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Kimmeridgian and early Tithonian cephalopods from the Kisújbánya Limestone Formation, Zengővárkony (Mecsek Mountains, southern Hungary), their faunal composition, palaeobiogeographic affinities, and taphonomic character

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Abstract: A new collection at Zengővárkony (Mecsek Mountains, Hungary) provided a rich and diverse but poorly preserved cephalopod-dominated fossil assemblage representing the Kimmeridgian and the lower Tithonian. The material came from mixed scree, soil, and amongst roots affected by weathering processes having been exposed to the elements for a long time. The nautiloid *Pseudaganides strambergensis* is the first record from the Mecsek Mountains. Due to the weathering, the ammonite fauna consists of mainly fragmentary and dissolved individuals that comprises 528 specimens belonging to 34 species and 30 genera out of which 20 species and 15 genera are reported for the first time from the Mecsek Mountains. The fauna includes specimens of known taxa. No new taxa are introduced. Based on the comparison with other faunas, this assemblage most closely resembles the fauna of the Venetian Alps (Italy). Additional faunal elements include aptychi (*Laevaptychus latus*, *Lamellaptychus murocostatus)*, belemnites (*Hibolithes semisulcatus*), and an indetermined brachiopod. The first record of *Spiraserpula spirolinites*, an encrusting fossil polychaete preserved on the internal mould of a *Taramelliceras* shell fragment indicates favourable bottom conditions for the epifauna. The presence of *Aspidoceras caletanum*, *Gravesia* aff. *gigas*, and *Pseudowaagenia inerme* indicates faunal connections with the Submediterranean Province of the Tethys, which is in line with the tectonic and palaeogeographical position of the Mecsek Zone during the Late Jurassic. The ammonite assemblage represents elements of five Tethysian ammonite zones of the Kimmeridgian and Tithonian. The lower Kimmeridgian Herbichi Zone is indicated by *Streblites tenuilobatus* and *Praesimoceras herbichi*. The upper Kimmeridgian Acanthicum Zone is indicated by *Aspidoceras acanthicum*, and the Cavouri Zone by *Mesosimoceras cavouri* and *Aspidoceras caletanum*. The upper Kimmeridgian Beckeri Zone is suggested by *Hybonoticeras pressulum* and *Pseudowaagenia inerme*. Whereas *Gravesia* aff. *gigas*, *Lithacoceras* aff. *siliceum*, and *Malagasites? denseplicatus* are faunal elements characterising the Early Tithonian Hybonotum Zone. Phylloceratid and lytoceratid specimens account only for 12% of the fauna, while the majority of the specimens belong to the Oppeliidae and Ataxioceratidae (60%).

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- Upper Jurassic;
- ammonites;
- Tisza Mega-unit;
- Submediterranean influence;
- serpulid encrustation

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Résumé : *Les céphalopodes du Kimméridgien et du Tithonien inférieur de la Formation du Calcaire de Kisújbánya, Zengővárkony (Massif du Mecsek, Hongrie méridionale), leur composition faunistique, leurs affinités paléobiogéographiques et leur caractéristiques taphonomiques.-* Un nouvel échantillonnage à Zengővárkony (Massif du Mecsek, Hongrie) a fourni un assemblage fossile dominé par les céphalopodes, riche et diversifié mais mal préservé, représentant le Kimméridgien et le Tithonien inférieur. Le matériel provient d'un mélange d'éboulis, de sols et de racines, le tout ayant été exposés aux éléments pendant une longue période et affecté par les processus d'altération. Le nautiloïde *Pseudaganides strambergensis* est signalé pour la première fois dans le Massif du Mecsek. En raison de l'altération, l'ammonitofaune consiste principalement en des éléments fragmentés et dissous qui représentent 528 spécimens appartenant à 34 espèces et 30 genres parmi lesquels 20 espèces et 15 genres sont signalés pour la première fois dans le Massif du Mecsek. La faune ne comporte que des spécimens de taxons déjà connus. Aucun nouveau taxon n'y est reconnu. En se fondant sur la comparaison avec d'autres faunes, cet assemblage ressemble très fortement à la faune des Alpes vénitiennes (Italie). Des éléments faunistiques additionnels incluent des aptychi (*Laevaptychus latus*, *Lamellaptychus murocostatus)*, des bélemnites (*Hibolithes semisulcatus*) et un brachiopode indéterminé. Le premier signalement de *Spiraserpula spirolinites,* un polychète fossile encroûtant conservé sur le moulage interne d'un fragment de coquille de *Taramelliceras*, indique des conditions de fond favorables à l'épifaune. La présence de *Aspidoceras caletanum*, *Gravesia* aff. *gigas* et de *Pseudowaagenia inerme* indique des connexions avec la province sub-méditerranéenne de la Téthys, qui dans le prolongement tectonique et paléogéographique de la Zone du Mecsek pendant le Jurassique supérieur. L'assemblage d'ammonites comporte des éléments de cinq ammonitozones téthysiennes du Kimméridgien et du Tithonien. La Zone à Herbichi du Kimméridgien inférieur est indiquée par *Streblites tenuilobatus* et *Praesimoceras herbichi*. La Zone à Acanthicum du Kimméridgien supérieur est caractérisée par *Aspidoceras acanthicum*, et la Zone à Cavouri par *Mesosimoceras cavouri* et *Aspidoceras caletanum*. La Zone à Beckeri du Kimméridgien supérieur est suggérée par *Hybonoticeras pressulum* et *Pseudowaagenia inerme*, tandis que *Gravesia* aff. *gigas*, *Lithacoceras* aff. *siliceum* et *Malagasites ? denseplicatus* sont des éléments faunistiques caractérisant la Zone à Hybonotum du Tithonien inférieur. Les spécimens de phyllocératides et de lytocératides représentent seulement 12% de la faune, tandis que la majorité des spécimens appartient aux Oppeliidae et aux Ataxioceratidae (60%).

Mots-clefs :

- taxonomie ;
- Jurassique supérieur ;
- ammonites ;
- Méga-unité de Tisza ;
- influence sub-méditerranéenne ;
- algues calcaires ;
- incrustation de serpulides

1. Introduction

Kimmeridgian and early Tithonian ammonites are widely known and abundant in Western Tethysian settings. Kimmeridgian ammonites have been studied in detail from many different localities of the Hungarian Transdanubian Middle Range (VIGH, 1961, 1984; FŐZY, 1993a; FŐZY *et al.*, 2011, 2013, among others). Kimmeridgian ammonites from the Mecsek Mountains were first trivially reported by PETERS (1862, p. 281). BÖCKH (1880, p. 17), who carried out geological mapping in the Zengővárkony region, reported with neither description nor figuration *Pygope diphya* from the Tithonian limestones of the abandoned quarry of Pusztafalu (today referred to as Zengővárkony), that nevertheless suggested for the first time the presence of Upper Jurassic strata in 1874. Later VADÁSZ (1935, p. 63) proved this Jurassic terrain by listing the following taxa from Zengővárkony, the only locality that provided Kimmeridgian ammonites from the Mecsek Mountains:

- *Ptychophylloceras* cf. *ptychoicum* QUENSTEDT
- *Holcophylloceras* cf. *polyolcum* BENECKE
- *Sowerbiceras* cf. *protortisulcatum* POMPECKJ
- *Lytoceras* cf. *sutile* OPPEL
- *Taramelliceras nobilis* NEUMAYR
- *Taramelliceras* cf. *compsa* OPPEL
- *Taramelliceras* cf. *trachynota* OPPEL
- *Taramelliceras* cf. *pseudoflexuosum* FAVRE
- *Taramelliceras succedens* OPPEL
- *Pseudowaagenia* cf. *haynaldi* HERBICH
- *Pseudowaagenia* cf. *pressulum* NEUMAYR

- *Aspidoceras* cf. *acanthicum* Oppel
- *Aspidoceras* cf. *neuburgensis* Oppel
- *Aspidoceras* cf. *cyclotum* Oppel
- *Aspidoceras* cf. *binodosum* Oppel
- *Aspidoceras* cf. *liparum* Oppel
- *Acanthosphaerites longispinum* Sowerby
- *Simoceras* sp.
- *Virgatosphinctes* sp.
- *Perisphinctes* div. sp.

The majority of the determinations reflect the poor preservation (whorl fragments, dissolution), and scarcity of collectible ammonite specimens. Vadász (1935, p. 62) concluded that this fauna represents the *Streblites tenuilobatus* 'level', which partly corresponds to the Strombecki and Herbichi zones of the current Mediterranean zonation. Regarding the Upper Jurassic-Lower Cretaceous lithostratigraphy of the Mecsek Mountains, Fülöp (1967) indicated a 160 m thick, continuous succession from the top Callovian to the Berriasian. It includes a 7 m thick Tithonian-Berriasian sequence at Zengővárkony with an unconformity at the T/B boundary and distribution of rich microfauna (Globochaete, Cadosina, Tintinnida, Saccocoma, and Radiolaria) around the boundary beds. At the beginning of the 1960s the Hungarian Geological Survey started 1:10.000 mapping in the region referring to a continuous Upper Jurassic sequence at Zengővárkony (Hetényi *et al.*, 1968) and mentioned a *Hybonoticeras hybonotum* (Oppel) from the Kimmeridgian at Zengővárkony. Nagy (1971, p. 324) added nominally some previously unknown ammonite taxa, with neither illustration or inventory numbers for his ammonites: *Hemihaploceras nobilis* [sic!] (Neumayr), *Taramelliceras trachinotum* (Oppel), *Ataxioceras polyplocum* (Reinecke), and *Aulacostephanus yo* (Orbigny). Wein (1974, p. 61) summarized the geological structure of the Mecsek Mountains, but only proved the faunal list of Vadász (1935). In the 1990s Főzy (1993b) conducted field work in the Mecsek Mountains and collected some Jurassic/Cretaceous ammonites concluding (Főzy, 1993b, p. 198) that Kimmeridgian ammonites are only found at Zengővárkony. Főzy (1993b, p. 198) practically replicated the faunal list of Vadász (1935, p. 63) adding two new taxa: *Taramelliceras pugile* (Neumayr) and ?*Orthosphinctes* sp. Főzy (1993b, p. 199) also referred to the occurrence of *Nebrodites cavouri* (Gemmellaro) absent from his faunal list, included in the '*Simoceras*' sp. of Vadász (1935) but without the repository number thwarting attempted retrieval of this specimen from the old collection of MBFSz (Mining and Geological Survey of Hungary). Based on his observations, and the earlier work of Vadász (1935), Főzy (1993b, p. 203) summarized that the Kimmeridgian fauna of Zengővárkony represents the upper Kimmeridgian Beckeri and Cavouri zones of the Mediterranean zonal scheme.

Tithonian strata can be found on the surface at a handful of places in the Mecsek Mountains (Wein, 1965; Főzy, 1993b, Fig. 2) representing the lower Tithonian albeit yielding only a poor ammonite fauna. Vadász (1935, p. 63) listed the following lower Tithonian ammonites from Zengővárkony: *Lytoceras* cf. *montanum* Oppel, *Aspidoceras* cf. *binodum* Oppel, *A.* cf. *cyclotum* Oppel, and *Perisphinctes cimbricus* Neumayr (= *Biplisphinctes cimbricus*, cf. Schlögl & Zorn, 2012). Nagy (1971, p. 326) added some interesting forms: *Prorasenia witteana* (Oppel), *Virgatosphinctes* [= *Paraulacosphinctes*] *transitorius* (Oppel), *Substreblites zonarius* (Oppel). Nagy and Raucsik (in Főzy, 2012) mentioned *Haploceras* cf. *elimatum* and *Usseliceras* sp. from the Kisújbánya Limestone Fm., but lacking description, illustration and accession numbers rendering specimens unavailable for this study. Recently Bujtor *et al.* (2021) reported a lower Tithonian ammonite from Zengővárkony (*Volanoceras volanense*), which indicates the Ponti Zone. Before the present authors started their field work, our knowledge on the Kimmeridgian/early Tithonian ammonite fauna of the Mecsek Mountains was based on faunal lists that reflected a hundred-year-old knowledge. It hinted at the presence of some lower and upper Kimmeridgian ammonite zones, as well as Tithonian strata. However systematic descriptions, taxonomic evaluations and zonal subdivisions were unavailable for the sequence.

The present authors conducted field work in July 2018 and revisited the locality in May 2019 and July 2020 for further collecting. The field work provided some 500 ammonites that represent the Kimmeridgian and lower Tithonian from the investigated locality, and provided many ammonite taxa previously unknown from the Mecsek Mountains. We also studied the old collection of the Mining and Geological Survey of Hungary, referred to hereafter as MBFSz and assessed deposited and unpublished material collected during field work by Andor Semsey, János Böckh (1874-1881), and Elemér Vadász (1930-1933). The aim of the present paper is to describe and figure for the first time the Kimmeridgian and lower Tithonian ammonites of Zengővárkony (Mecsek Mountains) that have been known since 1862 yet remained unpublished so far. Notwithstanding the poor preservation of this Kimmeridgian ammonite fauna from the Zengővárkony locality in the Mecsek Mountains these important specimens were collected to provide insights into the fauna and stratigraphy of the Upper Jurassic of this biogeographically and tectonically interesting unit.

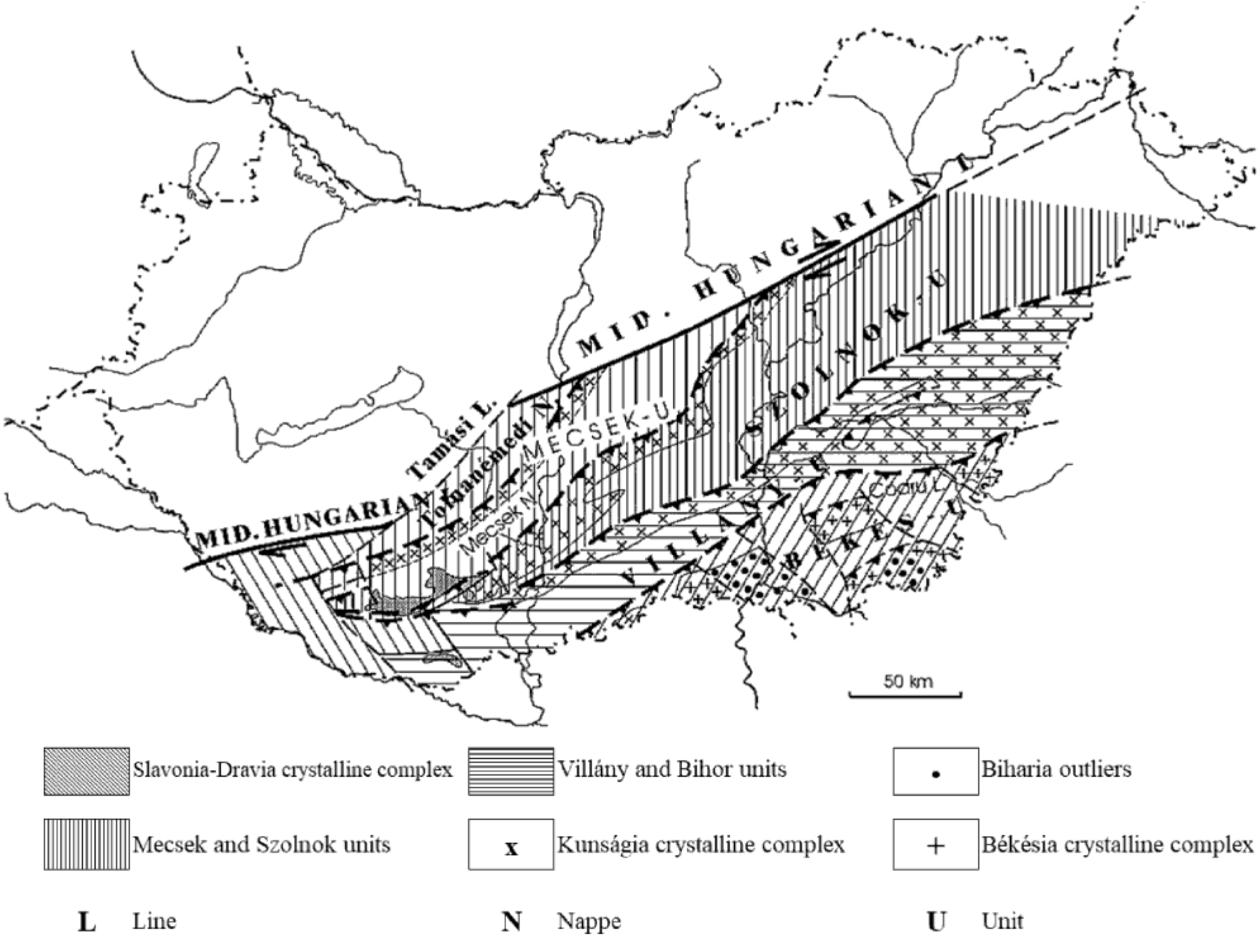
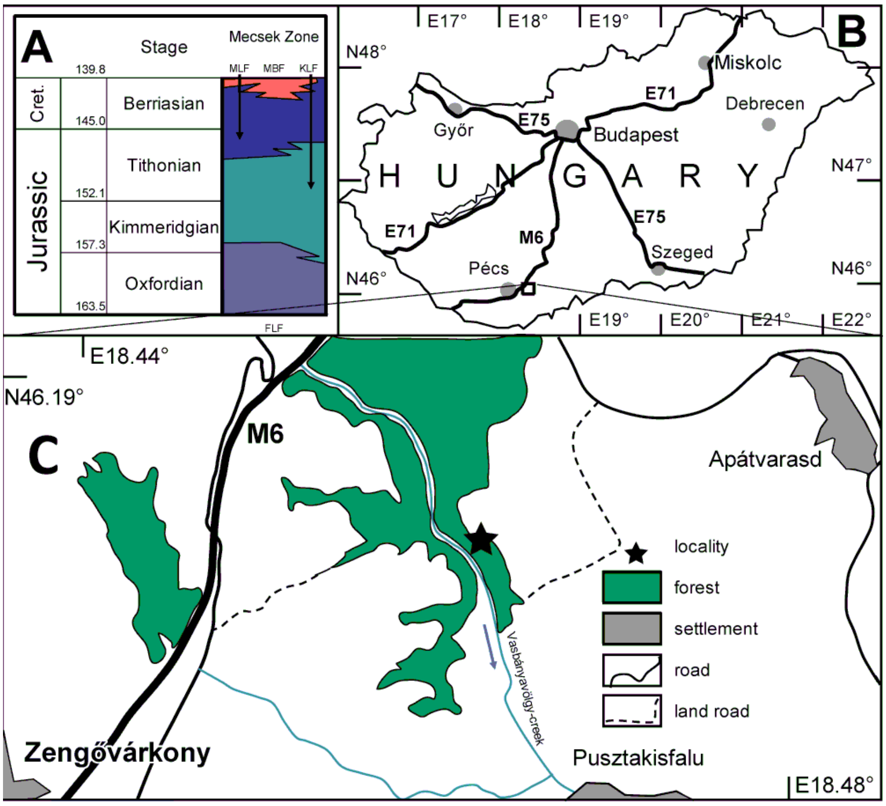


Figure 1: Structural position of the Mecsek Mountains in Hungary with the indication of the major tectonic units. Map based on HAAS and PÉRÓ (2004), simplified.

