48a–g

Material. A single fragment is reported from the Oroszlány O–1881 borehole at 295.5 m.

Description. The fragment consists of a quarter whorl with narrow umbilicus. Three prominent ridges present on the quarter whorl, plication appear between them on the outer flank. Ridges and the ribs are most pronounced towards the venter.

Discussion. The stronger ornamentation and the shape of the plicae make difference from *B. (B.) beudanti* (BRONGNIART, 1822).

Occurrence. The species is reported from the Early Albian sequences of *Douvilleiceras mammillatum* Zone of Oroszlány O–1881 borehole; otherwise the species documented from the *mammillatum* Zone worldwide.

Genus *Desmoceras* ZITTEL, 1884
Type species: *Ammonites latidorsatus* MICHELIN, 1838
Subgenus *Desmoceras* ZITTEL, 1884
Type species: *Ammonites latidorsatus* MICHELIN, 1838

***Desmoceras (Desmoceras) latidorsatum* (MICHELIN, 1838)**
Pl. III, Figure 25, Pl. XIV, Figure 10, Pl. XIX, Figures 3, 4, Pl. XXVI, Figures 1, 2, Pl. XXVIII, Figure 6

*1838 *Ammonites latidorsatus* MICHELIN, p. 101, Pl. 12, Figure 9
1841 *Ammonites latidorsatus* MICHELIN — D'ORBIGNY, p. 270, Pl. 80, Figures 1–5
1862 *Ammonites latidorsatus* MICHELIN — HAUER, p. 557
1968 *Desmoceras (Desmoceras) latidorsatum* (MICHELIN) — RENZ, p. 20, Pl. 1, Figure 12
1979 *Desmoceras (Desmoceras) latidorsatum* (MICHELIN) — SCHOLZ, p. 61, Text-Figure 18
1990 *D. (Desmoceras) latidorsatum* (MICHELIN) — MARCINOWSKI & WIEDMANN , p. 62, Pl. 7, Figures 2, 3
1984 *Desmoceras (Desmoceras) latidorsatum* (MICHELIN) — WRIGHT & KENNEDY, p. 61, Pl. 3, Figures 3, 5, 7, 8, 13
1996 *Desmoceras (Desmoceras) latidorsatum* (MICHELIN) — KENNEDY in GALE et al., p. 551, Figures 11h–j; 13d, o; 171 (pars)

Material. Two specimens from the basal pockets of Pénzeskút Marl Formation at Tilos Forest. Two specimens from the Bóly B–1 borehole at 984.4 m and 996.5 m; three specimens from Jásd J–42 borehole at 321.4; 304.6 and 175.5 m. 22 specimens from Bakonynána from beds no. 11, 13 and 15.

Description. Specimens are bubbled with depressed whorl section and deep, narrow umbilicus. Flanks are smooth (Pl. XIX, Figure 4), or stronger (Pl. XIX, Figure 3) constrictions are visible. If present, constrictions are slightly convex on mid-flank and slightly projected forwards on the venter. No suture visible.

Discussion. The variability of the species is fully discussed by WIEDMANN & DIENI (1968). Here we do not accept the opinion of WRIGHT & KENNEDY (1984) that a subgeneric and subspecies separation is not necessary.

Occurrence. The species is known from the condensed Late Albian basal pockets of Tilos Forest and Bakonynána; also reported from the Late Albian sequences of Bóly B–1 and Jásd J–42 boreholes. Otherwise the species was cosmopolitan from the Late Albian to Late Cenomanian.

Family Cleoniceratidae WHITEHOUSE, 1926
Genus *Cleoniceras* PARONA & BONARELLI, 1897
Type species: *Ammonites Cleon* D'ORBIGNY, 1950

***Cleoniceras* cf. *cleon* D'ORBIGNY, 1850**
Pl. XXV, Figure 1, 7

*1850 *Ammonites Cleon* D'ORBIGNY, p. 124
1908 *Sonneratia cleon* D'ORBIGNY — JACOB, p. 60, Pl. IX, Figures 6a, 6b, 6c
1909 *Desmoceras cleon* D'ORBIGNY — SINZOW, Pl. II, Figures 1, 2, 3, 4, 5, 6
1925a *Cleoniceras* aff. *cleon* (D'ORBIGNY) — SPATH, p. 91, Pl. 5, Figure 8

Material. A single, crushed fragment is from the Oroszlány O–1881 borehole at 321.4 m.

Description. A fragment of the flank with falcoid, slight ribs. No ridges, no constrictions are present.

Discussion. The fragment resembles to *Beudanticeras*, but ribs are present on the whole flank which makes the generic identification clear.

Occurrence. The species is known from the Early Albian sequence of Oroszlány O–1881 borehole; otherwise known from the *Douvilleiceras mammillatum* Superzone worldwide.

Superfamily Hoplitaceae H. DOUVILLÉ, 1890
Family Hoplitidae H. DOUVILLÉ, 1890
Subfamily Anahoplitinae BREISTROFFER, 1947
Genus *Anahoplites* HYATT, 1900 (= *Lepthoplites* SPATH, 1925a)
Type species: *Ammonites splendens* J. SOWERBY, 1814

***Anahoplites gracilis* (SPATH, 1928)**
Pl. XXVIII, Figure 15

1840 *Ammonites Renauxianus* D'ORBIGNY, p. 113, Pl. XXVII, Figures 1, 2
1860 *Ammonites Renauxianus* (D'ORBIGNY) — PICTET & CAMPICHE, p. 233, Pl. XXXI, Figures 5a–c
*1928 *Pleurohoplites renauxianus* var. *gracilis* SPATH, p. 243
1968 *Anahoplites gracilis* (SPATH) — RENZ, p. 36, Pl. 4, Figures 12–14
1985 *Anahoplites gracilis* (SPATH) — IMMEL & SEYED-EMAMI, p. 94, Pl. 1, Figure 10
1994 *Leptohoplites* sp. — LATIL, Pl. 5, Figure 3
2000 *Pleurohoplites (Pleurohoplites) renauxianus* (D'ORBIGNY, 1840) — AMÉDRO & ROBASZYNSKI, Pl. 1, Figure 7

Material. A shelled specimen from Bóly B–1 from 1000.3 m.

Description. Small, platycone, compressed specimen. Whorl section and the venter cannot be observed because of the heavy flattening. Umbilical shoulder is getting more elevated towards the last whorl, umbilical edge is 90 degrees. On the last whorl an umbilical row of tubercles arises and become more prominent and form bullae towards the venter. From these bullae 2–3 falcoid, prorsiradiate ribs start which end at the venter (hardly seen) at fine tubercles. Suture cannot be observed.

Discussion. The specimen shows good similarity to *Anahoplites cantabrigensis* SPATH, 1925a. But at the *A. gracilis* "[…the interspace between the ribs — and therefore the ventral tubercles — is getting twice bigger at the end of the pharagmocone.]" (RENZ 1968). Other characteristic of the species is that on the last whorl the *A. gracilis* have more or less 10 ribs while A. *cantabrigensis* has 20.

Occurrence. The species was first recorded from Hungary by BUJTOR (1989) from the Late Albian sequence of Bóly B–1 borehole; otherwise reported from the *Stoliczkaia (S.) dispar* Zone of the Boreal and Western Tethyan regions.

?Anahoplites picteti SPATH, 1925a
Pl. XXVI, Figure 3

1847–1853 *Ammonites splendens* PICTET — PICTET & ROUX, Pl. VI, Figure 6
*1925 *Anahoplites picteti* SPATH, p. 81
1926 *Anahoplites picteti* SPATH, p. 149, Pl. XIII, Figure 13; Text-Figure 43

Material. One fragmented specimen from Jásd J–42 borehole (176.7 m).

Description. A fragment of the lateral part of a flattened specimen. Ten ribs are present on the quarter whorl. Ribs cross the lateral part straight and become heavily prorsiradiate on the outer. No bifurcation or intermediate ribs. Involuteion, the venter and suture cannot be visible.

Discussion. Although the fragment is only a quarter whorl, it resembles very much to PICTET's original, refigured by SPATH (1925a). Due to the lack of ventral characters, here the questionned generic nomenclature is prefered.

Occurrence. The species is known from the Upper Albian sequence of Jásd J–42 borehole. Otherwise the species is reported from the English Lower Gault, from the *Mortoniceras (M.) inflatum* Zone.

Genus *Arrhaphoceras* WHITEHOUSE, 1927
Type species: *Ammonites woodwardi* SEELEY, 1865
Subgenus *Praeschloenbachia* SCHOLZ, 1973
Type species: *Schloenbachia (Praeschloenbachia) briacensis* SCHOLZ, 1973

Arrhaphoceras (Praeschloenbachia) sp.
Pl. XXVII, Figure 3

1985 *Acanthoceras* sp. — HORVÁTH, Taf. 4, Figure 34

Material. Two fragments at 216.9 and 449.3 metres depth from Jásd J–42.

Description. A fragment of the outer lateral part of an internal mould. Four, well developed spine-like tubercles appear on the ventrolateral region. Feeble, very slight sinuous ribs also can be visible. Neither the umbilical nor the ventral region can be visible.

Discussion. Due to the fragmented preservation the specific identification is not possible.

Occurrence. The species occurs in the Late Albian sequence of Jásd J–42 borehole; otherwise it is know from the Late Albian *Stoliczkaia (S.) dispar* Zone of Europe.

Subfamily Hoplitinae H. DOUVILLÉ, 1890
Genus *Discohoplites* SPATH, 1925a
Type species: *Ammonites coelonotus* SEELEY, 1865

?*Discohoplites* sp.
Pl. XXVI, Figure 4, 7, 12, 13, 16, 17

Material. Several fragments from Jásd J–42 borehole and from Tilos Forest (6 fragments) and Jásd 1 quarry (3 fragments).

Description. Small fragments of flanks, with the characteristic sigmoidal ribs.

Discussion. The fragments are too small or fragmentary for the more exact identification. Many cases just the impression of the venter can be seen.

Occurrence. The genus was a characteristic boreal genus in the Late Albian, in Hungary it is known from the Jásd J–42 borehole.

Discohoplites coelonotus (SEELEY, 1865)

Pl. XIV, Figure 6, Pl. XIX, Figures 5, 6; Pl. XXI, Figure 6; Pl. XXVI, Figures 5, 6, 10, 11, Pl. XXIV, Figure 14

*1865 Ammonites coelonotus SEELEY, p. 237, Pl. 10, Figure 2
1968 Discohoplites coelonotus (SEELEY) — RENZ, p. 22, Pl.2, Figures 4a, b; 5
1979 Hyphoplites (Discohoplites) coelonotus (SEELEY) s.l. — SCHOLZ, p. 72–74, Pl. 13, Figures 5, 8–11, 13
1989 Hyphoplites (Discohoplites) coelonatus coelonatus (SEELEY) — HORVÁTH, Pl. 3, Figure 1
1989 Hyphoplites (Discohoplites) coelonatus densecostatus (RENZ) — HORVÁTH, Pl. 3, Figures 2, 4
1989 Hyphoplites (Discohoplites) coelonatus transitorius SPATH — HORVÁTH, Pl. 3, Figures 2, 4
1996 Discohoplites coelonotus (SEELEY) — KENNEDY in GALE et al., p. 553, Figure 15q.
2000 Hyphoplites (Discohoplites) coelonotus (SEELEY) — AMEDRO & ROBASZYNSKI, Pl. 1, Figures 3, 4, 5, 8

Material. 14 specimens between 159.2–448.4 metres of Jásd J–42 borehole.

Description. Discoidal, involute forms with narrow umbilicus, characterized by dense, narrow falcoid ribs, flat, sulcate venter, slight umbilical bullae present but no ventrolateral ones.

Discussion. This *Discohoplites* species is discussed by RENZ (1968) and KENNEDY (in GALE et al. 1996).

Occurrence. The species is known from the *Stoliczkaia (S.) dispar* Zone of the condensed Upper Albian basal pockets of Tilos Forest and the *Stoliczkaia (S.) dispar* Zone of the Upper Albian sequence of Jásd J–42 borehole; otherwise reported from the *Stoliczkaia (S.) dispar* Zone of Southern England, Switzerland and Southern France.

Genus *Hyphoplites* SPATH, 1922a
Type species: *Ammonites falcatus* MANTELL, 1822

Hyphoplites sp.

Pl. XXVI, Figures 8, 9, 22, 31

Material. One specimen is from Jásd 1 quarry, two from Tilos Forest. Also reported from Jásd J–42 borehole between 333.5–114.7 m; at Jásd J–36 borehole between 209.9–9.6 m.

Description. Imprints of the ventral region, the venter is sulcate, ribs end at the edge of the sulca. If the lateral sid is visible, ribs can be observed.

Discussion. Specific characters as the umbilical region, the shape of the ribs on the flanks and the ventrolateral region cannot be observed together or partly.

Occurrence. The genus is documented from Europe and the Trans-Caspian region from Upper Albian – Lower Cenomanian sediments.

Hyphoplites falcatus aurora WRIGHT & WRIGHT, 1949

Pl. XXVI, Figures 19, 20, 21, 24, 32

* 1949 *Hyphoplites falcatus* (MANTELL) *aurora* WRIGHT & WRIGHT, p. 485, Pl. 29, Figures 3, 9; Pl. 30, Figure 5
1984 *Hyphoplites falcatus aurora* WRIGHT & WRIGHT — WRIGHT & KENNEDY, p. 66, Pl. 6, Figures 11–13; Pl. 7, Figure 2; Text-Figures 7E–G, 9C (with full synonymy)
non1989 *Hyphoplites (Hyphoplites) falcatus* (MANTELL) — HORVÁTH, Pl. 5, Figure 2

Material. Several fragments between 114.7–28.0 m from Jásd J–42 borehole.

Description. Imprints of discoidal, involute forms ornamented with strong, falcoid ribs that flatten on the outer lateral region. Ribs are single and start from umbilical bullae. Venter — if it is visible — flat and sulcate, the alternating, elongated, sharp, ear-like tubercles are prominent on the sides of the sulca. Body chamber cannot be visible.

Discussion. The flattened venter and the elongated ear-like tubercles are characteristic. Resembles to *Hyphoplites curvatus* (MANTELL, 1822) but tubercles of are sharper and more elongated.

Occurrence. The species occurs in the Late Albian sequence of Jásd J–42 borehole; otherwise it is known from the *Mantelliceras mantelli* Zone of the northern shore of the former Tethys.

Hyphoplites campichei SPATH, 1925a

Pl. XXV, Figure 8

1860 *Ammonites falcatus* MANTELL — PICTET & CAMPICHE, p. 210, Pl. 27, Figure 1
*1925a *Hyphoplites campichei* SPATH, p. 83
1968 *Hyphoplites campichei* SPATH, 1925 — RENZ, p.25, Pl. 2, Figures 8, 10; Text-Figures 9b, 10b
1984 *Hyphoplites campichei* SPATH, 1925 — WRIGHT & KENNEDY, p. 69, Pl. 6, Figures 2–6, 8, 9, Text-Figures 7J, 8A, B, F, 9A, E
1984 *Hyphoplites campichei* SPATH, 1925 — KENNEDY & JUIGNET, p. 115. Figures 11 (i), (j); Figures 30 (e)–(h)
1989 *Hyphoplites (Hyphoplites) campichei* SPATH, 1925 — HORVÁTH, Pl. 5, Figure 1
1996 *Hyphoplites campichei* SPATH, 1925 — KENNEDY in GALE et al., p. 553, Figure 15k
1997 *Hyphoplites* cf. *campichei* (SPATH) — SCHOLZ in FÜLÖP, p. 81
1997 *Hoplites campichei* SPATH — SCHOLZ in FÜLÖP, Pl. 1, Figure 6

Material. Six specimens between 115.0–9.6 metres from the Jásd J–36 borehole; thirteen fragments from Jásd J–42 borehole between 119.2– 333.5 m.

Description. Discoidal forms with narrow umbilicus. Fine, strongly prorsiradiate or falcoid ribs start from the umbilical bullae and later disappear still on the lateral side. Ventrolateral tubercles are prominent; the venter is flat and sulcate.

Discussion. It is common that lateral flanks are almost smooth as seen on Plate XXV, Figure 8.

Occurrence. The species occurs in the Late Albian sequence of Jásd J–36 borehole; otherwise it is know from the Western Tethyan region from the Early Cenomanian.

Hyphoplites costosus WRIGHT & WRIGHT, 1949

Pl. XXVI, Figures 15, 18, 23, 25, 26, 27, 28, 29, 30

*1949 *Hyphoplites costosus* WRIGHT & WRIGHT, p. 484, Pl. 29, Figure 7
1984 *Hyphoplites costosus* WRIGHT & WRIGHT, 1949 — WRIGHT & KENNEDY, p. 70, Pl. 7, Figure 12
1989 *Hyphoplites (Hyphoplites) costosus* WRIGHT & WRIGHT — HORVÁTH, Pl. 5, Figures 5, 8

Material. 28 specimens between 159.2–299.5 metres from Jásd J–42 borehole.

Description. Discoidal, involute forms with characteristic falcoid ribs which has neither umbilical nor ventral tubercles. Venter — if can be seen — sulcate.

Discussion. The lack of ventral tubercles distinguishes the species from *Hyphoplites curvatus pseudofalcatus* (SEMENOV 1899).

Occurrence. The species known from the condensed Upper Albian basal pockets of Tilos Forest and the Upper Albian sequence of Jásd J–42 borehole, otherwise reported from the Late Albian of Europe and Transcaspia.

?Family Engonoceratidae HYATT, 1900
Genus *Engonoceras* NEUMAYR & UHLIG, 1881
Type species: *Ammonites pierdenalis* BUCH, 1850

Engonoceras duboisi LATIL, 1989

Pl. XV, Figures 1, 4

*1989 *Engonoceras duboisi* LATIL, p. 56, Pl. 2, Figures 1–3
1990a *Engonoceras duboisi* LATIL — BUJTOR, p. 9–14, Pl. 1, Figures 1–4

Material. There are three, slightly deformed specimens from Tilos Forest.

Description. Oxycone, strongly involute phragmocones with distinct umbilical bullae. Ribs are very wide and flat, flexous, nearly disappear on midflank but end in clavi on the ventral edge. Venter flat with no ornamentation but zigzagging tubercles.

Discussion. The species, just as the genus itself, is very rare in the Hungarian Late Albian material. The specimen on Plate XV, Figure 2 is the same as that BUJTOR (1990a, 4A) figured. A detailed desrciption of ten *Engonoceras* species and a short discussion on the possible evolutionary origin is given by KENNEDY et al. (1998). The suture of one specimen was published by BUJTOR (1990a).

Occurrence. The species occurs in the condensed Upper Albian basal pockets of Tilos Forest; otherwise it is known only from the Late Albian of Southern France.

Superfamily Acanthocerataceae DE GROSSUVRE, 1894
Family Brancoceratidae SPATH, 1934
Subfamily Brancoceratinae SPATH, 1934
Genus *Hysteroceras* HYATT, 1900
Type species: *Ammonites varicosus* J. de C. SOWERBY, 1824

Hysteroceras binum (J. SOWERBY, 1815)

Pl. XIV, Figure 12; Pl. XXI, Figure 5; Pl. XXIV, Figure 13

*1815 *Ammonites binus* J. SOWERBY, p. 208, Pl. XCII, Figure 3
1934 *Hysteroceras binum* (J. SOWERBY, 1815) — SPATH, p. 478, Pl. 52, Figures 8, 9; Text-Figures 161j, 165

Material. Three specimens from Tilos Forest.

Description. Small, evolute, well preserved specimens with compressed whorl section. Ribs arise from prominent umbilical bullae, then cross the lateral part straight and tend to be weakening on the flank, finally getting stronger and wider on the outer flank with forming tubercles on the ventral edge. Ribs do not bifurcae, no intermedier ribs are present. Venter is carinated, ribs end in pairs on the two sides of the keel.

Discussion. The sides are flattened, the umbilical,the ventral tubercles are strong and the ribs are straight and weakening on the lateral region. Ribs of *H. varicosum* do not weaken on the midflank. The holotype has no intention of carinated venter, but SPATH's specimen (SPATH, 1934, Text-Figure 9) shows a good example for the keeled venter. The species shows good resemblance to *Mortoniceras (Mortoniceras) nanum* SPATH, 1933, but *nanum* is more robust and less compressed. The resemblance between *binum* and *Hysteroceras antipodeum* (R. ETHERIDGE Jr., 1902) is also remarkable, although *antipodeum* is reported only from the south-eastern hemisphere (ETHERIDGE Jr. 1902; HENDERSON 1990). Besides their slightly different stratigraphic range, the specification of *Hysteroceras, Cantabrigites* and some *Mortoniceras* species based on their morphological features seems obscure and need further investigations.

Occurrence. The species is known from the condensed Upper Albian basal pockets of Tilos Forest; otherwise the species is recorded from the varicosum subzone of the Late Albian *Mortoniceras (M.) inflatum* Zone, reported from England, France and probably from Nigeria.

Subfamily Mojsisovicziinae HYATT, 1903
Genus *Dipoloceras* HYATT, 1900
Type species: *Ammonites cristatus*, BRONGNIART in CUVIER & BRONGNIART, 1822

***Dipoloceras (Dipoloceras)* sp.**

Material. A single fragment from the bed no. 10 from Bakonynána, Zsidó Hill.

Description. A fragment of a depressed whorl section with three primary ribs. Two ribs have two, small lateral tubercles and a prominent, ventrolateral spine-like tubercle as well. The third rib is high, ear-like and without tubercles. The venter is strongly keeled. Whorl section is characteristic with the huge, ear-like ribs that overstrech the other ones.

Discussion. The very strong, spine-like ventrolateral tubercle and the ear-like rib characterize the genus.

Occurrence. The genus is known from the lower part of the Late Albian Pénzeskút Marl Formation from Bakonynána. Otherwise *Dipoloceras* is known from the Middle and Upper Albian deposits worldwide.

Subfamily Mortoniceratinae R. DOUVILLÉ, 1912
Genus *Mortoniceras* MEEK, 1876 (= *Pervinquieria* BÖHM, 1910)
Type species: *Ammonites vespertinus* MORTON, 1834

***Mortoniceras* sp.**
Pl. XXVIII, Figure 11, 12

Material. Five poorly preserved, fragmented specimens from Bóly B–1 borehole (1030.5, 1060.9, 1071.9, 1071.9 and 1096.3 metres) and several fragments from Jásd J–42 and Jásd J–36 boreholes, and surface outcrops of Tilos Forest (3 specimens) and Bakonynána (29 specimens).

Description. Small, evolute forms. The whorl section is hardly seen at any fragment but seems like trapezoidal. At the umbilical edge heavy tubercles can be visible. Straight or bit S-shaped ribs start from the umbilical tubercles and carrying a lateral and a ventral tubercle as well. Venter — if can be seen — carinated. Suture cannot be observed.

Discussion. Specimens show similarities to subgenus *Durnovarites* SPATH, 1932 but the identification would be uncertain.

Occurrence. The genus occurs in the condensed Late Albian – Early Cenomanian basal pockets of surface outcrops and the Late Albian sequence of Bóly B–1, Jásd J–42 and Jásd J–36 boreholes; otherwise was cosmopolitan in the Late Albian.

Subgenus *Mortoniceras* MEEK, 1876
Type species: *Ammonites vespertinus* MORTON, 1834

***Mortoniceras (Mortoniceras)* cf. *inflatum* (J. SOWERBY, 1817)**
Pl. XXIV, Figure 15

*1817 *Ammonites inflatus* J. SOWERBY, p. 170, Pl. 178
1933 *Mortoniceras (Pervinquieria) inflatum* (J. SOWERBY, 1817) — SPATH, Pl. 35, Figure 9; Pl. 37, Figure 1; Pl. 39, Figure 2; Pl. 42, Figure 6; Pl. 43, Figure 1; Pl. 46, Figures 1, 2; Text-Figures 125–129, 130a, b; 137d
1994 *Mortoniceras inflatum* (J. SOWERBY, 1817) — LATIL, Pl. 1, Figure 2 (refigured holotype)

Material. A single fragment from Bakonynána, Zsidó Hill section from bed no. 16.

Description. A fragment of a conch with depressed, quadrate-polygonal whorl section. Ribs are strong, slight impression of trituberculation is visible, but the tubercles are less prominent. Quadritubercualtion is also can be detected. The ribs are branching but intermedier ribs also present. The venter is strongly keeled. Suture is not preserved.

Discussion. Tuberculation is not so strong than in *M. (M) rostratum* (J. Sowerby, 1817), the third tubercle forms shoulder on the ventral edge. The specimen shows very good resemblance to Sowerby's holotype.

Occurrence. The species is known from Hungary from Bakonynána, Zsidó Hill, bed no. 16. of the lower part of the Upper Albian Pénzeskút Marl Formation. Otherwise the species is an index fossil of the Late Albian *Mortoniceras (M.) inflatum* Zone and known worldwide.

***Mortoniceras (Mortoniceras) rostratum* (J. Sowerby, 1817)**

*1817 *Ammonites rostratus* J. Sowerby, p. 163, Pl. 173
1932 *M. (Pervinquieria) rostrata* (Sowerby) — Spath, p. 402, Text-Figure 136 (refigured holotype)
1979 *Pervinqueria (Subschloenbachia) rostrata* (Sowerby, 1817) — Scholz, p. 111, Pl. 26, Figure 1; Pl. 27, Figures 1, 2
1994a *Mortoniceras rostratum* (J. Sowerby, 1818) — Latil, Pl. 1. Figure 1 (refigured holotype)

Material. A huge, adult specimen with the beginning of the rostrum from Bakonynána, bed. no. 12.

Description. An adult specimen of 195 mm in diameter shows the beginning of the rostrum at the end of the body chamber. Whorl section is poligonal. The conch is very evolute but rather dingy so the delicate ornamentation is not visible. Ribs are single, strong, quadrituberculate, equal in size, later on the body chamber the ribs are trituberculated. The venter is keeled. Suture cannot be visible.

Discussion. Although the specimen is in a poor preservation state, the type of ornamentation is closer to the slightly deformed original of J. Sowerby. Since the inner whorls are poorly preserved, the specific identification is questionnable. The rostrum is not a specific feature because it was probably correlated with the sexual dimorphism or a certain ontogenetic stage (or both).

Occurrence. The species known from Bakonynána, Zsidó Hill, from bed no. 12. Otherwise it is a cosmopolitan fossil of the Late Albian *Stoliczkaia (S.) dispar* Zone sediments.

Genus *Cantabrigites* Spath, 1932
Type species: *Mortoniceras (Cantabrigites) cantabrigense* Spath, 1932

***Cantbrigites cantabrigense* Spath, 1932**

Pl. XIV, Figures 11, 13; Pl. XXI, Figure 4, Pl. XXVIII, Figure 17

*1932 *Mortoniceras (Cantabrigites) cantabrigense* Spath, p. 438, Pl. 41, Figures 3, 4; Pl. 45, Figure 4; Pl. 46, Figure 8
1968 *Cantabrigites cantabrigense* Spath, 1933 — Renz, p. 58, Pl. 10, Figures 10a, b
1979 *Hysteroceras (Cantabrigites) cantabrigense* (Spath) — Scholz, p. 115, Pl. 29, Figures 11, 12
1981 *Cantabrigites cantabrigense* Spath, 1933 — Kennedy & Wright, Figures 30–32, 36–38
1989 *Hysteroceras (Cantabrigites) cantabrigense* helveticum (Renz) — Horváth, Pl. 2, Figures 3, 5
1989 *Hysteroceras (Cantabrigites) cantabrigense* (Spath) — Horváth, Pl. 2, Figures 7, 8
1989 *Hysteroceras (Cantabrigites) cantabrigense minor* (Spath) — Horváth, Pl. 3, Figures 5, 6
1996 *Cantabrigites cantabrigense* Spath, 1933 — Kennedy in Gale et al., p. 555, Figures 16i–k, 17f, h, j
1997 *Mortoniceras (Cantabrigites) cantabrigense* (Spath) — Scholz in Fülöp, p. 81

Material. Flattened, shelled specimens from Bóly B–1 (1092.8 m, 1033.5 m and 1071.9 m) and four specimens from Jásd J–42 borehole (471.8 m, 446.5 m, 446.2 m, 439.7 metres). Several specimens found at surface outcrops of Tilos Forest (6 specimens), Villó Hill (15 specimens) and Bakonynána (31 specimens).

Description. Small, medium evolute form with a slight excentricity at the last whorl. Ribs rectiradiate apart from the last whorl where prorsiradiate ribs are present. Tubercles are strong. Other features as for the genus.

Discussion. The specimen shows good similarity to *Cantabrigites subsimplex* Spath, 1933 but subsimplex has fewer ribs per whorl and coarser ornamentation. Probably the two species are intraspecific variations of each other. The phylogenetic relations of *Cantabrigites* with the Cenomanian *Euhystrichoceras* Spath, 1923 and *Algericeras* Spath, 1925b are discussed by Kennedy & Wright (1981).

Occurrence. The species occurs in the condensed Upper Albian basal pockets of surface outcrops and the Late Albian sequence of Bóly B–1, Jásd J–42 and Jásd J–36 boreholes; otherwise reported from the Late Albian *Stoliczkaia (S.) dispar* Zone of Europe.

Family Lyelliceratidae Spath, 1921a
Subfamily Stoliczkaiinae Breistroffer, 1953
Genus *Neophlycticeras* Spath, 1922a (= *Faraudiella* Breistroffer, 1947; *Eotropitoides* Casey, 1965)
Type species: *Ammonites brottianus* d'Orbigny, 1841
Subgenus *Neophlycticeras* Spath, 1922a
Type species: *Ammonites brottianus* d'Orbigny, 1841

Neophlycticeras (Neophlycticeras) blancheti (PICTET & CAMPICHE, 1859)
Pl. XV, Figures 5, 6; Pl. XX, Figures 3, 10

*1859	*Ammonites Blancheti* PICTET & CAMPICHE, p. 188, Pl. 23, Figures 2–6
1931	*Neophlycticeras blancheti* (PICTET & CAMPICHE) — SPATH, p. 323, Pl. 34, Figures 11a–c; 12a, b; 13a, b; Text-Figure 105
1979	*Stoliczkaia dispar* (D'ORBIGNY, 1841) — SCHOLZ, p. 83, Pl. 14, Figures 1, 2, 4, 5, 7; Pl. 15, Figure 1, ?4
non 1989	*Stoliczkaia dispar blancheti* (PICTET & CAMPICHE) — HORVÁTH, Pl. 1, Figure 7. (= Stoliczkaia sp.)
1994b	*Neophlycticeras (Neophlycticeras) blancheti* (PICTET & CAMPICHE, 1859) — KENNEDY & DELAMETTE, p. 1269, Figures 6.1–6.8, 6.19–6.22, 7.1–7.12, 7.15–7.17, 8.3, 9.1–9.2
1994	*Neophlycticeras (Neophlycticeras) blancheti* (PICTET & CAMPICHE, 1859) — WRIGHT & KENNEDY, p. 563, Figures 2a–m, 6d–f, 7a–h (with synonymy)

Material. Several specimens from Tilos Forest (13 specimens), Villó Hill (2 specimens) and Bakonynána, Zsidó Hill (31 specimens).

Description. Involute specimens with high, compressed whorl section. Flanks are convex; the maximum width is at lower third of the flanks. There are six–eight primary ribs appear on the last half whorl. There are 17–20 intercalated ribs appear on the last half whorl at the ventral shoulder. Ribs are low, straight or slightly prorsiradiate from the umbilical shoulder. Ribs bear clavi on the ventral edge and then follow until they form sipholal clavi.

Discussion. WRIGHT & KENNEDY (1994) fully discussed the genus and its relationship between Stoliczkaiinae. They also regarded *Stoliczkaia rhamnonotus* (SEELEY, 1865) to the genus *Neophlycticeras*. I agree with WRIGHT & KENNEDY (loc. cit) that *N. blancheti* (PICTET & CAMPICHE, 1859) and *N. sexangulatum* (SEELEY, 1865) are closely similar. Differences between them are listed by WRIGHT & KENNEDY (1994) as the following: "*N. (N) blancheti* differs from *N. (N) sexangulatum* (SEELEY, 1865) in its greater involution and whorl height, denser ribbing and finer tuberculation.". We can add nothing to their opinion, but we accept the necesity of a subgeneric division. KENNEDY & DELAMETTE (1994a) discussed the type specimen of the genus.

Occurrence. The species occurs in the condensed Upper Albian basal pockets of Pénzeskút Marl Formation in surface outcrops; otherwise is known from the lower part of Late Albian *Stoliczkaia (S.) dispar* Zone of the Western Tethys and Early Cenomanian of Texas (YOUNG 1979).

Genus *Stoliczkaia* NEUMAYR, 1875b (=*Villoutreysia* CASEY, 1965)
Type species: *Ammonites Dispar* D'ORBIGNY, 1841

Stoliczkaia sp.
Pl. XXV, Figure 10, 11, Pl. XXVI, Figure 34, Pl. XXVII, Figure 8, Pl. XXVIII, Figure 16

Material. 28 fragments from Tilos Forest, 3 fragments from Jásd 1 quarry .

Description. The fragments are too small or poorly preserved for more exact classification.

Subgenus *Stoliczkaia* NEUMAYR, 1875b
Type species: *Ammonites Dispar* D'ORBIGNY, 1841

Stoliczkaia (Stoliczkaia) dispar (D'ORBIGNY, 1841)
Pl. XVII., 1, Pl. XX, Figure 5, Pl. XXI, Figures 2, 3, Pl. XXV, Figure 9

*1841	*Ammonites Dispar* D'ORBIGNY, p. 142, Pl.45, Figures 1, 2
1931	*Stoliczkaia dispar* (D'ORBIGNY) — SPATH, p. 329, Pl. 33, Figures 3a, b; Text-Figure 108 (with full synonymy).
1979	*Stoliczkaia dispar* (D'ORBIGNY) — SCHOLZ, p. 83, Pl. 14, Figures 1–10, Pl. 15, Figures 1–5, Pl. 16, Figures 1–5, Pl. 17, Figures 1–5, Pl. 18, Figures 1–4, Pl. 19, Figures 1–6, Pl. 20, Figures 1–4, Text-Figures 22, 23
1985	*Stoliczkaia dispar* D'ORBIGNY– HORVÁTH, Pl. 2, Figure 14
1989	*Stoliczkaia dispar dispar* D'ORBIGNY– HORVÁTH, Pl. 1, Figure 9
1996	*Stoliczkaia dispar* (D'ORBIGNY) — KENNEDY in GALE et al., p. 559, Figure 17k
1997	*Stoliczkaia dispar* (D'ORBIGNY) — SCHOLZ in FÜLÖP, p. 81, Pl. 1, Figure 10

Material. Internal moulds from Tilos Forest (10 specimens), Jásd 1 quarry (10 specimens), Bakonynána (19 specimens); some specimens from Jásd J–42 borehole (429.3 m; 388.6 m), Jásd J–36 borehole (224.7–227.8 m) and Pusztavám Pv–980 borehole (350.6–351.0 m).

Description. Involute, compressed, slightly discoidal forms with narrow umbilicus. Prorsiradiate primary ribs start from the umbilical edge, and sometimes wear bullae on the inner flank. Intercalated ribs rise on midflank, both primaries and intercalated ones cross the venter with a pair of feeble tubercles on the ventral edge. Rib index is above 40. On the specimen at Pl. XXI, Figure 2 shows the loss of ornament at maturity; only the inner flank and ventrolateral–ventral ornamentation remain.

Discussion. The species and even the genus are almost absent the rich ammonite assemblage of the Hungarian borehole faunas that enclosed in a grey aleuritic marl. This can be explained by palaeotopographic and palaeogeographic reasons besides ecological factors, this was discussed in the previous chapter.

Distribution. The species occurs in the condensed Upper Albian basal pockets of Pénzeskút Marl Formation in surface outcrops and boreholes; otherwise the species is the index fossil of the Late Albian *Stoliczkaia (S.) dispar* Zone, distributed worldwide.

Stoliczkaia (Stoliczkaia) tenuis RENZ, 1968
Pl. XV, Figure 3; Pl. XX, Figure 2

*1968 Stoliczkaia (Stoliczkaia) tenuis RENZ, p. 48, Taf. 6, Figures 6a, b; 12a,b; Text-Figures 16b, f
1994 Stoliczkaia (Stoliczkaia) dispar (D'ORBIGNY, 1841) — WRIGHT & KENNEDY, Figures 11h, i, j, k, l, m, n, o, p, q, r, s, t, u, v; Figures 12, c, d
1994 Stoliczkaia (Stoliczkaia) clavigera (NEUMAYR, 1875) — WRIGHT & KENNEDY, Figures 12g, h

Material. Three internal moulds from Tilos Forest.