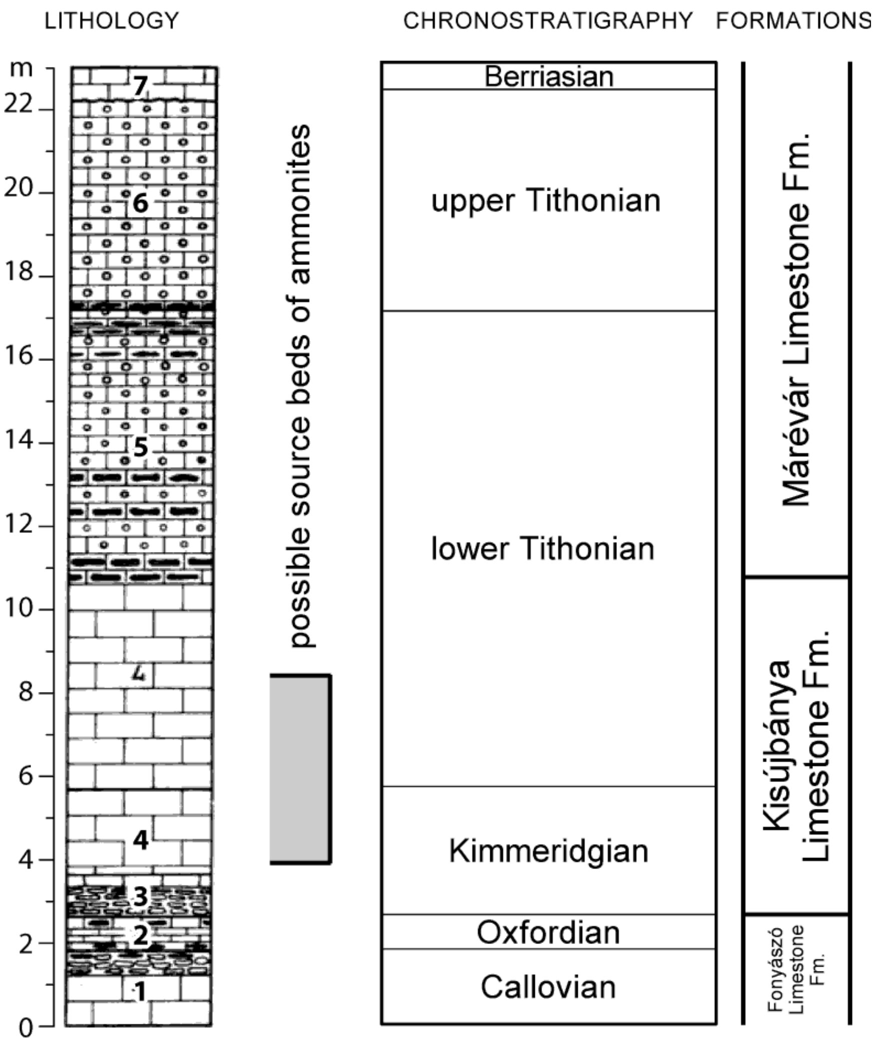
2. Geological setting

As the northernmost unit of the tectonic domain, the Mecsek Mountains (Fig. 1) belong to the Tisza Mega-Unit (HAAS & PÉRÓ, 2004) which is considered a microplate (VÖRÖS, 1993; CSONTOS & VÖRÖS, 2004) having a nappe structure. The Late Jurassic sedimentary succession of the Mecsek Mountains (Fig. 2) is characterized by calm, pelagic limestone sedimentation (RAUCSIK in FŐZY, 2012) with ammonitico rosso type red, nodular, sometimes cherty and thin Oxfordian and Kimmeridgian condensed beds with regular dissolution (NAGY, 1964). These formations (*e.g.*, Fonyászó Limestone Fm., Kisújbánya Limestone Fm.) are less than 50 metres in thickness. The youngest formation (Márévár Limestone Fm.) is characterized by a 100 m thick limestone succession with somehow elevated sea floor that has a maiolica facies character in the upper part. Around the T/B boundary, the first indication of the later pronounced volcanic activity (Mecsekjánosi Basalt Fm.) appears, which is intensified in the late Berriasian and related to a continental rifting of the tectonic zone. However, there are indications for the earlier (Oxfordian-Kimmeridgian) volcanic activities in the region (CSÁSZÁR & TURNŠEK, 1996). The Late Jurassic sedimentation in the Mecsek Mountains provided a thin, continuous, and at maximum 200 m thick limestone succession, which has a poorly preserved macrofauna dominated by ammonites accompanied by belemnites and very scarce brachiopods; irregular echinoids also occur.

Studied sections: The shallow valley of the Vasbányavölgy-creek (Fig. 2.C) cuts through the Middle Jurassic-Lower Cretaceous continuous limestone succession from the Oxfordian (NAGY, 1964) to the upper Berriasian (GRABOWSKI *et al.*, 2016), however Callovian strata is also present (MOLNÁR, 1961). South from the Zengővárkony lime-kilns, Early and Middle Jurassic strata are also exposed (SIDÓ, 1966). An abandoned quarry called 'Várkonyi mészkemence' (=lime-kiln of Várkony) on the right bank (west) of the Vasbányavölgy creek exposes the upper Kimmeridgian to the lower Berriasian strata of the Márévár Limestone Formation. In the old literature this was the source area for ammonites collected by Andor SEMSEY, János BÖCKH, Karl ZITTEL, and Elemér VADÁSZ (BÖCKH, 1880; VADÁSZ, 1935). However, on the left side (east) of the creek there is a smaller, also abandoned quarry that exposes an older formation (Kisújbánya Limestone Fm.) of typical red coloured, condensed horizons representing the



◀ **Figure 2:** Locality map and the lithostratigraphic subdivision of the Upper Jurassic-Lower Cretaceous (pars) strata mentioned in the text. **A.** Lithostratigraphy of the Mecsek zone for the study period. Numerical ages in million years after COHEN *et al.* (2013). **B.** Simplified map of Hungary. Black rectangle indicates the study area northeast from Pécs. **C.** The Zengővárkony area indicating the abandoned quarry. The star indicates the locality on the left (=Eastern) bank viewed looking south - which is downstream of the Vasbányavölgy creek, an abandoned small quarry from where the ammonites were collected. Legend: FLF: Fonyászó Limestone Fm; KLF: Kisújbánya Limestone Fm; MBF: Mecsekjánosi Basalt Fm; MLF: Márévár Limestone Fm. Arrow indicates the direction of water flow. Lithostratigraphic units after CSÁSZÁR (1996) for the Cretaceous and FŐZY (2012) for the Jurassic, simplifying and unifying their diagrams.



◀ **Figure 3:** The upper Jurassic-lower Cretaceous section at Zengővárkony, Mecsek Mountains traversing the abandoned quarries. Lithological column after NAGY (1961, 1964), simplified. Shaded stripe indicates the supposed stratigraphical position of the ammonites included in this study. Legend: 1: light coloured yellowish-grey thick bedded limestone; 2: thin bedded limestone; 3: marly-clayey, red coloured, patchy and nodular limestone; 4: light coloured yellowish-grey, thick bedded limestone; 5: light coloured yellowish-grey brecciated limestone with light grey flint nodules; 6: yellowish-white brecciated limestone; 7: brownish-yellow clayey limestone. Chronostratigraphic subdivision of the section is based on micropalaeontological investigations of NAGY (1961, 1964).

◀ **Figure 4:** Locality exposing the Kisújbánya Mészkő Formation. Ammonites were collected from scree, and from the mixed soil, debris and roots. One of the authors (Á.M.) points to the mixed soil and debris material from which the specimens appeared as cobbles. GPS coordinates: 46° 11'03.5"N 18°27'34.2"E.

lower Kimmeridgian. These typical *ammonitico rosso* strata (bed 3, Fig. 3) also provided a useful fauna for study representing the Strombecki and Herbichi zones, in accordance with VADÁSZ (1935). Above the red coloured, nodular limestone strata, bed 4 (on Fig. 3) evidences a colour change to yellowish-white, and ammonites disappear. The succession is then covered by scree, debris and soil. After careful field work and trial-channelling, a remarkably rich albeit poorly preserved, fragmentary ammonite assemblage was found in the scree, soil and among roots. These ammonites are weathered and dissolved being accumulated for thousands of years in the soil, while the host limestone beds were eroded. The ammonites represent the Kimmeridgian and the lower Tithonian strata, with the same lithological features (coarse-grained, yellowish-white or grey, poorly stratified limestone) that is typical for the Kisújbánya Limestone Formation. In Figure 3, we indicated the possible source rocks of the collected fauna, that is described in this paper. Careful analysis of the accession labels of older material housed in MBFSz, let us discriminate those ammonites that were collected here and six ammonite specimens from older repositories were included in this study. The present paper therefore describes the ammonites collected from scree and from among roots and mixed debris and soil from the so-called *'small quarry beside the lime-kiln of Várkony'* indicated by the star on Figure 2.C. The locality (Fig. 4) picture shows the accumulated material as cobbles and fragments during our field work that provided the remarkably rich and diverse ammonite fauna described herein. Ammonites were not sampled bed-by-bed, but were collected from the scree.

3. Materials and methods

The cephalopods from Zengővárkony available for our study comprise 525 specimens (including belemnites and aptychi). Of these 519 were collected by the authors and the other 6 are housed in the historical collection of the MBFSz with hand-written information on the original labels of János BÖCKH and Andor SEMSEY from the 1870-1880s. All six specimens referred to on the labels as *'small quarry beside the lime-kiln of Várkony'* are included in this paper.

Table 1: Higher taxa of macrofossils with numbers of specimens and percentages in the Zengővárkony fauna examined in the present paper.

Taxa	number of specimens	percentage
Ammonoidea	507	96.0
Annelida	1	0.2
Aptychi	12	2.3
Belemnoidea	6	1.1
Brachiopoda	1	0.2
Nautiloidea	1	0.2
Total	528	100.0

Macrofossils with the respective numbers of specimens and percentages are shown in Table 1 of the Zengővárkony Late Jurassic fauna examined in the present paper. The ammonite fauna is dominated by ataxioceratids, aspidoceratids and oppeliids, that represent 84% of the specimens but the less abundant phylloceratids and lytoceratids are also present. Abbreviations: FAD: First Appearance Datum; Fm: formation; D: diameter of the conch; Wb: width of the conch; Wh: height of the last whorl; U: diameter of the umbilicus or umbilical lobe - up to the context; L: lateral lobe;

N/2: number of primary ribs on the last half whorl; n.d.: no data due to the fragmentary status or poor preservation of the specimen. Dimensions are given in mm. Measurements were acquired by a manual caliper. Measurements in brackets refer to estimated data due to poor preservation. Scale bars indicate 1 cm, otherwise as noted. Rib curves are not prepared due to poor preservation of the specimens. Zonal subdivisions of Kimmeridgian and Tithonian follows ZEISS (2003) with the emendations of WIERZBOWSKI *et al.* (2016) and HESSELBO *et al.* (2020).

Abbreviations for aptychi: L: distance between the terminal point and the umbilicus projection; S: distance between the apex and the terminal point; L_{at}: distance between the terminal point and the point of maximum valve width (MĚCHOVÁ *et al.*, 2010).

Photos were taken by L.B. with a Nikon D3500 DSLR camera under natural sunlight. Due to the Covid-19 curfew the university facilities (laboratories, microscopes etc.) were permanently inaccessible, therefore ammonium-chloride coating of the fossils and laboratory photographic conditions were not available.

4. Systematic palaeontology

Repositories and institutional abbreviations. All specimens included in this study are deposited in the MBFSz palaeontological collection (of the Mining and Geological Survey of Hungary, Budapest); figured and measured specimens with the inventory numbers starting with "J" come from the historical MBFSz collection of MBFSz with specimens donated by János BÖCKH and Andor SEMSEY. Figured and measured specimens collected by the present authors are labelled with prefix "J 2020".

Taxonomic remarks. Systematics of Phyllo- and Lytoceratina are in accordance with ARKELL *et al.* (1957); systematics of the Ammonitina (excl. Perisphinctoidea) follows DONOVAN and CALLOMON (1980), and systematics of Perisphinctoidea are from ÉNAY and HOWARTH (2019). Recently PARENT *et al.* (2020) proposed to raise aspidoceratid ammonites to superfamily level: Their proposal is followed here. FISCHER and ZEISS (1987) and later SCHERZINGER *et al.* (2006) classified the subfamily Gravesiinae as incertae sedis at the family level according to the uncertain affinities of *Gravesia*. Their views were rejected by ÉNAY and HOWARTH (2019), and *Gravesia* is considered belonging to Ataxioceratinae, which is accepted here. Due to the limited number of specimens per taxa and their poor preservation subspecies names are not assigned in this study. KING and EVANS (2019) also suggested modified higher ranked systematics for nautiloids, which is followed here. Systematics of Serpulidae are from IPPOLITOV (2007).

Phylum Annelida LAMARCK, 1809
Class Polychaeta GRUBE, 1850
Subclass Canalipalpata ROUSE & FAUCHALD, 1997
Order Sabellida FAUCHALD, 1977
Family Serpulidae RAFINESQUE, 1815
Subfamily Serpulinae RAFINESQUE, 1815
Genus *Spiraserpula* REGENHARDT, 1961

Type species: *Spiraserpula spiraserpula* REGENHARDT, 1961

Spiraserpula spirolinites
(MÜNSTER in GOLDFUSS, 1831)
(Fig. 5.A1-A2)

1831. *Serpula Spirolinites* MÜNSTER, MÜNSTER in GOLDFUSS, p. 229, Pl. 68, fig. 5.a-c.
1996. *Serpula (Dorsoserpula) spirolinites* MÜNSTER in GOLDFUSS, GERASIMOV *et al.*, p. 50, Pl. 6, fig. 10.a-b.

Material. One fairly preserved specimen on an internal mould of a whorl fragment of a *Taramelliceras* (J 2020.291.1).

Dimensions. The only specimen has 6 mm maximum diameter.

Description. Small sized planispiral structure on the midflank of an ammonite internal mould. There are five, densely spaced spiral whorls that are firmly attached to each other. The spiral is three-dimensional and deepened into the mould. The width of the spiral ridge at the innermost part is 160 µm and continuously increasing till the end of the spiral where it has 500 µm width.

Remarks. The holotype consists of three, densely coiled individual spirals of 5 whorls that continued (GOLDFUSS, 1831, Pl. 68, fig. 5.b) or discontinued (*ibidem*, Pl. 68, fig. 5.a upper left) in meandering tubes. These tubes are positive calcareous fossils on a shell surface, while the present specimen is a negative imprint that originally was attached to the internal wall of the shell of the host *Taramelliceras* (*Franz Fürsich* personal comm.). The spiral structures are close to the holotype in the number of spirals, densely packed coils and diameter; however, the meandering continuation is not present but this is not necessarily preserved. After final burial the aragonite shell dissolved, but the infilling lime mud filled the conch and preserved the negative imprint of the originally internally attached serpulid tube. First record from Hungary.

Stratigraphic and geographic distribution. Callovian (IPPOLITOV, 2007) to Kimmeridgian-lower Tithonian of Mecsek Mountains, Hungary, Central Russia (GERASIMOV *et al.*, 1996), Bavaria, Germany (GOLDFUSS, 1831), Switzerland (TRIBOLET, 1873).

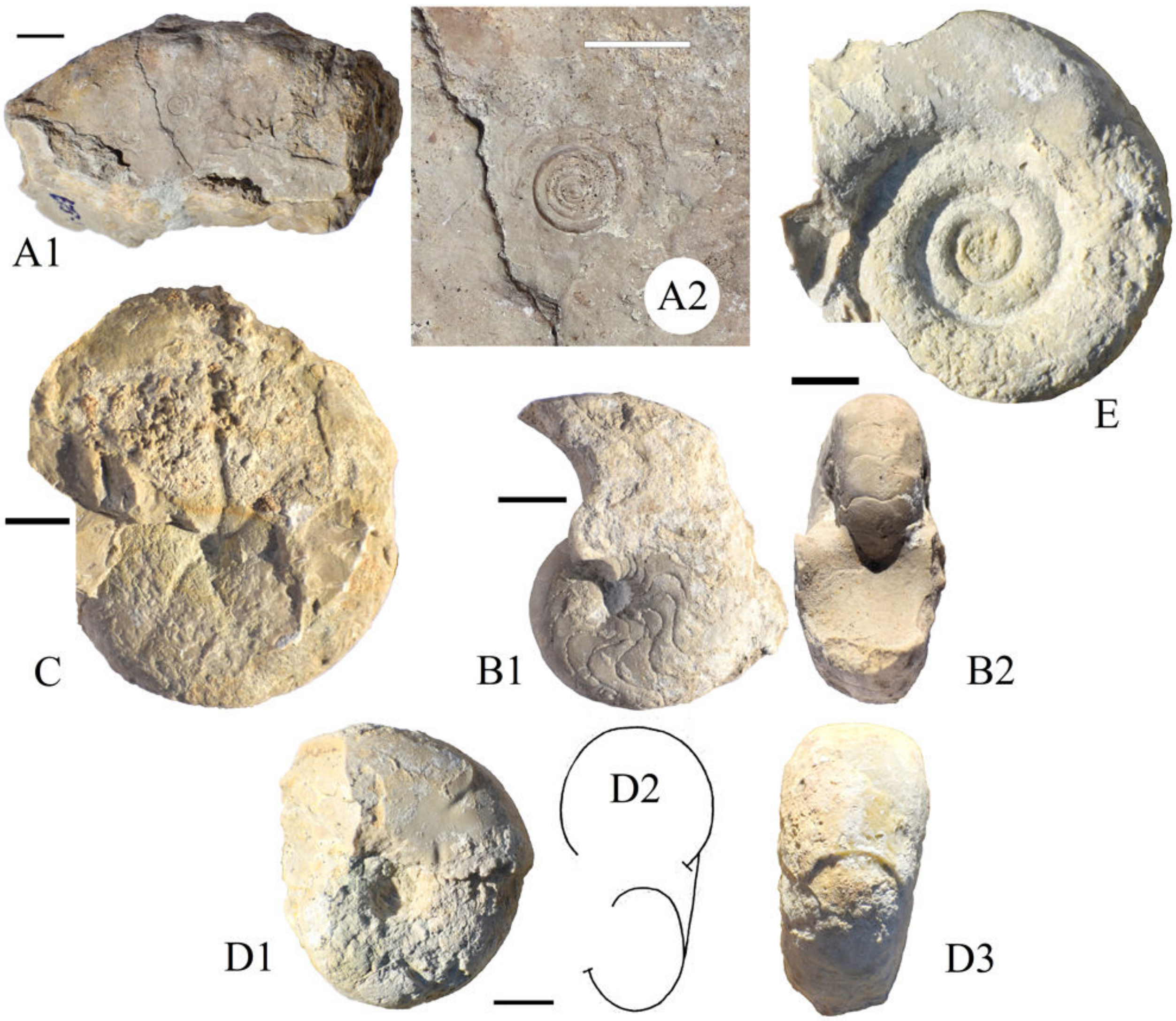


Figure 5: Upper Kimmeridgian-lower Tithonian annelids, nautiloids and ammonoids from Zengővárkony, Mecsek Mountains, Hungary. A. *Spiraserpula spirolinites* (MÜNSTER in GOLDFUSS, 1831) on the upper flank of a *Taramelliceras* sp. whorl fragment. A1. specimen J 2020.291.2; A2. close-up view of the polychaete spiral tube imprint on the internal mould. B. *Pseudaganides strambergensis* (OPPEL, 1865), specimen J 2020.265.1. B1. lateral view; B2. apertural view. C. *Calliphylloceras benacense* (CATULLO, 1847), specimen J 2020.327.1. D. *Sowerbyceras loryi* (MUNIER-CHALMAS in HÉBERT, 1875), specimen J 2020.267.1. D1. lateral view; D2. cross-section; D3. ventral view. E. *Lytoceras polycyclum* NEUMAYR, 1871a; I1. specimen J 2020.289.1. Scale bars indicate 1 cm except A2, which indicates 0.5 mm.

Phylum Mollusca LINNAEUS, 1758
Class Cephalopoda CUVIER, 1797
Subclass Nautilia WADE, 1988
[nom. corr. KING & EVANS, 2019]
Order Nautilida AGASSIZ, 1847
Family Nautilidae ORBIGNY, 1840
Subfamily Pseudaganinae KUMMEL, 1956
Genus *Pseudaganides* SPATH, 1927

Type species: *Nautilus kutchensis* WAAGEN, 1873

Pseudaganides strambergensis
(OPPEL, 1865)
(Fig. 5.B1-B2)

1865. *Nautilus Strambergensis* OPP., OPPEL, p. 546.
1868. *Nautilus Strambergensis* OPP., ZITTEL, p. 42, Pl. 2, figs. 8-11.
1916. *Nautilus strambergensis* ZITTEL, JEKELIUS, p. 265, Pl. 6, fig. 3.
1956. *Pseudaganides strambergensis* (OPPEL), KUMMEL, p. 392, fig. 15.J.
non 1973. *Nautilus strambergensis* ZITTEL, PREDA, Pl. 3, fig. 1.
2013. *Pseudaganides strambergensis* (OPPEL), FŐZY *et al.*, p. 29, Fig. 6.

Material. One fairly preserved internal mould.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.265.1.	47.6	(20)	(28)	(3)	0.714	0.588	0.06

Description. Small sized, fairly preserved phragmocone; compressed, involute with very small umbilicus; rounded umbilical shoulder, passing to convex flanks then converting into a rounded, smooth venter. Septums placed 6 mm from each other on the early, and 7 mm on later whorls. There is a shallow ventral lobe, and a high lateral lobe and a shallow saddle.

Remarks. The present specimen is most similar to the specimen of JEKELIUS (1916, Pl. 6, Fig. 3), the only difference is that the latter has body chamber on the last half whorl, while the present specimen is thoroughly septate. Its cross section is identical to the cross section of the specimen illustrated by KUMMEL (1956, p. 393, Fig. 15.J) Suture of the present specimen is similar to *P. schneidi* (SCHAIRER & BARTHEL, 1977, Pl. 11, fig. 3.a) however in cross section it is markedly different compared to the present specimen. *P. franconicus* has shallower lobes as JEKELIUS (1916) had already noted. PREDA (1973, Pl. 3, fig. 1) figured the ventral view of a very wide, depressed specimen, which is out of the range of this species. First record from the Mecsek Mountains.

Stratigraphic and geographic distribution. Upper Jurassic of Central Europe (Czech Republic: KUMMEL, 1956; Tithonian of Gerecse Mountains, Hungary: FŐZY *et al.*, 2013; Romania: JEKELIUS, 1916).

Subclass Ammonoidea ZITTEL, 1884
Order Ammonitida FISCHER, 1882
Suborder Phylloceratina ARKELL, 1950
Family Phylloceratidae ZITTEL, 1884
Subfamily Phylloceratine ZITTEL, 1884
Genus *Phylloceras* SUESS, 1865

Type species: *Ammonites heterophyllus* J. SOWERBY, 1820

Phylloceras sp. ind.

Material. 13 fragmentary internal moulds (J 2020.174.2, 198.1, 203.1, 204.1, 214.1, 233.1, 266.1 and below).

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.91.1.	43.6	17.2	25.3	2.5	0.680	0.580	0.057
J 2020.138.1.	58.8	(21)	(38)	1.7	0.553	0.646	0.029
J 2020.198.1.	(77)	24.3	(46)	(10)	0.528	0.597	0.130
J 2020.232.1.	79.3	26.5	44.5	9.6	0.595	0.561	0.121
J 2020.263.1.	63.6	23.4	39.9	6.5	0.586	0.627	0.102
J 2020.285.1.	70.3	(22)	(42)	(4)	0.524	0.597	0.057

Subfamily Calliphylloceratinae SPATH, 1927
Genus *Calliphylloceras* SPATH, 1927

Type species: *Phylloceras disputabile* ZITTEL, 1869

Calliphylloceras benacense (CATULLO, 1847)
(Fig. 5.C)

1847. *Ammonites benacensis*, CAT., CATULLO, p. 9 [seconda appendice], Pl. 13, fig. 1.a-b.
1871a. *Phylloceras Benacense* CATULLO, NEUMAYR, p. 336, Pl. 15, fig. 3.
? 1878. *Phylloceras Békasense* nov. sp., HERBICH, p. 112, Pl. 3, fig. 1.
1879. *Ammonites* (*Phylloceras*) *Benacensis*, CATULLO, FAVRE, p. 14, Pl. 2, fig. 1.
1959. *Calliphylloceras benacense* CAT., COLLIGNON, Pl. 97, fig. 368.
1976. *Calliphylloceras benacense* (CATULLO), JOLY, p. 192, Pl. 10, fig. 1; Pl. 44, fig. 1.a-b.
1984. *Calliphylloceras benacense* (CATULLO), VERMA & WESTERMANN, p. 28, Pl. 1, fig. 2.
1986. *Calliphylloceras benacense* (CATULLO), SARTI, p. 485, Pl. 1, fig. 1.
2007. *Calliphylloceras benacense* (CATULLO), CECCA & SAVARY, p. 514, Fig. 4.A.
2013. *Calliphylloceras benacense* (CATULLO), GRIGORE, p. 85, Pl. 1, figs. 1, 3.

Material. One fairly preserved internal mould.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.327.1.	65.8	(21)	(38)	4.5	0.553	0.577	0.068

Description. Fairly preserved, middle sized conch representing phragmocone and body chamber. Coiling involute, umbilicus small, shallow. Umbilical shoulder short, rounded. No ventral shoulder. Conch compressed, flanks convex, converging. Venter rounded. Fine, narrow, shallow line situated on the mid-siphonal region. There are six, shallow and wide constrictions on the conch that rise from the umbilical shoulder radially; shortly above the umbilical shoulder they become prorsiradiate and travel radially on the flanks. On the upper flank at ¾ flank height the constrictions slightly bend forward. Suture, aperture not seen.

Remarks. The present specimen lacks the fine riblets depicted on the holotype, however other representatives of the species (cf. COLLIGNON, 1959; JOLY, 1976) did not show them. This is due to the poor preservation of the studied ammonite. HERBICH (1878, p. 112) introduced his new species (*P. bekasense*) based on a single, poorly preserved specimen without differential diagnosis. His specimen is identical with CATULLO's holotype; therefore, its specific independence is questionable as GRIGORE (2013, p. 85) already underlined. First record from Hungary.

Stratigraphic and geographic distribution. *Calliphylloceras benacense* is reported from the upper Oxfordian to the uppermost Kimmeridgian. Geographically it has a wide geographic distribution in the Tethys (Mediterranean: CECCA & SAVARY, 2007; Submediterranean and Indo-Malagasy Provinces: COLLIGNON, 1959; VERMA & WESTERMANN, 1984).

Genus *Holcophylloceras* SPATH, 1927

Type species: *Phylloceras mediterraneum* NEUMAYR, 1871a

Holcophylloceras sp. ind.

Material. Six internal moulds (J 2020.152.1, 172.1, 207.1, 212.1, 231.1, 236.2).

Genus *Sowerbyceras*
PARONA & BONARELLI, 1895

Type species: *Ammonites tortisulcatus* ORBIGNY, 1840

Sowerbyceras loryi (MUNIER-CHALMAS in HÉBERT, 1875)

(Fig. 5.D1-D3)

1875. *Phylloceras Loryi*, MUNIER-CHALMAS, p. 388.
1877. *Ammonites* (*Phylloceras*) *Loryi* MUNIER-CHALMAS, FAVRE, p. 19, Pl. 1, figs. 14-15.
1907. *Phylloceras* (*Sowerbyceras*) *Loryi* MUNIER-CHALMAS, PERVINQUIÈRE, p. 15, Pl. 1, figs. 1-2.
1979. *Sowerbyceras loryi* (MUNIER-CHALMAS in HÉBERT), SAPUNOV, p. 36, Pl. 4, figs. 4-6.
1981. *Sowerbyceras loryi* (MUNIER-CHALMAS), PARISHEV & NIKITIN, p. 20, Pl. 6, fig. 7.
1989. *Sowerbyceras loryi* (MUNIER-CHALMAS), ALKAYA, p. 62, Pl. 1, fig. 1.
1993. *Sowerbyceras loryi* (MUNIER-CHALMAS in PILLET & DE FROMENTAL), SARTI, p. 54, Fig. 14, Pl. 1, figs. 3-4.
2011. *Sowerbyceras loryi loryi* (MUNIER-CHALMAS), GRIGORE, p. 197, Pl. 2, figs. 7, 9.
2011. *Sowerbyceras loryi* (MUNIER-CHALMAS *in* PILLET & DE FROMENTAL), REHÁKOVÁ *et al.*, Pl. 7, fig. 5.
2013. *Sowerbyceras loryi loryi* (MUNIER-CHALMAS), GRIGORE, p. 89, Pl. 2, figs. 7, 9.
2017. *Sowerbyceras loryi*, SARTI, Pl. 2, figs. E-I; Pl. 3, figs. A-D, G.

Material. 19 fragmentary internal moulds (J 2020.106.1, 270.1, 264.1, 279.1, 288.1, 314.1, 315.1, and below).

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.192.1.	64.1	(28)	(31)	(13)	0.903	0.484	0.203
J 2020.267.1.	48.8	21.7	(21)	8.0	1.033	0.430	0.164
J 2020.280.1.	70.8	25.8	(34)	(14)	0.759	0.480	0.198
J 2020.281.1.	58.6	(15)	(22)	(13)	0.682	0.375	0.222
J 2020.282.1.	(57)	19.2	(27)	(11)	0.711	0.474	0.193
J 2020.299.1.	62.4	(23)	(34)	(14)	0.676	0.545	0.224
J 2020.316.1.	59.6	(21)	(29)	(11)	0.724	0.486	0.185
J 2020.347.1.	(53)	(20)	(25)	(10)	0.800	0.472	0.189
J 2020.353.1.	56.1	(21)	(26)	(12)	0.807	0.463	0.214
J 2020.356.1.	57.4	(24)	(26)	(11)	0.923	0.453	0.192
J 2020.357.1.	64.8	(22)	(28)	(14)	0.786	0.432	0.216
J 2020.583.1.	75.3	(27)	(34)	13.9	0.794	0.451	0.185

Description. Coiling involute, shell compressed, flanks parallel of small and medium sized specimens. Umbilicus shallow, umbilical wall oblique, umbilical shoulder rounded. No sculpture preserved except for some constrictions that are shallow, and cross the venter without interruption. Constrictions prorsiradiate on the upper flank, bending gently backward on the ventral shoulder and cross the venter perpendicularly with shallow constriction. There are 3 constrictions per half whorl. Suture not seen.

Remarks. Due to the fragmentary status and poor preservation of the specimens, important features (coiling, number of constrictions per whorl) are not seen, however the ventral part is well preserved that allows a positive separation from other *Sowerbyceras* species. As SARTI stated (1993, p. 53) discrimination of *S. loryi* from *S. silenum* is possible based on 5 criteria out of which one is present here: In the case of *S. loryi* constrictions cross the venter gently to form only a shallow band, while in the case of *S. silenum* there is a strong, upfolding constriction crossing the venter. The ventral constriction shown by the present specimens is typical of *S. loryi* (SARTI, 1993, Pl. 1, fig. 4). Apart from these difficulties the present specimens most resemble the specimens of FAVRE (1877, Pl. 1, fig. 14.a, .c) and SAPUNOV (1979, Pl. 4, fig. 6.a-b). First record from the Mecsek Mountains.

Stratigraphic and geographic distribution. Known from the lower Kimmeridgian Herbichi Zone to the upper Kimmeridgian Beckeri Zone: In addition *loryi* is occasionally reported from the lower Tithonian Hybonotum Zone (SAPUNOV, 1979, p. 37). Geographically there are records from the Upper Kimmeridgian Acanthicum Zone, Eastern Carpathians: GRIGORE, 2013; Ukraine Pieniny Klippen Belt. Upper Kimmeridgian Sardinia, Veneto, Italy: SARTI, 1993; Sicily, Tunisia: PERVINQUIÈRE, 1907; Eastern Carpathians, Bulgaria: SAPUNOV, 1979; Hungary, Romania: GRIGORE, 2011, Turkey: ALKAYA, 1989. *Sowerbyceras loryi* is also reported from the Submediterranean Province; Crussol, France (FAVRE, 1877), Fribourg (Switzerland), Andalucia (Spain).

Suborder Lytoceratina HYATT, 1889
Family Lytoceratidae NEUMAYR, 1875
Subfamily Lytoceratinae NEUMAYR, 1875
Genus *Lytoceras* SUESS, 1865

Type species: *Ammonites fimbriatus* J. SOWERBY, 1817

Lytoceras sp. ind.

Material. 13 internal moulds (J 2020.127.1, 171.1, 247.1, 298.1, 301.1, 302.1, 312.1, 313.1, 328.1, 329.1, 330.1, 352.1, 358.1).

Lytoceras polycyclum NEUMAYR, 1871b

(Fig. 5.E)

1871b. *Lytoceras polycyclum* nov. sp., NEUMAYR, p. 24.
1873. *Lytoceras polycyclum* NEUMAYR, NEUMAYR, p. 160 [20], Pl. 31, fig. 4.
1878. *Lytoceras polycyclum*, NEUM., GEMMELLARO, p. 179, Pl. 2, fig. 5.
1907. *Lytoceras polycyclum* NEUMAYR, PERVINQUIÈRE, p. 17, Pl. 1, fig. 4.A-B.
? 1961. *Lytoceras polycyclum* NEUMAYR, RAKUS, p. 146, Pl. 11, fig. 1.
1966. *Lytoceras polycyclum camertinum* CANAVARI, ANĐELKOVIĆ, p. 22, Pl. 2, figs. 1, 6, 8.
1973. *Lytoceras polycyclum* NEUMAYR, PREDA, Pl. 4, figs. 3-4.
1979. *Lytoceras polycyclum* NEUMAYR, SAPUNOV, p. 39, Pl. 5, figs. 3-4.
1984. *Lytoceras polycyclum* (NEUMAYR), ROSSI, p. 88, Pl. 31, fig. 5.
1996. *Lytoceras* cf. *polycyclum* NEUMAYR, MAISCH, p. 53, Fig. 1.A-B.
2005. *Lytoceras polycyclum* (NEUMAYR), BOUGHDIRI *et al.*, p. 309. [in lit.]
2011. *Lytoceras polycyclum* NEUMAYR, BAUDOUIN *et al.*, Pl. 12, fig. 6.
2011. *Lytoceras polycyclum* NEUMAYR, REHÁKOVÁ *et al.*, Pl. 7, fig. 4.
2013. *Lytoceras polycyclum* (NEUMAYR), FŐZY & SCHERZINGER, p. 171, Pl. 4, figs. 1, 4.

Material. Nine internal moulds (J 2020.112.1, 130.1, and below).

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.125.1.	112.4	(43)	46.4	(38)	0.927	0.413	0.338
J 2020.134.1.	85.6	(34)	(33)	33.1	1.030	0.385	0.387
J 2020.142.1.	74.7	24.6	27.8	27.6	0.885	0.372	0.369
J 2020.177.1.	89.4	(28)	(31)	39.2	0.903	0.347	0.438
J 2020.268.1.	64.9	(25)	(24)	26.1	1.042	0.370	0.402
J 2020.289.1.	(45)	(15)	(14)	22.0	1.071	0.311	0.489
J 2020.345.1.	44.9	(12)	(16)	19.5	0.750	0.356	0.434

Description. Small to medium sized, worn, and crushed conchs of typical lytoceratid (=serpenticone) coiling with wide and shallow umbilicus representing mostly the phragmocone. Cross section circular to subcircular. If subcircular, then flanks inflated, convex. Umbilical shoulder rounded, smooth. Flanks convex, rounded. Venter smooth. All specimens worn, partly dissolved, suture weathered and reduced. If early whorls are preserved, they are crushed and flattened, but three whorls seen. No sculpture, constriction noted.

Remarks. If preservation is good, or even original shell remains preserved, radial, straight ribs thoroughly persist on the conch as Grigore (2013, p. 91) discussed. Naturally, in our case there is no trace of ribbing. The specimen of Rakus (1961, Pl. 11, fig. 2.) is evolute: Inner whorls bear wide ribs but coiling is not of lytoceratid but rather serpenticone, which questions this determination. Specimen J 2020.177.1. is most similar to specimen J464 of Sapunov (1979, Pl. 5, fig. 4) and MM i5862 of Rossi (1984, Pl. 31, fig. 5) representing the stock of low expansion rate, while J 2020.125.1. resembles cru104 of Baudouin *et al.* (2011, Pl. 12, fig. 6) and represents the stock of higher expansion rate of the last whorl (from Wb/Wh=1 to Wb/Wh<1). First record from the Mecsek Mountains.

Stratigraphic and geographic distribution. Generally, it is reported from the Kimmeridgian, but occasionally also known from the Tithonian. Geographically it has a typical Tethysian distribution: Italy, Sicily, Tunisia (Pervinquière, 1907; Boughdiri *et al.*, 2005), Hungary, Serbia: Anđelković, 1966; Bulgaria: Sapunov, 1979; Eastern Carpathians (Ukraine and Romania: Preda, 1973), however it also inhabited peri-Tethysian territories (Submediterranean Province: France (Crussol: Baudouin *et al.*, 2011), Austria, and southern Germany: Maisch, 1996).

Suborder Ammonitina Hyatt, 1889
Superfamily Haploceratoidea Zittel, 1884
Family Oppeliidae Douvillé, 1890
Subfamily Taramelliceratinae Spath, 1928
Genus *Taramelliceras* Del Campana, 1904
Subgenus *Taramelliceras* Del Campana, 1904

Type species: *Ammonites trachinotus* Oppel, 1862

***Taramelliceras* div. sp.**

Material. 98 poorly preserved, fragmentary or complete internal moulds (J 2020.103.1, 128.1, 154.1, 157.1, 163.1-166.1, 182.1, 213.1, 216.1, 220.1, 222.1, 226.1, 244.1, 277.1, 284.1, 369.1-447.1, 569.2, and below).

Remarks. These fragments definitely represent different species of *Taramelliceras*, most possibly *T.* (*T.*) *compsum*, *T.* (*T.*) *pugile*, *T.* (*T.*) *trachinotum*, and *T.* (*T.*) *pseudoflexuosum*, however the poor preservation hinders specific assignments.

***Taramelliceras* (*Taramelliceras*) *compsum* (Oppel, 1863)**
(Fig. 6.A1-A3)

1863. *Ammonites compsus* Opp., Oppel, p. 215, Pl. 57, fig. 1.a-b.
1872. *Oppelia compsa*, Opp., Gemmellaro, p. 144, Pl. 1, fig. 3.
1878. *Oppelia compsa* Oppel, Herbich, p. 150 [132], Pl. 5.
1879. *Oppelia compsa* Oppel, Fontannes, p. 34, Pl. 5, fig. 1.
1909. *Neumayria* cfr. *compsa* Opp., Koch, p. 267. [in lit.]
1916. *Oppelia compsa* Opp., Jekelius, p. 270, Fig. 12.
1935. *Taramelliceras* cf. *compsa* Opp., Vadász, p. 62. [in lit.]
1955. *Taramelliceras* (*Taramelliceras*) *compsum* (Oppel), Hölder, p. 110, Pl. 19, fig. 22.
1959. *Taramelliceras compsum* Opp. var. *crassa* nov. var., Collignon, Pl. 112, fig. 414.
1966. *Taramelliceras* (*Taramelliceras*) *compsum* (Oppel), Anđelković, p. 27, Pl. 6, figs. 1-2; Pl. 7, fig. 4; Pl. 10, figs. 3, 7; Pl. 24, fig. 1; Pl. 26, fig. 1.
1973. *Oppelia* (*Taramelliceras*) *compsa* Oppel, Preda, Pl. 9, fig. 5.
1977. *Taramelliceras* (*Taramelliceras*) *compsum comp sum* (Oppel), Sapunov, Pl. 4, fig. 1.
1978. *Taramelliceras* (*Taramelliceras*) *compsum* (Oppel), Olóriz, p. 83, Pl. 6, fig. 3.
1979. *Taramelliceras* (*Taramelliceras*) *compsum comp sum* (Oppel), Sapunov, p. 48, Fig. 5/1, Pl. 9, figs. 1-2.
1986. *Taramelliceras* (*Taramelliceras*) *compsum* (Oppel), Sarti, p. 496, Pl. 2, fig. 1.A-B.
1989. *Taramelliceras* (*Taramelliceras*) *compsum hol bei ni* Oppel, Alkaya, p. 63, Pl. 1, fig. 2.
1994. *Taramelliceras* (*Taramelliceras*) *compsum* (Oppel), Wierzbowski, Pl. 4, fig. 12.
1998. *Taramelliceras* (*Taramelliceras*) *compsum* (Oppel), Howarth, p. 37, Pl. 1, fig. 8.
1999. *Taramelliceras* (*T.*) aff. *T.* (*T.*) *compsum* (Oppel), Fat mi & Zeiss, p. 43, Pl. 6, fig. 2.
2005. *Taramelliceras* sp. gr. *compsum* (Oppel), Boughdiri *et al.*, Pl. 1, fig. 2.
2011. *Taramelliceras compsum* (Oppel), Baudouin *et al.*, p. 626, Pl. 1, figs. 1-4; Pl. 2, figs. 3-10; Pl. 3, figs. 1-7; Pl. 4, figs. 1-8; Pl. 5, figs. 1-6; Pl. 6, figs. 1-6; Pl. 7, figs. 1-11; Pl. 8, figs. 1-10.
2011. *Taramelliceras compsum* (Oppel), Főzy *et al.*, p. 418, Fig. 3.1-2.
2013. *Taramelliceras compsum* (Oppel), Főzy & Scherzinger, p. 173, Pl. 2, figs. 2, 6.

Material. 33, variously, but poorly preserved internal moulds (J 2078, J 2020.102.1, 141.1, 155.1, 319.1, 325.1, 338.1, 344.1, 349.1, 350.1, 351.1, 354.1, 360.1, and below).