Description. Small, moderately depressed, rather involute specimen. Primary ribs arise from umbilical bullae, cross straight the flank and weaken on midflank. Intercalated ribs appear, the total rib index on the last half whorl is 20. On the outer lateral part ribs getting prorsiradiate and wider and form tubercles on the ventral edge. The ventral part is flattened, almost smooth with a slight impression of siphonal tubercles.

Discussion. The identification of the specimens is equivocal due to the characteristic strong ventrolateral pair of tubercles and the flattened venter. However, some broken mature and huge specimens which determined as *S. (S.) notha* (SEELEY, 1865) or *S. (S) clavigera* (NEUMAYR, 1875b), has similar featured venter in the inner whorls.

Occurrence. The species occurs in the condensed Upper Albian basal pockets of Pénzeskút Marl Formation at Tilos Forest; otherwise the species is reported from the Late Albian *Stoliczkaia (S.) dispar* Zone of the type area of the "Vraconnian" in Switzerland.

Stoliczkaia (Stoliczkaia) notha (SEELEY, 1865)
Pl. XIX, Figure 7, Pl. XX, Figure 4

1968 *Stoliczkaia (Stoliczkaia) notha* (SEELEY, 1865) — WIEDMANN & DIENI, p. 147, Pl. 15, Figure 7, Text-Figures 96, 97
1979 *Stoliczkaia dispar* (SEELEY, 1865) — SCHOLZ, p. 83, Pl. 15, Figure 3; Pl. 16, Figures 4, 5; Pl. 17, Figures 4, 5, Pl. 18, Figure 4 (= *S. notha*, according to WRIGHT & KENNEDY, 1994)
1994b *Stoliczkaia (Stoliczkaia) notha* (SEELEY, 1865) — KENNEDY & DELAMETTE, p. 1270, Figures 4.20– 4.22, 4.26–4.37, 5.1, 9.11–9.14, 9.18, 9.19, 10.18–10.21
1994 *Stoliczkaia (Stoliczkaia) notha* (SEELEY, 1865) — WRIGHT & KENNEDY, p. 569, Figures 5a, d, e; 8a–r; 9a–k; 10a–j

Material. Ten internal moulds from Tilos Forest.

Description. Huge, mature, moderately involute, compressed specimens with paralel flanks. Ribs are feeble, rursiradiate, plicate and very steep. Primaries start from the umbilical edge, alternating with one or two intercalated ones that start on the midflank. Ribs cross the venter which is rounded. Early growth stage cannot be visible.

Discussion. The specimen is less involute and less compressed than *S. (S) dispar* (D'ORBIGNY, 1841), ribs are wider and steeper, also weakening on the midflank. Full discussion is given by WRIGHT & KENNEDY (1994).

Occurrence. The species occurs in the condensed Upper Albian basal pockets of Pénzeskút Marl Formation at Tilos Forest; otherwise the species is a characteristic fossil of the Late Albian *Stoliczkaia (S.) dispar* Zone of the Western Tethys and Angola.

Stoliczkaia (Stoliczkaia) clavigera (NEUMAYR, 1875b)
Pl. XX, Figure 1

*1875b *Stoliczkaia clavigera* NEUMAYR, p. 933
1968 *Stoliczkaia (Stoliczkaia)* cf. *clavigera* NEUMAYR — RENZ, p. 50, Pl. 6, Figure 7; Pl. 8, Figures 1–3
1989 *Stoliczkaia dispar* D'ORBIGNY f. clavigera — HORVÁTH, Pl. 4, Figure 5
1994 *Stoliczkaia (Stoliczkaia) clavigera* (NEUMAYR, 1875) — WRIGHT & KENNEDY, Figures 5b; 11k–m; 12e–h, k–n; 13a–c; 14a–c (with synonymy)

Material. Sixteen specimens from Tilos Forest.

Description. Involute specimens with almost rounded whorl section, narrow umbilicus and coarse ornamentation. Ribs prorsiradiate, primaries and intercalated ones alternating. Primary rib index on the last half whorl is 13. Ribs cross the venter straight, no tuberculation or bifurcation are visible. The venter is wide, rounded.

Discussion. Very similar to *S. (S.) dispar* (D'ORBIGNY, 1841) but whorl section is less compressed with wider and more rounded venter and coarser ornamentation. Discussion is given by WRIGHT & KENNEDY (1994).

Occurrence. The species occurs in the condensed Upper Albian basal pockets of Pénzeskút Marl Formation at Tilos Forest; otherwise the species is reported from the *Mortoniceras (M.) perinflatum* Subzone of the Late Albian *Stoliczkaia (S.) dispar* Zone.

Subgenus *Lamnayella* WRIGHT & KENNEDY, 1978
Type species: *Stoliczkaia (Lamnayella) juigneti* WRIGHT & KENNEDY, 1978

Stoliczkaia (Lamnayella) worthense (ADKINS, 1920)
Pl. XIX, Figure 9

*1920 *Acanthoceras worthense* ADKINS, p. 93, Pl. 1, Figures 11–13, 15–17, 20–25
2004a *Stoliczkaia (Lamnayella) worthense* (ADKINS, 1920) — KENNEDY, p. 884, Figures 15B, E, H–J, M–O; 17A–X; 18A–P; 19B–K; 20A–C

Material. A single specimen from Tilos Forest.

Description. Highly compressed, involute specimen with narrow and shallow umbilicus. The inner and the middle lateral part is smooth, the ornamentation appears at the outer third of the flank, where prorsiradiate, coarse ribs start which end at the ventrolateral shoulder. Rib index is 18 in a half whorl. The venter is narrow, flattened and the ventrolateral shoulder is ornamented by the ribs.

Discussion. The flattened venter and the ventrolateral rib ends of the specimens resembles to *Stoliczkaia (Stoliczkaia) tenuis* RENZ, 1968, but *S. (L.) worthense* is more compressed and the ornamentation lacks on the inner and mid lateral part.

Occurrence. The species occurs in the condensed Upper Albian basal pockets of Pénzeskút Marl Formation at Tilos Forest; otherwise the species is reported from the Late Albian of Texas.

Family Flickiidae ADKINS, 1928
Subfamily Salaziceratinae KENNEDY & WRIGHT, 1984
Genus *Zuluscaphites* VAN HOEPEN, 1955 (= *Huescarites* LATIL, 1990)
Type species: *Zuluscaphites orycteropusi* VAN HOEPEN, 1955

Zuluscaphites orycteropusi VAN HOEPEN, 1955
Pl. XVI, Figures 4, 5, 6, 13, 14, 15,

*1955 *Zuluscaphites orycteropusi* VAN HOEPEN, p. 359, Text-Figure 6
1979 *Salaziceras (Salaziceras) breistrofferi breistrofferi* SCHOLZ, p. 96, Pl. 21, Figures 21, 22, 25, 27, 28; Text Figures 25, 27A, Z
1979 *Salaziceras (Salaziceras) breistrofferi pseudonodosa* SCHOLZ, p. 96, Pl. 21, Figures 23, 24, 26; Text Figures 27R
1990 *Huescarites companyi* LATIL, p. 31, Pl. 1, Figures 1–3, 5–7; Text-Figures 1–6
1993 *Zuluscaphites orycteropusi* VAN HOEPEN, 1955 — KENNEDY & KLINGER, p. 64, Figures 1G, J; Figure 2
1994b *Zuluscaphites orycteropusi* VAN HOEPEN, 1955 — KENNEDY & DELAMETTE, p. 1278, Figures 6.9–6.11, 8.1, 9.3–9.7, 12.1–12.3, 12.6–12.9

Material. Seven specimens from Tilos Forest.

Description. The specimens are involute and bubbled, with circular-depressed whorl section and well rounded venter. The ornamentation varies from the smooth venter (Pl. XVI, Figure 4) to well — developed lateral bullae (Pl. XVI, Figure 6). The ornamentation consists lateral bullae which turn into primary ribs that cross the lateral and the ventral part straight. In between the primaries narrow intercalated ribs may appear (Pl. XVI, Figure 5). The ornamentation changes during the ontogeny — as it can be noticed on Figure 5, after reaching a certain size (in this case 15 mm) of the conch, ribs disappear from the venter and all the ornamentation is getting weaker and blunter. The conch is getting narrower towards the body chamber (Pl. XVI, Figures 6, 14). The venter is well rounded, ribs cross the venter without any trace of tuberculation.

Discussion. Despite of its name, WIEDMANN (1965, p. 443) proposed first that "*Zuluscaphites* merely represents a lyelliceratid inner whorl.". KENNEDY & KLINGER (1993) discussed the relationship between *Zuluscaphites* VAN HOEPEN (1955) and *Huescarites* LATIL, 1990 and concluded the latter as a junior synonym of *Zuluscaphites*. Here I follow their opinion. KENNEDY & KLINGER (1993) put the genus into the family Lyelliceratidae SPATH, 1921a, into the subfamily Stoliczkaiinae BREISTROFFER, 1953. In contrast, LATIL (1990) placed the genus *Huescarites* to the family Flickiidae ADKINS, 1928, into the subfamily Salaziceratinae KENNEDY & WRIGHT, 1984. According to morphological features and the transitional forms that occur in the Hungarian material, here I follow the classification proposed by LATIL (1990). It is difficult to separate *Z. helveticus, Z. orycteropusi* and *Salaziceras (Salaziceras) breistrofferi* SCHOLZ, 1979 from each other in the Hungarian material. It seems that there are transitional forms between the two genera. Examining Scholz's material, on the basis of the ornamentation and the outer morphology, the described specimens of *Salaziceras (Salaziceras) breistrofferi* SCHOLZ, 1979 belong to *Zuluscaphites orycteropusi* VAN HOEPEN, 1955. Siphonal clavi can be visible on SCHOLZ's specimen (1979: Pl. 21, Figure 21), on the specimen figured by KENNEDY & DELAMETTE (1994b: Figure 13–5) and the material described here (Pl. 16, Figure 13). Specimens figured by SCHOLZ (1979: Pl. 21, Figures 23, 24, 26) and referred to *Salaziceras (Salaziceras) breistrofferi pseudonodosa* SCHOLZ, 1979 develop ventral tubercles which can be recognized other specimens figured here.

Occurrence. The species occurs in the condensed Upper Albian basal pockets of Tilos Forest which age can be determined in the *Stoliczkaia (S.) dispar* Zone; otherwise its distribution is very restricted, known just from the lower part of the Late Albian *Stoliczkaia (S.) dispar* Zone of Spain, the Western Alps and Zululand.

Zuluscaphites helveticus KENNEDY & DELAMETTE, 1994b
Pl. XIV, Figure 14, Pl. XVI, Figures 1, 2, Pl. XX, Figure 7

*1994b *Zuluscaphites helveticus* KENNEDY & DELAMETTE, p. 1281, Figures 12–1, 2, 3, 6, 7, 8, 9

Material. Two specimens from Tilos Forest locality.

Description. Slightly bubbled, involute specimens with circular whorl section. The venter is smooth. The umbilical edge rounded and low. The lateral part is very delicately ornamented by blunt ribs. Blunt, wide primary ribs appear on the inner flank, intercalated ribs also may appear. After reaching the ventral edge, both ribs disappear.

Discussion. The separation of *helveticus* and *orycteropusi* is based on "compressed whorl section, coarse, feebly flexed ribs and distant irregular body chamber ornament distinguish [*Z. helveticus*] from *Zuluscaphites orycteropusi*". In my opinion, the smooth venter is also a specific character of helveticus. There is also a resemblance with *Metascaphites thomasi* (PERVINQUIÉRE 1907). Both forms have similar sculpture, but ribs appear on the inner lateral region on *Z. helveticus*, in contrast to the ventrolateral tubercled bullae of *M. thomasi*.

Occurrence. The species occurs in the condensed Upper Albian basal pockets of Tilos Forest which age can be determined in the *Stoliczkaia (S.) dispar* Zone; otherwise its distribution is very restricted, known just from the lower part of the Late Albian *Stoliczkaia (S.) dispar* Zone of the Western Alps.

Genus *Salaziceras* BREISTROFFER, 1936
Type species: *Ammonites salazacensis* HÉBERT & MUNIER-CHALMAS, 1875
Subgenus *Salaziceras* BREISTROFFER, 1936
Type species: *Ammonites salazacensis* HÉBERT & MUNIER-CHALMAS, 1875

Salaziceras (Salaziceras) salazacense salazacense (HÉBERT & MUNIER-CHALMAS, 1875)
Pl. XIV, Figure 15; Pl. XVI, Figures 7, 8, 9, 10, 11, 12, Pl. XX, Figure 6, 8, 9

1979 *S. (Salaziceras) salazacense salazacense* (HÉBERT & MUNIER-CHALMAS, 1875) — SCHOLZ, p. 92, Pl. 21, Figures 6–10, 13–15, 17; Text-Figures 25, 26A, 27B, H, I, J, L, M, U, V
1985 *Salaziceras (Salaziceras) salazacense gracilicostatus* SCHOLZ — HORVÁTH, p. 155, Pl. 2, Figure 2
1994 *Salaziceras (Salaziceras) Salazacense* (HÉBERT & MUNIER-CHALMAS, 1875) — KLINGER & KENNEDY, p. 146, Figures 1 A–H
1994a *Salaziceras (Salaziceras) Salazacense* (HÉBERT & MUNIER-CHALMAS, 1875) — LATIL, Pl. 6, Figure 3

Material. 11 specimens from Tilos Forest. A single specimen is from Jásd J–42 borehole at 377.3 m.

Description. Forms belong to this subspecies are involute, bubbled, slightly depressed ones. Thick, high primary ribs start from the umbilical edge, intercalated ribs appear on the midflank, both primaries and intercalated ones cross the venter straight. The venter is rounded.

Discussion. There is an interesting ontogenetical change can be seen on Pl. XX, Figure 9. The ribbed inner whorls tend to be smooth towards the aperture. The body chamber is completely smooth with an aperture that narrower than the previous whorls.

The Hungarian Salaziceras assemblage is unique because of its richness and high morphotypical variability. SCHOLZ (1979, pp. 91–97) separated five morphyotypes of the subspecies *Salaziceras*.

S. (S.) salazacense salazacense (HÉBERT & MUNIER-CHALMAS, 1875) — the same morphotype in the recently studied material is also referred to *S. (S) salazacense salazacense.*

S. (S.) salazacense gracilicostatus SCHOLZ, 1979 — this subspecies does not occur in the recently studied material. According to SCHOLZ's description, I agree with the establishment of this new subspecies.

S. (S.) salazacense peyrolasense SCHOLZ, 1979 — this subspecies, on the basis of his photographes, can be divided into two morphotypes: A: Pl. 21, Figures 16, 17, 20; B: Figures 18, 19. In the recently studied material the morphotype A is referred to *Zuluscaphites helveticus* KENNEDY & DELAMETTE, 1994. Morphotype B is referred to *Ficheuria kiliani* PERVINQUIÉRE, 1910. KENNEDY & DELAMETTE (1994b, p. 1282) referred all figured specimens of S. (S) salaziceras peyrolasense to *Ficheuria kiliani* PERVINQUIÉRE, 1910.

S. (S.) breistrofferi SCHOLZ, 1979 — studying SCHOLZ's material and compared the specimens with the recently collected ones, according to my opinion this subspecies does not exist, because all the figured specimens belong to *Zuluscaphites orycteropusi* an Hoepen, 1955. On SCHOLZ (1979) Pl. 21, on Figures 21a, b and a siphonal clavi can be recognized just as on a specimen documented here on Pl. XVI, Figure 13. The pseudonodosa subspecies of SCHOLZ is proposed as a new subspecies of *orycteropusi*.

In Hungary, *Salaziceras* occurs only in the surface outcrops, in yellowish white marl and are completely missing from borehole assemblages characterized by Desmoceratids and Hoplitids that indicate deeper water environments with the fine grained aleuritic, grey marly sediments. Presumably *Salaziceras* preferred warmer, shallower environments rather than open neritic waters.

Occurrence. The species occurs in the condensed Upper Albian basal pockets of surface outcrops; otherwise its distribution is very restricted, it is known only from the lower part of the Late Albian *Stoliczkaia (S.) dispar* Zone of France, England and Zululand. The genus is reported from Nigeria (FÖRSTER, SCHOLZ 1979) as well.

Subgenus *Noskytes* SCHOLZ, 1979
Type species: *Salaziceras (Noskytes) bakonyense* SCHOLZ, 1979

According to the Hungarian material, I follow SCHOLZ's classification, who established *Noskytes* as a subgenus of *Salaziceras*. Subgenus *Noskytes* can be characterize with distinctive morphological features as the rigid ribbing and the broad, flat, sulcate venter, therefore I do not accept it as a synonym of *Salaziceras*.

***Salaziceras (Noskytes) bakonyense* SCHOLZ, 1979**
Pl. XVI, Figure 19

*1979 *Salaziceras (Noskytes) bakonyense* SCHOLZ, p. 97. Pl. 22, Figures 1–5

Material. Six specimens from Tilos Forest.
Description. Bubbled, involute forms with deep umbilicus and depressed whorl section. Strong, coarse ribs start from the umbilical edge and cross the ventral region. Rib index is 7 on a half whorl. No intercalated or bifurcated ribs present. The venter is widely sulcate.
Discussion. Differs from the typical representatives of the subgenus *Salaziceras* are in its deeper, crater-like umbilicus and heavily sulcate venter. For detailed description see SCHOLZ (1979, p. 97). According to the well defined morphological differences we support to keep *Noskytes* as a valid subgenus of *Salaziceras*. Probably it would be even to worth to raise *Noskytes* to a generic position but the present material is not enough for further studies.
Occurrence. The subgenus and the species are reported only from the condensed Late Albian basal pockets of Tilos Forest.

Subfamily Flickiinae ADKINS, 1928
Genus *Ficheuria* PERVINQUIÉRE, 1910
Type species: *Ficheuria kiliani* PERVINQUIÉRE, 1910

***Ficheuria kiliani* PERVINQUIÉRE, 1910**
Pl. XVI, Figure 3; Pl. XVII, Figure 2

*1910 *Ficheuria kiliani* PERVINQUIÉRE, p. 35
1979 *Salaziceras (S) salazacense peyrolasense* n. sp. — SCHOLZ, p. 93, Pl. 21, Figures 16, 18, 19, 20 (only)
1994a *Ficheuria kiliani* PERVINQUIÉRE — LATIL, Pl. 6, Figure 4

Material. A single specimen from Tilos Forest, another one is from Bakonynána.
Description. Small, globular, very involute specimen with narrow, deep umbilicus. The whorl section is highly compressed. The umbilical edge is rounded; the flanks are convex and have the highest part on the middle. The venter is rounded. No ornamentation and suture visible.
Discussion. The genus is very rare, in the Hungarian material it is represented by only a single specimen. It could be confused with the almost smooth variation of *Salaziceras* which is also figured (Plate XVI, Figure 13), but *Salaziceras* has slightly ornamented cast and rather more evolutee umbilicus.
Occurrence. This rare genus is known from the condensed Upper Albian basal pockets of Tilos Forest, the Late Albian sequence of Bakonynána, otherwise the genus was described from North Africa, also reported from Japan.

Family Acanthoceratidae DE GROSSUVRE, 1894
Subfamily Mantelliceratinae HYATT, 1903
Genus *Mantelliceras* HYATT, 1903
Type species: *Ammonites mantelli* J. SOWERBY, 1814

***Mantelliceras* (?) sp.**
Pl. XXV, Figure 14; Pl. XXVI, Figure 35; Pl. XXVII, Figure 1, 7

Material. Two fragments from Jásd J–36 borehole between 152.7–157.2 m and 15.2–16.9 m; four specimens from Jásd J–42 borehole at 30.2 m; 125.8 m; 260.6 m 280.0 m and 297.8 m. *Description.* Rather involute, flattened specimens. Primary ribs are strong, start at the umbilical edge and cross the lateral side radially. Secondary ribs are randomly intercalated between primaries and start at the dorsolateral part. Sometimes tubercles are present on the umbilical edge and/or on the ribs. Venter and the suture cannot be observed.

Discussion. Characters necessary for the exact species level identification as the shape of venter, tuberculation and rib index are poorly or not preserved at all. The crushed, compressed fragments are referred to genus *Mantelliceras* on the base of the rigid ribbing and the presence of lateral, ventrolateral and ventral tubercles. These coarsely ribbed, tubercualted forms seem to be transitions between the genera *Stoliczkaia* and *Mantelliceras*, unfortunatelly the material is insufficient to base a new genera or species on. LÓPEZ-HORGUE et al. (1999) have published a similar form (Figures 16, y, z) from the top of the *Stoliczkaia (S.) dispar* Zone of Spain, captured as "*Stoliczkaia* sp. with tuberculate, *Mantelliceras couloni*-like outer whorl ornament…".

Occurrence. The genus *Mantelliceras* occurs in the Late Albian, *Stoliczkaia (S.) dispar* Zone sequences of Jásd J–36 and Jásd J–42 boreholes. The genus is known from the Lower Cenomanian *Mantelliceras mantelli* Zone worlwide. However, GALE et al. (1996) reported *Mantelliceras* specimens below the Albian/Cenomanian (A/C) boundary at Mont Risou, France and concluded that the first appearence of the genus *Mantelliceras* is not eligible to mark the position of the A/C boundary. This data corresponds to the Hungarian borehole sequences, where *Mantelliceras* spp. occur somewhere below the A/C boundary. The exact position of the A/C boundary is not penetrated at Jásd J–42 on the basis of the ammonite record.

Genus *Graysonites* YOUNG, 1958
Type species: *Graysonites lozoi* YOUNG, 1958

***Graysonites horvathi* sp. nov.**
Pl. XXIV, Figure 12

Material. A single specimen is from Jásd 1 quarry, Hungary, from bed no. 212 of the Pénzeskút Marl Formation, Late Albian. The unnamed specimen is marked with a question mark on the original label of the collector, A. HORVÁTH.

Derivation of name. To the honour of Anna HORVÁTH, a former Hungarian palaeontologist, who collected and studied Late Albian ammonites.

Location. Repository number is 2007.68.1, the specimen is housed at the Palaeontological Department of the Hungarian Natural History Museum (HNHM).

Dimensions.

	D	H	W	W/H	U
2007.68.1	–	26	43	0.6	–

Description. The specimen is a fragmented internal mould. Coiling is very evolute; the umbilical wall is low, rounded. The whorl section is polygonal, highly compressed, the whorl breadth to height ratio is 0.6 and the greatest is at midflank. Ventrolateral shoulders are narrow, rounded. Ribs on the inner whorls are untubercualted. There are 7 ribs on a quarter whorl, so the rib index can be calculated around 27–29. Ribs are coarse, straight and prorsiradiate on the flanks. Ribs start in umbilical bullae, these bullae elongated until the midflank. On the ventrolateral edge ribs bear a prominent, spine-like tubercle. On the top of the venter, just beside the ventrolateral tubercle, there is a larger spine stranding upwards, almost paralell with the sides. There is no trace of a keel on the narrow venter.

Discussion. The specimen shows good resemblance to the holotype of *Graysonites adkinsi* YOUNG, 1958, but the new species has denser ribbing, more prominent ventral spines and, as the main point, older stratigraphic position. This is the oldest record of the genus *Graysonites* YOUNG, 1958, which was stratigraphically positioned into the Lower Cenomanian.

Occurrence. The specimen was found in the bed no. 212 of Jásd 1 quarry , the exact position of the bed cannot be given due to the lack of the original documentation of the collecting. According to the accompanying fauna, the age of the Hungarian species can be placed into the *Stoliczkaia (S.) dispar* Zone, however, the genus itself is reported only from younger, Lower Cenomanian deposits of Spain, Japan, California, Texas and Brazil.

Subordo Ancyloceratina WIEDMANN, 1966
Superfamily Turrilitaceae GILL, 1871
Family Anisoceratidae HYATT, 1900
Genus *Anisoceras* PICTET, 1854
Type species: *Hamites saussureanus* PICTET in PICTET & ROUX, 1847

***Anisoceras armatum* (J. SOWERBY, 1817)**
Pl. XXII, Figures 1, 2; Pl. XXVI, Figure 33; Pl. XXVII, Figure 2

1939 *Anisoceras armatum* (J. SOWERBY) — SPATH, p. 543, Pl. LIX, Figure 6; Pl. LX, Figure 1; Pl. LXI, Figures 9–11; Pl. LXII, Figure 5; Text-Figure 191 (with full synonymy)

1968 *Anisoceras armatum* (J. SOWERBY) — RENZ, p. 75, Pl. 15, Figures 1, 3, Text-Figures 27d, 28a
1968 *Anisoceras perarmatum perarmatum* PICTET & CAMPICHE — RENZ, p. 74, Pl. 13, Figure 5, Pl. 14, Figures 1, 2, 3, 5; Text-Figures 27a, 28g
1989 *Anisoceras (Anisoceras) armatum* (SOWERBY) — HORVÁTH, Pl. 1, Figure 4, Pl. 2, Figure 2
non 1989 *Anisoceras (Anisoceras) armatum* (SOWERBY) f. *perarmatum* — HORVÁTH, Pl. 3, Figure 7 (= 1989 *Anisoceras perarmatum* PICTET & CAMPICHE)
1996 *Anisoceras armatum* (J. SOWERBY) — KENNEDY in GALE et al., p. 573, Figures 24d–f, h
1996 *Anisoceras perarmatum* PICTET & CAMPICHE — KENNEDY in GALE et al., p. 571, Figures 23a, e; 24a–c, g
1997 *Anisoceras (Anisoceras) perarmatum* (PICTET & CAMPICHE) — SCHOLZ in FÜLÖP, p. 81, Pl. 1, Figure 3

Material. 26 specimens from Tilos Forest, 55 from Bakonynána, 6 from Jásd 1 quarry and 5 from Villó Hill; three specimen is from Jásd J–42 borehole (456.5; 442.35 and 411.5 m) and a single specimen from Pusztavám Pv–980 borehole (454.0–455.0 m).

Description. A hook and a fragment of a shaft are figured on Pl. XXII. The whorl section is circular at the hook, slightly compressed at the shaft. The ornament consists wide, rursi- or rectiradiate ribs which are separated with wide interspaces. On the mid-ventral region ribs bear tubercles, then primary ribs can bifurcate or intercalated ribs appear. Pair of a ventrolateral tubercle appear on the ventral edge. Ribs cross the venter, become blunter and wider closer to the aperture. The dorsal part is smooth.

Discussion. According to the Hungarian material studied here, we agree that *Anisoceras armatum* (SOWERBY, 1817) and *Anisoceras perarmatum* PICTET & CAMPICHE, 1861 are "no more than variants of a single species" (KENNEDY in GALE et al. 1996, p. 573) as it was proposed by SCHOLZ (1979). At younger ontogenetic stage the ornamentation is finer as it can be observed on the studied material.

Occurrence. The species occurs in the condensed Upper Albian basal pockets of surface outcrops and in the Late Albian sequence of Jásd J–42 borehole; otherwise distributed worldwide in the Late Albian *Stoliczkaia (S.) dispar* Zone and probably reported from the Lower Cenomanian *Mantelliceras mantelli* Zone as well.

***Anisoceras pseudo-elegans* PICTET & CAMPICHE, 1861**

Pl. XVII, Figures 3, 4, 5, 6, 8

*1861 *Anisoceras pseudo-elegans* PICTET & CAMPICHE, p. 69, Pl. 1, Figures 5a, b
1939 *Anisoceras pseudo-elegans* PICTET & CAMPICHE — SPATH, p. 556, Pl. LIX, Figure 5; Pl. LX, Figures 2, 3; Pl. LXIII, Figure 12; Text-Figures 196a–d only
1968 *Anisoceras pseudoelegans* PICTET & CAMPICHE — RENZ, p.79, Pl.14, Figs 10–12; Pl. 16, Figure 7; Text-Figures 17i, 28k
1989 *Anisoceras (Anisoceras) pseudoelegans* (J. SOWERBY) — HORVÁTH, Pl. 1, Figure 8
1996 *Anisoceras pseudoelegans* PICTET & CAMPICHE — KENNEDY in GALE et al., p. 573, Figs 23c, d, f

Material. 5 fragmented shafts from Tilos Forest, 10 from Bakonynána.

Description. The whorl section is compressed. Fine, dense ribs start from the dorsal region; ribs are rursi- or rectiradiate. Thre are tubercles on the ventral edge which sit on two-three ribs. The ribs are cross the venter straight. The dorsal pari consist ribs as well.

Discussion. This species differs from *Anisoceras armatum* (J. SOWERBY, 1817) in its finer and denser ribbing.

Occurrence. The species occurs in the condensed Upper Albian basal pockets of Tilos Forest, the Late Albian sequence of Bakonynána; otherwise it was distributed in the Western Tethys and Zululand in the Late Albian *Stoliczkaia (S.) dispar* Zone.

Genus *Idiohamites* SPATH, 1925b
Type species: *Hamites tuberculatus* J. SOWERBY, 1818

***Idiohamites* sp. ind.**

Material. A shelled specimen from Bóly B–1 from 1072.7 m; three specimens from Jásd J–42 borehole (151.7 m, 192.0 m and 281.0–281.3 m).

Description. Shell characterized by the idiohamitid coiling which getting straight at the body chamber. The beginning of the shell and the aperture is cannot be observed. The specimen is laterally compressed so the whorl section and the dorsal and ventral side cannot be seen. Shell is ornamented with straight, radial ribs which become more prominent and wider towards the venter.

Discussion. The specimen shows similarities to *I. dorsetensis* SPATH, 1925b and *I. favrinus* (PICTET 1847) but the poor preservation and the flattening did not let us to see the specific characters.

Occurrence. The genus known from the Late Albian – Early Cenomanian sequence of Bóly B–1 and Jásd J–42 boreholes; otherwise reported from Upper Albian to Cenomanian deposits of Europe, North America and Madagascar.

Idiohamites spiniger (J. SOWERBY, 1818)
Pl. XXVIII, Figures 18, 19

1939 *Idiohamites spiniger* (J. SOWERBY) — SPATH, p. 584, Pl. 64, Figures 10, 11; Pl. 65, Figure 12
1987 *Idiohamites spiniger* (J. SOWERBY) — IMMEL, p. 130, Pl. 14, Figure 7

Material. Two shelled fargmens from Bóly B–1 borehole at 1046.1 m; 1072.4 metres depth.

Description. The coiling is idiohamitid, the specimens are heavily flattened. Primary and secondary ribs are straight. The primaries end in spines at the venter. The spines are one third length of the primary ribs they hold. The spines are present from the juvenile stage until the whole phragmocone.

Discussion. I. tuberculatus (J. SOWERBY, 1818) has similar characters that has *I. spiniger* (J. SOWERBY) so it is not unexpected that some authors merged the two species (SPATH, 1939, p. 583). The original description of J. SOWERBY (1818) spines was not mentioned (probably because of the lack of the shell). This is the first record of *I. spiniger* from Hungary.

Occurrence. The species occurs in the Late Albian sequence of Bóly B–1 borehole; otherwise the species is reported from the Upper Albian *Mortoniceras (M.) inflatum* Zone of Europe.

Idiohamites dorsetensis SPATH, 1939
Pl. XXVII, Figure 10

*1939 *Idiohamites dorsetensis* SPATH, p. 596, Pl. 62, Figures, 2, 3; Pl. 63, Figures 1, 9, 15; Pl. 65, Figure 2; Text-Figure 215
1968 *Idiohamites dorsetensis* SPATH — RENZ, p. 70, Pl. 11, Figures 39a–c, 40a–c; Pl.12, Figures 3a–c, 4a–c; Text-Figures 25a–d, f; 26a–b

Material. A single specimen from Jásd J–42 borehole at 258.4 m.

Description. A deformed, fragmented specimen consist the hook and a shaft. The coiling is idiohamitid. The ribs are sharp, dense, start from the umbilical edge, cross the lateral part, bear tubercles on the ventral egde. Rib index is 5.

Discussion. A pair of the ventral tubercles, the shape of coiling and the sharp, dense ribs well characterizes the specimen.

Occurrence. The species occurs in the Late Albian sequence of Jásd J–42 borehole; otherwise reported from the Upper Albian *Stoliczkaia (S.) dispar* Zone deposits of Europe.

Family Hamitidae GILL, 1871

According to MONKS' (1999) cladistic analysis done for the Albian heteromorph ammonites, a new cladistic term was proposed (MONKS 2002). In the present work MONKS's systematic revision for the family Hamitidae is followed.

Genus *Hamites* PARKINSON, 1811
Type species: *Hamites attenuatus* J. SOWERBY, 1814

Hamites sp. ind.

Material. Two poorly preserved specimens from Bóly B–1 at 1072.0 m and 1073.4 m.

Description. Small fragments of slightly curved specimens. Whorl height is constant, rib index RI = 3. The only ornamentation is straight, radial ribs which have the same width at any length. Suture cannot be observed.

Discussion. The specimens are too fragmented for more exact classification.

Occurrence. The genus occurs in the Late Albian sequence of Bóly B–1 borehole; otherwise reported from the Lower Albian to the Cenomanian worldwide.

Hamites cf. *intermedius* J. SOWERBY, 1814
Pl. XXVII, Figure 13

1941 *Hamites intermedius* J. SOWERBY — SPATH, p. 632, Pl. 70, Figure 19; Pl. 71, Figures 3, 5; Text-Figures 229a–d, m.
1989 *Hamites intermedius* J. SOWERBY — HORVÁTH, Pl. 6, Figure 6
1998 *Hamitella intermedius* (J. SOWERBY) — MONKS, p. 102, Figure 3.41

Material. A single specimen from Jásd J–42 borehole at 418.8 m.

Description. The specimen is a fragment of the hook, so the coiling cannot be observed. Blunt, wide ribs start at mid-flank, presumably cross the venter. The dorsal part is smooth.

Discussion. On the basis of the wide, blunt ribs, the specimen is referred to *H. intermedius* with question mark.

Occurrence. The species occurs in the Late Albian sequence of Jásd J–42 borehole; otherwise reported from the upper part of the *Mortoniceras (M.) inflatum* Zone of Europe.

Genus *Stomohamites* BREISTROFFER 1940
Type species: *Hamites virgulatus* BRONGNIART, 1822

Stomohamites virgulatus (BRONGNIART, 1822)
Pl. XXVIII, Figure 24

1939 *Hamites (Stomohamites) virgulatus* (BRONGNIART?) PICTET & CAMPICHE — SPATH, p. 635, Pl. LXXI, Figures 7–10; Pl. LXXII, Figure 11; Text-Figure 230
1979 *Hamites (Hamites) virgulatus* BRONGNIART, 1822 — SCHOLZ, p. 18
1985 *Hamites (Hamites) virgulatus* BRONGNIART — HORVÁTH, p. 151
1990 *Hamites (Hamites) virgulatus* BRONGNIART — MARCINOWSKI & WIEDMANN, p. 36, Pl. 2, Figure 12
1997 *Hamites (H) virgulatus* BRONGNIART — SCHOLZ in FÜLÖP, p. 81, Pl. 1, Figures 5, 8

Material. A single fragment from Jásd J–36 borehole between 22.1–25.2 metres and two specimens from Pusztavám Pv–980 borehole at 375.0–376.0 m and 434.0 m. Two specimens are from Bóly B–1 borehole at 1072.0 m and 1073.4 m. A single species from Jásd 1 quarry, 8 from Tilos Forest, 9 from Bakonynána.

Description. A fragment of a shaft with straight, wide, rursiradiate ribs. Rib index is 3.

Discussion. The species shows high intraspecific variation as it is discussed by SPATH (1941), WIEDMANN & DIENI (1968), SCHOLZ (1979) and COOPER & KENNEDY (1979).

Occurrence. The species is documented from the Late Albian sequences of Jásd J–42 and Pusztavám Pv–980 boreholes and Jásd 1 quarry and Tilos Forest; otherwise it was reported wordwide from the Middle Albian to the Middle Cenomanian.

Stomohamites subvirgulatus (SPATH, 1941)
Pl. XXV, Figure 15; Pl. XXVII, Figures 4, 5, 6, 9

*1941 *Hamites (Stomohamites) subvirgulatus* SPATH, p. 645, Text-Figures 234a–h
1968 *Hamites (Stomohamites) subvirgulatus* SPATH — RENZ, p. 66, Pl. 11, Figures 13, 14; Text-Figures 23e, 24a
1996 *Hamites subvirgulatus* SPATH, 1941 — KENNEDY in GALE et al., p. 567, Figures 20d, e, j; 25g, h, j; 26j, k

Material. Three specimens reported from Jásd J–42 borehole at 389.0, 414.25 and 430.95 metres depth; and a specimen from Bóly B–1 borehole at 976.3 m; a specimen from Jásd J–36 at 21.0–25.2 m. Fragments also known from Tilos Forest (6 specimens), Jásd 1 quarry (2 specimens), Villó Hill (3 specimes) and Bakonynána (9 specimens).