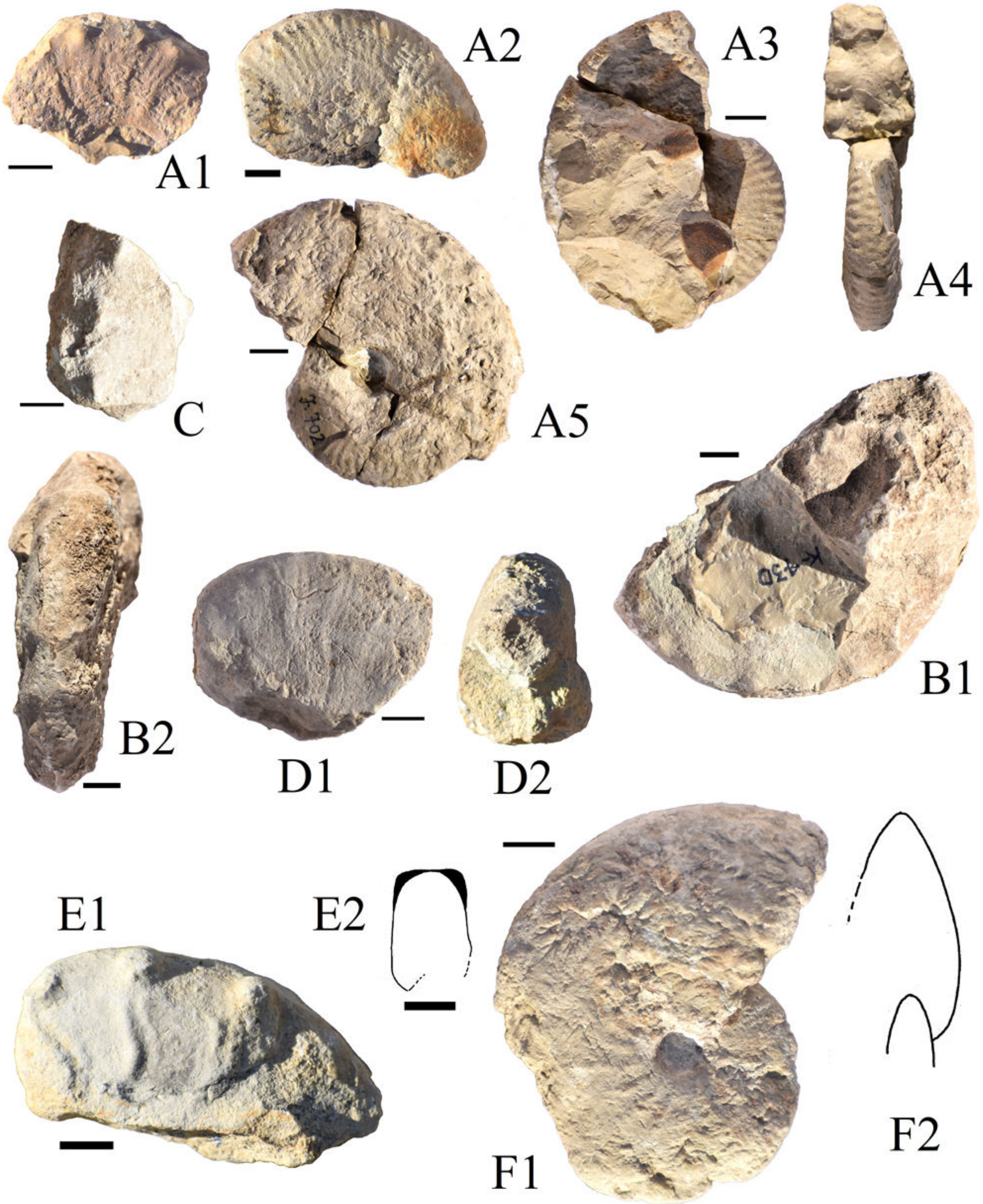


Figure 6: Upper Kimmeridgian-lower Tithonian ammonoids from Zengővárkony, Mecsek Mountains, Hungary. A. *Taramelliceras (Taramelliceras) compsum* (OPPEL, 1863), A1. specimen J 2078; A2. specimen J 2020.141.1; A3-A5: specimen J 702. A3, A5. lateral view; A4. cross-section. B. *Taramelliceras (Taramelliceras) pugile* (NEUMAYR, 1871b), specimen J 2020.133.1. B1. lateral view; B2. ventral view., specimen J 2020.225.1. C. *Taramelliceras (Taramelliceras)* cf. *trachinotum* (OPPEL, 1863), specimen J 2020.190.1; oblique ventral view. D. *Taramelliceras (Metahaploceras) strombecki* (OPPEL, 1857), specimen J 2020.223.1. D1. lateral view; D2. apertural view. E. *Hemihaploceras nobile* (NEUMAYR, 1873), specimen J 2020.577.1. E1. lateral view; E2. cross-section of specimen J 2020.582.1. F. *Streblites tenuilobatus* (OPPEL, 1863), specimen J 2020.115.1. F1. lateral view; F2. cross-section of specimen J 2020.114.1. Scale bars indicate 1 cm.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 702	76.4	(23)	(39)	(11)	0.590	0.510	0.144
J 2020.224.1.	(57)	(14)	(27)	(12)	0.518	0.474	0.210
J 2020.243.1.	(51)	(12)	(21)	(14)	0.571	0.411	0.274
J 2020.250.1.	71.0	(17)	(35)	(16)	0.486	0.493	0.225
J 2020.278.1.	118.5	(28)	(55)	(22)	0.509	0.464	0.185
J 2020.287.1.	93.7	26.3	(49)	(17)	0.537	0.523	0.181
J 2020.292.1.	(72)	(20)	(38)	(11)	0.523	0.528	0.153
J 2020.306.1.	72.5	14.0	37.5	(10)	0.373	0.517	0.138
J 2020.307.1.	72.6	(20)	(39)	(12)	0.513	0.537	0.165
J 2020.308.1.	72.4	(19)	(40)	(11)	0.475	0.552	0.152
J 2020.309.1.	75.2	(19)	(38)	(16)	0.500	0.505	0.213
J 2020.310.1.	71.9	(21)	(38)	(15)	0.553	0.529	0.209
J 2020.311.1.	(74)	(17)	(36)	(16)	0.472	0.486	0.216
J 2020.318.1.	88.0	22.2	(45)	(18)	0.493	0.511	0.204
J 2020.320.1.	132.0	(30)	(63)	(23)	0.476	0.477	0.174
J 2020.321.1.	114.8	31.4	(52)	(19)	0.604	0.453	0.165
J 2020.323.1.	92.2	(27)	(51)	(17)	0.529	0.553	0.184
J 2020.326.1.	101.0	(21)	(50)	(12)	0.420	0.495	0.119
J 2020.336.1.	61.0	16.8	(33)	(10)	0.509	0.541	0.164
J 2020.337.1.	80.5	(22)	(38)	(16)	0.579	0.472	0.199
J 2020.341.1.	(75)	(20)	(33)	(18)	0.606	0.440	0.240

Description. Small to medium sized phragmocone conchs. Umbilicus small, shallow. Umbilical wall short, oblique. Umbilical shoulder rounded. Flanks convex, converging, high oval. Ventral shoulder rounded. Venter rounded, smooth. From the midflank equal, prorsiradiate ribs travel toward the ventral shoulder. These ribs originate from the umbilical shoulder, however due to poor preservation it is rarely seen. On the early whorls, ribs end in elongated tubercles at the ventral shoulder, while on later whorls every third to fifth one ended in tubercles; majority of the primaries end on the ventral shoulder. On early whorls there is a row of fine tubercles on the mid-siphonal line that later diminish. Above 25 mm whorl height, the mid-siphonal line is devoid of tubercles, but primaries cross the venter, joining corresponding primaries. On the last half whorl there are 10 tubercles on the ventral shoulder. Intraspecific variation is expressed in the changing number of tubercles, their size, and the number of primary ribs between them. Sutural elements present but aperture not seen.

Remarks. This highly variable species was excellently discussed by BAUDOUIN *et al.* (2011). However, when the preservation is poor and/or fragmentary, there are difficulties in discriminating *compsum* from *T.* (*T.*) *pugile*. Notwithstanding, based on statistically significant material, some general guidelines could be outlined as BAUDOUIN *et al.* (2011, p. 633) demonstrated. Therefore, it is suggested here that the separation of poorly preserved specimens is reliable. The present specimens exhibit high intraspecific variation.

Stratigraphic and geographic distribution. *Taramelliceras compsum* is reported from the lower Kimmeridgian (Herbichi Zone) and upper Kimmeridgian (Acanthicum Zone). Outside the Western Tethys it occurs in younger Kimmeridgian strata. Geographically it has a wide distribution in the Western Tethys (Italy, Sicily: GEMMELLARO, 1872; Tunisia: BOUGHDIRI *et al.*, 2005; Hungary, Eastern Carpathians: PREDA, 1973; Bulgaria: SAPUNOV, 1977; Turkey: ALKAYA, 1989; Yemen: HOWARTH, 1998) and the adjacent Submediterranean Province (Betic Cordilleras Spain: OLÓRIZ, 1978; Crussol, Ardéche France, South Germany). It is also known from the northeastern Tethysian margin (Baluchistan: FATMI & ZEISS, 1999) and the Indo-Malagasy Province in the southern Tethys (Madagascar: COLLIGNON, 1959).

***Taramelliceras* (*Taramelliceras*) *pugile* (NEUMAYR, 1871b)**

(Fig. 6.B1-B2)

1871b. *Oppelia pugilis* nov. sp., NEUMAYR, p. 24.
1871a. *Oppelia pugilis* NEUMAYR, NEUMAYR, p. 167 [27], Pl. 32, figs. 1-2.
1872. *Oppelia pugilis*, NEUM., GEMMELLARO, p. 143, Pl. 1, fig. 2.
1879. *Oppelia pugilis* NEUMAYR, FONTANNES, p. 45, Pl. 7, figs. 1-2.
1959. *Taramelliceras pugile* (NEUMAYR), BERCKHEMER & HÖLDER, p. 76, Figs. 46-47, Pl. 16, fig. 77; Pl. 20, fig. 100.
1966. *Taramelliceras* (*Taramelliceras*) *pugile* (NEUMAYR), ANĐELKOVIĆ, p. 30, Fig. 23; Pl. 5, fig. 7; Pl. 24, fig. 4.
1973. *Oppelia* (*Taramelliceras*) *pugilis* NEUMAYR, PREDA, Pl. 7, fig. 2.
1977. *Taramelliceras* (*Taramelliceras*) *pugile* (NEUMAYR), SAPUNOV, Pl. 5, fig. 3.A-B.
1978. *Taramelliceras* (*Taramelliceras*) *pugile pugile* (NEUMAYR), OLÓRIZ, p. 94, Pl. 7, fig. 2.A-B.
1979. *Taramelliceras* (*Taramelliceras*) *pugile* (NEUMAYR), SAPUNOV, p. 51, Pl. 10, figs. 5-7; Pl. 11, figs. 1-2.
1986. *Taramelliceras* (*Taramelliceras*) *pugile* (NEUMAYR), SARTI, p. 494, Pl. 2, fig. 3.A-B.
1993b. *Taramelliceras pugile* (NEUM.), FŐZY, p. 198. [in lit.]
1993. *Taramelliceras* (*Taramelliceras*) *pugile pugile* (NEUMAYR), SARTI, p. 66, Pl. 4, fig. 1.
1995. *Taramelliceras pugile* (NEUMAYR), FŐZY, p. 135, Pl. 21, fig. 2.
1997. *Taramelliceras* (*Taramelliceras*) *pugile* (NEUMAYR), BENZAGGAGH & ATROPS, Pl. 3, fig. 2.
1999. *Taramelliceras* (*Hemihaploceras*) *pugile* (NEUMAYR), FATMI & ZEISS, p. 40, Pl. 7, fig. 1.
2004. *Taramelliceras pugile pugiloides* (CANAVARI), MARINO *et al.*, p. 368, Pl. 2, fig. 5.
2011. *Taramelliceras* (*Taramelliceras*) *pugile pugiloide* CANAVARI, REHÁKOVÁ *et al.*, Pl. 7, fig. 1.

Material. 11 poorly preserved internal moulds (J 2020.221.3, 295.1, 324.2, 339.1, 339.2, and below).

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.133.1.	112.8	(25)	(54)	19.4	0.463	0.479	0.172
J 2020.225.1.	106.0	(27)	(47)	(28)	0.574	0.443	0.264
J 2020.249.1.	110.6	(23)	(41)	(31)	0.561	0.371	0.280
J 2020.317.1.	114.0	(26)	48.1	(28)	0.540	0.422	0.245
J 2020.340.1.	97.2	(25)	51.6	(18)	0.484	0.531	0.185
J 2020.343.1.	90.6	(19)	(36)	(26)	0.528	0.397	0.287

Description. Medium to big sized conchs (to D=115 mm) representing phragmocone and body chamber. Conchs crushed, dissolved, fragmented. Umbilicus wide, shallow. Umbilical wall short, rounded. Flanks parallel or slightly converging. Ventral shoulder rounded. Venter rounded, smooth, sometimes forming a gentle and short keel. At the ventral shoulders corresponding rows of tubercles rise; there are 10 tubercles on the last half whorl. On the mid-siphonal line, in between the ventral shoulder row of tubercles, another row of tubercles rises. The height and length of these tubercles are equal or smaller than the tubercles on the ventral shoulder. No other sculpture. Suture, aperture not seen.

Remarks. Regarding the separation of specimens belong to *T. (T.) compsum* from the present species, see BAUDOUIN *et al.* (2011). Although the present specimens are poorly preserved, important features (*e.g.*, umbilicus, external tubercles, keel) are well seen, therefore specific determination is justified. Specimen J 2020.133.1. is closest to specimen F.G7.10.1 of OLÓRIZ (1978, Pl. 7, fig. 2.a-b); specimen J 2020.249.1 resembles specimen no. 168 of SARTI (1986, Pl. 2, fig. 3.a-b), and both represents the stock with robust mid-siphonal and ventral shoulder tubercles.

Stratigraphic and geographic distribution. *Taramelliceras pugile* is reported from the upper Kimmeridgian with wide geographic distribution in the western Tethys (Italy, Sicily: GEMMELLARO, 1872; Hungary, Eastern Carpathians: PREDA, 1973; Serbia: ANĐELKOVIĆ, 1966; Bulgaria: SAPUNOV, 1977; Tunisia: BENZAGGAGH & ATROPS, 1997), peri-Tethysian territories (Submediterranean: Betic Cordilleras Spain: OLÓRIZ, 1978; Crussol France: FONTANNES, 1879; southern Germany), and northern Tethys (Baluchistan: FATMI & ZEISS, 1999).

***Taramelliceras* (*Taramelliceras*) cf. *trachinotum* (OPPEL, 1863)**

(Fig. 6.C)

1863. *Ammonites trachinotus* OPP., OPPEL, p. 214, Pl. 56, fig. 4.a-b.
1870. *Oppelia trachynota* OPP., ZITTEL, p. 70, Pl. 5, fig. 3.
1875. *Oppelia trachynota* OPPEL, WAAGEN, p. 54, Pl. 10, fig. 6.
1877. *Ammonites* (*Oppelia*) *trachynotus* OPPEL, FAVRE, p. 34, Pl. 3, fig. 2.
1878. *Oppelia trachynota* OPPEL, HERBICH, p. 154 [136], Pl. 3, fig. 2.
1879. *Oppelia trachynota* OPPEL, FONTANNES, p. 36, Pl. 5, fig. 2.
1929. *Oppelia trachynota* OPPEL, WEGELE, p. 19 (113), Pl. 26, figs. 8-9.
1935. *Taramelliceras* cf. *trachynota* OPP., VADÁSZ, p. 62. [in lit.]
1955. *Taramelliceras* (*Taramelliceras*) *trachinotum* (OPPEL), HÖLDER, p. 102, Pl. 18, fig. 21.
1959. *Taramelliceras trachinotum* OPP., COLLIGNON, Pl. 114, fig. 426.
1966. *Taramelliceras trachinotum* (OPPEL), ANĐELKOVIĆ, p. 31, Pl. 4, fig. 2; Pl. 7, fig. 1.
1973. *Oppelia* (*Taramelliceras*) *trachynota* OPPEL, PREDA, Pl. 15, fig. 3.
1976. *Taramelliceras* aff. *trachinotum* (OPP.), FÜLÖP, p. 190, Pl. 33, fig. 2.
1976. *T.* (*Taramelliceras*) *trachynotum* (OPPEL), LILLO BEVIA, p. 463, Pl. 2, figs. 5-6.
1977. *Taramelliceras* (*Taramelliceras*) *trachinotum* (OPPEL), SAPUNOV, Pl. 3, fig. 1.
1978. *Taramelliceras* (*Taramelliceras*) *trachinotum* OPPEL, OLÓRIZ, p. 80, Pl. 9, figs. 2.A-B.
1979. *Taramelliceras* (*Taramelliceras*) *trachinotum* (OPPEL), SAPUNOV, p. 46, Pl. 8, fig. 1.
1984. *Taramelliceras* (*Taramelliceras*) *trachynotum* (OPPEL), VERMA & WESTERMANN, p. 35, Pl. 3, fig. 2.A-B.
1993. *Taramelliceras* (*Taramelliceras*) *trachinotum* (OPPEL), SARTI, p. 59, Pl. 3, fig. 1.
1997. *Taramelliceras* (*Taramelliceras*) *trachinotum* (OPPEL), BENZAGGAGH & ATROPS, Pl. 2, figs. 3-4.
2013. *Taramelliceras* cf. *trachinotum* (OPPEL), FŐZY & SCHERZINGER, p. 172, Pl. 14, fig. 1.

Material. 11 whorl fragments (J 2020.190.1, 201.1, 215.1, 246.1, 275.1, 291.1, 322.1, 324.2, 342.1, 355.1, 361.1) of internal moulds.

Dimensions. Due to poor preservation dimensions are not given.

Description. All fragments represent the ventral region from the midflank to the venter of body chambers. Cross section trapezoidal, flanks converging. Ventral shoulder gently rounded. On the ventral shoulder massive spines rise correspondingly. In the middle of the venter, along the mid-siphonal line, another row of tubercles rises. Length, height, and shape of the ventrolateral and mid-siphonal tubercles are equal. Apart from tubercles the conch is smooth, and unsculptured. Suture not seen.

Remarks. The holotype (OPPEL, 1863, Pl. 56, fig. 4.a-b) has more frequent mid-siphonal tubercles and fine ribs than the present specimens. Although there are fine ribs on the flanks of the present species, if the specimens are worn, these ribs are not preserved (cf. ANĐELKOVIĆ, 1997, Pl. 4, fig. 2). The present specimens are comparable to the specimen KNMI-MA31 of VERMA and WESTERMANN (1984, Pl. 3, fig. 2.b), the only notable difference is that the latter has stronger tubercles. The present specimens are also close to specimen F.G14.5.16 of OLÓRIZ (1978, Pl. 9, fig. 2.b), however the latter is more inflated and presents fine ribs on the mould. Notwithstanding, the present specimens do not show ribs, most probably due to the poor preservation.

Stratigraphic and geographic distribution. *Taramelliceras trachinotum* is reported from the upper Kimmeridgian. Geographically widespread from the Tethys (Italy: SARTI, 1993; Tunisia: BENZAGGAGH & ATROPS, 1997; Hungary, Serbia: ANĐELKOVIĆ, 1966; Bulgaria: SAPUNOV, 1979; Eastern Carpathians: PREDA, 1973) and from peri-Tethysian territories (Submediterranean: Betic Cordilleras, Alicante Spain: OLÓRIZ, 1978; Crussol France: FONTANNES, 1879; southern Germany). It is also known from the Indo-Malagasy Province of the southern Tethys (Kenya: VERMA & WESTERMANN, 1984; and Madagascar: COLLIGNON, 1959).