Description. Fragments are part of a coiled shaft with slightly compressed whorl section. The ornamentation of the fragments consist narrow, rursiradiate ribs, rib index is 5–8.

Discussion. According to KENNEDY (in GALE et al. 1996, p. 568): "*H. subvirgulatus* was introduced for compressed curved fragments with a rib density between those of *H. virgulatus* (BRONGNIART 1822) and *H. duplicatus* PICTET & CAMPICHE, 1861…".

Occurrence. The species occurs in the Late Albian sequences of Bóly B–1, Jásd J–42 and Pusztavám Pv–980 boreholes and the condensed Late Albian basal pockets of Tilos Forest, Jásd 1 quarry and Bakonynána; otherwise reported worldwide from the Upper Albian *Mortoniceras (M.) inflatum* and *Stoliczkaia (S.) dispar* Zone deposits.

Genus *Helicohamites* MONKS, 2002
Type species: *Baculita parkinsoni*, FLEMING, 1828

Helicohamites duplicatus (PICTET & CAMPICHE, 1861)
Pl. XXVIII, Figure 20

*1861 *Hamites (Stomohamites) duplicatus* PICTET & CAMPICHE, 1861, p. 98
1941 *Hamites (Stomohamites) duplicatus* PICTET & CAMPICHE — SPATH, p. 640, Pl. 72, Figures 12–16
1968 *Hamites (Stomohamites) duplicatus* PICTET & CAMPICHE — RENZ, p. 68, Pl. 11, Figures 19–22
non 1971 *Hamites (Stomohamites)* aff. *duplicatus* PICTET & CAMPICHE — NAGY I. Z., p. 15
1979 *Hamites (Stomohamites) duplicatus* PICTET & CAMPICHE — COOPER & KENNEDY, p. 227, Figures 16d, 32a

Material. Five shelled fragment from Bóly B–1 at 999.8 m; 1035.9 m, 1038.7 m; 1072.0 m and 1113.8 m and 2 fragments from Tilos Forest.

Description. Early whorls are coiled, then, during the ontogeny a shaft formed with a beginning of a hook at the end. Ribs are dense, RI = 10–12. Ribs before the aperture are getting widen. Suture cannot be observed.

Discussion. Dense ribs are well characterizing the subspecies. A *H. (S.) duplicatus* is described by NAGY I. Z. (1971) from the Barremian of Hungary, but this is a misidentification of an older, homeomorph form.

Occurrence. The species occurs in the Late Albian sequence of Bóly B–1 borehole and Tilos Forest; otherwise it is reported from the Upper Albian *Stoliczkaia (S.) dispar* Zone.

Helicohamites ibex **(SPATH, 1941)**
Pl. XXVII, Figure 16

*1941 *Hamites (Stomohamites) ibex* SPATH, 1937–43, p. 646, Pl. LXXI, Figure 14; Text-Figure 235

Material. A single fragment from Jásd J–42 borehole at 258.4 m and a fragment from Bóly B–1 borehole at 1072.0 m.

Description. Whorl section is cannot be observed. The fragment from Jásd J–42 borehole is quite big, a part of a helicoid shaft. Ribs are coarse, wide, intercalated ribs appear. The dorsal and the ventral part is cannot be observed.

Discussion. The species is very close to *S. virgulatus* (BRONGNIART, 1822), but whorl section is circular and rib irregularities are often, as it is discussed by SPATH (1941, p. 646).

Occurrence. The species occurs in the Late Albian sequence of Bóly B–1 borehole and the; also documented from the Late Albian sequence of Jásd J–42 borehole; otherwise reported from England, from Upper Albian deposits.

Genus *Ptychoceras* D'ORBIGNY, 1842
Type species: *Ptychoceras Puzosianum* (D'ORBIGNY, 1842)

Ptychoceras adpressum **(J. SOWERBY, 1814)**
Pl. XXVII, Figure 14

1842 *Hamites adpressus* J. SOWERBY — D'ORBIGNY, p. 555
1941 *Mastigoceras adpressum* (J. SOWERBY) — SPATH, p. 657, Text-Figure 241

Material. A single specimen from Jásd J–42 borehole (219.4 m)

Description. Small, ptychocon specimens with subcircular whorl section (if not flattened). The specimen is completely smooth.

Discussion. This specimen is twice at size that the tiny holotype figured by J. SOWERBY (1814). SOWERBY's original figure is republished by SPATH (1941) but the holotype is seems to be lost. The species is similar to *Ptychoceras puzosianum* (D'ORBIGNY, 1841) but much smaller. The shell ultrastructure of the genus is discussed by DOGUZHAEVA & MUTVEI (1989).

Occurrence. The species occurs in the Late Albian sequence of Jásd J–42 borehole; otherwise the species is reported worldwide from the Upper Albian *Mortoniceras (M.) inflatum* Zone deposits.

Genus *Hemiptychoceras* SPATH, 1925b
Type species: *Ptychoceras gaultinum* PICTET, 1847

Hemiptychoceras **sp. aff.** ***gaultinum*** **(PICTET, 1847)**

1968 *Hemiptychoceras gaultinum* (PICTET) — WIEDMANN & DIENI, p. 61, Pl. 5, Figures 6, 8; Pl. 6, Figure 12
1978 *Hemiptychoceras gaultianum gaultinum* (PICTET) — SCHOLZ, p. 44, Pl. 3, Figure 12
1979a *Hemiptychoceras gaultianum gaultinum* (PICTET) — SCHOLZ, p. 20, Pl. 1, Figure 17
1997 *Hemiptychoceras* sp. aff. *gaultinum* PICTET — SCHOLZ in FÜLÖP, p. 81, Pl. 1, Figure 1

Material. A shelled specimen from Bóly B–1 borehole from 1060.4 m.

Description. A small, heavily flattened ptychocone fragment, the whorl section is cannot be observed. Flanks are touching; the older flank is smooth but poorly preserved. The first fine, rectiradiate ribs start at the knee and very rapidly become wider and stronger on the younger flank. The ribs are crossing the venter straight.

Discussion. Fragments are not complete or the ontogeny had not yet finished because the pre-apertural constriction cannot be detected.

Occurrence. The species occurs in the Late Albian sequence of Bóly B–1 borehole; otherwise known from the Upper Albian deposits of Zululand and Europe.

Family Turrilitidae GILL, 1871

The phylogenic classification of Turrilitidae is revised and discussed by COOPER (1999). We follow his classification on the systematics of Turrilitidae.

Subfamily Turrilitinae GILL, 1871

Turrilitinae gen. et sp. indet.

Material. Eleven poorly preserved fragments from Bóly B–1 between 982–1005 m.
Description. Flattened fragments of the lateral side with traces of tubercles.
Discussion. The fragments are too smalll and poorly preserved for more precise identification.

Genus *Turrilitoides* SPATH, 1923
Type species: *Turrilites Hugardianus* D'ORBIGNY, 1842

Turrilitoides hugardianus (D'ORBIGNY, 1842)
Pl. XXIII, Figure 7, Pl. XXIV, Figures 8, 10

*1842 *Turrilites Hugardianus* D'ORBIGNY, p. 588, Pl. 147, Figures 9–11
1861 *Turrilites intermedius* PICTET & CAMPICHE, p. 127, Pl. 57, Figure 14
1930 *Turrilites densicostatus* PASSENDORFER, p. 673, Pl. 4, Figure 70
1968 *Turrilitoides (Turrilitoides) intermedius* (PICTET et CAMPICHE) — RENZ, p. 84, Pl. 17, Figures 24a, b; 25, 26a–b; Text-Figure 30f
1968 *Turrilitoides (Turrilitoides) hurgardianus hugardianus* (D'ORBIGNY) — RENZ, p. 84, Pl. 17, Figures 18a, b; 19–21; Text-Figures30a–d
1979 *Turrilites (Turrilitoides) hugardianus densicostatus* PASSENDORFER — SCHOLZ, p. 35
1979 *Turrilites (Turrilitoides) hugardianus hugardianus* (D'ORBIGNY) — SCHOLZ, p. 34, Pl. 7, Figures 1–14, Text-Figures 11A, B, C, D
1990 *Turrilitoides (Turrilitoides) intermedius* (PICTET & CAMPICHE) — MARCINOWSKI & WIEDMANN, p. 50, Pl. 4, Figures 9, 10
1990 *Turrilitoides (Turrilitoides) hurgardianus* (D'ORBIGNY) — MARCINOWSKI & WIEDMANN, p. 50, Pl. 4, Figures 9, 10
1994a *Turrilitoides intermedius* (PICTET & CAMPICHE, 1861) — LATIL, Pl. 5, Figure 10
1994a *Turrilitoides hugardianus* (D'ORBIGNY, 1842) — LATIL, Pl. 5, Figure 14
1998 *Turrilitoides hugardianus* (D'ORBIGNY, 1842) — COOPER, p. 146, Figures 1–32, 2, 6, 7A, 8B

Material. 20 specimens from Tilos Forest, 3 from Jásd 1 quarry, 17 from Villó Hill and 21 are from Bakonynána.

Description. Torticone forms with circular whorl section. The ornamentation consist of ribs which are untuberculated at any visible stage of growth. Rib index is 23–30.

Discussion. SCHOLZ (1979) united *Turrilites (Turrilitoides) densicostatus* PASSENDORFER, 1930 into a subspecies level of *T. hugardianus*. MARCINOWSKI & WIEDMANN (1990, p. 51) did not share SCHOLZ's opinion, they proposed to keep the two taxa as separate species, which can be distinguished on the basis of rib density. MARCINOWSKI & WIEDMANN (1990) discussed the differences between *T. intermedius* and *T. hugardianus* as "… *T. intermedius* can be separated from *T. hugardianus* and *T. densicostatus* on the basis of a larger apical angle of the helix, a more circular whorl section, and a number of about 30 ribs per whorl….ribs run straight across the whorls instead of curving.". COOPER (1998) has fully discussed the Turrilitidae, and use *T. intermedius* (PICTET & CAMPICHE, 1861) as a synonym of *T. hugardianus*. According to the Hungarian material, I share COOPER's and SCHOLZ's opinion beacuse neither a significant morphologic, nor stratigraphic difference can be demonstrated between the three species. There are no permanent pair of specific characters that can be the base of the separation between the three species (*Turrilitoides hugardianus* (D'ORBIGNY, 1842), *Turrilitoides intermedius* (PICTET & CAMPICHE, 1861) and *Turrilites (Turrilitoides) densicostatus* PASSENDORFER, 1930) and the said-to-be specific morphological characters are varies and none of them can be pointed out as an obligate specific one. For instance there are forms with higher apical angle but dense ribbing, while other high-angled form consist few ribs. The circular whorl section can be combined with dense or loose ribs, as well as with high or low apical ange.

Summarizing my opinion, according to the Hungarian material, a high intraspecific variation can be documented on *T. hugardianus* (D'ORBIGNY), and I was not able to point out at least two significant specific characters that can be permanent. Therefore I agree with SCHOLZ (1979, p. 34) and COOPER (1998, p. 147) on the contraction of the three species, but without a further investigation on the holotypes the merging of the three *Turrilitoides* species, even in subspecies level is not adviced.

Occurrence. The species occurs in the condensed Late Albian basal pockets of Tilos Forest, Jásd 1 quarry, Villó Hill and Bakonynána; otherwise reported from the Upper Albian *Mortoniceras (M.) inflatum* and *Stoliczkaia (S.) dispar* Zone deposits of Europe.

Genus *Mariella* NOWAK, 1916 (= *Bergericeras* WIEDMANN 1962c)
Type species: *Turrilites Bergeri* BRONGNIART, 1822

Mariella sp. indet.
Pl. XXVII, Figure 12

Material. A shelled fragment from Bóly B–1 (1005.7 m) and a small juvenile from Jásd J–42 borehole at 417.6 m; three fragments from Bakonynána.

Description. The fragment is supposedly the piece of the lateral part. On the whorl three rows of tubercles can be seen. Each tubercle is independent, not touching at all. Suture cannot be observed.

Discussion. Due to the poor preservation specific characters as the number of row of tubercles per whorl, apical angle, whorl section etc. cannot be observed; therefore more exact identification cannot be given.

Occurrence. The genus known from the Late Albian to Early Cenomanian worldwide.

Subgenus *Mariella* NOWAK, 1916
Type species: *Turrilites Bergeri* BRONGNIART, 1822

Mariella (Mariella) bergeri (BRONGNIART, 1822)
Pl. XVIII, Figure 1, Pl. XXIII, Figure 6, 8, Pl. XXIV, Figures 7, 9, Pl. XXVII, Figures 19, 20

1937 *Mariella bergeri* (BRONGNIART) — SPATH, p. 510, Pl. 57, Figure 28, Text-Figure 178
1968 *Mariella (Mariella) bergeri* (BRONGNIART) — RENZ, p. 85, Pl. 17, Figures 37a, b; 41a, b; Taf. 18, Figures 3, 4, 8; Text-Figures 31f, k
1979 *Turrilites (Bergericeras) bergeri bergeri* BRONGNIART — SCHOLZ, p. 40, Pl. 8, Figures 12, 14, 15, 17; Pl. 9, Figure 1; Text-Figure 11/j
1997 *P. (Bergericeras) bergeri* (BRONGNIART) — SCHOLZ in FÜLÖP, p. 81, Pl. 1, Figures 11, 12
1998 *Mariella bergeri* (BRONGNIART, 1822) — COOPER, p.160, Figures 5.1–5.4.

Material. 13 specimens from Tilos Forest, 5 specimens from Jásd 1 quarry, 2 specimens from Villó Hill and 34 specimens are from Bakonynána; seven specimens between 276.2 – 449.3 m from the sequence of Jásd J–42 borehole.

Description. Coiling is turriliticone; the apical angle is between 25–35°. The ornament comprises 26–38 ribs per whorl, ornamented by 4 rows of tubercles. Tubercles are equal in size and more or less equidistant.

Discussion. WIEDMANN & DIENI (1968) have discussed the species, COOPER (1998) also supported their opinion that the contemporaneous populations of *Mariella* can be covered with the transition series of *M. miliaris* (PICTET & CAMPICHE, 1861) – *M. bergeri* (BRONGNIART, 1822) – *M. crassituberculata* (SPATH, 1937).

Occurrence. The species occurs in the Late Albian sequence of Jásd J–42 borehole and the Upper Albian strata of Tilos Forest, Jásd 1 quarry, Villó Hill and Bakonynána; otherwise reported from the Late Albian *Stoliczkaia (S.) dispar* Zone deposits of the former Tethys.

Genus *Paraturrilites*, BREISTROFFER, 1947
Type species: *Turrilites gresslyi* (PICTET & CAMPICHE, 1861)

Here we follow COOPER's (1998) opinion who keep the genera *Paraturrilites* BREISTROFFER, 1947 and *Mariella* NOWAK, 1916 are separate taxa on the basis of three rows of tubercles at *Paraturrilites* versus the four rows of tubercles of *Mariella*.

Paraturrilites sp.
Pl. XXV, Figure 12; Pl. XXVII, Figures 23, 24; Pl. XXVIII, Figure 21

Material. One flattened fragment from Bóly B–1 borehole at 1005.7 m, two fragments from Jásd J–36 borehole and 198.2 m; and a fragment of a juvenile from the Jásd J–42 borehole at 120.2 m. 7 fragments are from Tilos Forest.

Description. The fragments are ornamented with three rows of tubercles.

Discussion. On the basis of the three rows of tubercles, the classification of COOPER (1998) is followed. The fragments are too small for the specification.

Occurrence. The genus is known from the Late Albian sequences of Bóly B–1, Jásd J–36 and Jásd J–42 boreholes; otherwise reported from the Late Albian worldwide.

Subfamily Ostlingoceratinae COOPER, 1999
Genus *Ostlingoceras* HYATT, 1900
Type species: *Turrilites Puzosianus* D'ORBIGNY, 1842

Ostlingoceras puzosianum (D'ORBIGNY, 1842)
Pl. XXIII, Figures 1, 2, 3, 4, 5, 9, Pl. XXIV, Figures 1, 2, 3, 4, 5, 6, 11, Pl. XXVII, Figure 18, Pl. XXVIII, Figure 23

*1842 *Turrilites Puzosianus* D'ORBIGNY, p. 587, Pl. 143, Figures 1, 2
1862 *Turrilites Puzosianus* D'ORBIGNY — HAUER, p. 637, Pl. 1, Figures 1, 2
1937 *Ostlingoceras puzosianum* (D'ORBIGNY) — SPATH, p. 523, Pl. 58, Figures 38, 39, 40
1979a *Ostlingoceras puzosianus* (D'ORBIGNY) — SCHOLZ, p. 42, Pl. 9, Figures 4, 9, 12, 13
1985 *Ostlingoceras puzosianus* (D'ORBIGNY) — HORVÁTH, Pl. 2, Figure 13
1997 *Ostlingoceras (Ostlingoceras) puzosianum* (D'ORBIGNY) — SCHOLZ in FÜLÖP, p. 81, Pl. 1, Figure 7
1998 *Ostlingoceras puzosianum* (D'ORBIGNY) — COOPER, p. 165, Figure 1.29, 5.8–5.9, 5.12

Material. Five fragments are reported from Bóly B–1 borehole at 962 m; 997, 5 m (two specimens), 1001.2 m and 1008.4 m.

Four specimens were found between 345.4–417.6 m of Jásd J–42 borehole as well. 260 specimens were collected from Tilos Forest.

Description. The apical angle and the whorl section cannot be observed due to the poor preservation. Strong, radiate ribs start at the ventral area and end before the first row of tubercles appears. Rib index cannot be counted because there is no whole whorl fragment. Ribs and tubercles are independent; each 8 rib has 9–10 tubercles. The stronger is the row of tubercles which is closest to the apical area; rows towards the aperture become less prominent. Tubercles can be detected even at the youngest part whereas here the ribs are very weak or not present at all. Aperture and suture cannot be observed.

Discussion. The extreme richness of *Ostlingoceras* in the Hungarian Upper Albian deposits is unique. Specimens found in the upper 6 strata of Tilos Forest are dividen into two groups: generally huge specimens with coarse ornamentation and small ones with fine ribbing. These two types can be interpreted as macro- and microconches as it was proposed by COOPER (1998). In the borehole assemblage *Ostlingoceras* specimens are small but probably this is caused the limited extension of the borehole sampling. Already SPATH (1937, p. 524) recognized that ribs and tubercles are not present at the same number, generally tubercles are more numerous than ribs.

Occurrence. The species occurs in the Late Albian sequence of Bóly B–1 borehole and the Late Albian strata of surface outcrops; also reported from the Late Albian sequence of Jásd J–42 borehole; otherwise it was reported from the Upper Albian *Stoliczkaia (S.) dispar* Zone of Europe, North Africa, Iran, Caucasus and Madagascar.

Family Baculitidae GILL, 1871

Baculitidae gen. et sp. indet.

Material. Four shelled specimens from Bóly B–1 borehole at 596.5 m; 977.9 m; 1035.7 m; 1080.8 metres.

Description. Straight fragments of shelled, heavily compressed specimens. Fragments ornamented with prorsiradiate ribs. Suture cannot be observed.

Discussion. The poor preservation does not allow more precise identification.

Genus *Lechites* NOWAK, 1908
Type species: *Baculites Gaudini* PICTET & CAMPICHE, 1861

Lechites sp. indet.

Material. Fourteen poorly preserved fragments were collected from Bóly B–1 borehole, one specimen from Jásd J–36 borehole, 5 from Villó Hill.

Description. Straight, compressed fragments with slight ventral ribs. Suture cannot be observed.

Discussion. The poor preservation does not allow more precise identification.

Occurrence. The genus is known from the Upper Albian to Lower Cenomanian deposits of Europe and the Americas.

Subgenus *Lechites* NOWAK, 1908
Type species: *Baculites Gaudini* PICTET & CAMPICHE, 1861

Lechites (Lechites) gaudini (PICTET & CAMPICHE, 1861)

Pl. XVII, Figure 7, Pl. XXII, Figure 5, 6, Pl. XXV, Figure 16, XXVII, Figures 22, Pl. XXVIII, Figure 25, 26, 27

*1861 *Baculites Gaudini* PICTET & CAMPICHE, p. 112, Pl. 55, Figures 5–11
1862 *Baculites Gaudini* PICTET & CAMPICHE — HAUER, p. 648, Pl. 2, Figures 6–9
1941 *Lechites gaudini* (PICTET & CAMPICHE) — SPATH, p. 662, Pl. 72, Figures 4–7, 9, 10 (with synonymy)
1968 *Lechites gaudini* (PICTET & CAMPICHE) — RENZ, p. 80, Pl. 17, Figures 1–3
1971 *Lechites gaudini* (PICTET & CAMPICHE) — NAGY I. Z., p. 17, Pl. 1, Figure 5
1977 *Lechites gaudini* (PICTET & CAMPICHE) — COOPER & KENNEDY, p. 644, Figure 1, 1–38, Figure 2, 1–30; Figure 3; Figure 4, 1–18; Figure 5, 1–15; Figures 6–7; Figure 8, 16–26
1979 *Lechites gaudini* (PICTET & CAMPICHE) — SCHOLZ, p. 12, Pl. 1, Figures 1, 2, 11, 12
1985 *Lechites gaudini* (PICTET & CAMPICHE) — HORVÁTH, Pl. 1, Figure 2
1997 *Lechites gaudini* (PICTET & CAMPICHE) — SCHOLZ in FÜLÖP, p. 81, Pl. 1, Figure 4

Material. Several shelled, heavily flattened specimens from Bóly B–1 borehole between 1030.0 and 1188.9 m; one internal mould from Jásd J–42 borehole at 474.5 m. 4 specimens were collected from Jásd 1 quarry, 32 internal moulds from Tilos Forest, 4 from Jásd 1 quarry, and 18 internal moulds from Bakonynána.

Description. Whorl section and aperture cannot be observed due to the heavy flattening. Ribs are prorsiradiate, narrow and sharp, RI = 3–5. The angle between ribs and the sides is between 30–70 degrees. Suture, dorsal and ventral part cannot be seen.

Discussion. According to the opinion of KENNEDY (GALE et al. 1996), "…specimens are referred to *Lechites* where constrictions are absent, and *Sciponoceras* HYATT, 1894 when present.". SPATH (1937), COOPER & KENNEDY (1977) and KENNEDY in GALE et al. (1996) have discussed the species.

Occurrence. Lechites (L.) gaudini was reported from Hungary from the Upper Albian (*Stoliczkaia (S.) dispar* Zone) surface outcrops of Tilos Forest, Bakonynána and Jásd 1 quarry; was also reported from the Late Albian (*Stoliczkaia (S.) dispar* Zone) sequence of Jásd J–42 borehole and the Late Albian (*Stoliczkaia (S.) dispar* Zone) sequence of Bóly B–1 borehole. The species characterises the *Stoliczkaia (S.) dispar* Zone but also known worldwide from the Late Albian upper, *Hysteroceras variscosum* Subzone of the *Mortoniceras (M.) inflatum* Zone.

Lechites (Lechites) moreti (BREISTROFFER, 1936)
Pl. XXII, Figures 7, 8; Pl. XXVII, Figures 11, 17, 21

*1936	*Baculites moreti* BREISTROFFER, p. 66
1941	*Lechites moreti* BREISTROFFER — SPATH, p. 665, Text-Figures 243a–d
1979	*Lechites gaudini moreti* (BREISTROFFER) — SCHOLZ, p. 14, Pl. 1, Figure 10; Text-Figure 5c
1989	*Lechites moreti* BREISTROFFER — HORVÁTH, Pl. 3, Figure 3; Pl. 4, Figure 1
1997	*Lechites moreti* BREISTROFFER — SCHOLZ in FÜLÖP, p. 81
1998	*Lechites moreti* BREISTROFFER — MONKS, p. 143

Material. Three fragments are from Jásd J–42 borehole at 474.5 m; 420.8 m and 394.0 m. Two internal moulds were collected from Tilos Forest.

Description. Straight fragments of a shaft ornamented by blunt, wide bulges, which are separated by narrow interspaces.

Discussion. SPATH (1941) and COOPER & KENNEDY (1977) have fully discussed the variation of the species.

Occurrence. The species is reported from Hungary from the Upper Albian (*Stoliczkaia (S.) dispar* Zone) surface outcrops of Tilos Forest; also reported from the Late Albian (*Stoliczkaia (S.) dispar* Zone) sequence of Jásd J–42 borehole. The species characterises the *Stoliczkaia (S.) dispar* Zone but also known from the Late Albian upper, *Hysteroceras variscosum* Subzone of the *Mortoniceras (M.) inflatum* Zone deposits of the former Tethys. SPATH (1941, p. 666) mentiones from England a Lower Cenomanian occurrence as well.

Lechites (Lechites) communis SPATH, 1941
Pl. XXII, Figures 3, 4, 9

*1941	*Lechites communis* SPATH, p. 666, Text-Figure 244
1977	*L. (Lechites) communis* SPATH — COOPER & KENNEDY, p. 644, Figures 5. 1–3 (refigured holotype)
1985	*Lechites communis* (SPATH) — HORVÁTH, Pl. 1, Figure 5

Material. One specimen is from Tilos Forest, one is from Bakonynána, bed no. 18–25

Description. Straight fragments of a shaft ornamented by narrow, dense, prorsiradiate ribs.

Discussion. Differs from *Lechites (Lechites) gaudini* (PICTET & CAMPICHE, 1861) in its fine, denser ribbing. According to COOPER & KENNEDY (1977), *L. (L.) gaudini* and *L. (L.) communis* are intraspecific variations of each other, having priority of the former name. On the basis of the Hungarian material, there are two, clearly different types of *Lechites* specimens and therefore I keep the two taxa separated.

Occurrence. The species occurs in the Late Albian *Stoliczkaia (S.) dispar* Zone deposits of Tilos Forest and Bakonynána, otherwise reported from the *Stoliczkaia (S.) dispar* Zone of England.

Genus *Sciponoceras* HYATT, 1894
Type species: *Hamites Baculoides* MANTELL, 1822

Sciponoceras sp.

Material. Shelled specimens from 861.8 m; 999.8 m and 1116.3 m and an internal mould from 618.2 m, both from Bóly B–1 borehole.

Description. Medium sized forms, whorl section cannot be observed because of the flattening, aperture neither. Ornamentation is widely interspaced srong, prorsiradiate ribs which cross the venter straight. Ribs are strongest on the venter, cross the lateral side and finally disappear on the dorsal part.

Discussion. According to the opinion of KENNEDY (GALE et al. 1996), "…specimens are referred to *Lechites* where constrictions are absent, and *Sciponoceras* HYATT, 1894 when present.".

Occurrence. The genus is reported from the Late Albian sequence of Bóly B–1 borehole, otherwise it is known from the Late Albian to Late Cenomanian, worldwide.

Superfamily Scaphitaceae GILL, 1871
Family Scaphitidae GILL, 1871
Subfamily Otoscaphitinae WRIGHT, 1953
Genus *Worthoceras* ADKINS, 1928
Type species: *Macroscaphites platydorsus* Scott, 1924

Worthoceras pygmaeum BUJTOR, 1991
Pl. XXVIII, Figures 22, 29, 30

1989 *Worthoceras pygmaeum* BUJTOR, p. 104, Pl. 11, Figures 5–8
*1991 *Worthoceras pygmaeum* BUJTOR, p. 537–542, Figure 2
1996 *Worthoceras pygmaeum* BUJTOR — KENNEDY in GALE et al, p. 586, Figures 30d, g, i, n
2005 *Worthoceras pygmaeum* BUJTOR — REBOULET et al., Figure 3E

Material. The three type specimens were described from Bóly B–1 borehole at 976.9 m; 975.8 m and 975.3 metres.

Description. Small, scaphitid specimens with long shaft and a small spire. Specimens are lack of ornament.

Discussion. The type species rediscribed here are fully described by BUJTOR (1991). *W. pygmaeum* differs from *W. worthense* (ADKINS, 1920) than the latter one has low prorsiradiate ribs on the shaft.

Occurrence. The species occurs in the Late Albian sequence of Bóly B–1 borehole; otherwise reported from the upper part of the Late Albian *Stoliczkaia (S.) dispar* Zone of France.

Genus *Yezoites* YABE, 1910
Type species: *Scaphites perrini* ANDERSON, 1902

Yezoites subevolutus (BÖSE, 1928)
Pl. XXV, Figure 17; Pl. XXVII, Figure 15

*1928 *Scaphites subevolutus* BÖSE, p. 225, Pl. 7, Figures 7–30; Pl. 18, Figure 8
1984 *Yezoites subevolutus* (BÖSE, 1928) — WRIGHT & KENNEDY, Text-Figure 149I–N
1996 *Yezoites subevolutus* (BÖSE, 1928) — KENNEDY in GALE et al., p. 589, Figures 30b, c, h, j, k
2005 *Yezoites subevolutus* (BÖSE, 1928) — KENNEDY et al., p. 419, Figure 53A–O

Material. One specimen is from Jásd J–36 borehole at 207.7 m; another specimen is from Jásd J–42 borehole at 152.3 m.

Description. The two heavily compressed described specimens represent the two different part of the phragmocone. The specimen of Jásd J–42 borehole (Pl. XXVII, Figure 15) is the spire, consists of an ornament of narrow, strong primary ribs ends in a small tubercle, and narrow, very dense, fine intercalated ones that appear on the midflank. Primary ribs disappear after ending in a tuberce on the midflank. At Jásd–32 specimen (Pl. XXV, Figure 17), the shaft is preserved well while the spire is heavily pyritized and preserved in a bad state. The shaft is ornamented with narrow, dense, strong primary ribs, rib index is 5. On the mid lateral part, very dense, fine intercalated ribs appear, while primary ribs disappear.

Discussion. The characteristic ornamentation and the stratigraphic position make the specification clear. KENNEDY (in GALE et al. 1996) mentiones that "Poorly preserved *Phylloceras*… are superficially similar, but much more involute and without primary ribs."

Occurrence. The species was found in the Late Albian sequence of Jásd J–42 and Jásd J–36 boreholes. In the sequence of Jásd J–42 borehole, *Y. subevolutus* occurs in the *Arrhaphoceras (Praeschloenbachia) briacensis* subzone of the Late Albian *Stoliczkaia (S.) dispar* Zone. Otherwise the species was described from the Early Cenomanian of Del Rio Clay, Texas. Also reported from the Latest Albian of Mont Risou (GALE et al. 1996), with few metres below the Albian/Cenomanian boundary.

Subfamily Scaphitinae GILL, 1871
Genus *Eoscaphites* BREISTROFFER, 1947
Type species: *Ammonites? circularis* J. de C. SOWERBY, 1836

?Eoscaphites sp. indet.

Material. Two shelled specimen from Bóly B–1 at 1044.8 and 1060.9 m.

Description. Small, laterally compressed specimens, so whorl section cannot be studied. Both specimens are fragments, the hook and the body chamber missing. Spirals are touching and the perforation on the beginning of the spiral as a generic character is well observed with microscope. Shaft is straight. Whorls are smooth or slightly ornamented with radiate ribs (1044.8 m). Suture cannot be observed.

Discussion. Due to the poor preservation even the generic level can be identify with question mark.

Occurrence. The genus known from the Upper Albian to Lower Cenomanian of Europe, Algeria and Madagascar.

Genus *Metascaphites* WIEDMANN, 1962c
Type species: *Scaphites (?) thomasi* PERVINQUIÉRE, 1907

Discussions on the systematic position of *Scaphites (?) Thomasi* PERVINQUIÉRE led to a complex brainstorming on the systematic position of genera *Zuluscaphites* Hoepen 1955, *Huescarites* LATIL, 1990 and *Metascaphites* WIEDMANN, 1962c. SCHOLZ (1979, p. 10) placed *S. (?) thomasi* PERVINQUIÉRE to *Noskytes*, a subgenus of *Salaziceras*. LATIL (1990, p. 33), KENNEDY & KLINGER (1993), WRIGHT & KENNEDY (1994) and KLINGER & KENNEDY (1994, p. 146) also discussed the relationship between *Zuluscaphites* HOEPEN 1955 and *Huescarites* LATIL, 1990, *Salaziceras* BREISTROFFER, 1936; *Scaphites* PARKINSON 1811 and *Metascaphites* WIEDMANN 1962c.

According to the features of the Hungarian materal, there are morhological similarities and supposedly transition forms between genera *Stoliczkaia* NEUMAYR, 1875b; *Zuluscaphites* VAN HOEPEN, 1955; genus *Salaziceras* BREISTROFFER, 1936; subgenus *Noskytes* SCHOLZ, 1979 and genus *Metascaphites* WIEDMANN, 1962c. Here the classification of WRIGHT et al. (1996) is followed. Due to the lack of the suturelines, we are not able to change the systematic position of genus *Metascaphites*. However, on the basis of the morphology WRIGHT & KENNEDY (1994) concluded: "if it does indeed belong to Stoliczkaiinae, it is probably a dwarf taxon allied to, and probably derived from *Shumarinaia*.". in my point of view, on the basis of the ornamentation and the fragmented suture of the Hungarian material, it is more likely that this genus belongs to Lyelliceratidae or Flickiidae. The genus was discussed by WIEDMANN (1962c, 1965).

Metascaphites thomasi (PERVINQUIÉRE, 1907)
Pl. XVI, Figure 16

*1907 *Scaphites (?) Thomasi* PERVINQUIÉRE, p. 121, Pl. 4, Figures 30, 31
1979 *Salaziceras (Noskytes) thomasi* (PERVINQUIÉRE, 1907) — SCHOLZ, p. 101, Pl. 22, Figure 6
1994 *Metascaphites thomasi* (PERVINQUIÉRE, 1907) — WRIGHT & KENNEDY, Figures 3a–c (refigured holotype)

Material. A single specimen from Tilos Forest.

Description. Very involute, small specimen with ribs that become tuberculate on the midflank then weaken on the outer-flank and cross the rounded venter straight. The specimen is slightly compressed. Ribs tend to be weakening both on the lateral and the ventral sides. Venter getting wider, and slightly flattened with strong ventrolateral tubercles. The venter is very broad and flat. Suture cannot be observed at none of the specimens.

Discussion. The systematic position of *M. thomasi* is uncertain. See above the discussion of the genus.

Occurrence. The species occurs in the condensed Late Albian basal pockets of Pénzeskút Marl Formation at Tilos Forest which age can be placed into the *Stoliczkaia (S.) dispar* Zone. Otherwise this rare species is reported from the Upper Albian – ?Lower Cenomanian deposits of Algeria (PERVINQUIÉRE 1907) and Hungary (SCHOLZ 1979). WIEDMANN (1962c) described *M. subthomasi* from Spain, but this form is somehow older.

***?Metascaphites kashaii* sp. nov.**
Pl. XV, Figure 2

Material. A single specimen is from the condensed Late Albian basal pocket of the Pénzeskút Marl at Tilos Forest.

Derivation of name. After our peregrine tiercel, Kashai.

Location. The holotype is housed in the Palaeontological Department of the Hungarian Natural History Museum, repository number is 2007.70.1.

Dimensions.

	D	W	H	W/H	U
2007.70.1.	27(100)	9(33)	9(33)	1	3(11)

Description. The specimen is very involute and compressed, with rounded whorl section. The umbilicus is narrow and shallow. Flanks are paralell. The umbilical shoulder is smooth, as well as the lower flank. The inner whorls are smooth; ornamentation appears just on the last whorl. Blunt, low, ribs appear on the outer third of the lateral part and form tubercles quickly on the ventrolateral edge. Ribs disappear after the tubercles; do not cross the well rounded, smooth venter. Reaching 24 mm in diameter, probably at the beginning of the body chamber, ribs appear but do not form tubercles on the ventrolateral edge but become stronger and prorsiradiately cross the venter. In this ribbed ontogenetic stage, the conch becomes more evolute. Before the aperture, a collar persists.

Discussion. This single specimen is referred to genus *Metascaphites* on the basis of the ornamentation and the smooth venter, but the systematic position is very uncertain — both for the specimen as well as for the genus *Metascaphites*.

The tubercles of kashaii are more on the ventral edge then on the holotype of *M. thomasi* (PERVINQUIÉRE, 1907). The Hungarian specimen shows close resemblance to an unregistered paralectotype of *Stoliczkaia (Shumarinaia) africana* (PERVINQUIÉRE, 1907) figured by WRIGHT & KENNEDY (1994, Figures 3r–t). The smooth, wide and rounded venter of the

Hungarian specimen is in contrast to the flattened venter of PERVINQUIÉRE's. The ornamentation of ?*M. kashaii* resembles very much to *Stoliczkaia (Shumarinaia) asiatica* MATSUMOTO, INOMA, 1975 figured by KENNEDY (2004a, Figures 21, V, W) as *S. (S.)* aff. *asiatica* MATSUMOTOV & INOMA, 1975. The resemblance with *Metascaphites thomasi* (PERVINQUIÉRE, 1907) is also remarkable, especially on the early ontogenetic stages. Tubercles appear just on the last whorl for both species, until then the mould is smooth.

Occurrence. The species occurs in the condensed Late Albian, *Stoliczkaia (S.) dispar* Zone basal pockets of Pénzeskút Marl Formation at Tilos Forest.

***?Metascaphites scholzi* sp. nov.**
Pl. XVI, Figure 17, 18

Material. Two specimens are from the condensed Late Albian basal pocket of the Pénzeskút Marl Formation at Tilos Forest.

Derivation of name. After Gábor Scholz, a Hungarian palaeontologist, who worked extensively on the Late Albian ammonite assemblage of Tilos Forest.

Location. The holotype is housed at the Palaeontological Department of the Hungarian Natural History Museum, repository no. 2007.69.1. The other specimen is at the private collection of Z. Evanics.

Dimensions.

	D	W	H	W/H	U
2007.69.1.	24(100)	14(58)	10(42)	0.714	3(12.5)
	25(100)	17(68)	10(40)	0.588	3(12)

Description. Rather involute specimen with slightly depressed whorl section.The umbilicus is narrow; the umbilical shoulder is low and rounded. Strong, wide primary ribs arise from the umbilical edge, which wear small tubercles on the outer third of the lateral part. At the outer lateral region intercalated ribs arise, both primaries and the intercalated ones cross the venter with slight prorsiradiation. The ornamentation changes at the diameter of 15 mm. The most peculiar is that the venter become smooth, flat and wide, the small tubercles getting coarser and become huge, so on the ventrolateral edge is ornamented by heavy, spine-like tubercles. On the last quarter whorl, the phragmocone is getting narrower and a collar is visible just befor the aperture.

Discussion. The specimen is referred to the genus *Metascaphites* on the basis of the smooth venter and the prominent ventrolateral tubercles. It differs from *M. thomasi* (PERVINQUIÉRE, 1907) in its coarser ornamentation and sculpture, and in the presence of ribs at the earlier whorls. It is differs from *M. kashaii* sp. nov. in its wider, flattened venter and the type of ribbing.

Occurrence. The species occurs in the condensed Upper Albian basal pockets of the Pénzeskút Marl Formation at Tilos Forest.

Genus *Scaphites* PARKINSON, 1811
Type species: *Scaphites equalis* J. SOWERBY, 1813

***Scaphites* sp. indet.**

Material. Bóly B–1 borehole 999.8 m; 1116.3 m.

Description. Small scaphitid forms in a very poor state of preservation, mostly heavily pyritized.

Discussion. Lacks of specific characters do not allow to determining more precise identification.

Subgenus *Scaphites* PARKINSON, 1811
Type species: *Scaphites equalis* J. SOWERBY, 1813

***Scaphites (Scaphites) hugardianus* D'ORBIGNY, 1842**
Pl. XVIII, Figures 2, 5, 6, 7, 8, 9, Pl. XXIII, Figures 11, 12

*1842 *Scaphites hugardianus* D'ORBIGNY, p. 521, 525
1965 *Scaphites hugardianus* D'ORBIGNY, 1842 — WIEDMANN, p. 423, Pl. 54, Figure 5; Pl. 57, Figures 1, 2, 6, 6, 7; Text-Figures 5d, e
1979 *Scaphites hugardianus* D'ORBIGNY — SCHOLZ, p. 43, Pl. 1, Figures 20–25
1989 *Scaphites (Scaphites) hugardianus* (D'ORBIGNY) — HORVÁTH, Pl. 1, Figure 3
1989 *Scaphites (Scaphites) merani* (PICTET & CAMPICHE) — HORVÁTH, Pl. 1, Figure 4
1994 *Scaphites hugardianus* D'ORBIGNY, 1842 — COOPER, pp. 165–193, Figure 1E–G
1996 *Scaphites (Scaphites) hugardianus* D'ORBIGNY 1842 — KENNEDY in GALE et al., p. 589–590, Text-Figure 17a–c, g
1997 *Scaphites merani* (PICTET & CAMPICHE) — SCHOLZ in FÜLÖP, p. 81, Pl. 1, Figure 2
1998 *Scaphites hugardianus* D'ORBIGNY — MONKS, p. 169, Figure 3. 88

Material. A single specimen is reported from Jásd J–36 borehole at 207.0–209.0 m; 31 specimens from Tilos Forest, 3 specimes from Jásd J–42 borehole at 411.25 m; 345.4, and 228.7 m. One specimen is found in Bóly B–1 borehole at 998.2 m, 6 specimens from Jásd 1 quarry and 45 specimens are collected from Bakonynána.

Description. Small and medium sized, scaphitid specimens, that ornamented by dense, prorsiradiate ribs with small tubercles on the body chamber. Ribs pass through the rounded venter.

Discussion. COOPER (1994) revised the genus *Scaphites* and concluded *Scaphites (Scaphites) meriani* PICTET & CAMPICHE, 1861 and *Scaphites (Scaphites) simplex* JUKES-BROWNE, 1875 as the intraspecific variants, so junior synonyms of *S. (S) hugardianus*. KENNEDY (in GALE et al. 1996, p. 589) kept separated the three species on the base of morphology and different stratigraphic distribution. Here the view of KENNEDY (loc. cit) is followed. MONKS (2000) also discussed the systematic position of the Scaphitidae, as well as WIEDMANN (1965) and COOPER (1994).

Occurrence. The species is reported from the condensed deposits of Late Albian *Stoliczkaia (S.) dispar* Zone of Tilos Forest and other surface outcrops; otherwise known from the Late Albian *Stoliczkaia (S.) dispar* Zone deposits of the former Western Tethys.

Scaphites (Scaphites) simplex (JUKES-BROWNE, 1875)

Pl. XXVIII, Figure 28

*1875 *Scaphites Meriani* var. *simplex* JUKES-BROWNE, p. 287, Pl. 14, Figure 3
1937 *Scaphites simplex* JUKES-BROWNE — SPATH, p. 504, Text-Figures 176c–f; 177a, b, d, e; Pl. 57, Figures 13–22
1965 *Scaphites (Scaphites) simplex* (JUKES-BROWNE) — WIEDMANN, p. 412, Pl. 54, Figures 1, 7; Pl. 55, Figures 4, 5; Text-Figure 3e
1997 *Scaphites (Scaphites) simplex* (JUKES-BROWNE) — SCHOLZ in FÜLÖP, p. 81

Material. A single specimen from the Pusztavám Pv–980 borehole at 460 m and a small specimen from Bóly B–1 borehole at 1034.5 m.

Description. Small, flattened, scaphitid specimens that ornamented by dense, prorsiradiate ribs that completely lack tubercles. The venter cannot be observed.

Discussion. Lack of tubercles on the final shaft and hook and the fine, dense ribbing with scaphitid coiling characterize the species. According to WIEDMANN (1965), *S. (S.) simplex* belongs to the *meriani* main stock and defined with the presence of untuberculated primary ribs, the rounded whorl section and the absence of lateral bulges. WIEDMANN (loc. cit) was fully discussed the species.

Occurrence. The species is reported from the Late Albian *Stoliczkaia (S.) dispar* Zone sequence of Bóly B–1 borehole; otherwise it is known from England, Switzerland, Spain and Algeria and restricted to the Late Albian *Mortoniceras (M.) inflatum* and *Stoliczkaia (S.) dispar* Zones.

Scaphites (Scaphites) evanicsi sp. nov.

Pl. XVIII, Figure 3, 4, 10, 11; Pl. XXIII, Figure 10

Material. Seven internal moulds, all from the condensed basal pockets of the Pénzeskút Marl Formation at Tilos Forest.

Derivation of name. After Zoltán Evanics, an amateur fossil hunter who collected the most beautiful specimens of this new species.

Location. The holotype is housed at the Palaeontological Department of the Hungarian Natural History Museum, Budapest. Repository number is 2007.71.1. Six additional specimens are in the private collection of Z. Evanics.

Dimensions. Here the measurement method of WIEDMANN (1965) is followed.

— D = greatest diameter of spiral portion and final hook,
— B = maximum thickness of spiral portion and final hook,
— d = diameter of the spiral portion,
— h = max. whorl height of the spiral portion,
— b = max. whorl thickness of the spiral portion,
— u = umbilical diameter of the spiral portion.

	D	B	d	h	b	u
Holotype	24	15	13	8.5	8.5	1

Description. Medium sized, compressed scaphitid form. The spire is involute, ornamented with fine lirae. The shaft and the hook have flat, almost paralell sides, the whorl section is quadrangled. The final hook is less inflated, the shaft is long and the venter is flattened. There are coarse tubercles appearing on the outer flank of the shaft but the sculpture changes towards the aperture. The tubercles form elongated bullae when the hook begins and become more prominent towards the aperture.

Discussion. This new *Scaphites* species described here has a completely smooth venter and coarse bullae on the lateral flank. *Scaphites (Scaphites) equalis* J. SOWERBY, 1814, which is reported adequately only from the Cenomanian, shows resemblance with the new species on the ornamentation of the lateral region, but the venter of *S. (S.) equalis* is always ribbed. *Scaphites wellmani* HENDERSON, 1973 described from New Zealand has similar sculpture, apart from the ribbed venter. WIEDMANN (1965) mentions that "In the more inflated forms the sculpture is coarser while the compressed specimens are more weakly ribbed.", in the case of the Hungarian specimens it is true.

Occurrence. The species is reported from the condensed, Late Albian *Stoliczkaia (S.) dispar* Zone basal pockets of Tilos Forest.

Superfamily Douvilleicerataceae PARONA & BONARELLI, 1897
Family Douvilleiceratidae PARONA & BONARELLI, 1897
Subfamily Douvilleiceratinae PARONA & BONARELLI, 1897
Genus *Douvilleiceras* GROSSUVRE, 1894
Type species: *Ammonites mammillatus* SCHLOTHEIM, 1813

Douvilleiceras mammillatum **(SCHLOTHEIM, 1813)**
Pl. XXV, Figure 3

1896 *Douvilleiceras mammillatum* (SCHLOTHEIM) — PARONA & BONARELLI, p. 95
1923 *Douvilleiceras mammillatum* (SCHLOTHEIM) — SPATH, p. 68, Pl. IV, Figures 3a, b; Pl. V, Figures 1–4
1990 *Douvilleiceras mammillatum* (SCHLOTHEIM) — MARCINOWSKI & WIEDMANN, p. 51, Pl. 7, Figures 5, 6

Material. A single specimen from Tatabánya Ta–1462 borehole at 338.4 m.

Description. Fragment of the last whorl, ornamented with coarse, mammillate tubercles.

Discussion. The mammillate tubercles characterize the species.

Occurrence. The species reported from Hungary only from the Early Albian sequence of Tatabánya Ta–1462 borehole; otherwise known worldwide from the Early Albian *Douvilleiceras mammillatum* Superzone. The genus is reported from the Late Albian basal pockets of the Tata Limestone Formation from the Kálvária Hill locality, Tata, Hungary.

Santonian stage

(OTTILIA SZIVES)

Geology and stratigraphy

Historical background

The Santonian stage was introduced by COQUAND (1857a, b) and presumably was named after the town of Saintes, southwest France. The base of the Santonian stage is defined by the first occurence of *Cladoceramus undulatoplicatus*, an inoceramid bivalve (LAMOLDA & HANCOCK 1996). The end of the stage is defined by the extinction of crinoid Marsupites testudinarius (GRADSTEIN et al. 2004).

The Santonian stage lasts from 85.8±0.7 to 83.5±0.7 Ma (GRADSTEIN et al. 2004) and contains only one ammonite zone in the Tethyan region (KENNEDY 1984, 1995; HANCOCK 1991; GRADSTEIN et al. 2004).

Table 16. Biozonation of the Santonian in the Tethyan faunal province after HANCOCK (1991) and GRADSTEIN et al. (2004)

Stage	Tethyan ammonite zones (HANCOCK 1991)	Tethyan ammonite subzones (GRADSTEIN et al. 2004)
Santonian	*Placenticeras polyopsis*	*Placenticeras paraplanum*
		Placenticeras gallicus

Discussions on ammonite biozonation of the stage (Table 16) are still in process (BIRKELUND et al. 1984, KENNEDY 1984, SCHULTZ et al. 1984, HANCOCK 1991, LAMOLDA & HANCOCK 1996) and faunas show endemic zonations. Because of the high differentiation of faunal provinces it seems impossible to find a good marker to define the lower and upper boundaries by ammonites, and even the ammonite biozonation of the stage is problematic. According to KENNEDY (1984) "… the Santonian may correspond to the range zone of *Placenticeras polyopsis* (DUJARDIN, 1837)… [in the type area]".

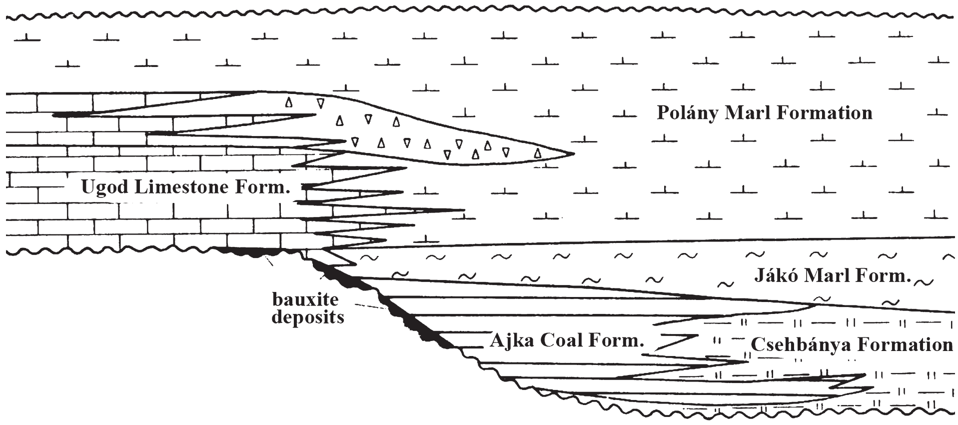
Santonian record in Hungary

The limited occurrence of Late Cretaceous ammonites in Hungary gives special interest to the fossil assemblage reported in the Santonian and Campanian chapters. Despite the relative abundance of other type of fossils, ammonites are extremely unique and rare in the Upper Cretaceous deposits of Hungary due to the Senonian sedimentation megacycle outlined in the introduction. Correlations of the Senonian formations mainly based on micropalaeontological data but no exact macrofossil record was given since the recent years.

Geological setting and stratigraphy

The presence of Upper Cretaceous sediments in Hungary was already known in the 19th century (HAUER 1862; J. BÖCKH 1874) and based mainly on recognition of Hippurites and Inoceramus specimens. Upper Cretaceous formations can be recognized on the surface in NW Hungary only in the Bakony Mountains.

The Hungarian Upper Cretaceous (Text-Figure 56), from the stratigraphical point of view, is represented by several formations but ammonites only were found in the Santonian Jákó Marl Formation and the Campanian – ?Maastrichtian (CSÁSZÁR [ed.] 1996) Polány Marl Formation. Hungarian Senonian sediments are rich in megafossils as gastropods, rudists and thin-shelled bivales. The Csabrendek Cr–2 borehole crossed the Jákó Marl Formation, where in the lower part, at 533.3 m depth a single ammonoid specimen was found. The Jákó Marl is blueish grey – grey marl usually called "Gryphean marl" due to its mollusc content. SUMMESBERGER (pers. comm) determined the fragment as an Upper Santonian *Placenticeras polyopsis* (DUJARDIN, 1837) published by PARTÉNYI (1986).



Text-Figure 56. Upper Cretaceous formations of NW Hungary after HAAS 1994

According to microfossil — sporomorph (GÓCZÁN & SIEGL FARKAS 1990), foraminifer (SIDÓ 1980) — data, the age of the formation is Campanian.

Systematic descriptions

Ordo Ammonoidea ZITTEL, 1884
Subordo Ammonitina HYATT, 1889
Superfamily Hoplitaceae DOUVILLÉ, 1890
Family Placenticeratidae HYATT, 1900
Genus *Placenticeras* MEEK, 1876
Type specimen: *Ammonites placenta* DEKAY, 1828

Placenticeras cf. *polyopsis* (DUJARDIN, 1837)
Text-Figure 57

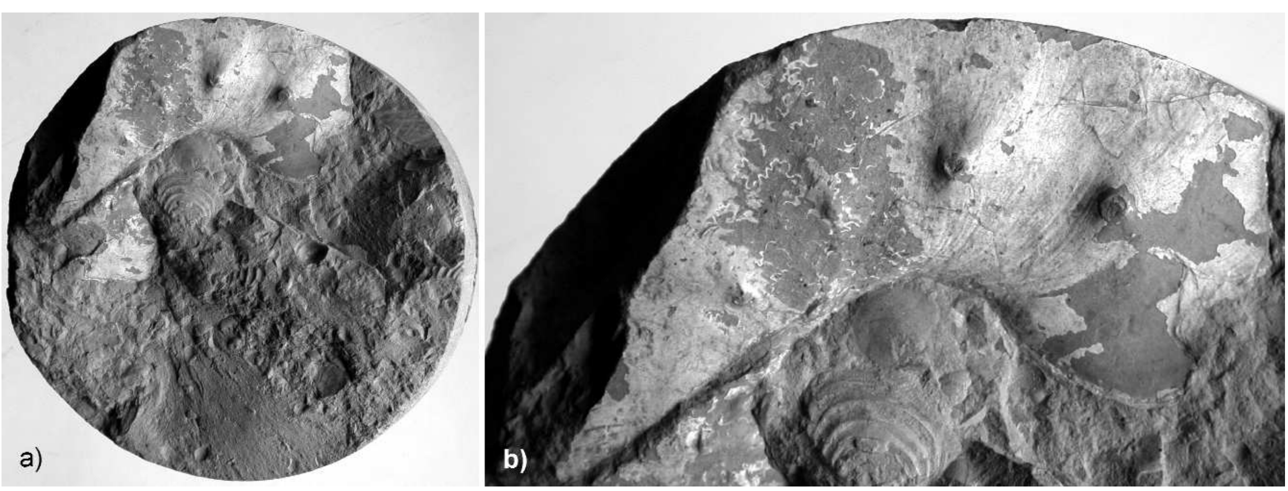
1983 *Placenticeras polyopsis* (DUJARDIN) — KENNEDY, WRIGHT, p. 856, Pls. 86–88, Text-Figures 1–4 (with full synonymy)
1986 *Placenticeras polyopsis* (DUJARDIN) — PARTÉNYI, p. 519–521, Figures 1, 2 (in Hungarian)
1995 *Placenticeras polyopsis* (DUJARDIN) — JAGT et al., p. 127, Pl. 1, Figures 3–6

Material. A single fragment from Csabrendek Cr–2 borehole at 533.3 m.

Description. Fragment of the outer whorl of a phragmocone. No ornamentation is visible apart from strong tubercles on the inner lateral region.

Discussion. Placenticeras polyopsys is an index species, ranges almost through the whole Santonian.

Occurrence. The first record of the species from Hungary is from the Late Santonian sequence of Csabrendek Cr–2 borehole; otherwise it is reported from the Santonian worldwide.



Text-Figure 57. *Placenticeras polyopsis* (DUJARDIN, 1837). Csabrendek Cr–2 borehole, 533.3 m. a) 0.5×, b) 1.5×

Campanian stage

(Ottilia Szives & István Főzy)

Geology and stratigraphy

Historical background

The Campanian stage was named by Coquand (1857b) after Grande Champagne (France). By radiometric dating, Campanian lasts from 83.5±0.7 to 70.6±0.6 Ma (Gradstein et al. 2004). The base of the stage was originally defined by de Grossuvre (1901) by the lowest occurence of ammonite *Placenticeras bidorsatum* (Roemer 1841). Hancock & Gale (1996) suggested the extinction of a crinoid *Marsupites testudinarius* as a provisional base marker. The end of the stage is defined by "mean of 12 biostratigraphic criteria of equal importance" (Gradstein et al. 2004). The Campanian/Maastrichtian boundary is discussed by Odin & Lamaurelle (2001).

The Campanian stage is divided into two or three substages (Hancock & Gale 1996) but "there is no formal recommendations for primary markers" (Gradstein et al. 2004) and the substage division. Ammonite zonation (Table 17) is based on the work of Schlüter (1871–1876); de Grossuvre (1894, 1901) and Haug (1911) as cited by Kennedy (1984). The position of the Santonian/Campanian boundary is discussed by Gale et al. (1995) and Gallemí et al. (1997).

Table 17. Ammonite zones for the Campanian and Lower Maastrichtian of the Western Interior (Kennedy et al. 1997a) and the Mediterranean–Submediterranean region (Wright et al. 1996)

Stages	Ammonite zones for the Western Interior (Kennedy et al, 1997a)	Ammonite zones for the Mediterranean and Submediterranean (Wright et al, 1996)	
Lower Maastrichtian		*Pachydiscus epiplectus*	
Upper Campanian	*Exiteloceras jenneyi*	Upper Campanian	*Nostroceras hyatti*
	Didymoceras stevensoni		*Bostrychoceras polyplocum*
	Didymoceras nebrasense		
Middle Campanian	Eight *Baculites* zones		*Hoplitoplacenticeras marroti*
Lower Campanian	*Baculites* sp. (weak flank ribs)	Lower Campanian	*Menabites delawarensis*
	Baculites sp. (smooth)		
	Scaphites hippocrepis **III**		
	Scaphites hippocrepis **II**		*Placenticeras bidorsatum*
	Scaphites hippocrepis I		
	Scaphites leei III		
Santonian	*Desmoscaphites bassleri*	*Placenticeras polyopsis*	

Zones beside each other does not mean the exact correlation between them. Zones present in Hungary on the basis of the ammonite record are shown in bold

The Campanian record in Hungary

There are only two dozens of Campanian ammonites found in Hungary. The assemblage collected specimen-by-specimen during decades, from various quarries of the Sümeg area by geologists or the local stone-miners, mostly without any documentation. Almost all the specimens were moved to one of the store houses of the Geological Institute of Hungary to the countryside.

Geological setting and stratigraphy

The last, youngest member of Upper Cretaceous marls is the pale yellowish-white Polány Marl which contains the peculiar ammonite fauna studied below.

HAUER (1862) named the Polány Marl as "Schichten von Polány" for the first time. During the next hundred years many authors (HAUER 1866; J. BÖCKH 1874; LÓCZY 1913; NOSZKY 1934, 1942; CZABALAY 1964) were working on the stratigraphy and palaeontology of the Upper Cretaceous sequences. The Polány Marl Formation is divided into three members and described as a sequence of deep basin and slope facies sediments which deposited in deeper neritic and shallow bathyal environments (CSÁSZÁR [ed.] 1996). The complete thickness of the marl is from 200 to 800 metres, depending on the location. The most detailed monograph of the Sümeg area is by (HAAS et al. 1985, HAAS & EDELÉNYI 1979).

The monograph of HAAS et al. (1985) contains names of ammonites found nearby in the Polány Marl as *Scaphites* sp. and *Pachydiscus neubergicus* SCHLOTHEIM. The integrated research of the micro- and macrofauna and flora placed the age of the formation into the Late Campanian to Maastrichtian (HAAS et al. 1985). BODROGI et al. (1997) revised some ammonites housed at the Hungarian Geological Museum and previously figured by SIEGL-FARKAS & SUMMESBERGER (1998). All the ammonites — apart from *P. polyopsis* (DUJARDIN, 1837), which is from the underlying Jákó Marl Formation — were collected from the lower part of the Polány Marl. The conclusion was again "…ammonite-bearing layers are Santonian to Campanian and not Maastrichtian… *Menabites* Zone in the Santonian and *Eupachydiscus levyi* Zone in the Lower Campanian." BODROGI et al. (1998) concluded that "…all the examplars of *Pachydiscus neubergicus* (HAUER, 1858) were revised as *Pachydiscus (P.) praecolligatus* COLLIGNON, 1955 and *Eupachydiscus levyi* (DE GROSSUVRE, 1894) by Yazykova so all the taxa support Santonian to Campanian age rather than Maastrichtian.". Some specimens collected by Kocsis L. are housed at the Palaeontological Department of the Natural History Museum recently published by FŐZY (2001). In his paper the author gives a detailed systematic description of the studied material containing *Hypophylloceras* sp., *Pachydiscus* cf. *levyi* DE GROSSUVRE, 1894, *Pachydiscus* cf. *praecolligatus* COLLIGNON, 1955, *Menabites (Delawarella) suemegensis* FŐZY, 2001 and a nautilid *Angulithes* cf. *westphalicus* (SCHLÜTER, 1872) so the ammonite data suggests early Late Campanian age — probably corresponding to the *Delawarella delawarensis* Zone used in the Western Interior.

Besides ammonite data, micropalaeontologic investigations have also produced significant results. The age of the Polány Marl according to planktonic foraminifers is Campanian–Maastrichtian (SIDÓ 1980), the lower part can be placed in the *Globotruncana globigerinoides – Globotruncana marginata* Zones in the Early Campanian. The palynologic investigation (GÓCZÁN & SIEGL-FARKAS 1990) placed the lower part of the formation into the Upper Campanian and the upper part into the Maastrichtian. One of the latest results based on nannofossil studies of the Sümeg region (FOGARASI in BODROGI et al. 1998) concluded at the presence of late Early Campanian CC18–(19) nannoplankton zones (FOGARASI pers. comm.). The most recent data (Görög, pers. comm.) is from the Tapolcafő section, where the marl and the underlying Ugod Limestone is unconform. The planktonic and benthonic foraminifers sampled from the lowermost part of the Polány Marl just above the unconformity indicate the Mid-Campanian *Globotruncana ventricosa* Zone.

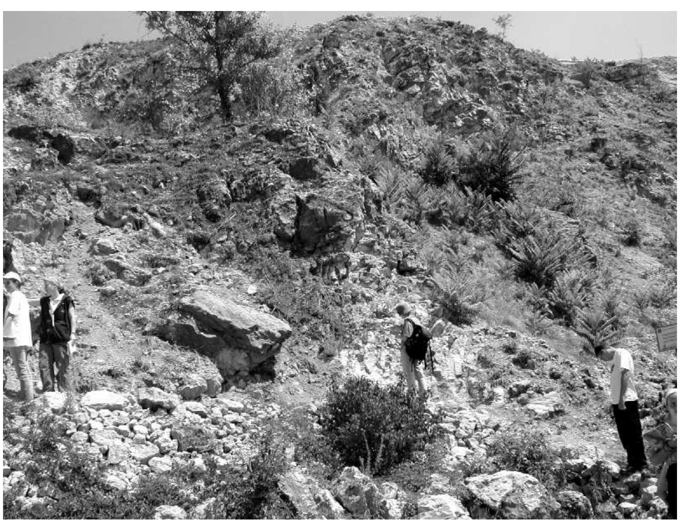
Studied sections

SÜMEG AREA

Campanian ammonites are only known from the Sümeg area of the Southern Bakony Mountains from the Polány Marl Formation. Some specimens of the Hungarian Geological Museum are clearly from the Upper Cretaceous sediments of Hungary but original designations did not contain the exact collecting locality.

HARASZT QUARRIES

Ammonite collecting mainly was done by J. NOSZKY in the mid 1940's and later by L. Kocsis. NOSZKY indicated the locality as the "village quarry north of Sümeg" but without any details about the precise stratigraphic levels of the specimens. In the area of Sümeg there are numerous small, abandoned quarries called "Haraszt quarries" but it is not clear where exactly the ammonites were collected from. The most likely is that most of the ammonites labelled as "Haraszt Quarry" are from the biggest quarry among others that situated north of the road no. 84 close to the town of Sümeg. Nowadays these abandoned quarry pits are used as garbage dumps thus the possibility of further collecting is limited.

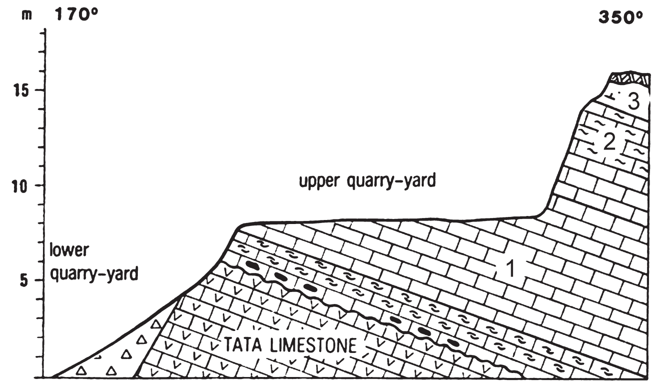


Text-Figure 58. View of the upper quarry-yard and the Campanian section of Sintérlap Quarry

SINTÉRLAP QUARRY

„The Sintérlap Quarry on the north-west side of the Köves Hill provides an excellent exposure of the

Text-Figure 59. View of the upper quarry-yard and the Campanian section of Sintérlap Quarry



Text-Figure 60. Simplified section of Sintérlap Quarry after HAAS et al. (1985). 1, 2 — Ugod Limestone Formation, 3 — Polány Marl Formation

Hippurites-bearing, bioclastic limestone (and the overlying yellow marl) overlying the rough surface of the Aptian Tata Limestone" (HAAS et al. 1985). Sintérlap Quarry was the biggest of Sümeg quarries excavated for decades and expose strata from Aptian to Campanian. After the abandonance the quarry is recultivated as a geological pathway. On the north side of the quarry (Text-Figure 58), in the upper quarry-yard the heteropic facies of rudist Ugod Limestone and the yellow Polány Marl is exposed. This was the collecting place (Text-Figure 59) of some ammonite specimens found by J. Haas. For further details on the general overview of the geological settings of the Sümeg region see HAAS et al. (1985) (Text-Figure 60). Ammonite data of the Campanian ammonites found in the Sümeg area is presented (Table 18). Exact collecting locality if it is known is shown at each specimen.

Table 18. Ammonite data from the Campanian sediments of Sümeg area

Ammonite taxa	Number of specimens	Repository numbers	Locality
Pachydiscus praecolligatus COLLIGNON, 1955	4	M63/1345/3, 4, 5, 6	Sümeg, town quarry (?)
Pachydiscus praecolligatus COLLIGNON, 1955	1	M63/1360/1	Sümeg, Haraszt quarries (?)
Pachydiscus praecolligatus COLLIGNON, 1955	1	–	Sümeg, Haraszt quarries (S/449)
Pachydiscus praecolligatus COLLIGNON, 1955	1	–	Sümeg, town quarry(?) (S/337)
Pachydiscus praecolligatus COLLIGNON, 1955	1	M63/1357	Sümeg, town quarry(?)
Pachydiscus cf. *levyi* DE GROSSUVRE, 1894	1	M63/1360/1	Sümeg
Pachydiscus	2	M63/1359/1, 2	Sümeg
Pachydiscus cf. *levyi* DE GROSSUVRE, 1894	1	–	Sümeg, town quarry(?) (S/371)
Pachydiscus	1	M63/1348	Sümeg, Hárskút (?)
Pachydiscus cf. *levyi* DE GROSSUVRE, 1894	1	–	Sümeg, Jeszenszky quarry (?), (S/350)
Pachydiscus cf. *levyi* DE GROSSUVRE, 1894	1	M63/1344	Sümeg, Sintérlap quarry
Pachydiscus cf. *levyi* DE GROSSUVRE, 1894	1	–	Sümeg, Hárskút (?)
Pachydiscus sp.	1	–	Sümeg, outcrop no. 2 (?)
Pachydiscus sp.	1	–	Sümeg, Haraszt quarries (207/28)
Pachydiscus sp.	1	GMH K2727	Sümeg, Haraszt quarries
Pachydiscus sp.	1	-	Sümeg, Haraszt quarries
Pachydiscus sp.	1	M63/1358	Sümeg, town quarry (?)
Menabites sp.	1	–	Sümeg, outcrop no 18 (?)
Menabites (Delawarella) suemegensis FŐZY, 2001	1	M63/1355	Sümeg, town quarry (?)
Menabites sp.	1	M63/1361	–
Menabites sp.	2	–	Sümeg, Haraszt quarries
Menabites sp.	1	–	Sümeg, outcrop no. 18 (?)
?Baculites sp.	1	–	–
Scaphites hippocrepis II–III (DE KAY, 1828)	1	–	Sümeg, Sintérlap Quarry
Brahmaites sp.	1	–	Sümeg, outcrop no. 22 (?)
Glyptoxoceras sp.	1	–	Sümeg, Haraszt quarries

TAPOLCAFŐ

An additional, huge specimen was also found by J. Haas in the quarry of Tapolcafő. The crinoidal Aptian limestone was excavated in the nowadays abandoned quarry for decades, but there is a small outcrop of Campanian Polány Marl at the upper part of the almost vertical 15–20 m high quarry wall. A huge specimen was fallen down from somewhere, found by the miners and J. Haas bartered it for a bottle of wine.

Biostratigraphic evaluation of the Hungarian Campanian ammonites

The cephalopod fauna described above provided new, more exact ammonite data of the stratigraphic position of Polány Marl Formation. A *Scaphites hippocrepis* II–III (DEKAY, 1828) was collected from the base of the formation at Sintérlap Quarry, and indicates Early Campanian age. The Campanian age is also supported by *Brahmaites* sp., *Glyptoxoceras* sp., *Menabites* spp. On the basis of other fossil evidences from the above strata, the marl ranges up to the basal Maastrichtian but there is no ammonite evidence yet to support its Maastrichtian age. *Scaphites hippocrepis* II–III (DEKAY, 1828), *Brahmaites* sp. and *Glyptoxoceras* sp. are reported from Hungary for the first time.

Systematic descriptions

Ordo Ammonoidea ZITTEL, 1884
Subordo Ammonitina HYATT, 1889
Family KOSSMATiceratidae SPATH, 1922b
Subfamily KOSSMATiceratinae SPATH, 1922b
Genus *Brahmaites* KOSSMAT, 1897
Type species: *Ammonites brahma* FORBES, 1846

Brahmaites sp.

Pl. XL, Figure 1

Material. A single specimen from the Polány Marl Formation at the Sümeg area originally labelled as "from the quarry no. 22 at Sümeg". This quarry was not identifyable recently.

Description. Evolute, compressed form, the inner whorls are not visible. There is a strong, collared, prorsiradiate constriction on the outer whorl and some slight ribs are also appearing.

Discussion. The bad state of preservation did not allow the more exact determination.

Occurrence. The genus occurs from the Lower to Upper Maastrichtian wordwide.

Family Pachydiscidae SPATH, 1922b
Genus *Pachydiscus* ZITTEL, 1884
Type species: *Ammonites neubergicus* HAUER, 1858

Pachydiscus cf. *levyi* DE GROSSUVRE, 1894

Pl. XXXV, Figure 1; Pl. XXXVI, Figures 1,

*1894 *Pachydiscus levyi* DE GROSSUVRE, p. 178, Pl. 21; Pl. 30. Figures 1, 2
1997 *Eupachydiscus levyi* DE GROSSUVRE — YAZIKOVA in BODROGI et al., p. 693
1997 *Pachydiscus levyi* DE GROSSUVRE, 1894 — SUMMESBERGER in SIEGL-FARKAS, p. 85, Pl. 8, Figures 1–3
1998 *Eupachydiscus levyi* DE GROSSUVRE, 1894 — SUMMESBERGER in SIEGL-FARKAS & SUMMESBERGER, p. 266, Pl. 1, Figures 1, 2
1998 *Eupachydiscus levyi* DE GROSSUVRE, 1894 — YAZIKOVA in BODROGI et al., p. 1191, Pl. 1, Figures a–d
2001 *Pachydiscus levyi* DE GROSSUVRE, 1894 — FŐZY, p. 28, Pl. II, Figure 1; Pl. 3, Figure 1

Material. Six specimens from the Sümeg area without more exact locality. Repository numbers are: M.63.1345/1, 2; M.63.1344.