Subgenus *Metahaploceras* SPATH, 1925

Type species: *Ammonites lingulatus nudus* QUENSTEDT, 1849

Taramelliceras (*Metahaploceras*) aff. *strombecki* (OPPEL, 1857)

(Fig. 6.D1-D2)

1849. *Ammonites lingulatus nudus*, QUENSTEDT, p. 130, Pl. 9, fig. 8.
1857. *Ammonites Strombecki* n. sp., OPPEL, p. 687.
1878. *Oppelia Strombecki* OPPEL, HERBICH, p. 148 [130], Pl. 4, fig. 1.
1907. *Neumayria* cf. *Strombecki* OPPEL, PERVINQUIÈRE, p. 19. [in lit.]
1955. *Taramelliceras* (*Metahaploceras*) *strombecki* (OPPEL), HÖLDER, p. 135, Figs. 157-161.
1973. *Oppelia* (*Taramelliceras*) *strombecki* OPPEL, PREDA, Pl. 6, fig. 1.
1978. *Taramelliceras* (*Metahaploceras*) *strombecki* (OPPEL), OLÓRIZ, p. 110, Pl. 10, fig. 1.
1993. *Taramelliceras* (*Metahaploceras*) *strombecki* (OPPEL), SARTI, p. 58, Pl. 1, fig. 6.A-B.
1994. *Taramelliceras* (*Metahaploceras*) *strombecki* (OPP.), SCHLEGELMILCH, p. 40, Pl. 11, fig. 3.
2003. *Taramelliceras* (*Metahaploceras*) cf. *strombecki* (OPPEL), LUKENEDER *et al.*, p. 226, Pl. 1, figs. 7-8.
2011. *Taramelliceras strombecki* (OPPEL), FŐZY *et al.*, p. 417, Fig. 2.3-2.4.
2013. *Metahaploceras strombecki* (OPPEL), FŐZY & SCHERZINGER, p. 174, Pl. 2, fig. 7.

Material. Three poorly preserved whorl fragments and internal moulds (J 2020.156.1, 158.1, 223.1).

Dimensions. Due to fragmentary status, dimensions are not given.

Description. These whorl fragments most probably belonged to large-sized (?adult) ammonites and represent body chambers. Umbilical region not preserved. Middle and upper flank sculptured with fine, s-shaped ribs, occasionally ending in fine tubercles at the ventral shoulder. Sometimes the fine ribs cross the venter continuously forming a forwardly convex gentle bend. Specimen J 2020.223.1 most similar to HERBICH's specimen (1878, Pl. 4, fig. 1) with smooth flank, fine ribs and occasional fine and short tubercles. Cross section is compressed, oval, venter rounded. Suture not seen.

Remarks. Although coiling, umbilical region and midflank area are uncertain, the smooth upper flank, fine sculpture and cross section definitely associate this species with the *strombecki* species. *T. (M.) nodosiusculum* (FONTANNES, 1879) is also comparable however the latter has more frequent and less sinuous ribbing (cf. OLÓRIZ, 1978, p. 115). The poor preservaton justifies the uncertain assignment. First record from the Mecsek Mountains.

Stratigraphic and geographic distribution. *Taramelliceras strombecki* is reported from the Strombecki Zone, lower Kimmeridgian, however it occurs in younger strata (*e.g.*, Herbichi Zone: FŐZY *et al.*, 2011). Geographically it is typical of the Tethysian (Mediterranean Province: Italy: SARTI, 1993; Hungary, Eastern Carpathians: PREDA, 1973; Algeria: BOUCHEMLA *et al.*, 2020; Tunisia: PERVINQUIÈRE, 1907), and peri-Tethysian settings (Submediterranean Province: Betic Cordilleras Spain: OLÓRIZ, 1978; southern Germany: SCHLEGELMILCH, 1994).

Genus *Hemihaploceras* SPATH, 1925

Type species: *Oppelia nobilis* NEUMAYR, 1873

Hemihaploceras nobile (NEUMAYR, 1873)

(Fig. 6.E1-E2)

1873. *Oppelia nobilis* nov. sp., NEUMAYR, p. 167 [27], Pl. 32, Figs. 3-4.
1877. *Ammonites* (*Oppelia*) *nobilis* NEUMAYR, FAVRE, p. 36, Pl. 2, fig. 14.
1879. *Oppelia nobilis* NEUMAYR, FONTANNES, p. 46, Pl. 3, fig. 4.
1935. *Taramelliceras nobilis* NEUM., VADÁSZ, p. 62. [in lit.]
1959. *Taramelliceras (Hemihaploceras) nobile* (NEUMAYR), BERCKHEMER & HÖLDER, p. 77, Pl. 16, fig. 74.
1966. *Hemihaploceras nobilis* (NEUMAYR), ANĐELKOVIĆ, p. 42, Pl. 4, fig. 3; Pl. 6, fig. 6.
1973. *Oppelia* (*Taramelliceras*) *nobilis* NEUMAYR, PREDA, Pl. 17, fig. 14.
1977. *Hemihaploceras nobile* (NEUMAYR), SAPUNOV, Pl. 6, fig. 4.
1978. *Hemihaploceras nobile* (NEUMAYR), OLÓRIZ, p. 117, Pl. 7, fig. 5.
1979. *Hemihaploceras nobile* (NEUMAYR), SAPUNOV, p. 59, Pl. 13, figs. 1-4.
1989. *Hemihaploceras nobile* (NEUMAYR), FŐZY, Pl. 4, fig. 1.
1995. *Hemihaploceras nobile* (NEUMAYR), FŐZY, p. 136, Pl. 21, fig. 1.
1997. *Taramelliceras* (*Hemihaploceras*) *nobile* (NEUMAYR), BENZAGGAGH & ATROPS, Pl. 3, fig. 1.
1999. *Hemihaploceras* sp. cf. *nobile* (NEUMAYR), CARACUEL & OLÓRIZ, Fig. 5.3.
2010. *Hemihaploceras* (*Hemihaploceras*) *nobile* (NEUMAYR), MANDL *et al.*, p. 94.
2018. *Hemihaploceras nobile* (NEUMAYR), METODIEV, p. 98, Fig. 1.c-d.

Material. 12 poorly preserved internal moulds of whorl fragments (J 2020.147.1, 362.1, 577.1-582.1, 585.1-588.1).

Dimensions. Due to fragmentary status, dimensions are not given.

Description. Worn, dissolved fragments of internal mould. Umbilicus, inner whorls lost. Flanks convex, converging. Cross section compressed, oval, through the ventral shoulder tubercles, rectangular. Venter flat, smooth, rounded, no tubercles on the mid-siphonal ridge. On the ventral shoulder strong, wide, paired tubercles rise that correspond to each other. Below the tubercles on the upper flank, fine, wide, shallow, s-shaped double ribs rise and travel toward the lower flank. Suture, aperture not seen.

Remarks. Lack of ventral tubercles on mid-siphonal ridge, characteristic sculpture, cross section, and coiling provide an unmistakeable and easy-to-recognize species (OLÓRIZ, 1978 p. 119). Its intraspecific variety is restricted to coiling, and strength of sculpture. Specimen J 2020.577.1 is most similar to the holotype of NEUMAYR (1873, Pl. 32, fig. 3.a) and represents the more evolute and strongly sculptured morphs of the species. Specimen J 2020.581.1 most similar to specimen J182 of SAPUNOV (1979, Pl. 13, fig. 3) and represents the faintly sculptured stock with well-developed tubercles.

Stratigraphic and geographic distribution. *Hemihaploceras nobile* is reported from the upper Kimmeridgian Cavouri and Beckeri zones from the northern and southern margins of the western Tethys.

Subfamily Streblitinae SPATH, 1925
Genus *Streblites* HYATT, 1900

Type species: *Ammonites tenuilobatus* OPPEL, 1857

***Streblites tenuilobatus* (OPPEL, 1857)**
(Fig. 6.F1-F2)

1857. *Ammonites tenuilobatus*, n. sp., OPPEL, p. 686.
1863. *Ammonites tenuilobatus* OPP., OPPEL, p. 160, Pl. 50, fig. 1.a-b.
1867. *Ammonites tenuilobatus* OPPEL, PICTET, p. 235, Pl. 36, fig. 10.
1876. *Ammonites tenuilobatus* OPPEL, DUMORTIER & FONTANNES, p. 52, Pl. 7, figs. 1-2.
1877. *Ammonites* (*Oppelia*) *tenuilobatus* OPPEL, FAVRE, p. 26, Pl. 2, fig. 5.
1878. *Oppelia tenuilobata*, OPP., GEMMELLARO, p. 186, Pl. 2, fig. 6.
1879. *Oppelia tenuilobata* OPPEL, FONTANNES, p. 22, Pl. 3, figs. 5-6.
1907. *Oppelia tenuilobata* OPP., TOULA, p. 22, Pl. 5, fig. 6.
1929. *Streblites tenuilobatus* OPPEL, WEGELE, p. 11 [105], Pl. 25, figs. 7-9.
1973. *Oppelia* (*Streblites*) *tenuilobatus* OPPEL, PREDA, Pl. 10, fig. 5.
1977. *Streblites tenuilobatus* (OPPEL), ZIEGLER, Pl. 3, fig. 6.
1978. *Streblites tenuilobatus* (OPPEL), OLÓRIZ, p. 44, Pl. 4, figs. 2-3.
1979. *Streblites tenuilobatus* (OPPEL), SAPUNOV, p. 62, Pl. 14, fig. 1.A-B.
1988. *Streblites tenuilobatus frotho* (OPPEL), ABDULKASUMZADE, p. 105, Pl. 12, fig. 8.
2000. *Streblites tenuilobatus* (OPPEL), GRIGORE, Pl. 1, fig. 4.
2000. *Streblites tenuilobatus* (OPPEL), GYGI, p. 73, Pl. 14, fig. 4.
2011. *Streblites* cf. *tenuilobatus* (OPPEL), FŐZY *et al.*, p. 418, Fig. 3.3.
2018. *Streblites tenuilobatus* (OPPEL), GRIGORE, p. 16, Pl. 1, figs. 8, 11-12.

Material. Two relatively well-preserved internal moulds.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.114.1.	86.4	(24)	49.7	8.2	0.483	0.575	0.095
J 2020.115.1.	83.6	23	48.2	7.3	0.477	0.576	0.087

Description. Highly involute, strongly compressed shell. Phragmocone cross section is oxyconic (cross section of living chamber is more rounded, with inflated flank as OLÓRIZ (1978, p. 54) demonstrated). Umbilicus small, shallow. Umbilical wall vertical or oblique. Umbilical shoulder slightly rounded. At the umbilical shoulder, fine, radial ribs rise that become shortly prorsiradiate and disappear at the lower third of the midflank. There are 9 ribs on half whorl. Upper flank and venter dissolved; no sculpture preserved. Venter acute in cross section, and slightly rounded.

Remarks. The preservation is poor, therefore the lateral tubercles and the fine secondary ribs on the upper flank are not preserved. The present specimens are most similar to material illustrated by DUMORTIER and FONTANNES (1876, Pl. 7, fig. 2) and OLÓRIZ (1978, Pl. 4, fig. 3). Although the sculpture is poorly preserved, the U/D ratio is decisive for the specific designation as OLÓRIZ (1978, p. 47) demonstrated. In the case of *S. tenuilobatus* s. str. it is 8-10%. Our specimens fall into this range (8.7% and 9.5%). Due to the poor preservation, any ventral fine ribbing is uncertain. The year of erecting this species by OPPEL varies in literature. Many authors (*e.g.*, DUMORTIER & FONTANNES, 1876; GYGI, 2000; PICTET, 1867; SAPUNOV, 1979) refer it to 1858, others even to 1863 (*e.g.*, OLÓRIZ, 1978; FŐZY *et al.*, 2011). Correctly it is 1857 when OPPEL published his second volume of Juraformation ('Jahreshefte' 13), pp. 439-694. First record from the Mecsek Mountains.

Stratigraphic and geographic distribution. *Streblites tenuilobatus* is a typical faunal element of the Kimmeridgian Herbichi Zone with stray individuals from the Acanthicum Zone. Geographically widespread in the western Tethys (Mediterranean: Sicily, Hungary, Eastern Carpathians, Bulgaria; and Submediterranean: Betic Cordilleras Spain, Crussol France, southern Germany; Provinces), also along the northern margin of the Tethys (Azerbaijan).

Superfamily Perisphinctoidea STEINMANN, 1890
Family Perisphinctidae STEINMANN, 1890
Perisphinctidae gen. et sp. ind.

Material. 11 poorly preserved internal moulds (J 2020.174.1, 176.1, 239.1, 248.1, 557.1-562.1, and below).

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.237.1.	86.4	(24)	(23)	(50)	1.043	0.266	0.579

Subfamily Passendorferiinae MELÉNDEZ, 1989
Genus *Praesimoceras* SARTI, 1990
[emend. GYGI, 2003, p. 91]

Type species: *Ammonites nodulatus* (QUENSTEDT, 1888)

***Praesimoceras* cf. *herbichi* (HAUER, 1866)**
(Fig. 7.A1-A2)

1866. *Ammonites Herbichi* n. sp., HAUER, p. 194 [24]
1873. *Simoceras Herbichi* v. HAUER, NEUMAYR, p. 186 [46], Pl. 40, figs. 1-2.
1877. *Ammonites* (*Simoceras*) *Herbichi* v. HAUER, FAVRE, p. 55, Pl. 6, fig. 2; Pl. 7, fig. 3.
1879. *Simoceras herbichi* von HAUER, FONTANNES, p. 83, Pl. 11, fig. 11.

1959. *Nebrodites* (*Mesosimoceras*) *herbichi* (von HAUER), ZIEGLER, Pl. 1, fig. 21.
1966. *Pseudosimoceras herbichi* (v. HAUER), ANĐELKOVIĆ, p. 96, Pl. 10, fig. 2.
1973. *Pseudosimoceras herbichi* (HAUER), PREDA, Pl. 16, fig. 2.
1978. *Nebrodites* (*Mesosimoceras*) *herbichi* (v. HAUER), OLÓRIZ, p. 182, Fig. 2.A-B, Pl. 16, fig. 1.
1999. *Nebrodites* (*Mesosimoceras*) cf. *N. (M.) herbichi* (von HAUER), FATMI & ZEISS, p. 50, Pl. 37, fig. 3.
2000. *Presimoceras herbichi* (HAUER), GRIGORE, Pl. 2, fig. 1.
2003. *Praesimoceras* cf. *herbichi* (von HAUER), GYGI, p. 92, Fig. 100.
2003. *Presimoceras* cf. *herbichi* (HAUER), RASSER *et al.*, Pl. 1, fig. 9-11.
2010. *Presimoceras herbichi* (von HAUER), GRIGORE, p. 287, Pl. 1, figs. 2, 4, 6-7.
2010. *Nebrodites* (*Mesosimoceras*) *herbichi* (von HAUER), MANDL *et al.*, p. 95, Pl. 14, fig. 18.
2011. *Presimoceras herbichi* (HAUER), PETTI *et al.*, p. 166, Pl. 2, fig. 2.A-B.
2013. *Presimoceras* cf. *herbichi* (von HAUER), FŐZY & SCHERZINGER, p. 177, Pl. 3, figs. 2, 5-6.

Material. Two poorly preserved, fragmented internal moulds (J 2020.109.1, and below).

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.117.1.	(175)	28.8	42.3	(100)	0.681	0.242	0.571

Description. Whorl fragments of big sized conch representing body chamber. Strongly evolute, serpenticone coiling. Early whorls lost. Umbilical wall rounded, smooth, oblique. Flanks converging. Ventral shoulder rounded, venter and its mid-siphonal region eroded and dissolved; not well preserved. Cross section high subtrapezoidal. At the umbilical shoulder strong, widely spaced, radial or slightly prorsiradiate ribs occur. There are 22 ribs on specimen J 2020.117.1, which represents just less than a half whorl. Intercalatory ribs and constrictions may occur. Neither suture nor aperture seen.

Remarks. The ratios of conch of the present specimen fits remarkably well with the figured specimen of NEUMAYR (1873) (U/D= 0.57 here, 0.61 by NEUMAYR; Wh/D= 0.24 here, 0.22 for NEUMAYR, at diameter 175 mm here, and 140 mm in NEUMAYR (1873, p. 186 [46]). Number of ribs varies as the diameter increases: At greater diameters, the number of ribs per half whorl decreases. This is well documented by the authors who have given detailed palaeontological descriptions or well-described accounts of specimens (NEUMAYR, 1873; ZIEGLER, 1959; PREDA, 1973; OLÓRIZ, 1978; GRIGORE, 2010) and varies between 12-33 with gradual decrease as the diameter increases. The poor preservation (loss of internal whorls, presence of only less than a half whorl with dissolved ventral region) creates pitfalls of assigning these collected fragments into any distinct species. The lateral view of the present specimens may refer to *herbichi* but also *P. teres* and *P. planulascinctum* are comparable, however their ventral region cannot be compared. The present specimens are tentatively assigned to *herbichi* based on whorl section and ribbing. Fragments collected are considered to represent middle whorls of this perisphinctid. First record from the Mecsek Mountains.

Stratigraphic and geographic distribution. *Praesimoceras herbichi* is reported from the upper part of the Strombecki and the Herbichi zones of the lower Kimmeridgian with a wide geographic distribution in the western Tethysian and peri-Tethysian (Submediterranean Province) territories and also from the northern Tethys (Baluchistan).

Genus *Mesosimoceras* SPATH, 1925

Type species. *Simoceras Cavouri* GEMMELLARO, 1872

Mesosimoceras cavouri (GEMMELLARO, 1872)

(Fig. 7.B1-B2)

1872. *Simoceras Cavouri* GEMM., GEMMELLARO, p. 151, Pl. 2, figs. 3-4.
1966. *Mesosimoceras covouri* (GEMMELLARO), ANĐELKOVIĆ, p.98, Pl.8, fig. 2; Pl. 11, fig. 7; Pl. 20, fig. 5.
1978. *Nebrodites* (*Mesosimoceras*) *cavouri* (GEMMELLARO), OLÓRIZ, p. 178, Pl. 15, fig. 5.
1979. *Nebrodites* (*Mesosimoceras*) *cavouri* (GEMMELLARO), SAPUNOV, p. 118, Pl. 32, fig. 2.
1989. *Nebrodites* (*Mesosimoceras*) *cavouri* (GEMMELLARO), FŐZY, p. 152, Pl. 1, fig. 3.
1990. *Mesosimoceras cavouri* (GEMMELLARO), SARTI, p. 47, Fig. 6.A.
2000. *Mesosimoceras cavouri* (GEMMELLARO), GRIGORE, Pl. 3, fig. 5.
2011. *Nebrodites cavouri* (GEMMELLARO), FŐZY *et al.*, p. 419, Fig. 4.
2013. *Mesosimoceras cavouri* (GEMMELLARO), FŐZY & SCHERZINGER, p. 176, Pl. 3, fig. 8.
2016. *Mesosimoceras cavouri* (GEMMELLARO), SCHERZINGER *et al.*, p. 146, Fig. 2.

Material. One incomplete, fairly preserved whorl fragment.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.290.1.	n.d.	14.5	20.4	n.d.	0.711	n.d.	n.d.

Description. Fairly preserved whorl fragment. Based on the fragment coiling very much evolute (=serpenticone). Umbilicus not seen. Umbilical wall very short, rounded. Simple, strong, radial ribs rise at umbilical wall, cross the umbilical shoulder and travel radially through flanks. Venter not preserved. Cross section compressed, oval, flanks convex, converging. Suture, aperture not preserved.