Description. Huge and deformed internal moulds with evolute coiling and shallow umbilicus. The inner whorls are exposed on Pl. XXXVI, Figure 1, consist of slight ornament of umbilical bullae. Later, on the last whorl, umbilical bullae are persistent on the inner flank; the middle lateral area is almost smooth, on the outer flank ribs appear again.

Discussion. The specimens referred to the genus *Pachydiscus* on the basis of the nearly smooth mid-lateral part. KENNEDY (1983) discussed the origin of Pachydiscidae.

Occurrence. The species first appear in the Lower Maastrichtian of Austria, Poland, Ukraine and Zululand; it occurs in the lower Upper Maastrichtian of Denmark and the Upper Maastrichtian of India.

Pachydiscus praecolligatus COLLIGNON, 1955

Pl. XXX, Figures 1–4, Pl. XXXV, Figure 2

*1955 *Pachydiscus precolligatus* COLLIGNON, p. 64, Pl. 21, Figure 1; Pl. 25, Figures 2, 3
1997 *Pachydiscus precolligatus* COLLIGNON — YAZIKOVA in BODROGI et al., p. 693
1998 *Pachydiscus precolligatus* COLLIGNON — YAZIKOVA in BODROGI et al., p. 191
2001 *Pachydiscus precolligatus* COLLIGNON — FŐZY, p. 30, Pl. III, Figures 2, 3 only

Material. Eight specimens from the Sümeg area, all from the Haraszt Quarry. Repository numbers are: M.63./1357

Description. Medium sized specimens with moderately evolute and deep umbilicus. The umbilical shoulder is rounded, but most of the specimens are compressed and deformed. Narrow, but high primary ribs start from the umbilical edge, crossing the lateral part straight but during the ontogeny they are getting slightly sinuous and prorsiradiate. Intermedier ribs appear on the midflank, one or two between two primaries. The venter is rounded and both the primary and the intermedier ribs cross it.

Discussion. The type of *P. precolligatus* (COLLIGNON 1955; Pl. 21, Figure 1) is supposedly a mature specimen, 140 mm of diameter. This diameter fits well to the Hungarian specimens, while other Pachydiscid forms are three–ten times bigger in the Hungarian record. The changing of the ornamentation during the ontogeny can be visible on the holotype, as well as on the specimen figured here (Pl. XXXV, Figure 2).

Occurrence. The species first appears in the Lower Maastrichtian of Austria, Poland, Ukraine and Zululand, also occurs in the lower Upper Maastrichtian of Denmark and the Upper Maastrichtian of India.

Family Collignoniceratidae WRIGHT & WRIGHT, 1951
Subfamily Texanitinae COLLIGNON, 1948
Genus *Menabites* COLLIGNON, 1948
Type species: *Menabites menabensis* COLLIGNON, 1948
Subgenus *Delawarella* COLLIGNON, 1948
Type species: *Ammonites delawarensis* MORTON, 1830

Menabites (Delawarella) suemegensis FŐZY, 2001
Pl. XLI, Figure 1

*2001 *Menabites (Delawarella) suemegensis* FŐZY, p. 32, Pl. IV

Material. The single, deformed holotype is refigured here, it is from the "Községi Kőbánya" (Village Quarry) at Sümeg area, repository number is M.63.1355.
Description. The specimen is very evolute with shallow, wide umbilicus. Coarse primary ribs start at the umbilical edge, rib index is 12 on a half whorl. There are 4 rows of tubercles, on the inner lateral part, one is at the outer lateral end and the last tubercle is on the ventrolateral edge. Ribs do not cross the venter, leaving the mid-ventral region smooth.
Discussion. The species is fully described and discussed by FŐZY (2001).
Occurrence. The species first appear in the Lower Maastrichtian of Austria, Poland, Ukraine, Zululand; it occurs in the lower Upper Maastrichtian of Denmark and the Upper Maastrichtian of India.

Subordo Ancyloceratina WIEDMANN, 1966
Superfamily Turrilitaceae GILL, 1871
Family Diplomoceratidae SPATH, 1926
Subfamily Diplomoceratinae SPATH, 1926
Genus *Glyptoxoceras* SPATH, 1925c
Type species: *Hamites rugatus* FORBES, 1846

***Glyptoxoceras* sp.**
Pl. XL, Figure 2

Material. A single specimen from the Haraszt Quarry, Sümeg, collected by J. NOSZKY.
Description. The flattened specimen show helicoid coiling but the inner whorls are destroyed, presumably during the preparation without the initial part and body chamber. The helix is ornamented with narrow, dense, equally spaced ribs; rib index is 9–11. The ventral region and the suture are cannot be observed.
Discussion. On the basis of the fine, dense ribs and the mode of coiling the specimen is referred to the genus *Glaptoxoceras*. Several Lower Campanian *Glyptoxoceras* species — *G. retrorsum* (SCHLÜTER, 1872); *G. aquisgranense* (SCHLÜTER, 1872); *G. indicum* (FORBES, 1846) — are very similar but ornamented with less dense ribs.
Occurrence. In Hungary the species was collected from the Campanian–Maastrichtian Polány Marl Formation, exact stratigraphic position unknown, but on the basis of lithologic features it is supposedly from the lowermost, Lower Campanian part. The genus ranges from the Lower Santonian to the Upper Maastrichtian.

Family Baculitidae GILL, 1871
Genus *Baculites* LAMARCK, 1799
Type species: *Baculites vertebralis* LAMARCK, 1801.

?*Baculites* sp.
Pl. XL, Figure 3

Material. A single specimen was collected in the Sümeg area, the exact locality is not mentioned on the original designation.
Description. Approximately 50 mm long poorly preserved internal mold, with compressed whorl section. No ornamentation can be observed apart from a slight dorsolateral bulla marked with arrow.
Discussion. The pooor preservation and therefore the complete lack of ornamentation makes the specimen almost unidentifyable.
Occurrence. The genus ranges from Upper Turonian to Upper Maastrichtian.

Superfamily Scaphitaceae GILL, 1871
Family Scaphitidae GILL, 1871
Subfamily Scaphitinae GILL, 1871
Genus *Scaphites* PARKINSON, 1811
Type species: *Scaphites equalis* J. SOWERBY, 1813
Subgenus *Scaphites* PARKINSON, 1811
Type species: *Scaphites equalis* J. SOWERBY, 1813

Scaphites (Scaphites) hippocrepis **(DEKAY, 1828) II–III**
Pl. XL, Figure 4

1969 *Scaphites hippocrepis* (DEKAY) II — COBBAN, p. 18, Pl. 2, Figures 18–37; Pl. 5, Figures 5–18; 24–27; 33–35; Text-Figure 18
1992b *Scaphites hippocrepis* (DEKAY) — COBBAN & KENNEDY, Figures 5, 6, 13
1995 *Scaphites hippocrepis* (DEKAY) — KENNEDY & JAGT, p. 288, Figures 7. 1–23; Figures 8.1–8.5
1997a *Scaphites hippocrepis* II (DEKAY) — KENNEDY et al., p. 38, Figure 24D
1997b *Scaphites hippocrepis* III (DEKAY) — KENNEDY et al., p. 14, Figure 11

Material. A single specimen from Sümeg area, the quarry name is not signed. The Figure 3 shows the exact collecting place of the specimen, as on the very bottom of the section as we have known from the collector, Prof. J. Haas.

Description. The specimen is small, ornamented with dense, rather coarse ribs which increase by intercalation and branching on the outer flank. The flanks flattened and have strong umbilicolateral and rounded ventrolateral tubercles. It lacks of any trace of additional nodes of the final hook which reminds of group II of COBBAN (1969).

Discussion. According to the detrmination of Scholz, the specimen was referred to "*Hoploscaphites constrictus* SOWERBY", but the characteristic of the ornamentation makes clear the position of the fragment in the *hippocrepis* II–III group of COBBAN (1969). The last members of genus *Scaphites* are from the *hippocrepis* group, which characterize the late Early Campanian.

Occurrence. The species occurs in the lowermost part of the Polány Marl section at Sümeg, and characteize late Early Campanian age. Otherwise, the species was cosmopolitan in the Early Campanian.

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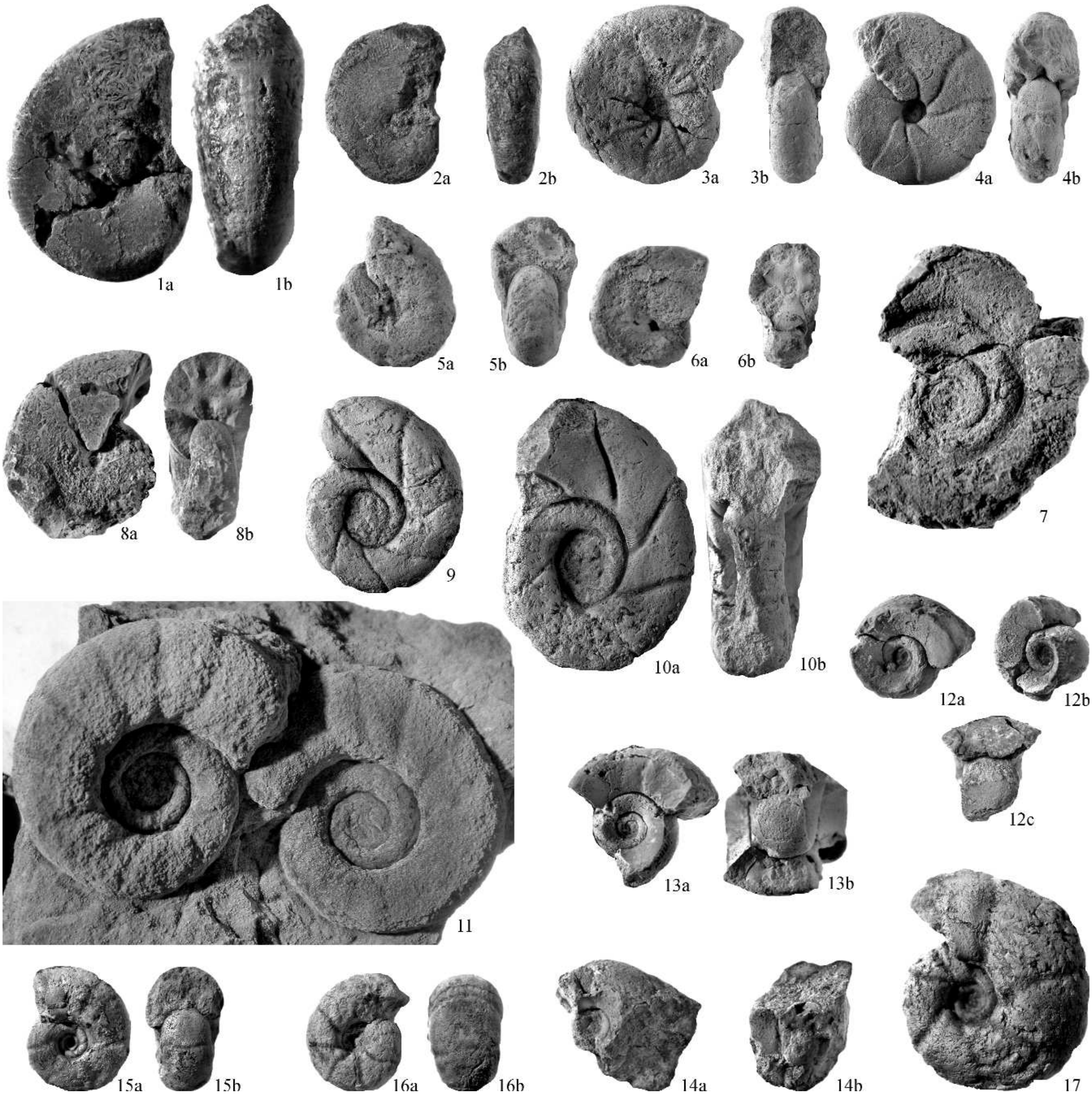
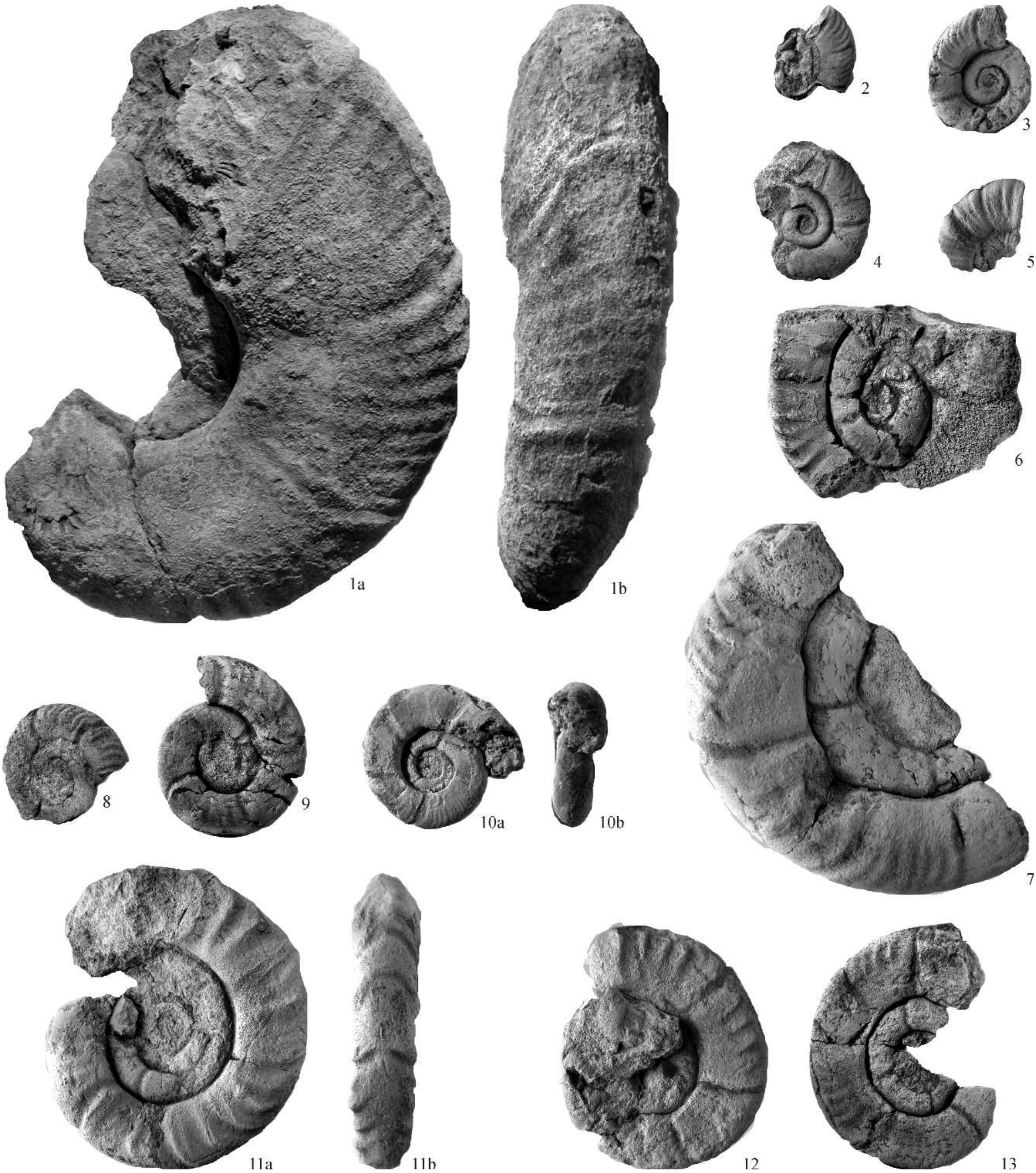


1. *Phylloceras (Hypophylloceras) subseresitense* WIEDMANN, 1963; Fazekas street.
2. *Phylloceras (Hypophylloceras)* cf. *velledae* (MICHELIN, 1834), Kálvária Hill.
3. *Holcophylloceras guettardi* (RASPAIL, 1831), Kálvária Hill.
4. *Holcophylloceras guettardi* (RASPAIL, 1831), Kálvária Hill.
5. *Partschiceras baborense* (COQUAND, 1880), Kálvária Hill.
6. *Partschiceras baborense* (COQUAND, 1880), Kálvária Hill.
7. *Lytoceras* sp., Fazekas street.
8. *Partschiceras baborense* (COQUAND, 1880), Kálvária Hill.
9. *Tetragonites (Tetragonites) heterosulcatum* (ANTHULA, 1899), Kálvária Hill.
10. *Tetragonites (Tetragonites) heterosulcatum* (ANTHULA, 1899), Kálvária Hill.
11. *Tetragonites (Tetragonites) duvalianus* (D'ORBIGNY, 1841) Kékkő Quarry.
12. *Jauberticeras jaubertianum* (D'ORBIGNY, 1851), Fazekas street.
13. *Jauberticeras jaubertianum* (D'ORBIGNY, 1851), Fazekas street.
14. *Gabbioceras michelianum* (D'ORBIGNY, 1850), Fazekas street.
15. *Valdedorsella getulina* (COQUAND, 1880), Kálvária Hill.
16. *Valdedorsella getulina* (COQUAND, 1880), Kálvária Hill.
17. *Valdedorsella getulina* (COQUAND, 1880), Kálvária Hill.

All specimens are in natural size and from the condensed Late Aptian basal pockets of the Tata Limestone Formation. Exact locality is shown at each specimen.



1. *?Beudanticeras* sp., Vájáriskola. 0.8×.
2. *Parasilesites kilianiformis* (FALLOT, 1920a), Kálvária Hill.
3. *Parasilesites kilianiformis* (FALLOT, 1920a), Kálvária Hill.
4. *Silesitoides superstes* (JACOB, 1908), Kálvária Hill.
5. *Parasilesites kilianiformis* (FALLOT, 1920a), Fazekas street.
6. *Silesites escragnollensis* (JACOB, 1908), Kálvária Hill.
7. *Silesites escragnollensis* (JACOB, 1908), Kálvária Hill.
8. *Silesites escragnollensis* (JACOB, 1908), Fazekas street.
9. *Silesites escragnollensis* (JACOB, 1908), Kálvária Hill.
10. *Silesitoides superstes* (JACOB, 1908), Kálvária Hill.
11. *Silesites escragnollensis* (JACOB, 1908), Kálvária Hill.
12. *Silesites escragnollensis* (JACOB, 1908), Kálvária Hill.
13. *Silesites escragnollensis* (JACOB, 1908), Kálvária Hill.

All specimens are in natural size and from the condensed Late Aptian basal pockets of the Tata Limestone Formation. Exact locality is shown at each specimen.

1. *Melchiorites emerici* (Raspail, 1831), Kálvária Hill.
2. *Melchiorites melchioris* (Tietze, 1872), Eperkés Hill.
3. *Melchiorites melchioris* (Tietze, 1872) , Kálvária Hill.
4. *Melchiorites emerici* (Raspail, 1831), Kálvária Hill.
5. *Melchiorites melchioris* (Tietze, 1872), Kálvária Hill.
6. *Melchiorites melchioris* (Tietze, 1872), Kálvária Hill.
7. *Beudanticeras (Beudanticeras) convergens* (Jacob, 1908), Vájáriskola.
8. *Beudanticeras (Beudanticeras) convergens* (Jacob, 1908), Kékkő Quarry.
9. *Beudanticeras (Beudanticeras) beudanti* (Brongniart, 1822), Kálvária Hill.
10. *Beudanticeras (Beudanticeras) beudanti* (Brongniart, 1822), Fazekas street.
11. *Beudanticeras (Beudanticeras) beudanti* (Brongniart, 1822), Fazekas street.
12. *Beudanticeras (Beudanticeras) beudanti* (Brongniart, 1822), Kálvária Hill.
13. *Beudanticeras (Beudanticeras) beudanti* (Brongniart, 1822), Kálvária Hill.
14. *Uhligella balmensis* (Jacob, 1908), Kálvária Hill.
15. *Uhligella clansayensis* (Jacob, 1905), Kálvária Hill.
16. *Uhligella balmensis* (Jacob, 1908), Kálvária Hill.
17. *Uhligella balmensis* (Jacob, 1908), Fazekas street.
18. *Uhligella balmensis* (Jacob, 1908), Kálvária Hill.
19. *Uhligella clansayensis* (Jacob, 1905), Fazekas street.
20. *Uhligella balmensis* (Jacob, 1908), Kálvária Hill.
21. *Zuercherella zuercheri* (Jacob & Tobler, 1906), Kékkő Quarry.
22. *? Zuercherella zuercheri* (Jacob & Tobler, 1906), Fazekas street.
23. *Zuercherella zuercheri* (Jacob & Tobler, 1906), Vájáriskola.
24. *Valdedorsella getulina* (Coquand, 1880), Kékkő Quarry.
25. *Desmoceras* (*Desmoceras*) cf. *latidorsatum* (Michelin, 1838), Vájáriskola. 0.8×.

All specimens are in natural size and from the condensed Late Aptian basal pockets of the Tata Limestone Formation. Exact locality is shown at each specimen.

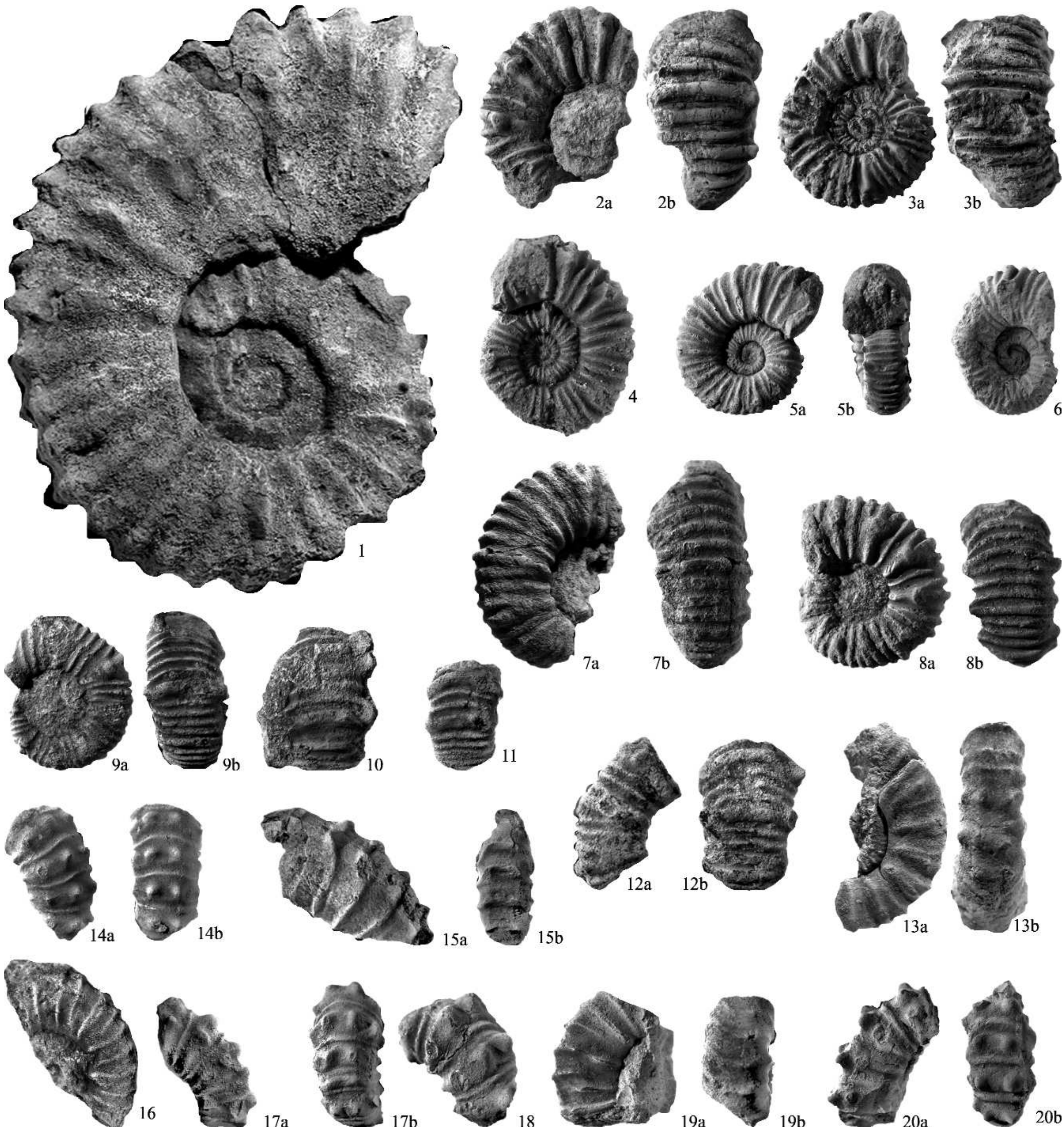
1. *Dufrenoyia katalinae* sp. nov., holotype, HNHM rep. nr. 2007.103.1. Fazekas street.
2. *Silesites superstes* (JACOB, 1908), Kálvária Hill.
3. *Ptychoceras laeve* (MATHERON, 1842), Eperkés Hill.
4. *Ptychoceras laeve* (MATHERON, 1842), Kálvária Hill.
5. *Ptychoceras laeve* (MATHERON, 1842), Kálvária Hill.
6. ?*Ancyloceras matheroni* (D'ORBIGNY, 1841), Fazekas street.
7. *Protanisoceras acteon* (D'ORBIGNY, 1850), Eperkés Hill.
8. P*rotanisoceras acteon* (D'ORBIGNY, 1850), Eperkés Hill.
9. *Hamites praegibbosus* SPATH, 1941, Eperkés Hill.
10. *Tonohamites boldii*, SZIVES & MONKS, 2002, Eperkés Hill.
11. *Hamites fueloepi* SZIVES & MONKS, 2002, Kékkő Quarry.
12. *Hamites fueloepi* SZIVES & MONKS, 2002, Kékkő Quarry.

All specimens are in natural size and from the condensed Late Aptian basal pockets of the Tata Limestone Formation. Exact locality is shown at each specimen.

1. *Ephamulina arcuata* COLLIGNON, 1963, Kékkő Quarry.
2. *Ephamulina arcuata* COLLIGNON, 1963, Kékkő Quarry.
3. *Hamites kalvariensis* SZIVES & MONKS, 2002, Kálvária Hill.
4. *Hamites kalvariensis* SZIVES & MONKS, 2002, Kálvária Hill.
5. *Protanisoceras acteon* (D'ORBIGNY, 1850). Tata, no exact locality was given on the original label.
6. *Hamites kalvariensis* SZIVES & MONKS, 2002, Kálvária Hill.
7. *Procheloniceras albrechti austriae* (UHLIG, 1883), Kálvária Hill.
8. *Cheloniceras (Paracheloniceras) rerati* COLLIGNON, 1962, Kékkő Quarry.
9. *Cheloniceras (Paracheloniceras) rerati* COLLIGNON, 1962, Kékkő Quarry.
10. *Cheloniceras (Paracheloniceras) rerati* COLLIGNON, 1962, Kékkő Quarry.
11. *Cheloniceras (Paracheloniceras) rerati* COLLIGNON, 1962, Kékkő Quarry.
12. *Cheloniceras (Paracheloniceras) rerati* COLLIGNON, 1962, Kékkő Quarry.

All specimens are in natural size and from the condensed Late Aptian basal pockets of the Tata Limestone Formation. Exact locality is shown at each specimen.

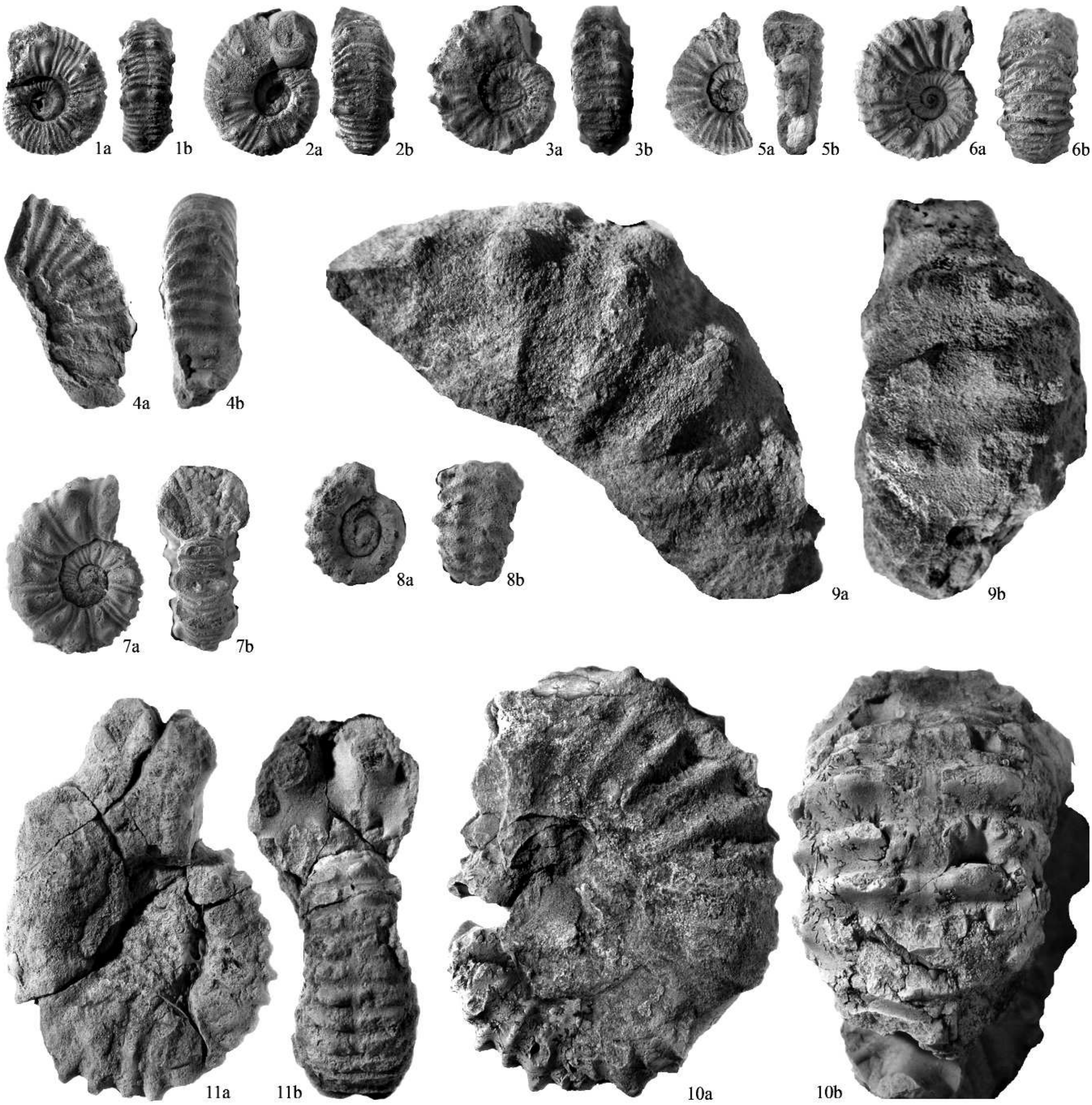
PLATE VI



1. *Procheloniceras albrechti austriae* (Uhlig, 1883), Kálvária Hill, 0.7×
2. *Cheloniceras (Cheloniceras) cornuelianum* (d'Orbigny, 1841), Kálvária Hill.
3. *Cheloniceras (Cheloniceras) cornuelianum* (d'Orbigny, 1841), Kálvária Hill.
4. *Diadochoceras nodosocostatum* (d'Orbigny, 1841), Kálvária Hill.
5. *Diadochoceras nodosocostatum* (d'Orbigny, 1841), Kálvária Hill.
6. *Diadochoceras nodosocostatum* (d'Orbigny, 1841), Kálvária Hill.
7. *Cheloniceras (Cheloniceras) cornuelianum* (d'Orbigny, 1841), Kálvária Hill.
8. *Cheloniceras (Cheloniceras) cornuelianum* (d'Orbigny, 1841), Kálvária Hill.
9. *Cheloniceras (Cheloniceras) cornuelianum* (d'Orbigny, 1841), Fazekas street.
10. *Cheloniceras (Epicheloniceras)* sp., Kálvária Hill.
11. *Cheloniceras (Epicheloniceras)* sp., Kálvária Hill.
12. *Cheloniceras (Cheloniceras) cornuelianum* (d'Orbigny, 1841), Kálvária Hill.
13. *Diadochoceras margariti* Mikhailova, 1963, Fazekas street.
14. *Diadochoceras spinosum* Mikhailova 1963, Fazekas street.
15. *Diadochoceras margariti* Mikhailova, 1963, Kálvária Hill.
16. *Diadochoceras margariti* Mikhailova, 1963, Kálvária Hill.
17. *Diadochoceras spinosum* Mikhailova 1963, Fazekas street.
18. *Diadochoceras spinosum* Mikhailova 1963, Kálvária Hill.
19. *Diadochoceras margariti* Mikhailova 1963, Kálvária Hill.
20. *Diadochoceras spinosum* Mikhailova 1963, Kálvária Hill.

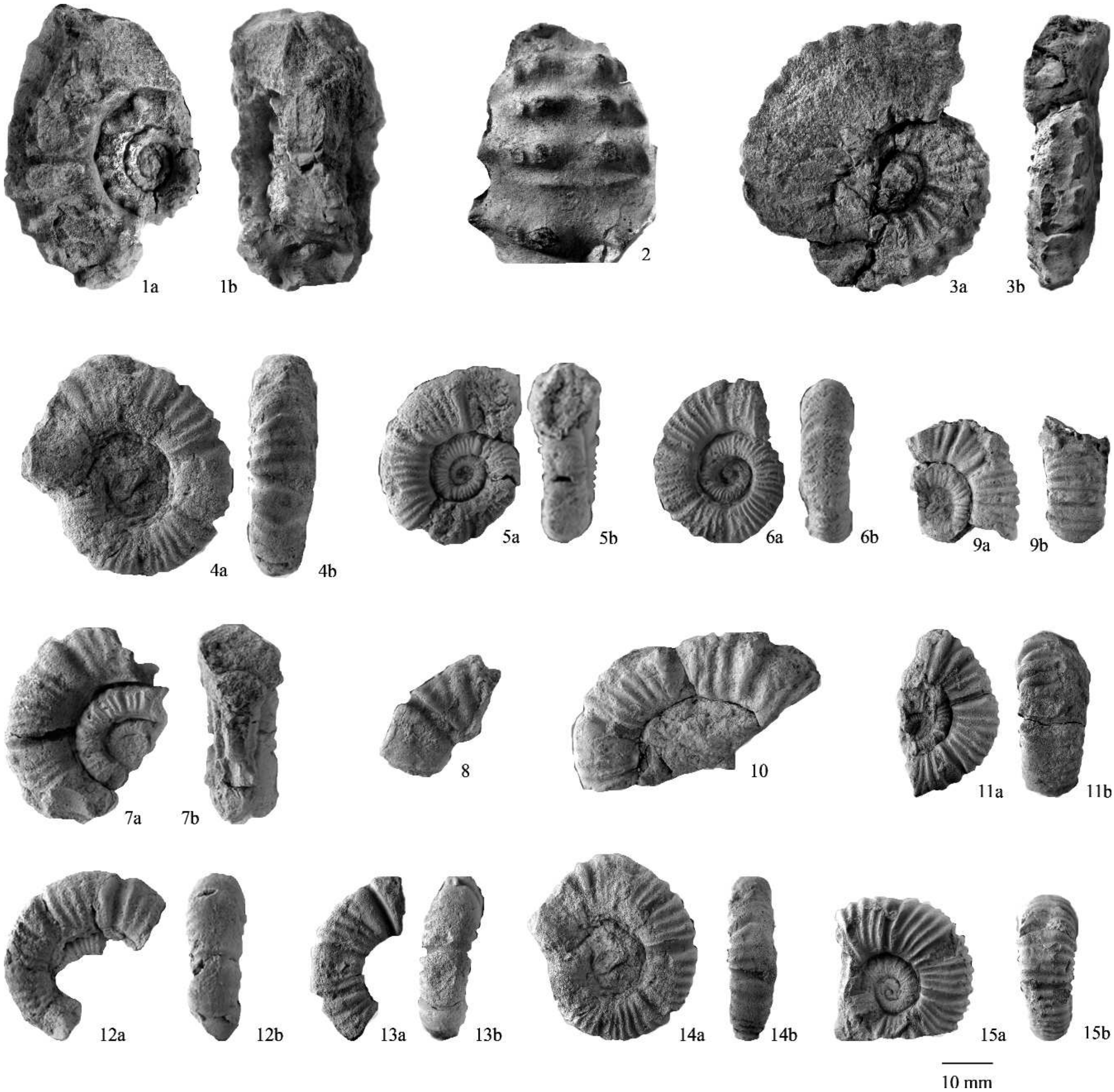
All specimens are in natural size and from the condensed Late Aptian basal pockets of the Tata Limestone Formation. Exact locality is shown at each specimen.

PLATE VII



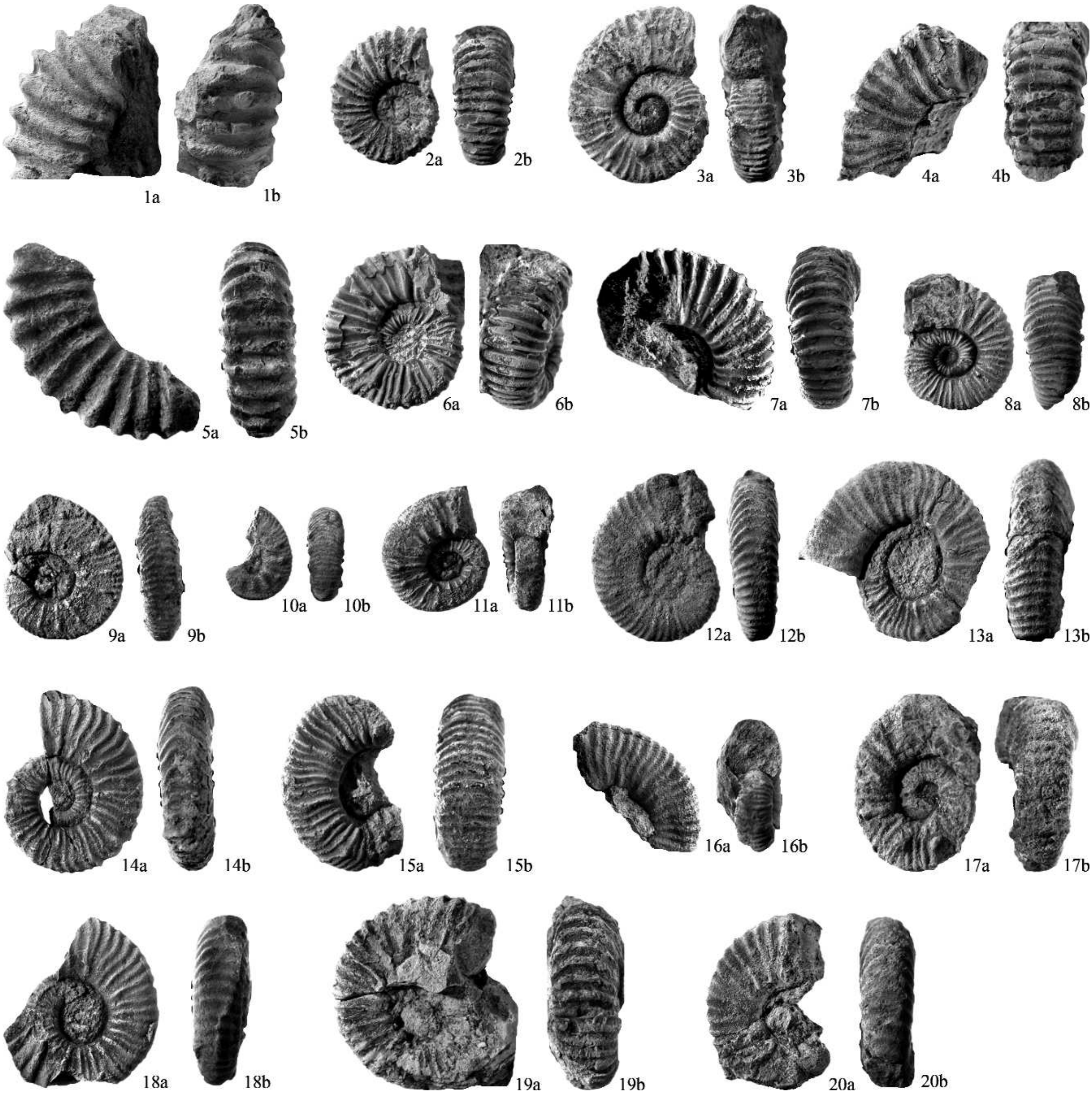
1. *Diadochoceras nodosocostatum* (d'Orbigny, 1841), Kálvária Hill.
2. *Diadochoceras nodosocostatum* (d'Orbigny, 1841), Kálvária Hill.
3. *Diadochoceras nodosocostatum* (d'Orbigny, 1841), Kálvária Hill.
4. *Diadochoceras hokodzense* Mikhailova, 1963, Kálvária Hill.
5. *Diadochoceras hokodzense* Mikhailova, 1963, Kálvária Hill.
6. *Diadochoceras nodosocostatum* (d'Orbigny, 1841), Kálvária Hill.
7. *Diadochoceras spinosum* Mikhailova, 1963, Kálvária Hill.
8. *Eodouvilleiceras* sp. juv., Fazekas street.
9. *Eoouvilleiceras clansayense* (Jacob, 1905), Vájáriskola.
10. *Eodouvilleiceras clansayense* (Jacob, 1905), Fazekas street. 0.8×.
11. *Eoouvilleiceras clansayense* (Jacob, 1905), Kálvária Hill.

All specimens are in natural size and from the condensed Late Aptian basal pockets of the Tata Limestone Formation. Exact locality is shown at each specimen.



1. *Eoouvilleiceras* sp., Kékkő Quarry.
2. *?Douvilleiceras* sp., Kálvária Hill, plaster cast.
3. *Mathoceras sumerensis* (STOYKOVA, 1990), Vájáriskola.
4. *?Protacanthoplites originalis* SHARIKADZE et al., 2004, Kálvária Hill. Repository no. GMH is K15284.
5. *?Protacanthoplites originalis* SHARIKADZE et al., 2004, Kálvária Hill. Repository no. GMH is K15308.
6. *?Protacanthoplites originalis* SHARIKADZE et al., 2004, Kálvária Hill. Repository no. GMH is K15304.
7. *?Protacanthoplites originalis* SHARIKADZE et al., 2004, Kálvária Hill. Repository no. GMH is K15295.
8. *?Protacanthoplites originalis* SHARIKADZE et al., 2004, Kálvária Hill. Repository no. GMH is K15280.
9. *?Protacanthoplites originalis* SHARIKADZE et al., 2004, Kálvária Hill. Repository no. GMH is K15291.
10. *?Protacanthoplites originalis* SHARIKADZE et al., 2004, Kálvária Hill. Repository no. GMH is K15287.
11. *?Protacanthoplites originalis* SHARIKADZE et al., 2004, Kálvária Hill. Repository no. GMH is K15283.
12. *?Protacanthoplites originalis* SHARIKADZE et al., 2004, Kálvária Hill. Repository no. GMH is K15297.
13. *?Protacanthoplites originalis* SHARIKADZE et al., 2004, Kálvária Hill. Repository no. GMH is K15292.
14. *?Protacanthoplites originalis* SHARIKADZE et al., 2004, Kálvária Hill. Repository no. GMH is K15284.
15. *?Protacanthoplites originalis* SHARIKADZE et al., 2004, Kálvária Hill. Repository no. GMH is K15281.

All specimens are from the condensed Late Aptian basal pockets of the Tata Limestone Formation. Exact locality is shown at each specimen. The log indicates 10 mm.

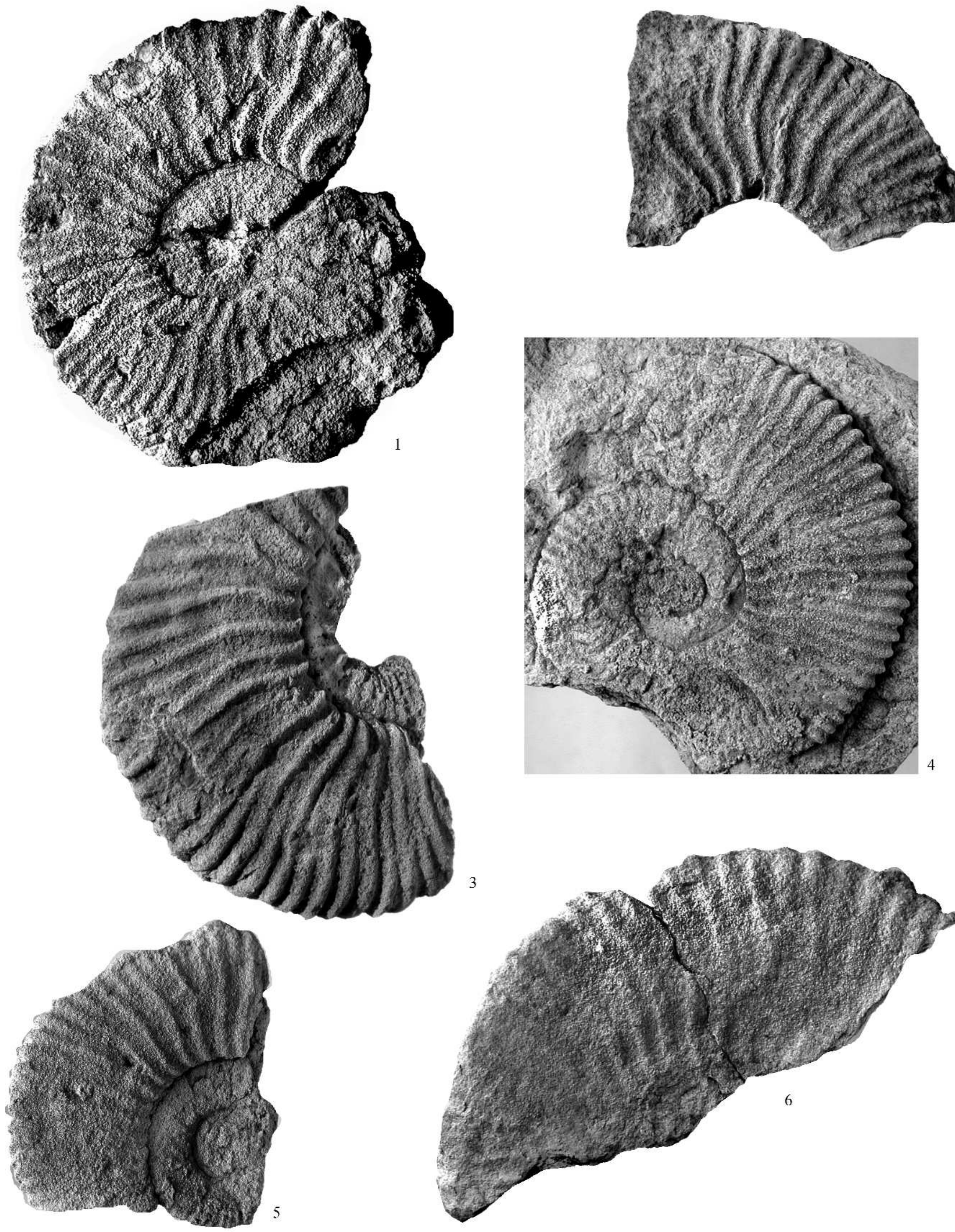


1. *Colombiceras tobleri* (JACOB, 1908), Fazekas street.
2. *Acanthohoplites abichi* (ANTHULA, 1899), Kálvária Hill.
3. *Acanthohoplites abichi* (ANTHULA, 1899), Kálvária Hill.
4. *Colombiceras tobleri* (JACOB, 1908), Kálvária Hill.
5. *Acanthohoplites bigoureti* (SEUNES, 1887), Vájáriskola.
6. *Acanthohoplites abichi* (ANTHULA, 1899), Eperkés Hill.
7. *Acanthohoplites* sp., Kálvária Hill.
8. *Acanthohoplites abichi* (ANTHULA, 1899), Kálvária Hill.
9. *Acanthohoplites andranomenensis* (BESAIRE, 1936), Kálvária Hill.
10. *Acanthohoplites andranomenensis* (BESAIRE, 1936), Kálvária Hill.
11. *Acanthohoplites andranomenensis* (BESAIRE, 1936), Kálvária Hill.
12. *Acanthohoplites aschiltaensis* (ANTHULA, 1899), Kálvária Hill.
13. *Acanthohoplites aschiltaensis* (ANTHULA, 1899), Fazekas street.
14. *Acanthohoplites aschiltaensis* (ANTHULA, 1899), Kálvária Hill.
15. *Acanthohoplites abichi* (ANTHULA, 1899), Kálvária Hill.
16. *Acanthohoplites aschiltaensis* (ANTHULA, 1899), Kálvária Hill.
17. *Acanthohoplites aschiltaensis* (ANTHULA, 1899), Kálvária Hill.
18. *Acanthohoplites aschiltaensis* (ANTHULA, 1899), Fazekas street.
19. *Acanthohoplites* sp., Eperkés Hill.
20. *Acanthohoplites aschiltaensis* (ANTHULA, 1899), Kálvária Hill.

All specimens are in natural size and from the condensed Late Aptian basal pockets of the Tata Limestone Formation. Exact locality is shown at each specimen.

1. *Acanthohoplites bigoureti* (SEUNES, 1887), Vájáriskola.
2. *Acanthohoplites* sp., Vájáriskola.
3. *Hypacanthoplites* sp., Kálvária Hill.
4. *Nolaniceras nolani* (SEUNES, 1887), Kálvária Hill.
5. *Acanthohoplites abichi* (ANTHULA, 1899), Kálvária Hill.
6. *Hypacanthoplites milletianus* (D'ORBIGNY, 1841), Kékkő Quarry.
7. *Acanthohoplites bigoureti* (SEUNES, 1887), Vájáriskola.
8. *Hypacanthoplites elegans* (FRITEL, 1906), Vájáriskola.
9. *Hypacanthohoplites acutecostum* (RIEDEL, 1938); Vájáriskola.
10. *Hypacanthoplites plesiotypicus* (FRITEL, 1906) = *H. jacobi* (COLLET, 1907), Fazekas street.
11. *Hypacanthoplites elegans* (FRITEL, 1906), Kálvária Hill.
12. *Hypacanthoplites elegans* (FRITEL, 1906), Vájáriskola.
13. *Hypacanthohoplites acutecostum* (RIEDEL, 1938); Vájáriskola.
14. *Hypacanthoplites* sp.
15. *Hypacanthohoplites acutecostum* (RIEDEL, 1938); Vájáriskola.
16. *Hypacanthoplites plesiotypicus* (FRITEL, 1906) = *H. jacobi* (COLLET, 1907), Fazekas street.
17. *Hypacanthoplites milletianus* (D'ORBIGNY, 1841), Fazekas street.
18. *Hypacanthoplites plesiotypicus* (FRITEL, 1906) = *H. jacobi* (COLLET, 1907), Kálvária Hill.
19. *Hypacanthoplites plesiotypicus* (FRITEL, 1906) = *H. jacobi* (COLLET, 1907), Fazekas street.
20. *Nolaniceras nolani* (SEUNES, 1887), Kálvária Hill.
21. *Nolaniceras nolani* (SEUNES, 1887), Kálvária Hill.
22. *Hypacanthoplites* sp., Kálvária Hill.
23. *Hypacanthoplites plesiotypicus* (FRITEL, 1906) = *H. Jacobi* (COLLET, 1907), Fazekas street.

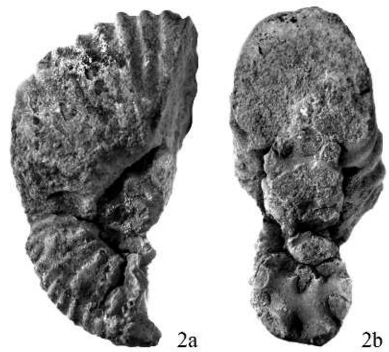
All specimens are in natural size and from the condensed Late Aptian basal pockets of the Tata Limestone Formation. Exact locality is shown at each specimen.



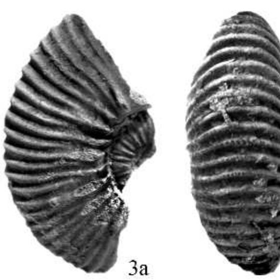
1. *Parahoplites melchioris* (ANTHULA, 1899); Kékkő Quarry.
2. *Parahoplites tenuicostatus* (SINZOW, 1907); Kálvária Hill.
3. *Parahoplites tenuicostatus* (SINZOW, 1907), Vájáriskola.
4. *Parahoplites melchioris* (ANTHULA, 1899), Kékkő Quarry.
5. *Parahoplites melchioris* (ANTHULA, 1899), Vájáriskola.
6. *Parahoplites tenuicostatus* (SINZOW, 1907), Kékkő Quarry.

All specimens are in natural size and from the condensed Late Aptian basal pockets of the Tata Limestone Formation. Exact locality is shown at each specimen.

1



2a 2b

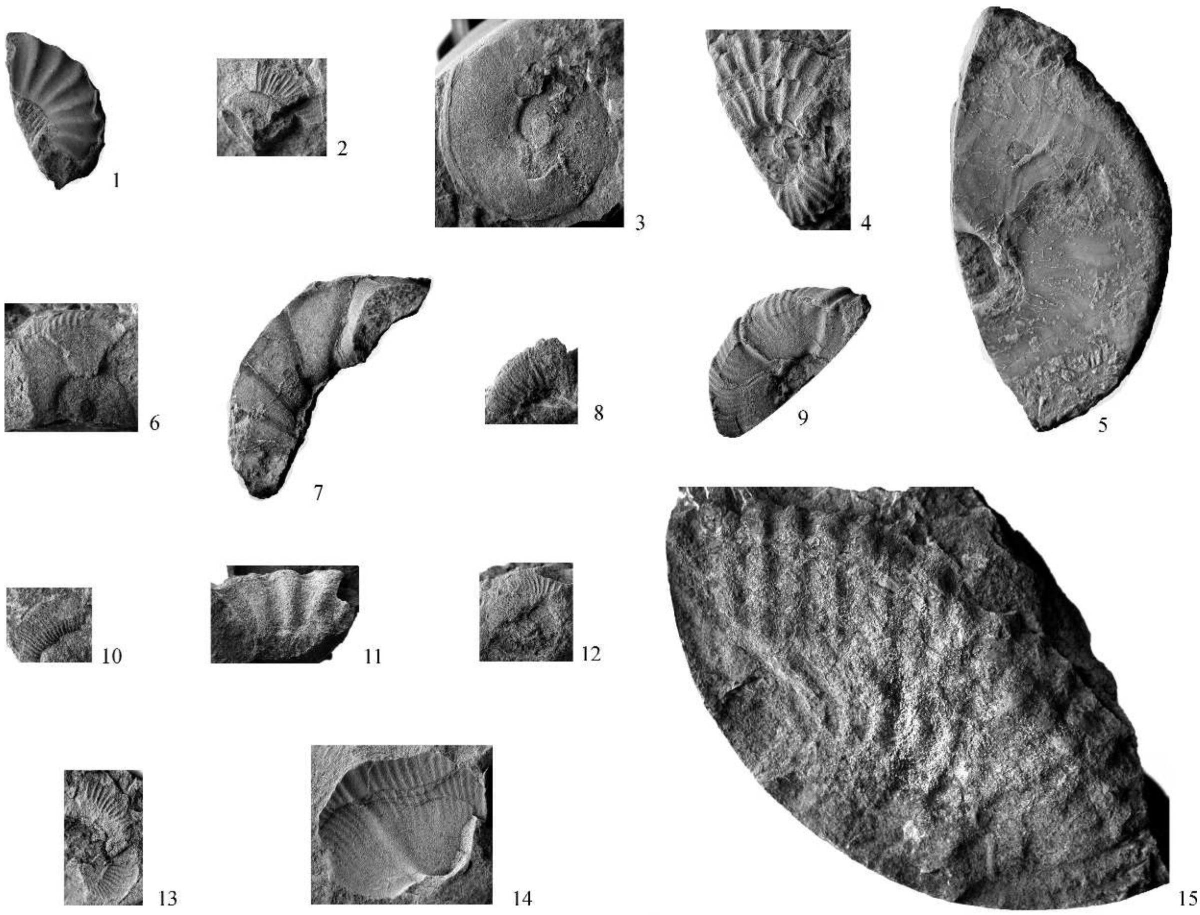


3a 3b

4

1. *Parahoplites robustus* (Sinzow, 1907); Kékkő Quarry.
2. *Parahoplites multicostatus* Sinzow, 1907; Kékkő Quarry.
3. *Parahoplites multicostatus* Sinzow, 1907; Kékkő Quarry.
4. *Parahoplites robustus* (Sinzow, 1907); Fazekas street.

All specimens are in natural size and from the condensed Late Aptian basal pockets of the Tata Limestone Formation. Exact locality is shown at each specimen.

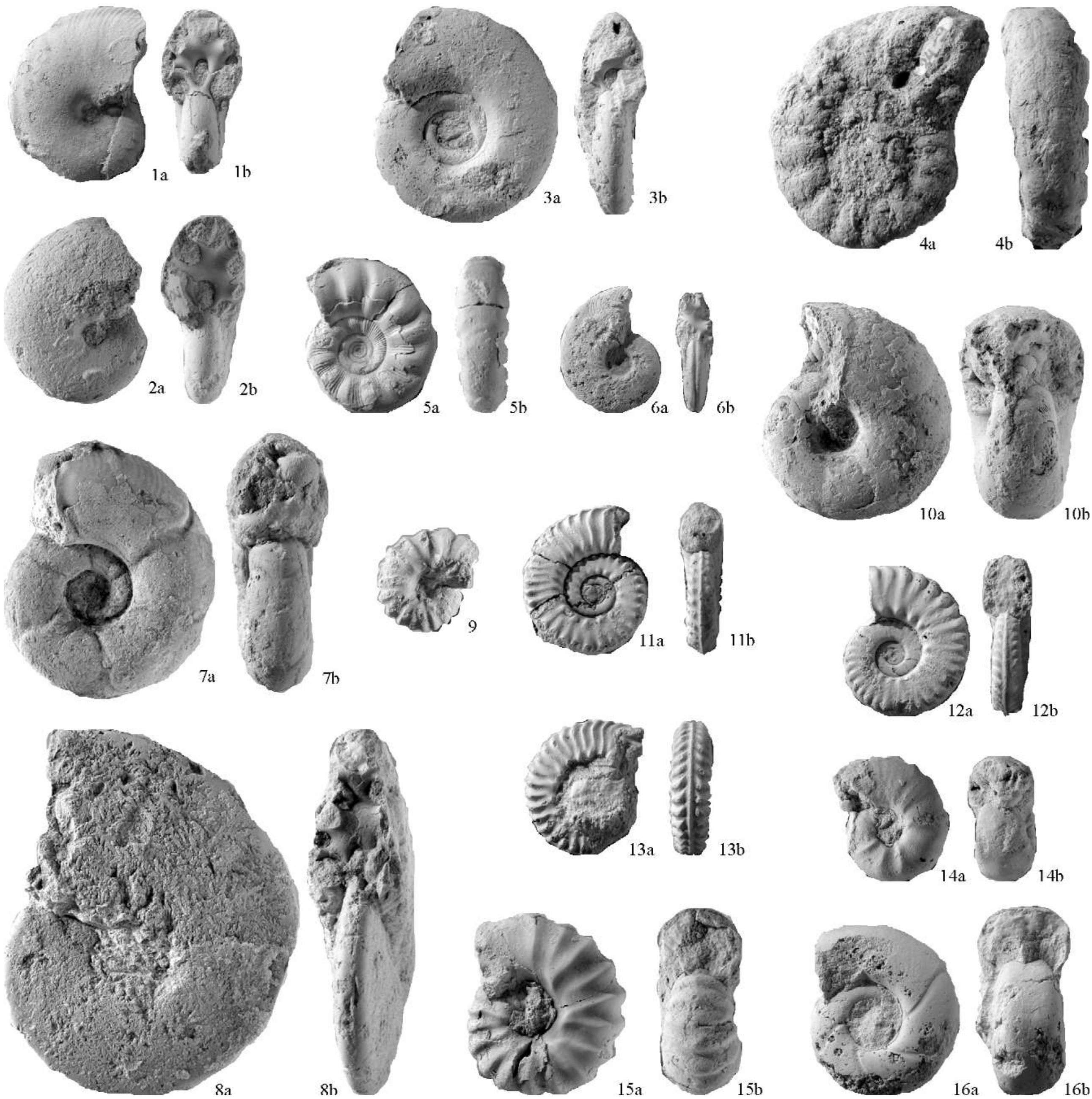


1. *Brancoceras senequeri* (D’ORBIGNY, 1841), Tatabánya Ta–1462, 210.8 m.
2. *Neosilesites nepos* (DOUVILLÉ, 1917), Tatabánya Ta-1462, 255.5 m.
3. ?*Melchiorites melchioris* (TIETZE, 1872), Tatabánya Ta–1462, 265.0 m.
4. ?*Hypacanthoplites* sp., Tatabánya Ta–1462, 260.0 m.
5. *Beudanticeras (Beudanticeras) convergens* (JACOB, 1908), Tatabánya Ta–1462, 299.2–319.0 m.
6. *Parasilesites kilianiformis* (FALLOT, 1910), Tatabánya Ta–1462, 223.2 m.
7. *Tetragonites (Tetragonites) duvalianus* (D’ORBIGNY, 1840), Tatabánya Ta–1462, 221.3 m.
8. *Nolaniceras nolani* (SEUNES, 1887), Tatabánya Ta–1462, 277.8 m.

All specimens are in natural size. Depth is given by each specimen.

9. *Puzosia (Puzosia) mayoriana* (D’ORBIGNY, 1841), Tatabánya Ta–1462, 213.0 m.
10. *Neosilesites nepos* (DOUVILLÉ, 1917), Tatabánya Ta–1462, 265 m.
11. *Cheloniceras (Paracheloniceras) rerati* COLLIGNON, 1962, Tatabánya Ta–1462, 330.5 m.
12. *Neosilesites nepos* (DOUVILLÉ, 1917), Tatabánya Ta–1462, 253.0 m.
13. *Neosilesites nepos* (DOUVILLÉ, 1917), Tatabánya Ta–1462, 258.0 m.
14. *Holcophylloceras guettardi* (RASPAIL, 1831), Tatabánya Ta–1462, 230.0 m.
15. *Parahoplites robustus* (SINZOW, 1907); Tatabánya Ta–1462, 277.8 m.

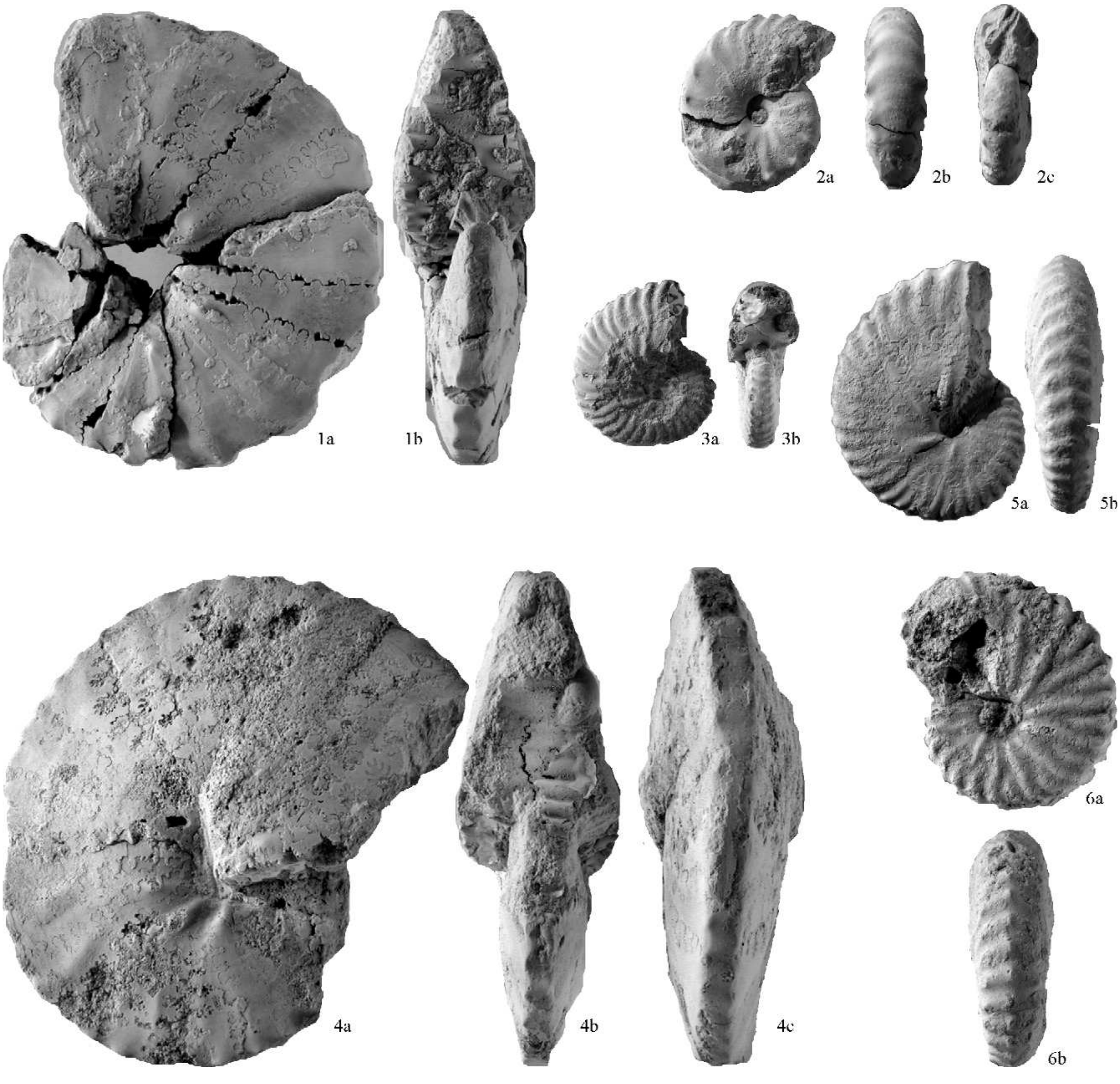
PLATE XIV



EZPC, Tilos Forest.

1. *Phylloceras seresitense* PERVINQUIÉRE, 1907. 114–2.
2. *Phylloceras seresitense* PERVINQUIÉRE, 1907. 7.
3. *Zelandites dozei* (FALLOT, 1885), 114–2.
4. *Kossmatella* cf. *muhlenbecki* (FALLOT, 1885).
5. *Kossmatella romana* WIEDMANN, 1962; 10. 114–2.
6. *Discohoplites coelonotus* (SEELEY, 1865); 1. 24–89.
7. *Puzosia (Puzosia) mayoriana* (D'ORBIGNY, 1841); 1. 19.
8. *Beudanticeras (Beudanticeras) beudanti* (BRONGNIART, 1822).
9. *Salaziceras (Salaziceras) salazacense salazacense* (HÉBERT & MUNIER-CHALMAS, 1875).
10. *Desmoceras (Desmoceras) latidorsatum* (MICHELIN, 1838), 1. 12.
11. *Cantabrigites cantabrigense* SPATH, 1933. 24–7.
12. *Hysteroceras binum* (J. SOWERBY, 1815); 3. 24–90.
13. *Cantabrigites cantabrigense* SPATH, 1933; 4. 24–91.
14. *Zuluscaphites helveticus* KENNEDY & DELAMETTE, 1994; 2. 4384.
15. *Salaziceras (Salaziceras) salazacense salazacense* (HÉBERT & MUNIER-CHALMAS, 1875).
16. *Tetragonites (Tetragonites) timotheanus* (PICTET, 1847), 114–1.

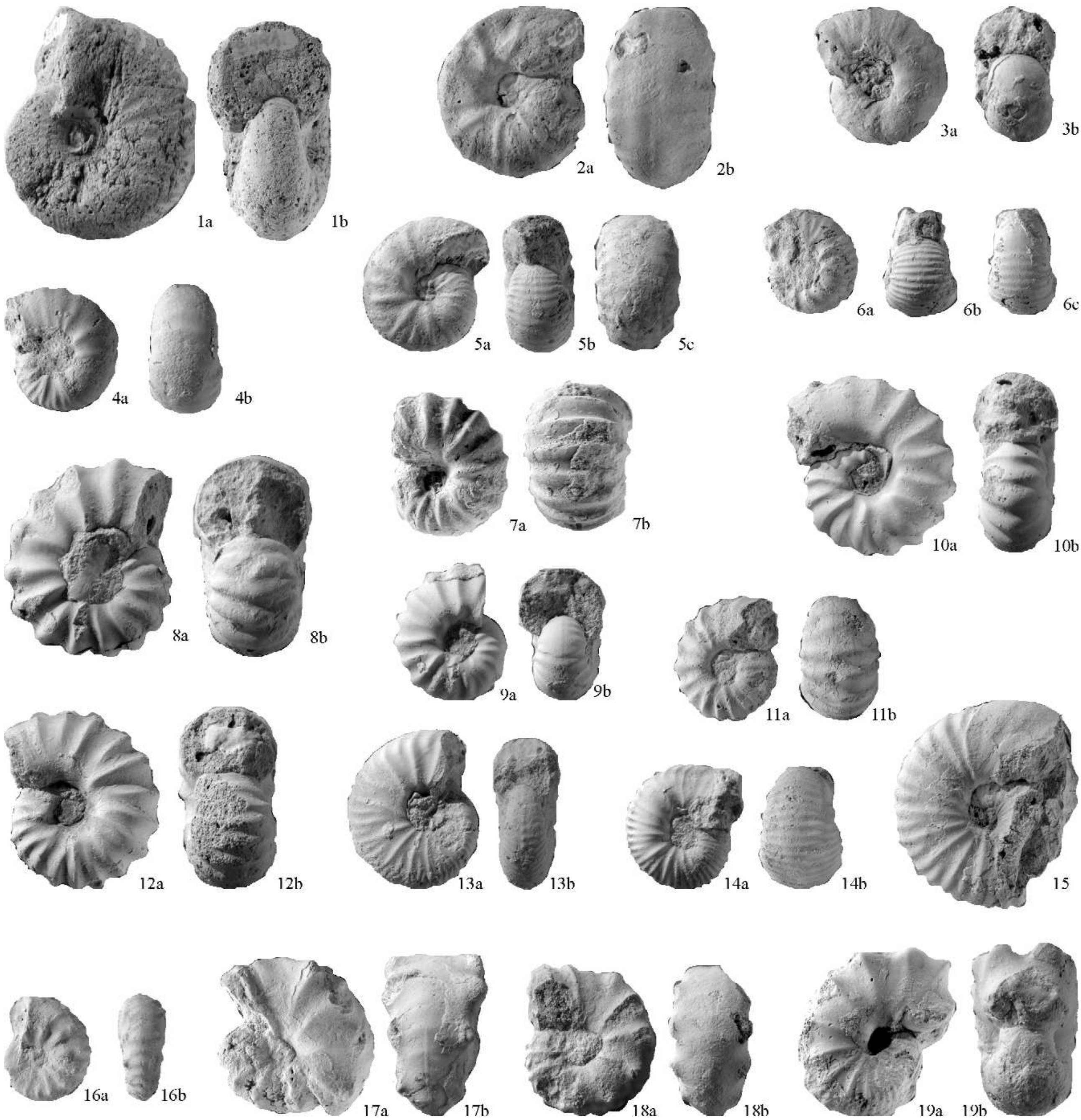
All figures are in natural size and from the basal pockets of the Late Albian Pénzeskút Marl Formation, Hungary. Numbers follow the original designation of the collector.



EZPC, Tilos Forest.

1. *Engonoceras duboisi*, LATIL, 1989; 3. 5444.
2. *?Metascaphites kashaii* sp. nov. Holotype, HNHM repository no. 2007.70.1, Original no. the collector is 5435.
3. *Stoliczkaia (Stoliczkaia) tenuis* RENZ, 1968. 1.3.
4. *Engonoceras duboisi* LATIL, 1989; 4. 5445.
5. *Neophlycticeras (N.) blancheti* (PICTET & CAMPICHE, 1859), 80.24–97.
6. *Neophlycticeras (N.) blancheti* (PICTET & CAMPICHE, 1859).