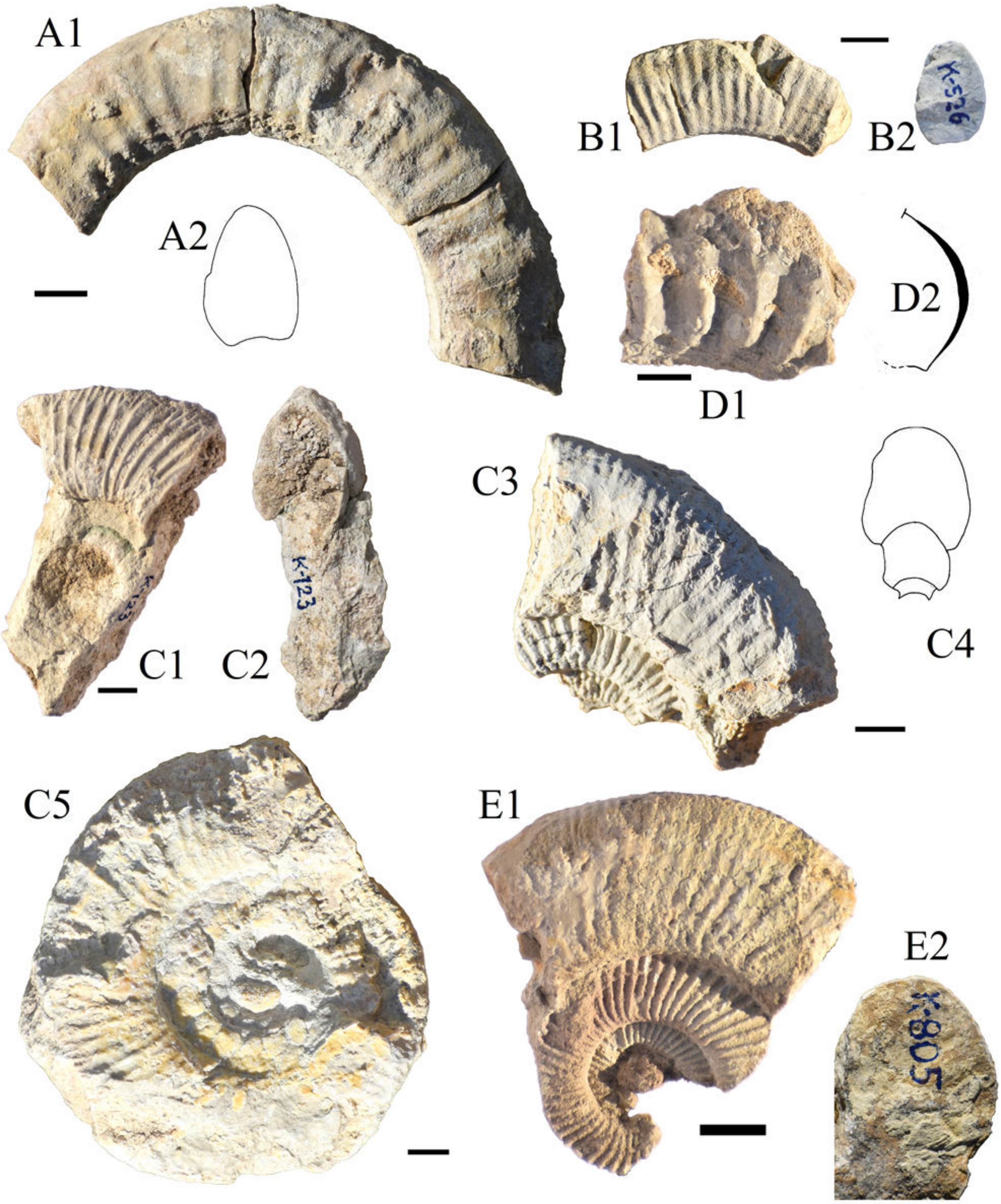


Figure 7: Upper Kimmeridgian-lower Tithonian ammonoids from Zengővárkony, Mecsek Mountains, Hungary. A. *Praesimoceras herbichi* (HAUER, 1866), specimen J 2020.117.1. A1. lateral view; A2. cross-section. B. *Mesosimoceras cavouri* (GEMMELLARO, 1872), specimen J 2020.290.1. B1. lateral view; B2. cross-section. C. Ataxioceratidae sp., specimen J 2020.105.1. C1. lateral view; C2. apertural view; specimen J 2020.107.1. C3. lateral view; C4. cross-section., C5. specimen J 2020.572.1. D. *Crussoliceras* sp. ind., specimen J 2020.269.1. D1. lateral view; D2. cross-section. E. *Progeronia* sp. ind., specimen J 2020.368.1. E1. lateral view; E2. cross-section of specimen J 2020.571.1.

Remarks. Although the collected fragment represents only a short whorl segment, the cross section, simple ribbing and coiling allows assignation to the characteristic *cavouri* biospecies. There are only two species assigned to this genus (SARTI, 1990): *M. cavouri* and *M. risgoviensis*. Based on the differential analysis of SARTI (1990, p. 41) the present specimen is tentatively assigned to the former on the grounds that the collected specimen shows hardly overlapping coils, no constrictions, nor tubercles on the ventrolateral shoulder. Whereas the collected specimen differs from *risgoviensis* by fainter sculpture and simple ribbing. First record from the Mecsek Mountains.

Stratigraphic and geographic distribution. FAD in the lower part of Kimmeridgian Cavouri Zone; it is known to the end of Beckeri Zone in the Mediterranean Tethys, with stray occurrences in the Submediterranean Province.

Family Ataxioceratidae Buckmann, 1921
Subfamily Ataxioceratinae Buckmann, 1921
Ataxioceratidae div. sp.
(Fig. 7.C1-C5)

Material. 118 poorly preserved internal moulds, mainly whorl fragments (J 2020.88.1, 92.1, 94.1, 99.1, 100.1, 104.1, 107.1, 108.1, 113.1, 121.1-124.1, 126.1, 135.1, 137.1, 139.1, 140.1, 173.1, 175.1, 179.1, 180.1, 181.1, 183.1, 187.1, 188.1, 189.1, 195.1-197.1, 199.1, 200.1, 206.1, 208.1, 209.1, 210.1, 218.1, 234.1, 235.1, 238.1, 240.1, 241.1, 245.1, 303.1.-305.1, 497.1-556.1, 584.1, and below).

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.118.1.	103.3	(28)	(32)	(44)	0.875	0.310	0.426
J 2020.151.1.	(95)	(30)	(31)	(47)	0.968	0.326	0.495
J 2020.178.1.	(71)	(21)	21.3	30.4	0.986	0.300	0.428
J 2020.194.1.	(68)	20.6	(22)	(33)	0.936	0.323	0.485
J 2020.572.1.	(91)	(29)	(30)	(41)	0.967	0.330	0.451
J 2020.573.1.	(76)	(22)	(26)	33.4	0.846	0.342	0.439
J 2020.574.1.	(107)	(23)	(31)	(48)	0.742	0.290	0.448
J 2020.575.1.	(110)	(30)	(34)	44.6	0.882	0.309	0.405
J 2020.576.1.	73.4	23.2	(19)	39.6	1.221	0.259	0.539

Description. Poorly preserved fragments of conchs of body chamber and phragmocone. In better preserved specimens, umbilicus wide, shallow, 2-3 whorls seen if present. Whorl section circular, subcircular to oval. Finer or stronger, radial to prorsiradiate ribs rise at umbilical shoulder being prorsiradiate on flanks and cross the venter continuously. Ribs bifurcate on the upper flanks. Single ribs, constrictions and virgatotomous ribs may be present. Suture, aperture not seen.

Remarks. The various collected whorl fragments definitely belong to many different Ataxioceratidae species and genera. Ataxioceratid ammonites are abundant and important biogeographical and biostratigraphical indicators in the Submediterranean Province of the Tethys and adjacent areas.

Genus *Crussoliceras* Énay, 1959

Type species. *Ammonites Crusoliensis* Fontannes, 1879

***Crussoliceras* sp.**
(Fig. 7.D1-D2)

Material. One poorly preserved internal mould (J 2020.269.1).

Dimensions. Due to the fragmentary status, dimensions are not given.

Description. Poorly preserved, fragmentary internal mould of a body chamber with less than 30 mm whorl height. Only 4 ribs preserved of the whorl fragment. Cross section oval, slightly compressed. Strong, rectiradiate ribs rise from the umbilical region that bend forward and radial on midflank. Ribs slightly prorsiradiate on the upper flank. Venter not preserved. Ribs highest on midflank. Ribs may bifurcate on upper flank. Suture, umbilicus, peristome not preserved.

Remarks. The strong, coarse and projected, sparsely placed, sometimes bifurcating ribbing that raised above the flanks and the oval cross section is typical for the genus. Unfortunately, the paucity, poor preservation and fragmentary status restricted further determination. The typical bifurcation of ribs on the upper flank is well visible on the third rib. The present specimen shows similarities toward the inner whorls of *C. crusoliense* Fontannes, *C. geyeri* Sapunov and *C. sayni* Camus & Thieuloy, however the fragmentary status hinders specific determination. First record from the Mecsek Mountains.

Stratigraphic and geographic distribution. *Crussoliceras* is typical of the Kimmeridgian. Geographically it occurs in the Submediterranean Province (SE France, Spain, French and Swiss Jura Mountains), however it is reported from the Mediterranean Province (Morocco, Bulgaria), also by Énay and Howarth (2019).

Genus *Progeronia* Arkell, 1953

Type species: *Perisphinctes progeron* Ammon, 1875

***Progeronia* sp.**
(Fig. 7.E1-E2)

Material. Two poorly preserved and fragmentary internal moulds (J 2020.368.1, 571.1).

Dimensions. Due to fragmentary status dimensions are not given.

Description. Poorly preserved whorl fragments of phragmocone. Conch rather evolute, compressed. Umbilicus wide, profound. Three whorls seen. Umbilical wall vertical on inner, and oblique on outer whorls. Umbilical shoulder rounded. Flanks convex, converging. Venter rounded. Fine, simple, rectiradiate ribs rise on the umbilical wall, bending forward upward and become radial on the umbilical shoulder. Passing the umbilical shoulder bend forward and become prorsiradiate; ribs travel straightforward on the flank and bifurcate on the upper third. Bifurcated ribs continuously cross the venter. Number of primaries per half whorl acquired at D=20 mm: 21; D=45 mm: 27; D=100 mm: 36 [estimated]. Cross section compressed, rounded trapezoidal. Neither suture nor aperture seen.

Remarks. *Progeronia* is an important genus in the Kimmeridgian (Olóriz, 1978, p. 399). The poor and fragmentary collected material prevented specific determination. Rib curve not presented. Due to the poor material available, only the number of ribs is counted per half whorl at estimated diameters. Based on the very estimated rib curve of specimen J 2020.368.1, this may belong to the *P. unicompta* - *P. simplex* group (cf. SARTI, 1993, Fig. 23). First record from the Mecsek Mountains.

Stratigraphic and geographic distribution. *Progeronia* species are typical for the Kimmeridgian; geographically the species noted above are reported from the western Tethys and Submediterranean Province (ÉNAY & HOWARTH, 2019).

Genus *Gravesia* SALFELD, 1913

Type species: *Ammonites Gravesianus* ORBIGNY, 1847

***Gravesia* aff. *gigas* (ZIETEN, 1830)**
(Fig. 8.A1-A3)

1830. *Ammonites gigas*, ZIETEN, p. 17, Pl. 13, fig. 1.a-b.
1959. G*ravesia* cf. *gigas* (ZIETEN), BERCKHEMER & HÖLDER, p. 66, Fig. 35.B, G, Pl. 15, fig. 71.
1963. *Gravesia gigas* (ZIETEN), HAHN, p. 97, Pl. 9, figs. 1-4; Pl. 10, fig. 1-2.
1966. *Gravesia gigas* (ZIETEN), ÉNAY, p. 7, Pl. A, fig. 1.A-B.
1967. *Gravesia gigas* (ZIETEN), COPE, p. 12, Pl. 1, fig. 1.
1977. *Gravesia gigas* (ZIETEN), ZIEGLER, Pl. 6, fig. 5.
1989. *Gravesia gigas gigas* (ZIETEN), HANTZPERGUE, p. 191, Figs. 48.A-F, 49.A-B, 50.A-C, 57-58, 128.16; Pl. 17, figs. A-C.
1994. *Gravesia gigas* (ZIETEN), FISCHER, p. 186, Pl. 85, fig. 2; Pl. 86, fig. 1.
2010. *Gravesia* cf. *gigas*, GALLOIS & ETCHES, Fig. 8.a-b.
2015. *Gravesia gigas* (ZIETEN), COMMENT *et al.*, Pl. 5, fig. 1.
2016. *Gravesia gigas intermedia* HANTZPERGUE, SCHERZINGER & SCHWEIGERT, Figs. 4.A-F, 5.A-B, .D, .G-H, 6.A-E.

Material. One worn internal mould from mixed debris and soil.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.101.1.	113.9	44.1	(34)	39.1	1.297	0.298	0.343

Description. Small-sized *Gravesia* with rather involute, compressed conch. Umbilicus is wide and shallow. Umbilical wall vertical and high. Umbilical shoulder, flanks and venter all rounded. At the umbilical shoulder or a little higher (uncertainty due to the poor preservation) low tubercles rise. Prorsiradiate ribs emanate from the low tubercles that bifurcate below the midflank. Ribs travel toward the venter, however due to poor preservation their crossing the venter is not visible. The phragmocone is worn and dissolved; suture only partly preserved and dissolved but approximately resembling the suture of Figure 48.C in HANTZPERGUE (1989, p. 194).

Remarks. Reliable identification of *Gravesia* species is based on the analysis of coiling, cross section (cf. GALLOIS & ETCHES, 2010, Fig. 9) and sculpture. The present specimen has similar fine sculpture and dense ribbing comparable to *G. irius* (ORBIGNY, 1850), as seen on the specimen illustrated by SCHWEIGERT (1999, p. 34, Fig. 4), however the cross section of the latter one is much more depressed. *Gravesia gravesiana* and *Gravesia gigas intermedia* are more evolute than the present specimen. The collected specimen compares favourably to a specimen of *Gravesia gigas* illustrated by COMMENT *et al.* (2015, Pl. 1, fig. 1.a-b) based on their cross sections and ribbing. The cross section of the present specimen is perhaps closest to the specimen of *Gravesia* cf. *gigas* in BERCKHEMER and HÖLDER (1959, p. 64, Fig. 35.a). However, although there are common characters with *G. gigas*, and *G. irius*, the poor preservation prevented a precise determination. First record from Hungary.

Stratigraphic and geographic distribution. Reported from the lower Tithonian (middle Hybonotum Zone) in the Franco-German Bioma, England. Its FAD indicates the Tithonian (COMMENT *et al.*, 2015) and Portlandian (HANTZPERGUE, 1989). Geographically *Gravesia gigas* is only reported from the Subboreal and the Submediterranean Provinces in western Europe therefore the Hungarian occurrence indicates the extreme southern limit of its distribution.

Subfamily Lithacoceratinae ZEISS, 1968
Genus *Lithacoceras* HYATT, 1900
[= *Discosphinctoides* OLÓRIZ, 1978; *Silicisphinctes* SCHWEIGERT & ZEISS, 1999]

Type species: *Ammonites Ulmensis* OPPEL, 1858

? *Lithacoceras* sp.
(Fig. 8.B1-B2)

Material. Two poorly preserved internal moulds from the quarry floor amongst debris (J 2020.97.1, 367.1, and below).

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D	N/2
J 2020.97.1.	151	32	45	72	0.711	0.298	0.477	32

Description. Big sized, poorly preserved conch representing the phragmocone and body chamber. Coiling serpenticone, three whorls seen. Umbilicus wide, shallow. Umbilical wall short, vertical. Umbilical shoulder rounded. Flanks parallel or slightly converge. No ventral shoulder. Venter rounded. At the umbilical shoulder densely placed, fine, prorsiradiate ribs rise. Ribs bifurcate on the upper flank, around 2/3 of the whorl height, where the new whorl touches the previous. Bifurcation regular, no single ribs observed. Ribs cross the venter radially. Whorl section compressed oval. Suture, aperture and constrictions not seen.

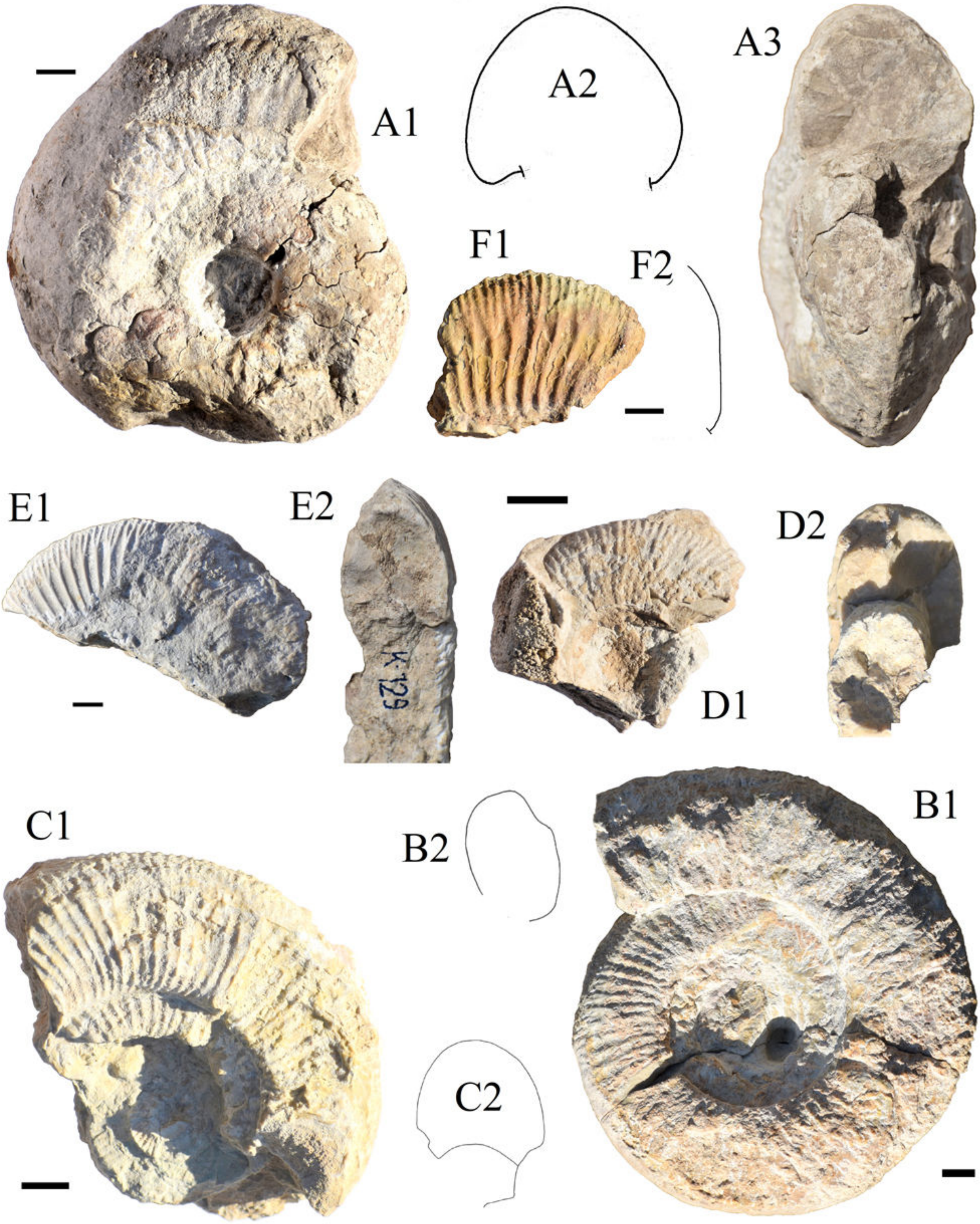


Figure 8: Upper Kimmeridgian-lower Tithonian ammonoids from Zengővárkony, Mecsek Mountains, Hungary. A. *Gravesia* aff. *gigas* (ZIETEN, 1830), specimen J 2020.101.1. A1. lateral view; A2. apertural view; A3. cross section. B. ?*Lithacoceras* sp., specimen J 2020.97.1. B1. lateral view; B2. cross-section. C. *Lithacoceras* sp. juv., specimen J 2020.365.1. C1. lateral view; C2. cross-section. D. *Lithacoceras* aff. *siliceum* (QUENSTEDT, 1857), specimen J 2020.185.1. D1. lateral view; D2. apertural view.E. *Euvirgalithacoceras*? sp., specimen J 2020.111.1. E1. lateral view; E2. apertural view. F. *Euvirgalithacoceras* aff. *ombonii* (DEL CAMPANA, 1905), specimen J 2020.589.1. F1. lateral view; F2. cross section. Scale bars indicate 1 cm.

Remarks. The original designation of the genus by OLÓRIZ (1978, p. 481) fits to the present specimen. Unfortunately, further designation is impossible. On one hand, there are many species included in this genus: *L. ardescicus*, *L. geron*, *L. modestus*, *L. neohispanicum*, *L. praenuntians*, *L. rhodaniforme*, *L. rigida*, *L. roubyanus*, *L. stenocyclus*, *L. subborealis*, *L. vandellii*, *L. virgu-*

latiformis. These species show fine distinctions and variations of their rib density and thickness, bifurcation, trifurcation, number of intercalatory ribs and whorl section. Careful analysis would require construction of rib curves for complete specimens and of good preservation but on the other hand, the poor preservation of the present specimen prevents positive assignation to any of these species however there are certain similarities with *L. roubyanus*, and *L. praenuntians*. First record from the Mecsek Mountains.

Stratigraphic and geographic distribution. Reported from the upper Kimmeridgian of the Submediterranean Province (OLÓRIZ, 1978) and Indo-Malagasy Province (ÉNAY & HOWARTH, 2019).

Lithacoceras sp. juv.