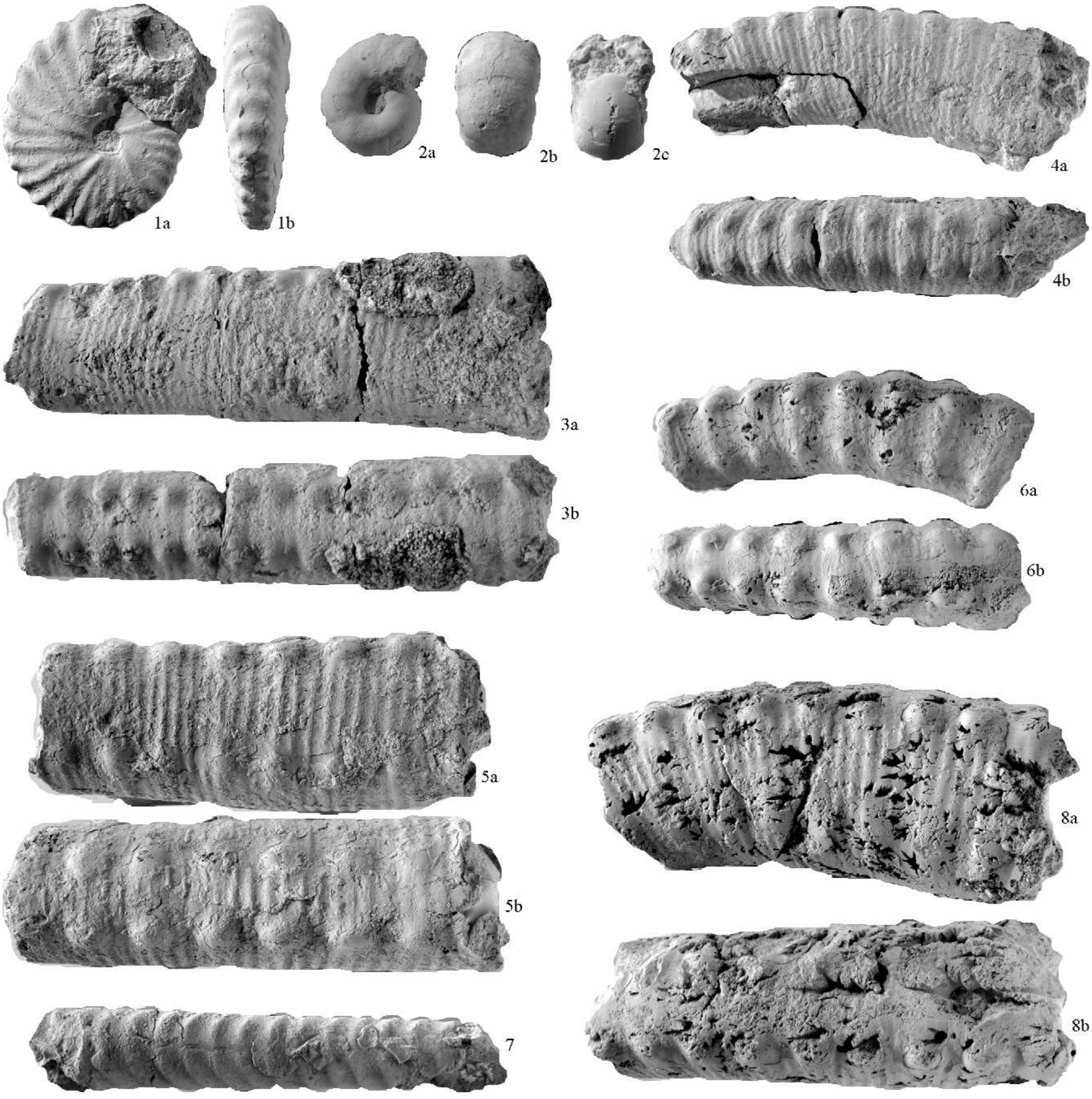
All figures are in natural size and from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Hungary. Numbers follow the original designation of the collector, the repository number is given for Figure 2.



EZPC, Tilos Forest.

1. *Zuluscaphites helveticus* KENNEDY & DELAMETTE, 1994. 1.5441.
2. *Zuluscaphites helveticus* KENNEDY & DELAMETTE, 1994. 32.24–5437.
3. *Ficheuria kiliani* PERVINQUIÉRE, 1910, 4383.
4. *Zuluscaphites orycteropusi* VAN HOEPEN, 1955; 30.24–7.
5. *Zuluscaphites orycteropusi* VAN HOEPEN, 1955; 3.5436.
6. *Zuluscaphites orycteropusi* VAN HOEPEN, 1955; 14.114–7.
7. *Salaziceras (Salaziceras) salazacense salazacense* (HÉBERT & MUNIER-CHALMAS, 1875). 1. 17.
8. *Salaziceras (Salaziceras) salazacense salazacense* (HÉBERT & MUNIER-CHALMAS, 1875). 7.5439.
9. *Salaziceras (Salaziceras) salazacense salazacense* (HÉBERT & MUNIER-CHALMAS, 1875). 13.24–88.
10. *Salaziceras (Salaziceras) salazacense salazacense* (HÉBERT & MUNIER-CHALMAS, 1875). 12. 24–56.
11. *Salaziceras (Salaziceras) salazacense salazacense* (HÉBERT & MUNIER-CHALMAS, 1875). 10.24–256.
12. *Salaziceras (Salaziceras) salazacense salazacense* (HÉBERT & MUNIER-CHALMAS, 1875). 10.
13. *Zuluscaphites orycteropusi* VAN HOEPEN, 1955; 2.5432.
14. *Zuluscaphites orycteropusi* VAN HOEPEN, 1955; 31.4370.
15. *Zuluscaphites orycteropusi* VAN HOEPEN, 1955; 9. 5440.
16. *Metascaphites thomasi* PERVINQUIÉRE, 1907; 32. 114–5434.
17. *?Metascaphites scholzi* sp. nov. 6.24–5431.
18. *?Metascaphites scholzi* sp. nov. Holotype, HNHM repository no. 2007.69.1. Original no. the collector is 5.5433.
19. *Salaziceras (Noskytes) bakonyense* SCHOLZ, 1979. 8.5430.

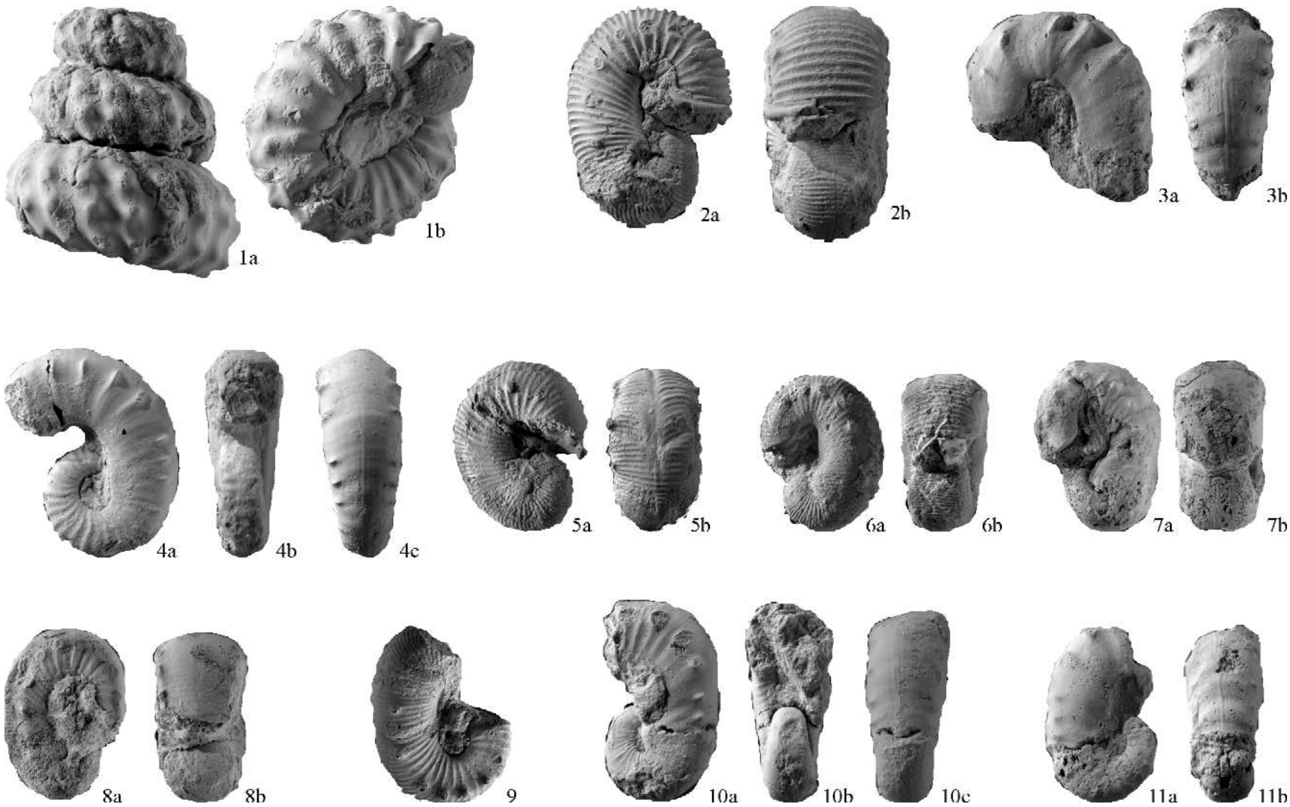
All figures are in natural size and from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Hungary from Tilos Forest locality. All specimens from the Evanics Collection, numbers follow the original designation of the collector.



EZPC, Tilos Forest.

1. *Stoliczkaia (Stoliczkaia) dispar* (D'ORBIGNY, 1841).
2. *Ficheuria kiliani* PERVINQUIÉRE, 1910, 4390.
3. *Anisoceras pseudo-elegans* PICTET & CAMPICHE (1861), 35.1267.
4. *Anisoceras pseudo-elegans* PICTET & CAMPICHE (1861), 36.114–2.
5. *Anisoceras pseudo-elegans* PICTET & CAMPICHE (1861), 33.114–97.
6. *Anisoceras pseudo-elegans* PICTET & CAMPICHE (1861), 34.114–1.
7. *Lechites (Lechites) gaudini* (PICTET & CAMPICHE, 1861), 44.
8. *Anisoceras pseudo-elegans* PICTET & CAMPICHE, (1861).

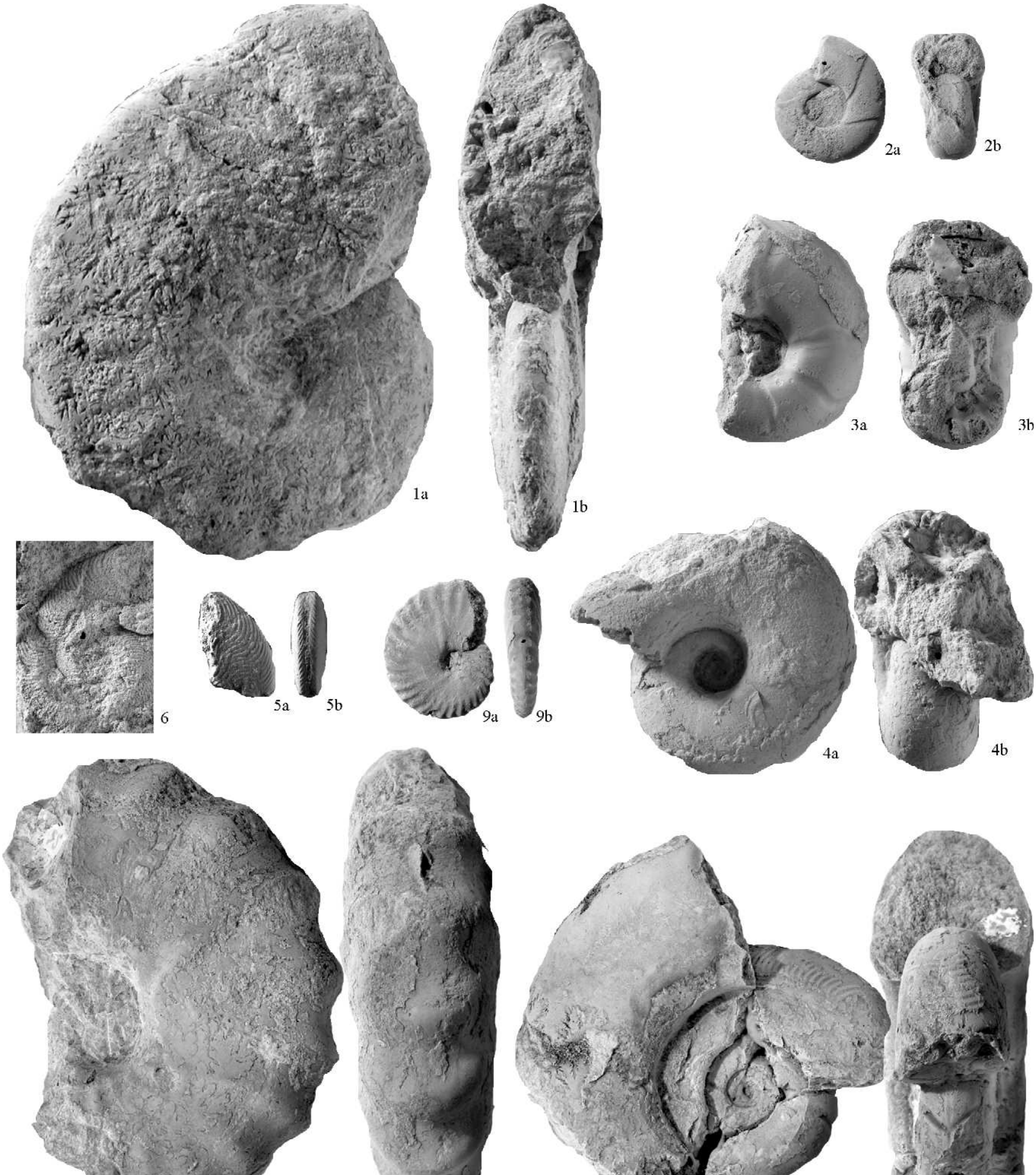
All figures are in natural size and from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Hungary. Numbers follow the original designation of the collector.



EZPC, Tilos Forest.

1. *Mariella (Mariella) bergeri* (BRONGNIART, 1822). 1.2.
2. *Scaphites (Scaphites) hugardianus* (D'ORBIGNY, 1842).
3. *Scaphites (Scaphites) evanicsi* sp. nov. 10.5448.
4. *Scaphites (Scaphites) evanicsi*, sp. nov. 24–96.
5. *Scaphites (Scaphites) hugardianus* (D'ORBIGNY, 1842).
6. *Scaphites (Scaphites) hugardianus* (D'ORBIGNY, 1842).
7. *Scaphites (Scaphites) hugardianus* (D'ORBIGNY, 1842).
8. *Scaphites (Scaphites) hugardianus* (D'ORBIGNY, 1842).
9. *Scaphites (Scaphites) hugardianus* (D'ORBIGNY, 1842).
10. *Scaphites (Scaphites) evanicsi* sp. nov.
11. *Scaphites (Scaphites) evanicsi* sp. nov.

All figures are in natural size and from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Hungary. Numbers follow the original designation of the collector.



Tilos Forest, collection of HNHM.

1. *Beudanticeras (Beudanticeras) beudanti* (Brongniart, 1822), 5.3; HNHM repository no. 2007.44.1. 0.85×.
2. *Tetragonites (Tetragonites) timotheanus* (Pictet, 1847).
3. *Desmoceras (Desmoceras) latidorsatum* (Michelin, 1838), 1.2. HNHM repository no. 2007.35.1.
4. *Desmoceras (Desmoceras) latidorsatum* (Michelin, 1838), 1.50; HNHM repository no. 2007.42.1.
5. *Discohoplites coelonotus* (Seeley, 1865), 5.16.
6. *Discohoplites coelonotus* (Seeley, 1865), 5.11; HNHM repository no. 2007.54.1.
7. *Stoliczkaia (Stoliczkaia) notha* (Seeley, 1865); HNHM repository no. 2007.80.1.
8. *Puzosia (Puzosia) mayoriana* (d'Orbigny, 1841); HNHM repository no. 2007.83.1.
9. *Stoliczkaia (Lamnayella) worthense* (Adkins, 1920); HNHM repository no. 2007.84.1.

All figures are in natural size and from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary.

PLATE XX

Tilos Forest, collection of HNHM.

1. *Stoliczkaia (Stoliczkaia) clavigera* (NEUMAYR, 1875); 1.13. HNHM repository no. 2007.37.1.
2. *Stoliczkaia (Stoliczkaia) tenuis* RENZ, 1968. HNHM repository no. 2007.72.1.
3. *Neophlycticeras blancheti* (PICTET & CAMPICHE, 1859). 1.3. HNHM repository no. 2007.66.1.
4. *Stoliczkaia (Stoliczkaia) notha* (SEELEY, 1865), 1.35. HNHM repository no. 2007.40.1.
5. *Stoliczkaia (Stoliczkaia) dispar* (D'ORBIGNY, 1841), 1.34. HNHM repository no. 2007.60.1.
6. *Salaziceras (Salaziceras) salazacense salazacense* (HÉBERT & MUNIER-CHALMAS, 1875). 1.16.
7. *Zuluscaphites helveticus* KENNEDY & DELAMETTE, 1994; 1.17. HNHM repository no. 2007.72.1.
8. *Salaziceras (Salaziceras) salazacense salazacense* (HÉBERT & MUNIER-CHALMAS, 1875). HNHM repository no. 2007.78.1.
9. *Salaziceras (Salaziceras) salazacense salazacense* (HÉBERT & MUNIER-CHALMAS, 1875). HNHM repository no. 2007.74.1.
10. *Neophlycticeras (N.) blancheti* (PICTET & CAMPICHE, 1859). HNHM repository no. 2007.49.1.

All figures are in natural size and from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary.

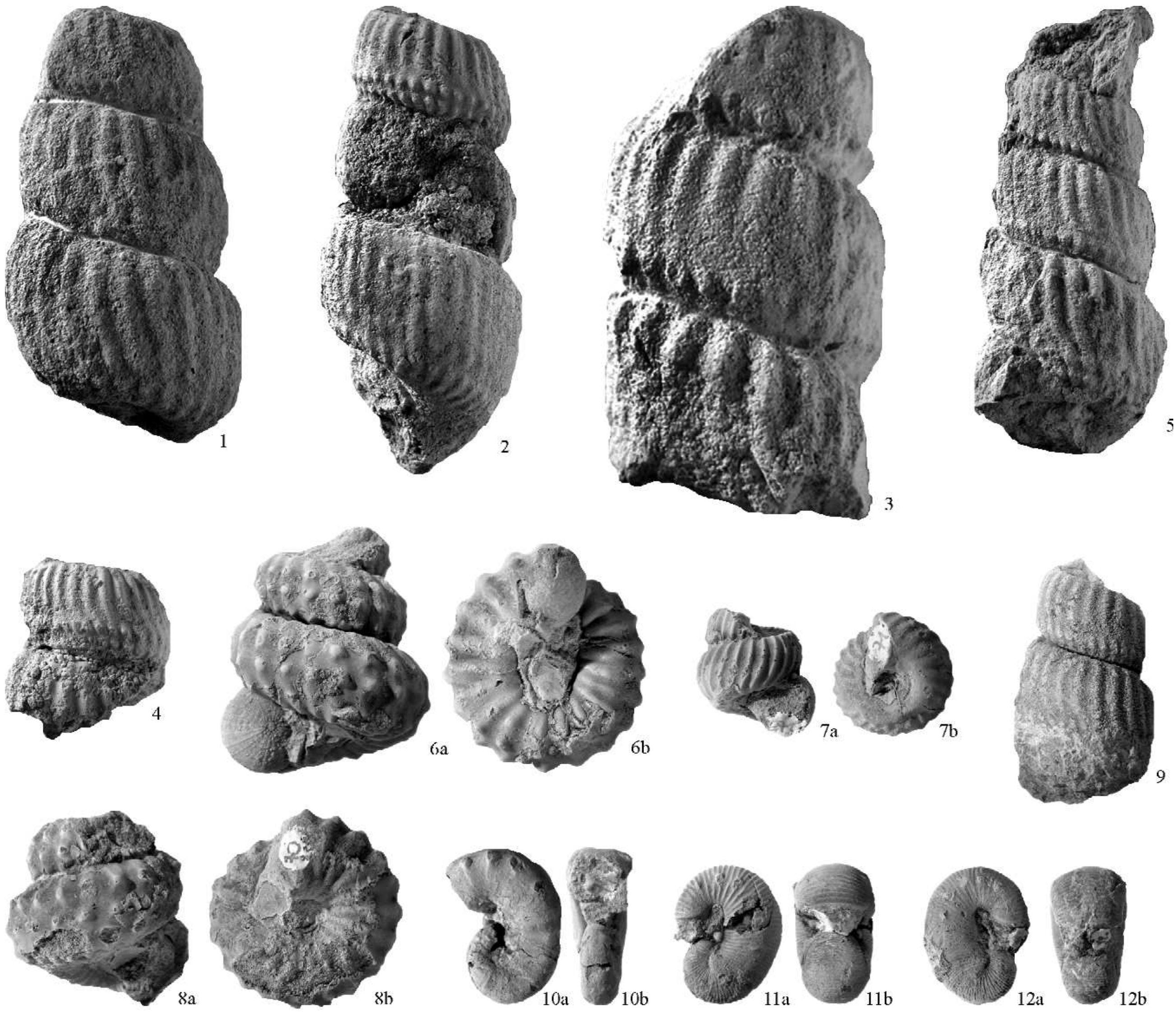
1. *Beudanticeras (Beudanticeras) beudanti* (BRONGNIART, 1822), 1.48. The specimen is from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.43.1. 0.8×.
2. *Stoliczkaia (Stoliczkaia) dispar* (D'ORBIGNY, 1841), 1.51. The specimen is from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.58.1.
3. *Stoliczkaia (Stoliczkaia) dispar* (D'ORBIGNY, 1841), 7.10. From the seventh bed above the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.67.1.
4. *Cantabrigites cantabrigense* SPATH, 1933, 1.80. The specimen is from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.65.1.
5. *Hysteroceras binum* (J. SOWERBY, 1815), 1.58. The specimen is from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.63.1.
6. *Discohoplites coelonotus* (SEELEY, 1865), 8.1. From the eighth bed above the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.33.1.

All figures are in natural size. Repository numbers of HNHM are given at each specimen figured here.

PLATE XXII

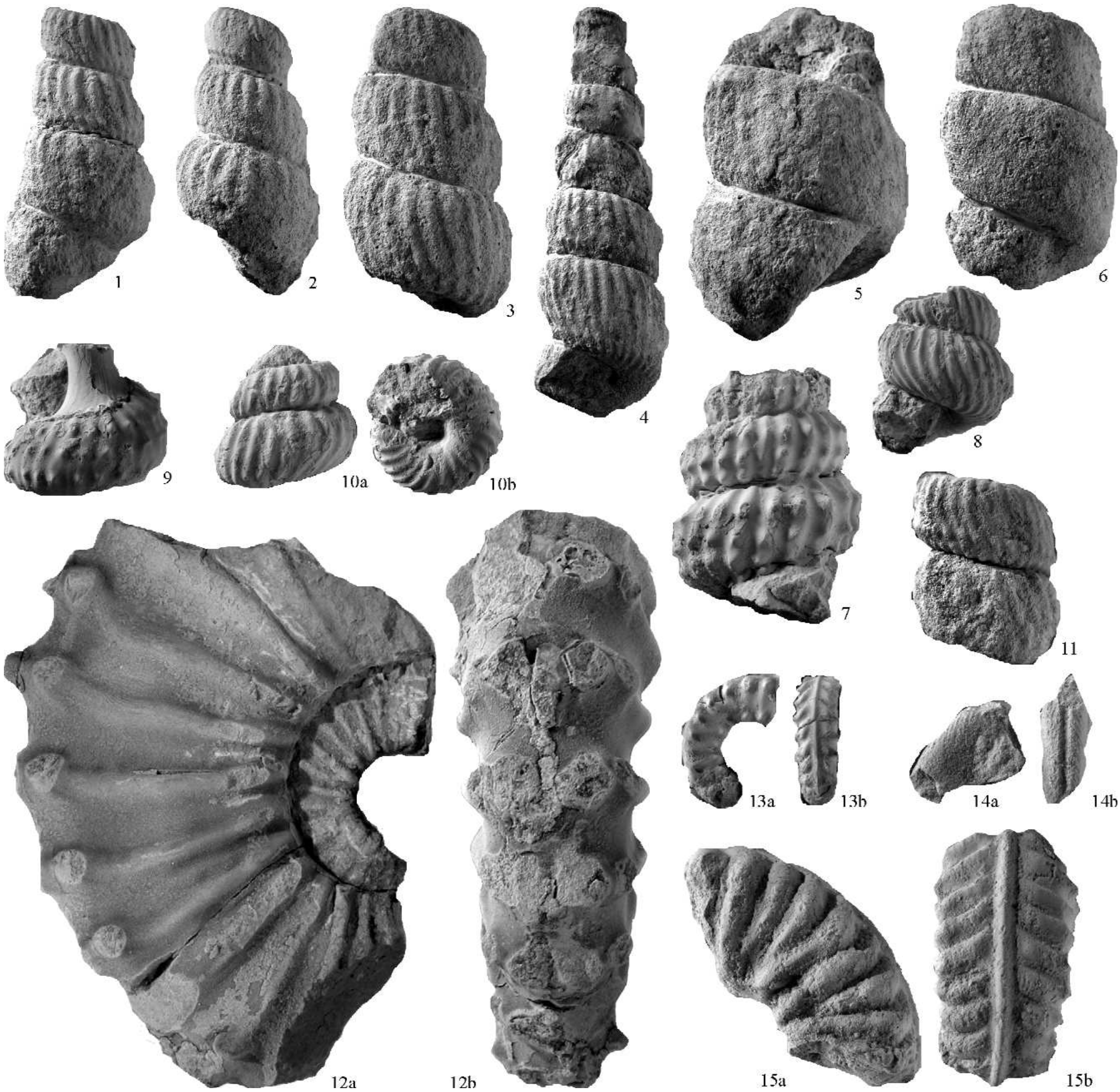
1. *Anisoceras armatum* (J. SOWERBY, 1817), 1.4. The specimen is from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.55.1.
2. *Anisoceras armatum* (J. SOWERBY, 1817), 1.33. The specimen is from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. 2×. HNHM repository no. 2007.31.1.
3. *Lechites (Lechites) communis* SPATH, 1941; 1.81. The specimen is from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary.
4. *Lechites (Lechites) communis* SPATH, 1941; 8.10. From the eighth bed above the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary.
5. *Lechites (Lechites) gaudini* (PICTET & CAMPICHE, 1861), 0.82. From the Top of the Late Albian Zirc Limestone Formation, the bed just below the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.47.1.
6. *Lechites (Lechites) gaudini* (PICTET & CAMPICHE, 1861), The specimen is from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary.
7. *Lechites (Lechites) moreti* (BREISTROFFER, 1936); 1.82. The specimen is from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary.
8. *Lechites (Lechites) moreti* (BREISTROFFER, 1936); 1.73. The specimen is from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.45.1.
9. *Lechites (Lechites) communis* SPATH, 1941; The specimen is from the condensed basal pockets of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.48.1.

All figures are in natural size apart from Figure 2, which is 2× enlarged. Repository numbers of HNHM are given at each specimen figured here.



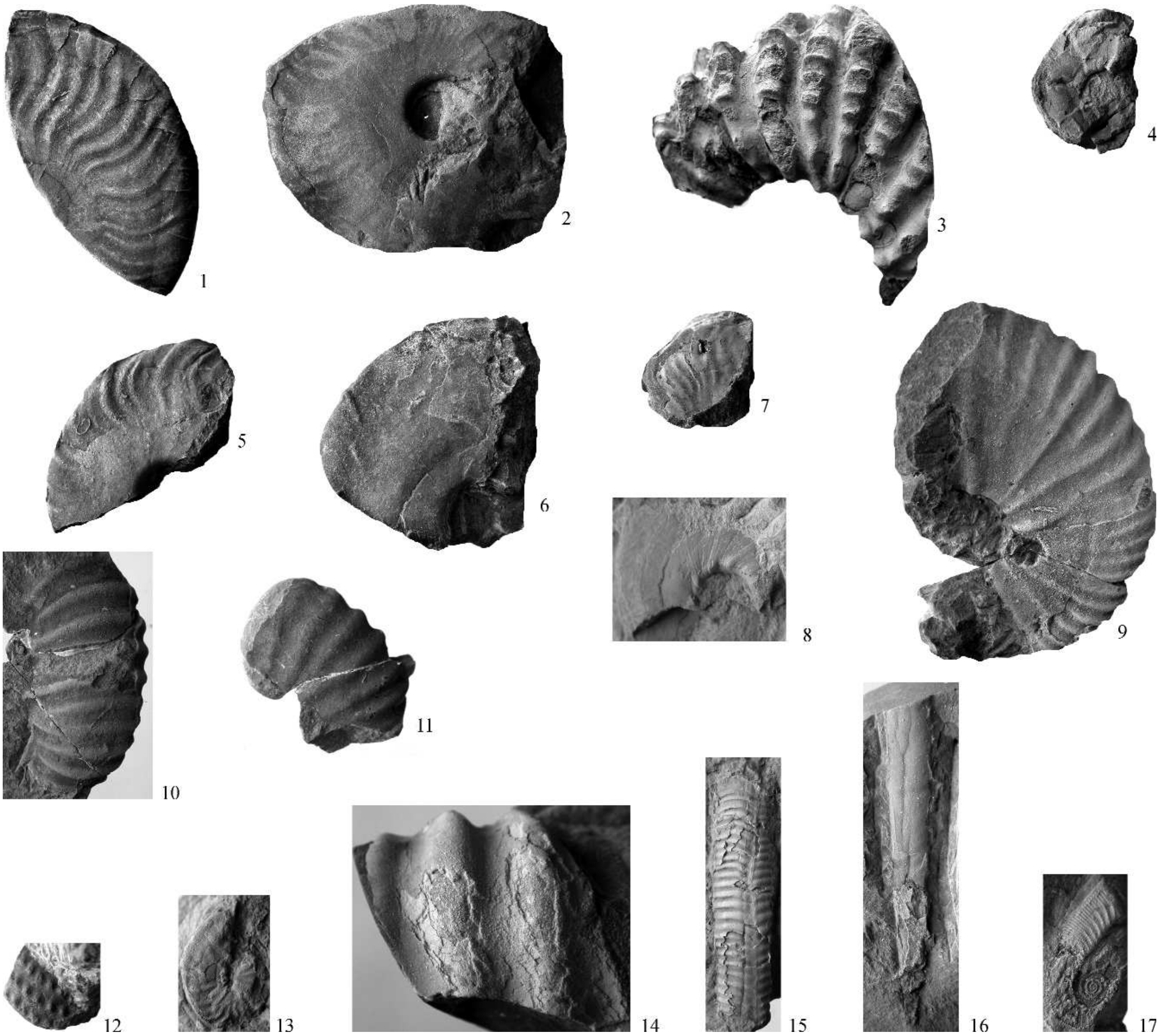
1. *Ostlingoceras puzosianum* (d'Orbigny, 1842), 5.1. From the fifth bed above the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.50.1. 0.5×.
2. *Ostlingoceras puzosianum* (d'Orbigny, 1842), 5.15. From the fifth bed above the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.51.1. 0.5×.
3. *Ostlingoceras puzosianum* (d'Orbigny, 1842), 5.10. From the fifth bed above the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.46.1.
4. *Ostlingoceras puzosianum* (d'Orbigny, 1842), 5.12. From the fifth bed above the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.52.1.
5. *Ostlingoceras puzosianum* (d'Orbigny, 1842), 3.10. From the third bed above the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. 53.1.
6. *Mariella (Mariella) bergeri* (Brongniart, 1822), HNHM repository no. 2007.75.1.
7. *Turrilitoides hugardianus* (d'Orbigny, 1842b), HNHM repository no. 2007.79.1.
8. *Mariella (Mariella) bergeri* (Brongniart, 1822), HNHM repository no. 2007.76.1.
9. *Ostlingoceras puzosianum* (d'Orbigny, 1842), HNHM repository no. 2007.77.1.
10. *Scaphites (Scaphites) evanicsi* sp. nov. Holotype. HNHM repository no. 2007.71.1.
11. *Scaphites (Scaphites) hugardianus* (d'Orbigny, 1842). HNHM repository no. 2007.59.1.
12. *Scaphites (Scaphites) hugardianus* (d'Orbigny, 1842).

All figures are in natural size.



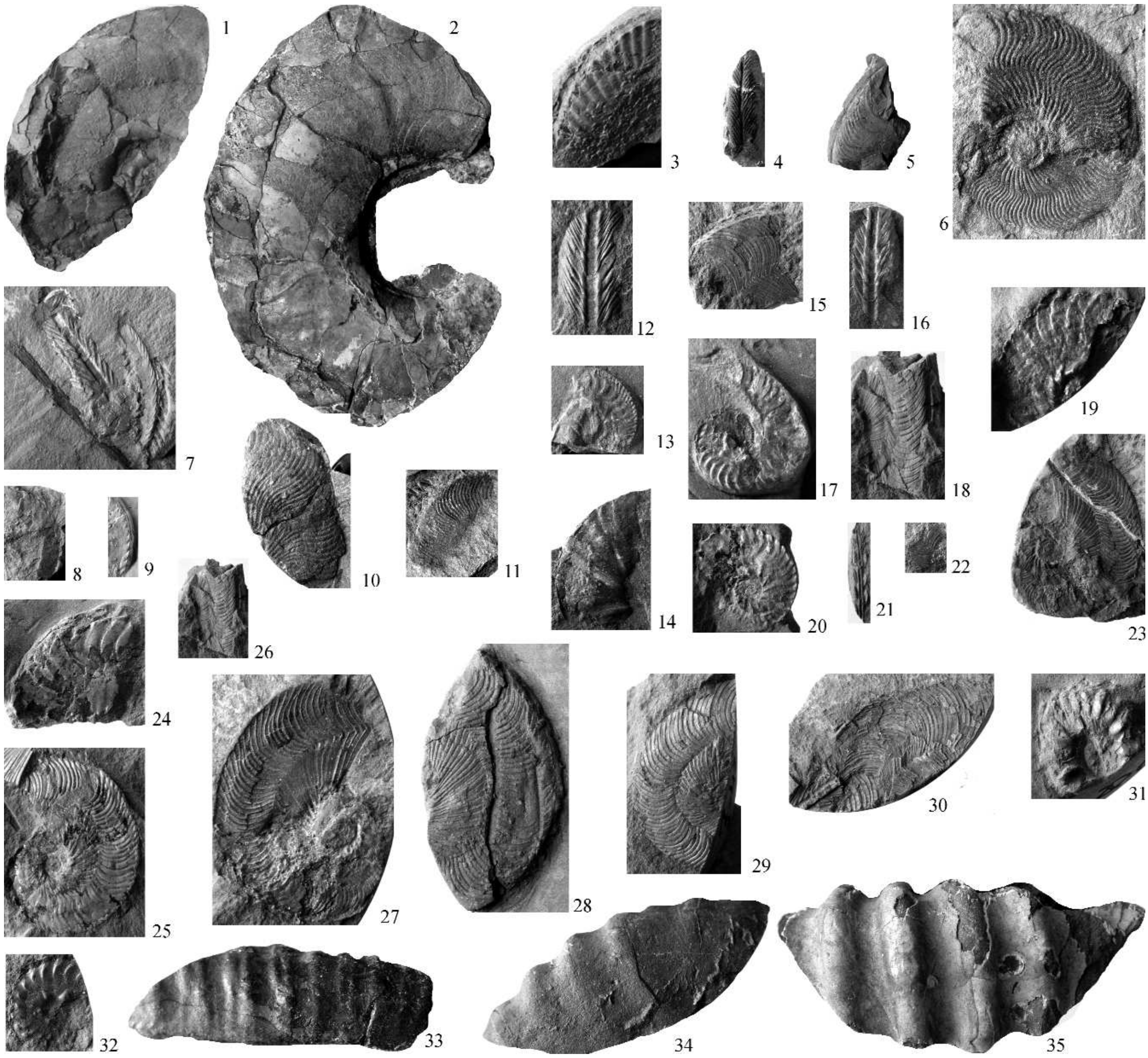
1. *Ostlingoceras puzosianum* (D'ORBIGNY, 1842), 5.14. From the fifth bed above the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.57.1. 0.8×.
2. *Ostlingoceras puzosianum* (D'ORBIGNY, 1842), 5.13. From the fifth bed above the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.34.1. 0.8×.
3. *Ostlingoceras puzosianum* (D'ORBIGNY, 1842), 5.1. From the fifth bed above the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. 0.8×.
4. *Ostlingoceras puzosianum* (D'ORBIGNY, 1842), 3.13. From the third bed above the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.56.1. 0.8×.
5. *Ostlingoceras puzosianum* (D'ORBIGNY, 1842), 2.11. From the second bed above the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.36.1. 0.8×.
6. *Ostlingoceras puzosianum* (D'ORBIGNY, 1842), 2.10. From the second bed above the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.38.1.
7. *Mariella (Mariella) bergeri* (BRONGNIART, 1822), 1.25. HNHM repository no. 2007.62.1.
8. *Turrilitoides hugardianus* (D'ORBIGNY, 1842), 1.69. HNHM repository no. 2007.64.1.
9. *Mariella (Mariella) bergeri* (BRONGNIART, 1822), 1.63. HNHM repository no. 2007.61.1.
10. *Turrilitoides hugardianus* (D'ORBIGNY, 1842b), 1.10. HNHM repository no. 2007.32.1.
11. *Ostlingoceras puzosianum* (D'ORBIGNY, 1842), 6.10. From the sixth bed above the condensed, glauconitic basal beds of the Late Albian Pénzeskút Marl Formation, Tilos Forest, Hungary. HNHM repository no. 2007.41.1.
12. *Graysonites horvathi* n. sp. holotype, Jásd 1 quarry, bed. no. 212. HNHM repository no. 2007.68.1.
13. *Hysteroceras binum* (J. SOWERBY, 1815); 30, Jásd 1 quarry bed. no. 14.
14. *Discohoplites coelonotus* (SEELEY, 1865), Jásd 1 quarry, bed no. 7.
15. *Mortoniceras (Mortoniceras)* cf. *inflatum* (J. SOWERBY, 1817), Bakonynána Zsidó Hill, bed no. 16., specimen no. 100. HNHM repository no. 2007.81.1.