(Fig. 8.C1-C2)

Material. One fragmentary and poorly preserved internal mould.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D	N/2
J 2020.365.1.	n.d.	34.4	(36)	(52)	0.955	n.d.	n.d.	40

Description. Poorly preserved and crushed internal mould of half whorl segment with a small fragment of inner whorl attached. Coiling evolute, umbilicus wide, shallow. Four whorls partly seen. Umbilical shoulder vertical, short, smooth. Umbilical shoulder rounded. Flanks convex, converging. Venter rounded, no mid-siphonal ridge or band seen. Cross section rounded trapezoidal; conch slightly compressed. Fine, densely spaced ribs rise from the umbilical edge. Ribs rectiradiate on the umbilical wall, bending forward on the umbilical shoulder, then flex on the flank. Ribs bifurcate at 2/3 of the flank. Bifurcating ribs equally spaced and uniform, crossing the venter continuously.

Remarks. The poor preservation and fragmentary status did not allow for the precise counting of ribs per whorl or half whorl; therefore rib curve analysis was not undertaken. Whorl section of the present specimen is very close to the holotype of *Lithacoceras delcampanai* (SARTI, 1993, Fig. 37, no. A413V). The only difference is that the collected specimen has slightly inflated flanks, forming a transition between the holotype and the specimen no. ME479 (illustrated by SARTI, 1993) having subcircular cross section. Number of ribs is difficult to assess. Only two quarter whorls are preserved moderately enough to estimate a rib count. The specimens of SARTI (1993, Fig. 39.W-X) show 60-70 primaries at a diameter of 110 mm. Calculation for the collected specimen at a comparable diameter based on the last quarter whorl approximates to 76 (19x4), however this is an overestimation because the earlier whorls show fewer primaries (cf. SARTI, 1993, Fig. 39). The poor preservation therefore did not justify a specific assignment.

Stratigraphic and geographic distribution. As for *Lithacoceras* sp. above.

Lithacoceras aff. *siliceum* (QUENSTEDT, 1857)

(Fig. 8.D1-D2)

1857. *Amm. planulatus siliceous*, QUENSTEDT, p. 775, Pl. 95, fig. 27.
1888. *Amm. planulatus siliceous*, QUENSTEDT, p. 1073, Pl. 125, fig. 2.
1959. *Perisphinctes siliceus* (QUENSTEDT), BERCKHEMER & HÖLDER, p. 41, Pl. 14, figs. 69-70; Pl. 16, fig. 73.
1959. *Perisphinctes siliceus* (QUENSTEDT), HÖLDER & ZIEGLER, p. 187, Pl. 17, fig. 2.
1968. *Usseliceras* (*Subplanitoides*) *siliceum* (F.A. QUENSTEDT), ZEISS, p. 64, Pl. 4, fig. 1.
1993. *Subplanitoides siliceum* (QUENSTEDT), OLÓRIZ *et al.*, p. 281, Pl. 2, fig. 3.
1994. *Usseliceras* (*Subplanitoides*) *siliceum* (QU.), SCHLEGELMILCH, Pl. 43, fig. 4.
2018. *Lithacoceras* (*Silicisphinctes*) sp. gr. *siliceus* (QUENSTEDT), ÉNAY, p. 83, Pl. 7, fig. 3.

Material. One poorly preserved and fragmentary internal mould (J 2020.185.1).

Dimensions. Due to the fragmentary status, dimensions are not given.

Description. Small sized phragmocone fragment. Inner whorl segments also visible. Umbilicus wide and shallow. Smooth umbilical wall. Umbilical shoulder rounded. Flanks converging. No ventral shoulder. Venter rounded. Oval cross section. Densely spaced and fine radial or prorsiradiate ribs emanate from the umbilical shoulder. Radial ribs gently bend forward at about 1/3 of the flank and travel through the upper whorl side and cross the venter. A mid-siphonal bend or groove is unobserved. Ribs appear to bifurcate on the upper whorl and bidichotomous ribbing may occur. Secondary ribs may appear on the upper flank. Primaries and secondaries have a comparable sculpture. There are 26 ventral ribs and 14 primaries on the last quarter whorl. Neither suture nor peristome are seen.

Remarks. Although the present specimen is poorly preserved and fragmentary, the dense ribbing, bifurcation and bidichotomous ribs (also characteristic for many other genera) most probably refers the collected specimen to *Lithacoceras*. Almost all the figured specimens depict adult microconchs with well-developed lappets creating difficulties when analysing early growth stages. Collected whorl fragment is closest to specimen IGM-6187 illustrated by OLÓRIZ *et al.* (1993, Pl. 2, fig. 3) with its rather straight and sometimes polyplocoid ribbing. ZEISS (1968, Pl. 4, fig. 1) and SCHLEGELMILCH (1994, Pl. 43, fig. 4) refigured the holotype specimen (QUENSTEDT, 1857, Pl. 95, fig. 27) of an adult microconch with lappets. The poor preservation and juvenile growth stage of the present specimens prevented analysis of important characters (number of ribs, adult stage, complete whorls) and the specimen is only tentatively allied to the group *siliceum* as *Lithacoceras* aff. *siliceum*. First record from Hungary.

Stratigraphic and geographic distribution. *Lithacoceras siliceum* has been reported from the lower Tithonian (Hybonotum Zone) of Mexico, southern Germany, France and Hungary.

Genus *Euvirgalithacoceras* Zeiss *et al.*, 1996 [= *Subplanites* Spath, 1925]

Type species: *Virgatosphinctes supremus* Schneid, 1915

Euvirgalithacoceras? sp.

(Fig. 8.E1-E2)

Material. 2 fragmentary, poorly preserved internal moulds from mixed debris and soil.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.105.1.	(90)	27.7	(36)	(35)	0.769	0.400	0.389
J 2020.111.1.	(103)	(25)	(36)	(42)	0.694	0.350	0.408

Description. Middle sized, rather evolute conch. Umbilicus wide, shallow. Umbilical wall inclined inward, forming a folded umbilical shoulder. Cross section rounded trapezoidal with inwardly inclined umbilical shoulder. Strong, simple, and prorsiradiate ribs appear at the umbilical shoulder that branch on the upper part of the flank (roughly at three quarter of whorl height). Branching of the primaries bipartiate. Virgatotomous branching occurs, too. At the height of branching intercalating secondary ribs may appear. Venter, suture, constrictions not seen.

Remarks. The presence of virgatotomous ribs on both specimens suggests on one hand that these specimens may belong to Virgatosphinctinae and probably represent early, internal whorls of *Euvirgalithacoceras* or *Pachysphinctes*. Assigning the present specimens to *Euvirgalithacoceras* is supported by the fact that some of the ribs are virgatotomous. On the other hand, important features (venter, number of primaries per one or half whorl) are not preserved, therefore even generic assignment is tentative. Imlay (1981, Pl. 8, fig. 15) figured a very similar specimen from the Boreal Faunal Realm (Alaska). First record from the Mecsek Mountains.

Stratigraphic and geographic distribution. *Euvirgalithacoceras* is an upper Kimmeridgian-lower Tithonian taxon with ubiquitous distribution both in Boreal and Tethysian Faunal Realms.

Euvirgalithacoceras aff. *ombonii* (Del Campana, 1905)

(Fig. 8.F1-F2)

1905. *Perisphinctes ombonii*, Del Campana, p. 83, Pl. 3, fig. 8.
1993. *Subplanites ombonii* (Del Campana), Sarti, p. 88, Figs. 33, 35.H, Pl. 11, fig. 3.

Material. One poorly preserved whorl fragment (J 2020.589.1).

Dimensions. Due to fragmentary status, dimensions are not given.

Description. The tiny whorl fragment represents partially the umbilical shoulder and flank up to the venter. Umbilicus not preserved. Strong, flexuous, distantly spaced primary ribs rise from the umbilical shoulder. Ribs bifurcate at 2/3 of the flank. Ribs polygirate, sometimes intercalatory ribs appear. Ribs bifurcate and trifurcate.

Remarks. Cross section of the present fragment is comparable to specimen A4V illustrated by Sarti (1993, Fig. 33.A). Similar species are *E. moernsheimensis* and *E. reisi*, however Sarti (1993, p. 89) made a detailed differential diagnosis that is only partially applicable to the present specimen. On one hand it strengthens its position in this species; but on the other hand, the present specimen is only a whorl fragment, hence umbilicus and coiling are uncertain, therefore doubts justify assignment to *Euvirgalithacoceras* aff. *ombonii*. First record from Hungary.

Stratigraphic and geographic distribution. Stratigraphically *Euvirgalithacoceras ombonii* occurs in the upper part of the Beckeri Zone of the Mediterranean Tethys.

Subfamily Torquatisphinctinae Tavera, 1985
Genus *Torquatisphinctes* Spath, 1924

Type species: *Ammonites torquatus* J. de C. Sowerby, 1840

Torquatisphinctes aff. *laxus* Olóriz, 1978

(Fig. 9.A)

1978. *Torquatisphinctes laxus* n. sp., Olóriz, p. 454, Pl. 40, fig. 4.
1993. *Torquatisphinctes laxus* Oloriz, Sarti, p. 87, Pl. 10, fig. 1.
1994. *Torquatisphinctes laxus* Oloriz, Schlegelmilch, p. 90, Pl. 41, fig. 3.
2004. *Torquatisphinctes* gr. *laxus* Oloriz, Marino *et al.*, Pl. 2, fig. 4.

Material. Two poorly preserved internal moulds.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D	N/2
J 2020.144.1.	100.7	(27)	(29)	48.4	0.931	0.288	0.481	31
J 2020.364.1.	(110)	(30)	(35)	49.7	0.857	0.318	0.452	31

Description. Medium size, evolute conch fragments of the body chamber. Cross section compressed, rounded subrectangular. Umbilical wall deep, smooth, vertical. Umbilical shoulder rounded. Strong, slightly prorsiradiate primary ribs originate at the umbilical shoulder crossing the venter continuously. On the midflank or higher (usually 2/3 of the flank) ribs bifurcate and also cross the venter continuously. There are 31 primary ribs on the last half whorl. At least 2 primary ribs are unbifurcated. There may be more; however, the poor preservation restricted analysis. Neither suture nor constrictions visible.

Remarks. Published specimens do not allow thorough comparisons, however the number of primary ribs on the last whorl can elucidate the intraspecific variation of the ribbing. Due to the poor preservation of the present specimens, only the number of primary ribs of the last half whorl is calculated. These numbers can vary between 25-31 as follows: 25 in Sarti (1993, Pl. 10, fig. 1); F.G12.20.3: 27 (holotype, Olóriz, 1978, Pl. 40, fig. 4); 29 in Marino *et al.* (2004, Pl. 2, fig. 4); and E51: 31 (Schlegelmilch, 1994, p. 216, Pl. 41, fig. 3). Number of primary ribs per half whorl of the collected specimens falls in this range, however, all the measured parameters and the general features of our material suggests referral to this species. Related species (*T. intermedius* and *T. regularis*) either bear more single primary ribs, or the prorsiradiate primaries bend pronouncedly forward or the umbilicus is wider. Unfortunately, these features are uncertain for the Hungarian specimens, which are tentatively assigned to *Torquatisphinctes laxus*. First record from the Mecsek Mountains.

Stratigraphic and geographic distribution. *Torquatisphinctes laxus* is reported from the upper Kimmeridgian (Beckeri Zone) to the lower Tithonian Hybonotum Zone of Betic Cordilleras Spain, southern Germany, Hungary, the Eastern Carpathians and Sicily.

Genus *Pachysphinctes* Dietrich, 1925 [= *Balochistaniceras* Fatmi & Zeiss, 1999]

Type species: *Perisphinctes africogermanus* Dietrich, 1925

Pachysphinctes sp.
(Fig. 9.B1-B4)

Material. 12 poorly preserved internal moulds (J 2020.184.1, 211.1, 366.1, 563.1-568.1, and below).

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D	N/2
J 2020.148.1.	87.6	(20)	(27)	44.5	0.741	0.308	0.508	24
J 2020.286.1.	(67)	(24)	(21)	(30)	1.143	0.313	0.448	27
J 2020.363.1.	104.3	(27)	29.4	51.1	0.918	0.282	0.490	26

Description. Poorly preserved, fragmented, evolute conch. Umbilicus wide, shallow. Umbilical wall rounded, inclined, short and smooth. Umbilical shoulder rounded. Flanks convex, rounded. Venter rounded, no ventral shoulder. Distinct, dense, radial or slightly prorsiradiate ribs rise from the umbilical shoulder. Ribs regularly bifurcate just above the midflank. Ribs cross the venter without interruption. Rarely, constrictions are present. Suture and aperture not seen.

Remarks. The generic diagnosis emended by Olóriz (1978, p. 461) clearly stated that there is no trifurcation of ribs s. str. which is a generic feature for the genus. The present specimens show only bifurcation, which strengthens the designation of these specimens to *Pachysphinctes*. *P. bathyplocus* (Waagen) figured by Howarth (1998, Pl. 5, fig. 1.a), which has the same number of primary ribs per half whorl shows a U/D range of 0.45-0.55. This is the same for *P. adelus* (Gemmellaro) having 25 primary ribs per half whorl (Olóriz, 1978, Pl. 54, fig. 2), where the U/D range is 0.51-0.52. Having poorly preserved fragmentary and incomplete specimens to hand any assignment to species-level would be poorly justified: *Pachysphinctes* sp. is an adequate initial determination. First record from the Mecsek Mountains.

Stratigraphic and geographic distribution. It is reported from the upper Kimmeridgian in the Tethys (Indo-Malagasy Province: Énay & Howarth, 2019).

Subfamily Virgatosphinctinae Spath, 1923
Genus *Malagasites* Énay, 2009

Type species. *Perisphinctes* (*Virgatosphinctes*) *Haydeni* Uhlig, 1910

Malagasites? *denseplicatus* (Waagen, 1875)
(Fig. 9.C)

1875. *Perisphinctes denseplicatus* Waagen, n. sp., Waagen, p. 201, Pl. 46, fig. 3; Pl. 55, figs. 1-2.
1910. *Perisphinctes* (*Virgatosphinctes*) *denseplicatus* Waagen, Uhlig, p. 313, Pl. 53, fig. 3, Pl. 54, fig. 1; Pl. 55, figs. 1-3; Pl. 56, fig. 1.
1935. *Virgatosphinctes* sp., Vadász, p. 62. [in lit.]
1943. *Virgatosphinctes* cf. *V. denseplicatus* (Waagen), Imlay, p. 535, Pl. 89, figs. 1-4.
1979. *Virgatosphinctes* aff. *denseplicatus* (Waagen), Thomson, p. 16, Fig. 5, Pls. 3.j-k, 4.a.
1989. "*Virgatosphinctes*" sp. aff. *V. denseplicatus* (Waagen), Myczyński, p. 99, Pl. 8, fig. 1; Pl. 12, fig. 5.
non 1991. "*Virgatosphinctes*" *denseplicatus* (Waagen), Olóriz & Tintori, p. 471, Pl. 22, fig. 2.
non 2004. *Virgatosphinctes denseplicatus* (Waagen), Yin & Énay, p. 673, Fig. 4.4.
2004. *Virgatosphinctes denseplicatus* (Waagen), Yin & Énay, p. 673, Fig. 4.3.
2016. *Virgatosphinctes denseplicatus* (Waagen), Pandey *et al.*, p. 148, Figs. 6.A-C, 7, Pl. 1, fig. 5; Pl. 2, fig. 1.

Material. Two poorly preserved internal moulds, whorl fragments from Zengővárkony.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D	N/2
J 711	94.6	29.4	(33)	35.8	0.891	0.349	0.378	44
J 2020.150.1.	93.8	(28)	(27)	39.9	1.037	0.288	0.425	43

Description. Mid-sized conchs representing body chambers lacking the early whorls, which are crushed and/or dissolved. Umbilicus wide, shallow. Umbilical wall low. Umbilical shoulder rounded. Flanks converging, subparallel. No ventral shoulder. Venter rounded. Cross section oval to rounded trapezoidal. Sculpture consists of fine, densely placed ribs that rise on the lower part of the umbilical wall, flexing backward and cross the upper flank; on the lower flank bending forward to become radial on the midflank then start to bend backward again on the upper flank and crossing the mid-siphonal line perpendicularly. Ribs bifurcate at upper 2/3 of flank. Rarely, bidichotomous ribs usually form around constrictions. No band or groove seen on the mid-siphonal line. Constrictions are present following the shape of the primaries numbering one constriction per half whorl. Neither suture nor aperture are visible.

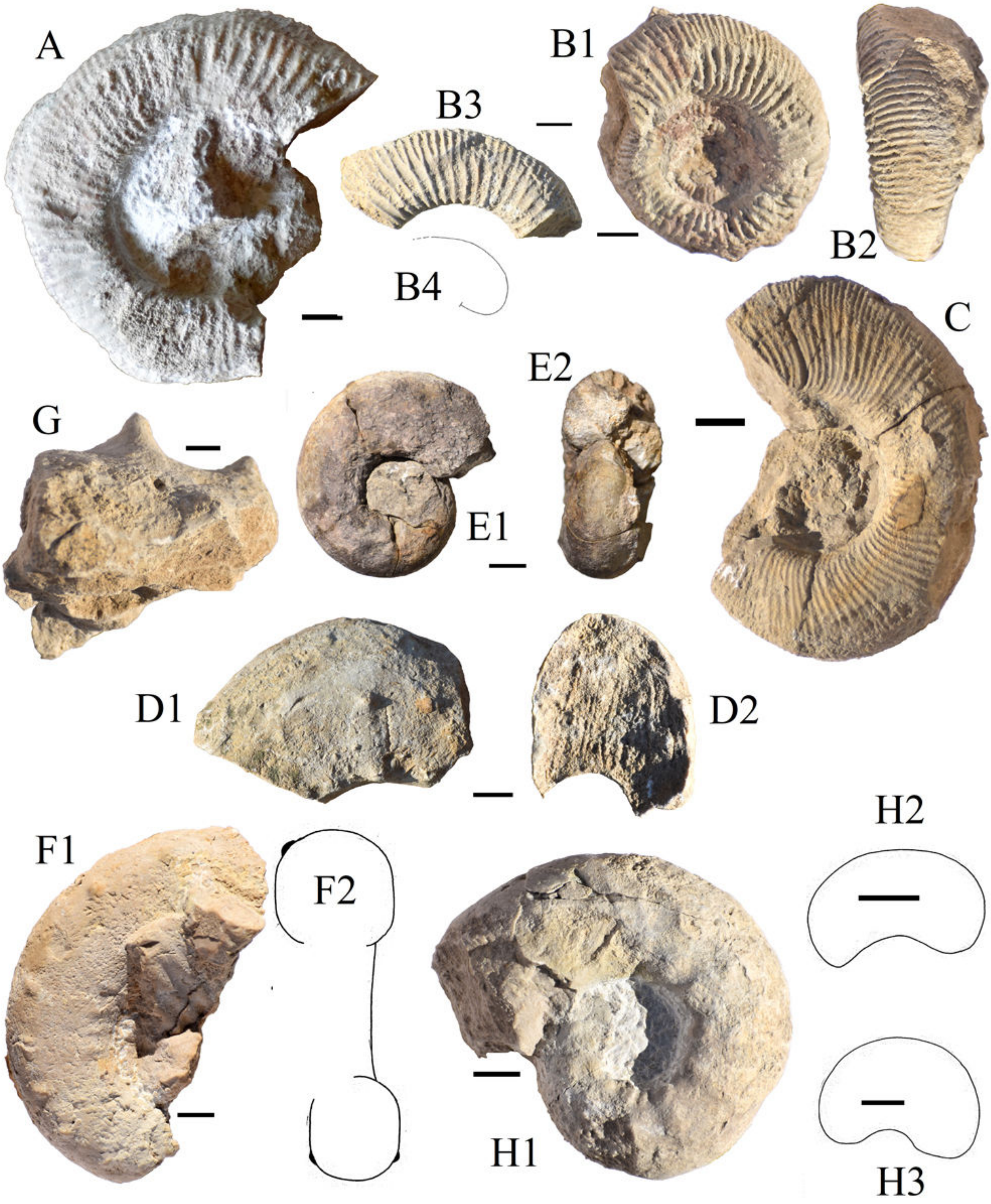


Figure 9: Upper Kimmeridgian-lower Tithonian ammonoids from Zengővárkony, Mecsek Mountains, Hungary. A. *Torquatisphinctes* aff. *laxus* OLÓRIZ, 1978, specimen J 2020.144.1. B. *Pachysphinctes* sp., specimen J 2020.563.1. B1. lateral view; B2. ventral view; specimen J 2020.184.1. B3. lateral view; B4. cross-section. C. *Malagasites? Denseplicatus* (WAAGEN, 1875), specimen J 711. D. *Aspidoceras acanthicum* (OPPEL, 1863), specimen J 2020.131.1. D1. lateral view; D2. cross-section of specimen J 2020.228.1. E. *Aspidoceras binodum* (OPPEL, 1863), specimen J 2097. E1. lateral view; E2. apertural view. F. *Aspidoceras caletanum* (OPPEL, 1863), specimen J 2020.87.1. F1. lateral view; F2. cross-section. G. *Aspidoceras* ex gr. *longispinum* (SOWERBY, 1825), specimen J 2020.274.1. H. *Aspidoceras rogoznicense* (ZEJSZNER, 1846), specimen J 2020.143.1. H1. lateral view; H2. cross-section of specimen J 2020.110.1; H3. cross section of specimen J 2020.273.1. Scale bars indicate 1 cm.