All figures are in natural size. Repository numbers of HNHM are given at each specimen figured here.



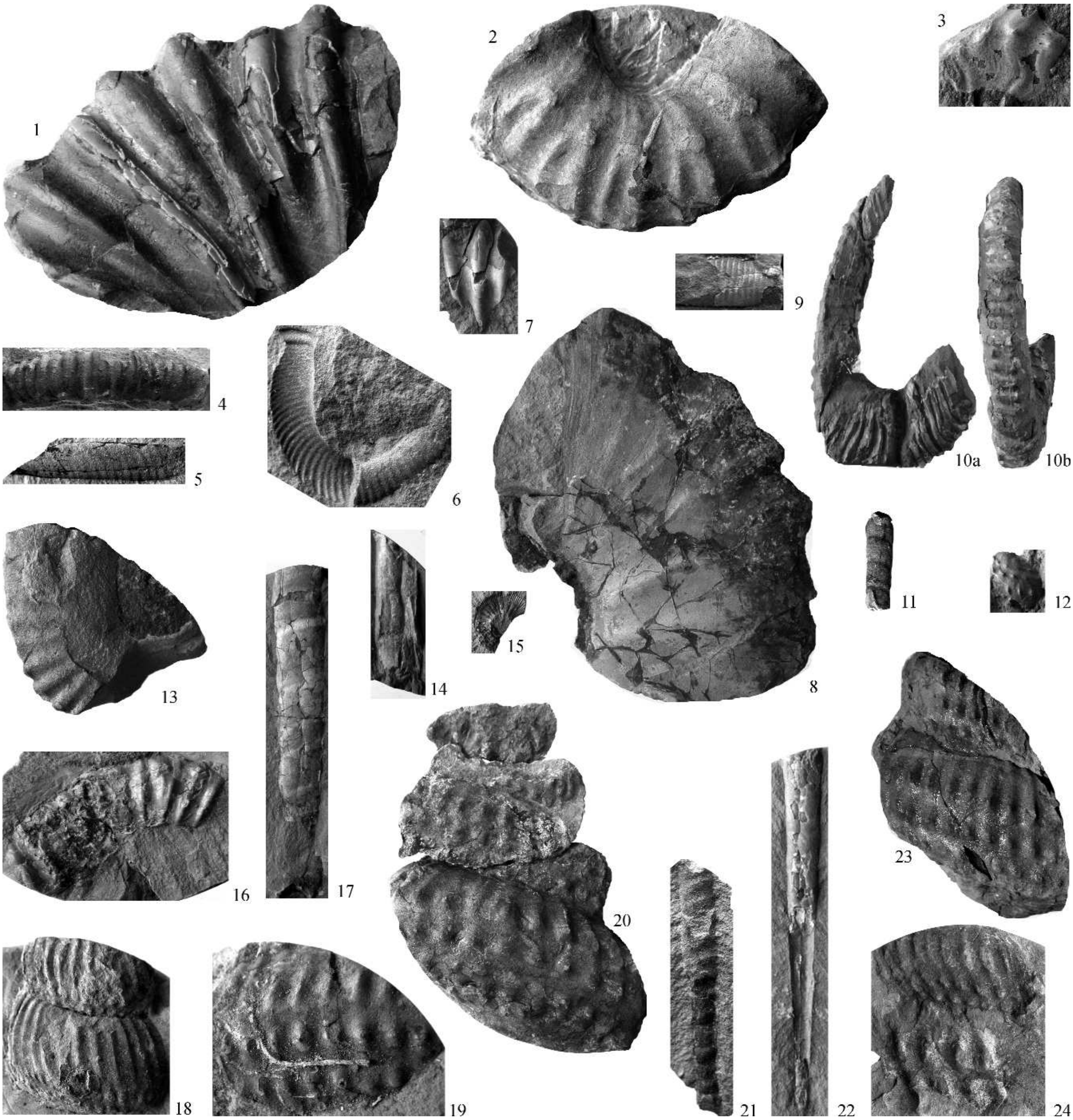
1. *Cleoniceras* cf. *cleon* (D'ORBIGNY, 1850), Tatabánya Ta–1383, 230.0–256.5 m.
2. *Beudanticeras (Beudanticeras) beudanti* (BRONGNIART, 1822), Tatabánya Ta–1383, 230.0–256.5 m.
3. *Douvilleiceras mammillatum* (SCHLOTHEIM, 1813), Oroszlány O–1881, 338.4 m.
4. *Parasilesites kilianiformis* (FALLOT, 1910), Ta–1423, 292.4 m.
5. *Beudanticeras (Beudanticeras) dupinianum* (D'ORBIGNY, 1841), Oroszlány O–1881, 295.5 m.
6. *Beudanticeras (Beudanticeras) beudanti* (BRONGNIART, 1822), Oroszlány O–1881, 295.5 m.
7. *Cleoniceras* cf. *cleon* (D'ORBIGNY, 1850), Oroszlány O–1881, 321.4 m.
8. *Hyphoplites campichei* SPATH, 1925; Jásd J–36, 16.9 m.
9. *Stoliczkaia (Stoliczkaia) dispar* (D'ORBIGNY, 1841); Jásd J–36, 224.7–227.4 m.
10. *Stoliczkaia* sp., Jásd J–36, 198.2–201.2 m.
11. *Stoliczkaia* sp., Jásd J–36, 224.7–227.2 m.
12. *Paraturrilites* sp.; Jásd J–36, 198.2 m.
13. Ammonite sp., Jásd J–36, 15.2 m.
14. ?*Mantelliceras* sp., Jásd J–36, 152.7–157.2 m.
15. *Stomohamites subvirgulatus* (SPATH, 1941); Jásd J–36, 22.1–25.2 m.
16. *Lechites (Lechites) gaudini* (PICTET & CAMPICHE, 1861); Jásd J–36, 146.9 m.
17. *Yezoites subevolutus* (BÖSE, 1928), Jásd J–36, 207.7 m.

All figures are in natural size. All specimens are from the collection of the GMH, repository numbers of GMH are not given.



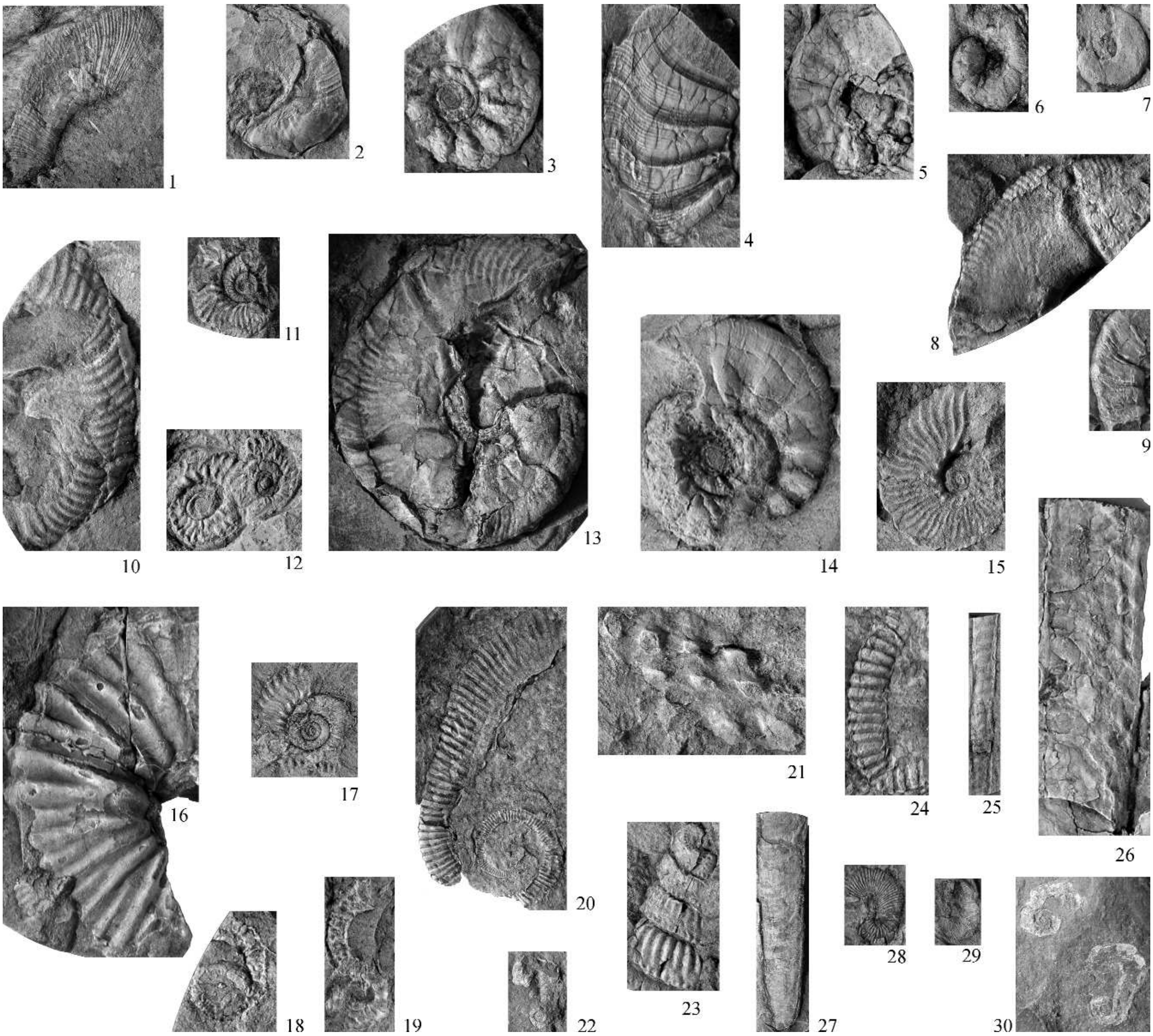
1. *Desmoceras (Desmoceras) latidorsatum* (Michelin, 1838); Jásd J-42, 175.5 m.
2. *Desmoceras (Desmoceras) latidorsatum* (Michelin, 1838); Jásd J-42, 321.4 m.
3. *?Anahoplites picteti* Spath, 1925; Jásd J-42, 176.7 m. K13832.
4. *Discohoplites* sp., Jásd J-42, 418,5 m.
5. *Discohoplites coelonotus* (Seeley, 1865), Jásd J-42, 157.2 m.
6. *Discohoplites coelonotus* (Seeley, 1865), Jásd J-42, 424.7 m. K13835.
7. *Discohoplites* sp., Jásd J-42, 428.8 m.
8. *Hyphoplites* sp.; Jásd J-42, 418.5 m.
9. *Hyphoplites* sp.; Jásd J-42, 158.3 m.
10. *Discohoplites coelonotus* (Seeley, 1865); Jásd J-42, 159.2 m.
11. *Discohoplites coelonotus* (Seeley, 1865); Jásd J-42, 411.5 m.
12. *Discohoplites* sp., Jásd J-42, 428.6 m.
13. *Discohoplites* sp. juv., Jásd J-42, 210.4 m.
14. *Kossmatella* (?) sp., Jásd J-42, 218.7 m.
15. *Hyphoplites costosus* Wright & Wright, 1949, Jásd J-42, 205.9 m.
16. *Discohoplites* sp., Jásd J-42, 205.5 m.
17. ?*Discohoplites* sp., Jásd J-42, 213.9 m. K13837.
18. *Hyphoplites costosus* Wright & Wright, 1949, Jásd J-42, 114.7 m.
19. *Hyphoplites falcatus aurora* Wright & Wright, 1949; Jásd J-42, 228.0 m.
20. *Hyphoplites falcatus aurora* Wright & Wright, 1949; (Jásd J-42, 221.7 m.
21. *Hyphoplites falcatus aurora* Wright & Wright, 1949; Jásd J-42, 183.9 m.
22. *Hyphoplites* sp., Jásd J-42, 196.9 m.
23. *Hyphoplites costosus* Wright & Wright, 1949, Jásd J-42, 209.6 m.
24. *Hyphoplites falcatus aurora* Wright & Wright, 1949; Jásd J-42, 212.7 m.
25. *Hyphoplites costosus* Wright & Wright, 1949, Jásd J-42, 212.7 m.
26. *Hyphoplites costosus* Wright & Wright, 1949, Jásd J-42, 114.7 m.
27. *Hyphoplites costosus* Wright & Wright, 1949, Jásd J-42, 204.3 m.
28. *Hyphoplites costosus* Wright & Wright, 1949, Jásd J-42, 207.3 m.
29. *Hyphoplites costosus* Wright & Wright, 1949, Jásd J-42, 211.7 m.
30. *Hyphoplites costosus* Wright & Wright, 1949, Jásd J-42, 114.7 m.
31. *?Hyphoplites* sp., like a *H. curvatus arausionensis* (Hébert & Munier-Chalmas, 1875); Jásd J-42, 206.4 m.
32. *Hyphoplites falcatus aurora* Wright & Wright, 1949; Jásd J-42, 200.7 m.
33. *Anisoceras armatum* (Sowerby, 1817), Jásd J-42, 411.5 m.
34. *Stoliczkaia* sp., Jásd J-42, 429.3 m.
35. *?Mantelliceras* sp., Jásd J-42, 297.8 m.

All figures are in natural size. All specimens are from the collection of the GMH, repository numbers of GMH are not given.



1. ?*Mantelliceras* sp., Jásd J–42, 260.6 m.
2. *Anisoceras armatum* (J. Sowerby, 1817), Jásd J–42, 442.3 m.
3. *Arrhaphoceras (Praeschloenbachia)* sp., Jásd J–42, 216.9 m.
4. *Stomohamites subvirgulatus* (Spath, 1941); Jásd J–42, 389.0 m.
5. *Stomohamites subvirgulatus* (Spath, 1941); Jásd J–42, 441.3 m.
6. *Stomohamites subvirgulatus* (Spath, 1941); Jásd J–42, 430.9 m.
7. ?*Mantelliceras* sp., Jásd J–42, 125.8 m.
8. *Stoliczkaia* sp., Jásd J–42, 388.6 m.
9. *Stomohamites subvirgulatus* (Spath, 1941); Jásd J–42, 340.5 m.
10. *Idiohamites dorsetensis* Spath, 1939; Jásd J–42, 192.0 m.
11. *Lechites (Lechites) moreti* (Breistroffer, 1936), Jásd J–42, 420.8 m.
12. ?*Mariella* sp. juv., Jásd J–42, 120.2 m.
13. *Hamites* cf. *intermedius* J. Sowerby, 1814; Jásd J–42, 418.8 m.
14. *Ptychoceras adpressum* (J. Sowerby, 1814); Jásd J–42, 219.4 m.
15. *Yezoites subevolutus* (Böse, 1928); Jásd J–42, 152.3 m.
16. *Helicohamites ibex* (Spath, 1941); Jásd J–42, 258.4 m.
17. *Lechites (Lechites) moreti* (Breistroffer, 1936), Jásd J–42, 394.0 m.
18. *Ostlingoceras puzosianum* (d'Orbigny, 1842), Jásd J–42, 417.6 m.
19. *Mariella (Mariella) bergeri* (Brongniart, 1822), Jásd J–42, 408.7 m.
20. *Mariella (Mariella) bergeri* (Brongniart, 1822), Jásd J–42, 388.5 m.
21. *Lechites (Lechites) moreti* (Breistroffer, 1936), Jásd J–42, 474.5 m.
22. *Lechites (Lechites) gaudini* (Pictet & Campiche, 1961), Jásd J–42, 149.6 m.
23. *Paraturrilites* sp., Jásd J–42, 377.2 m.
24. *Paraturrilites* sp., Jásd J–42, 345.4 m.

All figures are in natural size. All specimens are from the collection of the GMH, repository numbers of GMH are not given.



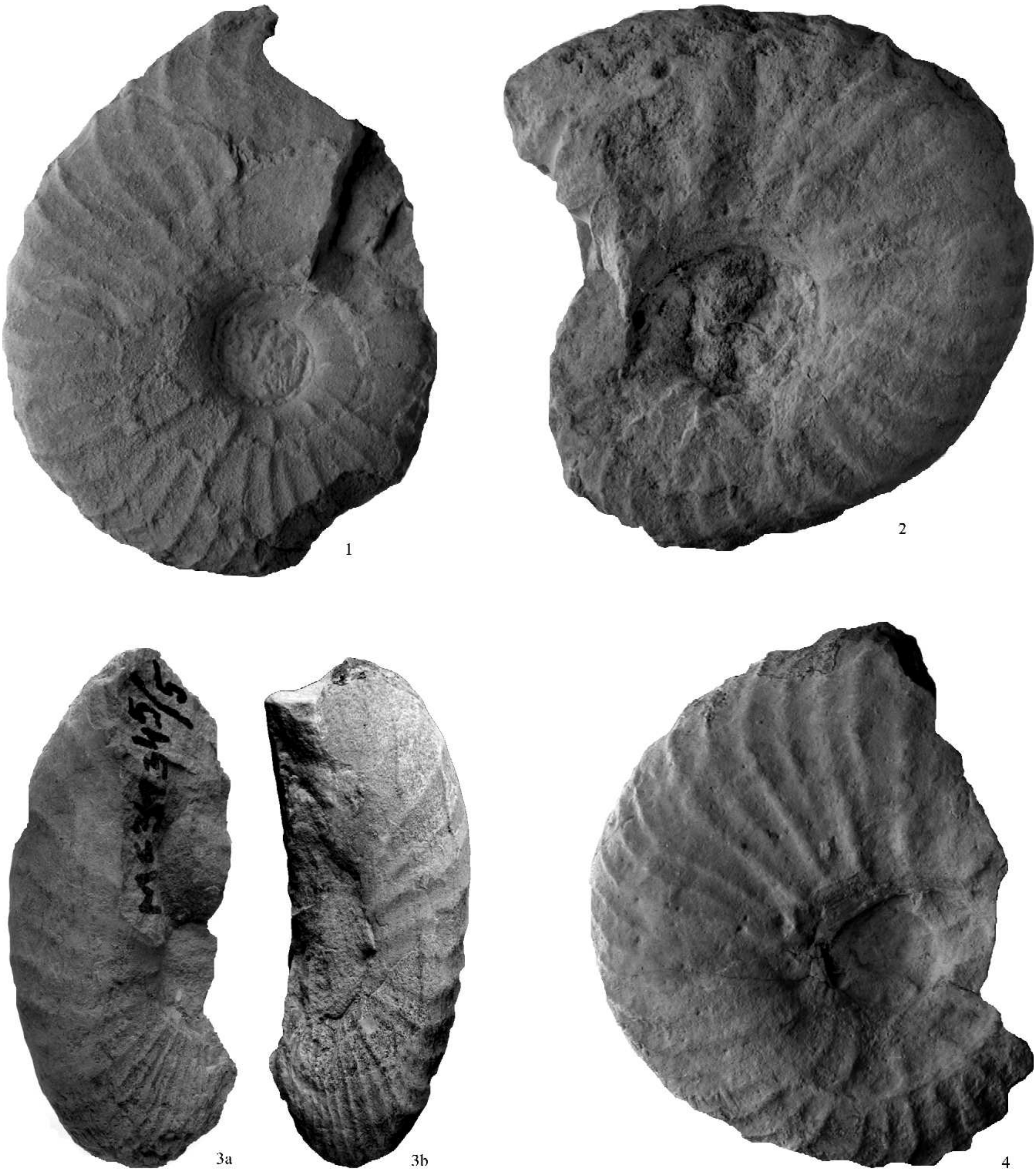
1. *Eogaudryceras* sp., Bóly B–1, 1096.0 m.
2. *Eogaudryceras* sp., Bóly B–1, 1099.6 m.
3. *Kossmatella romana* WIEDMANN, 1962, Bóly B–1, 988.0 m.
4. *Kossmatella agassiziana* (PICTET, 1847), Bóly B–1, 1171.7 m.
5. *Kossmatella* sp., Bóly B–1, 1001.65 m.
6. *Desmoceras (Desmoceras) latidorsatum* (MICHELIN, 1838), Bóly B–1, 996.5 m.
7. *Tetragonites* sp., Bóly B–1, 983.1 m.
8. *Puzosia (Puzosia) mayoriana* (D'ORBIGNY, 1841), Bóly B–1, 1171.6 m.
9. *Kossmatella romana* WIEDMANN, 1962, Bóly B–1, 1117.3 m.
10. *Puzosia (Puzosia) mayoriana* (D'ORBIGNY, 1841), Bóly B–1, 1006.2 m.
11. *Mortoniceras* sp., Bóly B–1, 1033.5 m.
12. *Mortoniceras* sp., Bóly B–1, 1071.9 m.
13. *Puzosia (Puzosia) mayoriana* (D'ORBIGNY, 1841), Bóly B–1, 993.1 m.
14. *Kossmatella romana* WIEDMANN, 1962, Bóly B–1, 1001.8 m.
15. *Anahoplites gracilis* SPATH, 1928; Bóly B–1, 1000.3 m.
16. *Stoliczkais* sp., Bóly B–1, 907.2 m.
17. *Cantabrigites cantabrigense* SPATH, 1933; Bóly B–1, 1092.8 m.
18. *Idiohamites spiniger* (J. SOWERBY, 1818), Bóly B–1, 1046.1 m.
19. *Idiohamites spiniger* (J. SOWERBY, 1818), Bóly B–1, 1071.7 m.
20. *Helicohamites duplicatus* (PICTET & CAMPICHE, 1861); Bóly B–1, 1113.8 m.
21. *Paraturrilites* sp. Bóly B–1, 1005.7 m.
22. *Worthoceras pygmaeum* BUJTOR, 1991; Bóly B–1, K–13731, holotype.
23. *Ostlingoceras puzosianum* (D'ORBIGNY, 1842), Bóly B–1, 1001.2 m.
24. *Stomohamites virgulatus* (BRONGNIART, 1822); Bóly B–1, 1001.2 m.
25. *Lechites (Lechites) gaudini* PICTET & CAMPICHE, 1861; Bóly B–1, 1030.0 m.
26. *Lechites (Lechites) gaudini* PICTET & CAMPICHE, 1861; Bóly B–1, 1114.1 m.
27. *Lechites (Lechites) gaudini* PICTET & CAMPICHE, 1861; Bóly B–1, 604.5 m.
28. *Scaphites (Scaphites) simplex* (JUKES-BROWNE, 1875), Bóly B–1, 1034.6 m.
29. *Worthoceras pygmaeum* BUJTOR, 1991; Bóly B–1, K–13732, paratype.
30. *Worthoceras pygmaeum* BUJTOR, 1991; Bóly B–1, K–13730, paratype.

All figures are in natural size. All specimens are from the collection of the GMH, repository numbers of GMH are not given apart from the type specimens of *Worthoceras pygmaeum* BUJTOR, 1989.

1a 1b

1. *Phylloceras* sp. Repository no. HNHM M.63.1357. 1×.

The specimen is from the Early Campanian Polány Marl Formation of Hungary.



1. *Pachydiscus precolligatus* COLLIGNON, 1955, Sümeg Haraszt Quarry. Repository no. HNHM M.63.1360/1.
2. *Pachydiscus precolligatus* COLLIGNON, 1955, Sümeg Haraszt Quarry. Repository no. HNHM M.63.1345/6.
3. *Pachydiscus precolligatus* COLLIGNON, 1955, Sümeg Haraszt Quarry. Repository no. HNHM M.63.1345/5.
4. *Pachydiscus precolligatus* COLLIGNON, 1955, Sümeg Haraszt Quarry. Repository no. HNHM M.63.1345/4.

All taxa is from the Early Campanian Polány Marl Formation of Hungary.

1

1. *Pachydiscus* sp., Sümeg, Haraszt Quarry. 1×.

The specimen is from the Early Campanian Polány Marl Formation of Hungary.

1. *Pachydiscus* sp., Sümeg, Haraszt Quarry. 0.33×.

The specimen is from the Early Campanian Polány Marl Formation of Hungary.

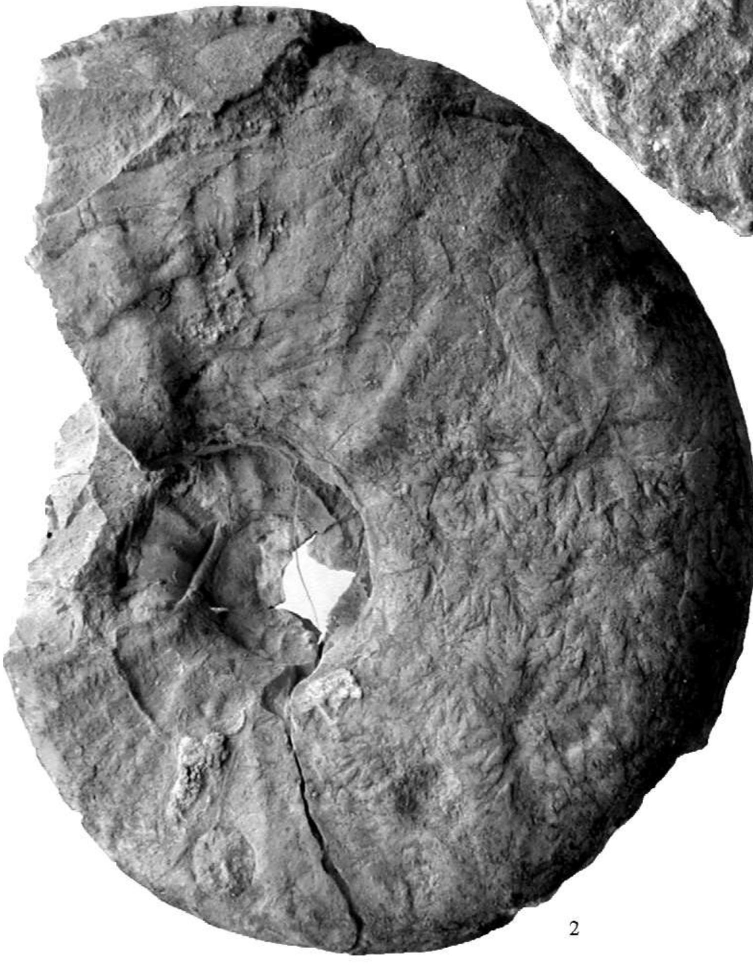
1. *Pachydiscus* sp., Sümeg, Haraszt Quarry. 0.5×.

The specimen is from the Early Campanian Polány Marl Formation of Hungary.

1. *Pachydiscus* sp. Repository no. GMH K2727, Sümeg, Haraszt Quarry. 0.33×.

The specimen is from the Early Campanian Polány Marl Formation of Hungary.


1


2

1. *Pachydiscus* cf. *levyi* (DE GROSSUVRE, 1894), Sümeg, Haraszt Quarry. Repository no. HNHM M.63.1345/1. 1×.

2. *Pachydiscus precolligatus* COLLIGNON 1955; Sümeg, Haraszt Quarry. Repository no. HNHM M.63.1345/3. 1×.

All taxa is from the Early Campanian Polány Marl Formation of Hungary.

1

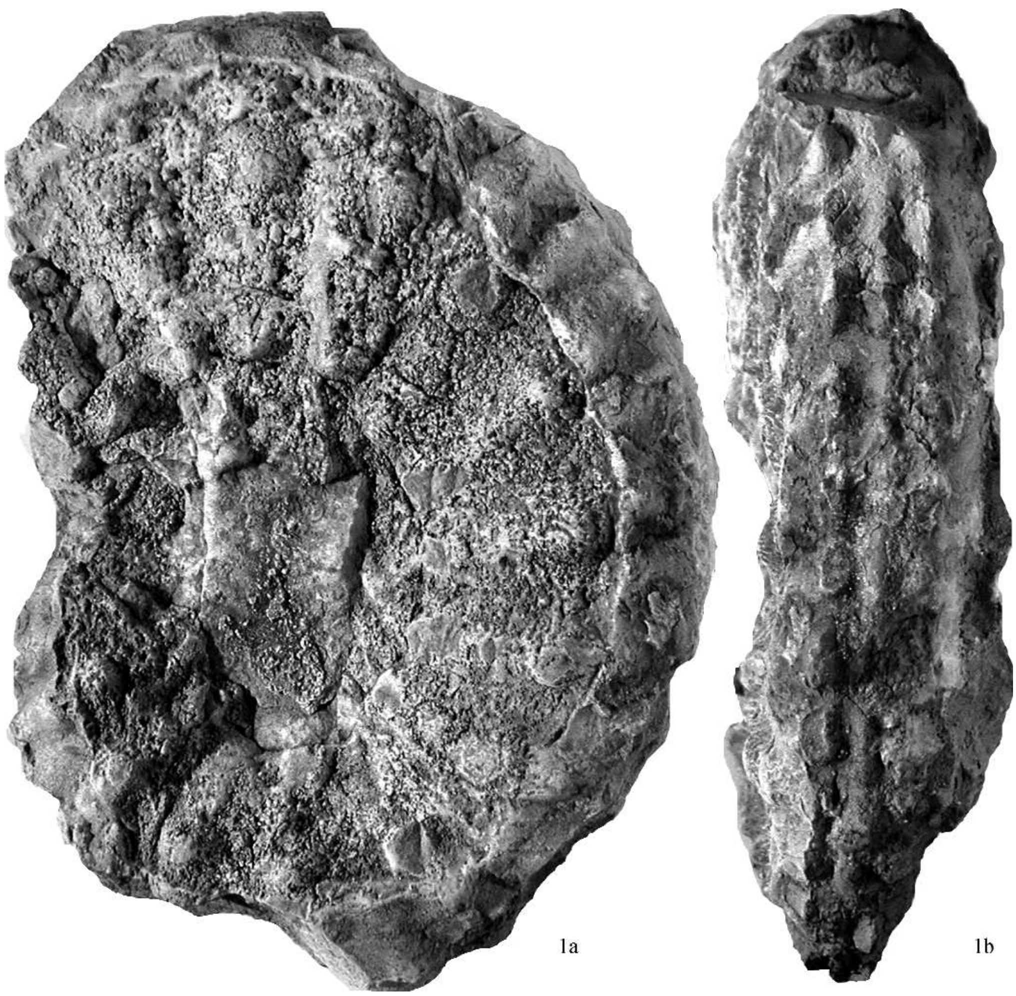
1. *Pachydiscus* cf. *levyi* (DE GROSSUVRE), Sümeg, Haraszt Quarry. Repository no. HNHM M.63.1344. 1×.

The specimen is from the Early Campanian Polány Marl Formation of Hungary.

1

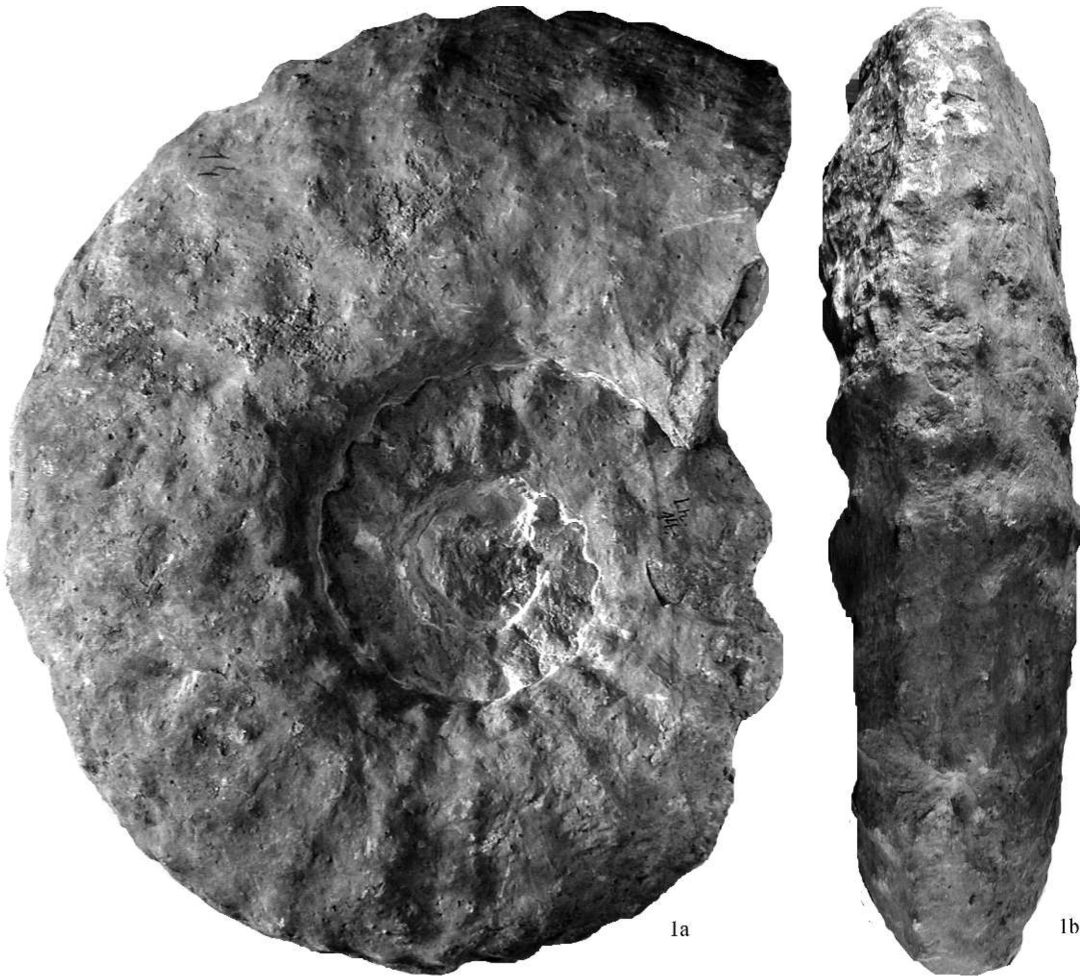
1. *Menabites* sp., Sümeg, Haraszt Quarry. 1×.

The specimen is from the Early Campanian Polány Marl Formation of Hungary.



1. *Menabites* sp., Sümeg, Haraszt Quarry. 1×.

The specimen is from the Early Campanian Polány Marl Formation of Hungary.



1. *Menabites* sp., Sümeg, Haraszt Quarry. 1×.

The specimen is from the Early Campanian Polány Marl Formation of Hungary.

1. *Brahmaites* sp., Sümeg, Sintérlap Quarry. 1×.
2. *Glyptoxoceras* sp., Sümeg Sintérlap Quarry. 1×.
3. *Baculites* sp., Sümeg Sintérlap Quarry. 1×.
4. *Scaphites hippocrepis* II–III (DEKAY 1828); Sümeg Sintérlap Quarry. 1×.
5. *Menabites* sp., Sümeg Sintérlap Quarry. 1×.

All taxa is from the Early Campanian Polány Marl Formation of Hungary.

1. *Menabites (Delawarella) suemegensis* FŐZY 2001; Sümeg Town Quarry. M.63.1355. 1×.

The specimen is from the Early Campanian Polány Marl Formation of Hungary.