Remarks. The *Virgatosphinctes* sp. referred to by VADÁSZ (1935, p. 62) is the same specimen under label J 711 collected by János BÖCKH in 1877, which is described and illustrated here. There are no ribs joining at the umbilical shoulder, and the absence of virgatotomous ribbing refers the specimen to this species as MYCZYŃSKI (1989, p. 98) underlined. The present specimens most resemble the KG.712.68 specimen illustrated by THOMSON (1979). OLÓRIZ and TINTORI (1991) and YIN and ÉNAY (2004, p. 673, Fig. 4.4.) illustrated morphs with virgatotomous ribbing. Specimen J 711 compares favourably to specimen USNM 103363b of IMLAY (1943, Pl. 89, fig. 4) and represents the finer ribbed and more compressed variety of the species as IMLAY (1943, p. 535) noted. When ÉNAY (2009) introduced this genus, he included forms described from the Indo-Malagasy province (ÉNAY & HOWARTH, 2019). The present specimens are only tentatively placed in *Malagasites*.

Stratigraphic and geographic distribution. According to BARDHAN *et al.* (2007, p. 381) *Virgatosphinctes* (including *V. denseplicatus*) is a typical Indo-Madagascan form and typically restricted to peri-Gondwanan regions. From the Western Tethys it is reported from Mexico, Cuba and now Hungary in the early Tithonian.

Superfamily Aspidoceratoidea ZITTEL, 1895
Family Aspidoceratidae ZITTEL, 1895
Subfamily Aspidoceratinae ZITTEL, 1895
Genus *Aspidoceras* ZITTEL, 1868

Type species: *Ammonites Rogoznicensis* ZEJSZNER, 1846

***Aspidoceras* div. sp.**

Material. 54 poorly preserved, dissolved, mostly fragmentary specimens (J 2020.129.1, 132.1, 167.1-170.1, 193.1, 202.1, 219.1, 227.1, 242.1, 276.1, 300.1, 456.1-2020.496.1, 569.1).

Dimensions. Due to poor preservation dimensions are not given.

Remarks. These fragments definitely represent a range of different *Aspidoceras* species; however, the poor preservation prevented specific designations. The fragments may belong to *A. acanthicum*, *A. apenninicum*, *A. binodum*, *A. sesquinodosum*, or perhaps *A. uninodosum*.

***Aspidoceras acanthicum* (OPPEL, 1863)**
(Fig. 9.D1-D2)

1863. *Ammonites acanthicus* OPP., OPPEL, p. 219.
1872. *Aspidoceras acanthicum*, OPP., GEMMELLARO, p. 148, Pl. 2, figs. 8-9.
1873. *Aspidoceras acanthicum* OPPEL, NEUMAYR, p. 195 [55], Pl. 41.
1876. *Ammonites acanthicus* OPPEL, DUMORTIER & FONTANNES, p. 125, Pl. 18, figs. 4-5.
1878. *Aspidoceras acanthicum* OPPEL, HERBICH, p. 174 [156], Pl. 16, fig. 2.
1879. *Aspidoceras acanthicum* OPPEL, FONTANNES, p. 88, Pl. 12, fig. 5.
1886. *Aspidoceras acanthicum* OPP., PAVLOW, p. 75, Pl. 2, fig. 2.
1931. *Aspidoceras* aff. *acanthicum* (OPPEL), SPATH, p. 624, Pl. 123, fig. 7.
1935. *Aspidoceras* cf. *acanthicum* OPP., VADÁSZ, p. 62. [in lit.]
1959. *Aspidoceras acanthicum* OPP., COLLIGNON, Pl. 128, figs. 479-480.
1966. *Aspidoceras acanthicum* (OPPEL), ANĐELKOVIĆ, p. 75, Pl. 28, fig. 1.
1973. *Aspidoceras acanthicum* OPPEL, PREDA, Pl. 10, fig. 11; Pl. 18, fig. 8.
1976. *Euaspidoceras* sp. gr. *acanthicum*, LILLO BEVIA, p. 26, Pl. 6, figs. 1-2.
1977. *Aspidoceras acanthicum* (OPPEL), ZIEGLER, Pl. 4, fig. 1.
1978. *Aspidoceras acanthicum acanthicum* (OPPEL), OLÓRIZ, p. 301, Pl. 23, fig. 3.
1984. *Aspidoceras* (*Aspidoceras*) *acanthicum* (OPPEL), ROSSI, p. 107, Pl. 34, fig. 5.
1984. *Aspidoceras* cf. *A. acanthicum* (OPPEL), VERMA & WESTERMANN, p. 63, Pl. 14, figs. 1-3, Pl. 15, fig. 1.
1985a. *Aspidoceras acanthicum* (OPPEL), CHECA, p. 74, Fig. II.3.5, .10, Pl. 8, fig. 1.
1986. *Aspidoceras acanthicum* (OPPEL), SARTI, p. 505, Pl. 6, fig. 3.A-B.
1991. *Aspidoceras acanthicum* (OPPEL), KRISHNA & PATHAK, p. 11, Pl. 1, fig. 2.
1993. *Aspidoceras acanthicum* (OPPEL), SARTI, p. 124, Pl. 26, fig. 2.
1997. *Aspidoceras acanthicum* (OPP.), HANTZPERGUE *et al.*, Pl. 24, fig. 8.
1999. *Aspidoceras* (*A.*) *acanthicum acanthicum* (OPPEL), FATMI & ZEISS, p. 73, Pl. 34, fig. 3; Pl. 35, fig. 2.
2011. *Aspidoceras acanthicum* (OPPEL), BAUDOUIN *et al.*, Pl. 11, fig. 6.
2013. *Physodoceras acanthicum* (OPPEL), FŐZY & SCHERZINGER, p. 185, Pl. 11, fig. 3; Pl. 12, fig. 1.

Material. Two whorl fragments of large sized specimens (J 2020.131.1, 228.1).

Dimensions. Due to fragmentary status, dimensions not given.

Description. Coiling not seen. Fragments represent phragmocones, septae not seen. Cross section is oval, convex, midflanks converging or parallel. Umbilical wall deep, smooth and vertical. At the umbilical shoulder big, well developed tubercles are erected. On the midflank, or on the upper midflank a second row of tubercles are situated above the umbilical tubercles. There are 3 tubercles per quarter whorl. Tubercles may interconnect by fine, short rib like folds. Venter smooth and rounded, no ventral shoulder. Cross section compressed, usually higher than wide. Suture not seen.

Remarks. This is a frequent species with high intraspecific variability and usually to large diameters (D>200 mm). The holotype specimen illustrated by OPPEL is also a substantially sized (D=200 mm) specimen. The present whorl fragments also represent large individuals. CHECA (1985a, Pl. 8, fig. 1) published an atypical specimen with one row of tubercles at the umbilical shoulder. The present specimens are closest to the specimens of BAUDOUIN *et al.* (2011, Pl. 11, fig. 6), COLLIGNON (1959, Pl. 128, fig. 479), DUMORTIER & FONTANNES (1876, Pl. 18, fig. 4), HERBICH (1878, Pl. 16, fig. 2), ROSSI (1984, Pl. 34, fig. 5). CHECA (1985a, Pl. 8, fig. 1), OLÓRIZ (1978, Pl. 23, fig. 3) and SARTI (1993, Pl. 26, fig. 2), whereas SPATH (1931, Pl. 123, fig. 7.a) depicted less heavily ornamented varieties of this species. Whorl section of specimen J 2020.228.1 is comparable to the cross section of the holotype refigured by CHECA (1985a, Fig. II.3.5.C).

Stratigraphic and geographic distribution. *Aspidoceras acanthicum* is reported from the Acanthicum Zone of the upper Kimmeridgian. It has a wide geographic distribution in the Tethysian (Mediterranean, Submediterranean, and Indo-Malagasy Provinces) and the Boreal Faunal Realms (Subboreal Province).

Aspidoceras binodum (OPPEL, 1863)

(Fig. 9.E1-E2)

1863. *Ammonites binodus* OPP., OPPEL, p. 217.
1907. *Aspidoceras binodum* OPP. sp., TOULA, p. 64, Pl. 14.
1929. *Physodoceras binodum* OPPEL, WEGELE, p. 89 (183), Pl. 11, fig. 3.
1931. *Aspidoceras* cf. *binodum* (OPPEL), SPATH, p. 637, Pl. 119, fig. 2.a-b.
1935. *Aspidoceras binodosum* OPP., VADÁSZ, p. 62. [in lit.]
1959. *Aspidoceras* aff. *binodum* OPP., COLLIGNON, Pl. 129, fig. 482.
1966. *Physodoceras binodum* (OPPEL), ANĐELKOVIĆ, p. 86, Pl. 25, fig. 1.
1973. *Aspidoceras binodum* OPPEL, PREDA, Pl. 18, figs. 3-5.
1978. *Aspidoceras binodum* (OPPEL), OLÓRIZ, p. 289, Pl. 24, figs. 2-4.
1985a. *Aspidoceras binodum* (OPPEL), CHECA, p. 54, Fig. II.3.1, .6, Pl. 1, fig. 1; Pl. 2, figs. 2-5.
1994. *Aspidoceras* cf. *binodum* (OPPEL), WIERZBOWSKI, Pl. 4, figs. 10-11.
1999. *Aspidoceras* (*Aspidoceras*) aff. *binodum* (OPPEL), FATMI & ZEISS, p. 76, Pl. 26, fig. 2.
2003. *Aspidoceras binodum* (OPPEL), GYGI, p. 141, fig. 162.

Material. Seven fairly preserved internal moulds from the MBFSz collection and from mixed debris and soil.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2097	57.1	30.4	(25)	16.3	1.216	0.438	0.285
J 2020.119.1.	(77)	(40)	(38)	19.0	1.053	0.493	0.247
J 2020.149.1.	(60)	(26)	(20)	19.9	1.300	0.333	0.332
J 2020.297.1.	54.5	(24)	(22)	(17)	1.091	0.404	0.312
J 2020.333.1.	(61)	(26)	(24)	(22)	1.083	0.393	0.361
J 2020.335.1.	76.2	(31)	(31)	(22)	1.000	0.407	0.289
J 2020.348.1.	(90)	(42)	(38)	27.5	1.105	0.422	0.305

Description. Small to medium sized phragmocone conchs. Umbilicus moderate, deep, umbilical wall vertical, smooth and profound. Umbilical shoulder rounded; flanks convex. No ventral shoulder. Venter rounded, smooth. Cross section depressed, subcircular. Stronger or weaker tubercles are located at the umbilical shoulder. There are 8 peri-umbilical tubercles on the last half whorl. A second row of tubercles appear on the lower flank, that sometimes correspond to the peri-umbilical row of tubercles. They are densely placed close to each other or sometimes adherent. On the last half whorl there are fewer tubercles in the upper row than at the umbilical shoulder. Rarely, on the well-preserved septate parts, delicate, fine and shallow folds rise from some tubercles of the lower flank, that travel toward the venter, but disappear at the upper flank. Remains of suture lines are preserved; but no aperture seen.

Remarks. According to CHECA (1985a, p. 56) *A. binodum* and *A. rogoznicense* show morphological overlapping characters, however their markedly different stratigraphic position helps to properly discriminate between them. Based on lithological characters the specimens are representative of these two species. Specimen J 2020.119.1. is closest to Ch.G27.1.7 of CHECA (1985a, Pl. 2, fig. 5) representing the morphospecies with well-developed tubercles. Specimen J2097 is closest to No. 93 of SPATH (1931, Pl. 119, fig. 2a) and represents morphs with fainter tubercles.

Stratigraphic and geographic distribution. *Aspidoceras binodum* is reported from the lower Kimmeridgian Bimammatum to Acanthicum zones. It has a wide geographic distribution in the western Tethys and adjacent territories in the Submediterranean Province and also from the northern Tethys (Baluchistan) and the southern Tethys (Madagascar).

Aspidoceras caletanum (OPPEL, 1863)

(Fig. 9.F1-F2)

1863. *Ammonites Caletanus* OPP., OPPEL, p. 220.
1877. *Ammonites* (*Aspidoceras*) *Caletanus* d'ORBIGNY, FAVRE, p. 60, Pl. 7, fig. 6.
1881. *Ammonites caletanus* OPPEL, GOSSELET, Pl. 12, fig. 10.
1886. *Aspidoceras Caletanum* OPP., PAVLOW, p. 73, Pl. 8, fig. 1.a-b.
1985a. *Aspidoceras caletanum* (OPPEL), CHECA, p. 94, Fig. II.3.14, .17, Pl. 15, fig. 2.
1989. *Aspidoceras caletanum* (OPPEL), HANTZPERGUE, p. 330, Figs. 110.A-K, 111-112, 118-119; Pl. 43, figs. A-E; Pl. 44, figs. A-B.
1994. *Aspidoceras caletanum* (OPPEL), FISCHER, p. 178, Pl. 81, figs. 1-2; Pl. 82, fig. 1.
1997. *Aspidoceras caletanum* (OPP.), HANTZPERGUE *et al.*, Pl. 23, fig. 8.
1997. *Aspidoceras* ex gr. *caletanum* (OPPEL), KUTEK & ZEISS, Pl. 14, fig. 1.
1999. *Aspidoceras caletanum* (OPPEL), SCHWEIGERT, p. 30, fig. 2.
2015. *Aspidoceras caletanum* (OPPEL), COMMENT *et al.*, Pl. 4, figs. 2, 4-5; Pl. 5, figs. 3, 5.

Material. One internal mould resting on the quarry floor amongst debris.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.87.1.	98.4	33.4	(33)	35.7	1.012	0.335	0.362

Description. Comparatively well-preserved half whorl represents part of the phragmocone is septate throughout. Coiling evolute, umbilicus wide and shallow. Umbilical wall vertical, umbilical shoulder rounded. Flanks parallel, ventral shoulder rounded; venter smooth. At the umbilical shoulder fine, radial tubercles rise, that diminish rapidly toward midflank. Shallow, fine tubercles are located at the umbilical shoulder. There are 9 ventrolateral tubercles per half whorl. Cross section oval, with parallel flanks. Suture not seen.

Remarks. According to HANTZPERGUE (in FISCHER, 1994, p. 178) *A. caletanum* differs from *A. longispinum* with its subcircular cross section and more evolute coiling, which is typical of the present specimen, which compares favourably to the specimen illustrated by COMMENT *et al.* (2015, Pl. 5, fig. 3.a-b). It is identical in cross section to the specimen of CHECA (1985a, Fig. II.3.14.B). There are the same number of tubercles (nine) on the ventral shoulders compared to specimens illustrated by GOSSELET (1881, Pl. 12, fig. 10), HANTZPERGUE (1989, Pl. 44, fig. B) and PAVLOW (1886, Pl. 8, fig. 1.a). The collected specimen differs from the others only in having ventrolateral tubercles upper, slightly below on the ventrolateral shoulder. Specimens of this biospecies usually exceed 140 mm reaching 250 mm in diameter; however, the range stretches from 64 mm (HANTZPERGUE, 1989) to 252 mm (CHECA, 1985a). First record from Hungary.

Stratigraphic and geographic distribution. *Aspidoceras caletanum* is reported from the upper Kimmeridgian Eudoxus Zone (Caletanum Subzone) from the Subboreal Province with occasional occurrences within the Submediterranean Province.

Aspidoceras ex gr. *longispinum* (SOWERBY, 1825)

(Fig. 9.G)

1873. *Aspidoceras longispinum* SOWERBY, NEUMAYR, p. 196 [56], Pl. 42, fig. 1.
1874. *Ammonites longispinus* SOWERBY, LORIOL & PELLAT, p. 276, Pl. 2, fig. 2.
1877. *Ammonites* (*Aspidoceras*) *longispinus* SOWERBY, FAVRE, p. 60, Pl. 7, figs. 7-8.
1879. *Aspidoceras longispinum* SOWERBY, FONTANNES, p. 87, Pl. 12, fig. 4.
1907. *Aspidoceras longispinum* SOW., TOULA, p. 67, Pl. 15.
1935. *Acanthosphaerites longispinum* SOW., VADÁSZ, p. 62. [in lit.]
1959. *Aspidoceras longispinum* SOW. var. *antsavolensis* nov. var., COLLIGNON, Pl. 110, figs. 404-405.
1963. *Aspidoceras longispinum* (SOWERBY), PACHUCKI, p. 2, Pl. 1, fig. 1.
1971. *Aspidoceras longispinum* (J. de C. SOWERBY), CALLOMON & COPE, p. 174, Pl. 12, figs. 1-3.
1973. *Aspidoceras longispinum* (SOWERBY), PREDA, Pl. 17, fig. 3.
1978. *Aspidoceras* sp. aff. *A. longispinum* (SOWERBY), OLÓRIZ, p. 293, Pl. 24, fig. 1.
1979. *Aspidoceras longispinum* (J. de C. SOWERBY), SAPUNOV, p. 140, Pl. 42, fig. 2.
1979. *Aspidoceras longispinum* (SOWERBY), SCHAIRER & BARTHEL, p. 18, Figs. 3-4, Pl. 3, figs. 3-8; Pl. 4.
1985a. *Aspidoceras longispinum* (SOWERBY), CHECA, p. 76, Fig. II.3.10-11, .15, Pl. 9, figs. 1-3; Pl. 10, fig. 2; Pl. 14, fig. 2; Pl. 15, fig. 1.
1986. *Aspidoceras longispinum* (SOWERBY), SARTI, p. 504, Pl. 5, fig. 4.
1989. *Aspidoceras longispinum* (SOWERBY), CHECA & MARTIN-RAMOS, Fig. 1.A.
2006. *Physodoceras* cf. *longispinum* (SOWERBY), SCHERZINGER & MITTA, p. 230, Fig. 3.3.
2009. *Aspidoceras* sp. aff. *A. longispinum* (SOWERBY), ÉNAY, p. 194, Pl. 46, fig. 1.a-b.
2011. *Aspidoceras* cfr. *longispinum* (SOWERBY), PETTI *et al.*, p. 169, Pl. 1, fig. 1.A-B.

Material. One poorly preserved whorl fragment (J 2020.274.1).

Dimensions. Due to fragmentary status, dimensions are not given.

Description. The whorl fragment represents the midflank region of a large sized specimen. Three tubercles seen. The height of the tallest tubercle is 13 mm. Tubercles are paired and widely spaced. Shell is smooth otherwise. Suture, venter and umbilicus not seen.

Remarks. CALLOMON and COPE (1971) refigured the holotype and emphasized the important specific characters: Rather widely spaced and paired, not very prominent tubercles that are directed outwards perpendicular to the plane of the spiral. Although the orientation of the fragment is somehow dubious, based on the above description a specific determination is possible.

Stratigraphic and geographic distribution. *Aspidoceras longispinum* has a long stratigraphic range from the lower Kimmeridgian Herbichi Zone to the lower Tithonian Hybonotum Zone. Geographically it has a remarkably widespread distribution from the Mediterranean and Submediterranean Provinces of the Tethysian Realm (including Nepal) with stray individuals venturing into the Subboreal Province of the Boreal Realm.

Aspidoceras rogoznicense (ZEJSZNER, 1846)

(Fig. 9.H1-H3)

1846. *Ammonites Rogoznicensis*, ZEJSZNER, Pl. 4, fig. 4.a-d.
1868. *Ammonites* (*Aspidoceras*) *Rogoznicensis* ZEUSCHN., ZITTEL, p. 116, Pl. 24, figs. 4-5.
1870. *Aspidoceras Rogoznicense* ZEUSCHN., ZITTEL, p. 79, Pl. 7, fig. 1.A-B.
1871a. *Aspidoceras Rogoznicense* ZEUSCHN., GEMMELLARO, p. 241, Pl. 12, figs. 7-9.
1976. *Aspidoceras rogoznicense* (ZEUSCHN.), FÜLÖP, p. 194, Pl. 35, fig. 7.
1978. *Aspidoceras rogoniscense* (ZEUSCHNER), OLÓRIZ, p. 279, Pl. 23, fig. 4; Pl. 24, fig. 6.
1979. *Aspidoceras rogoznicense* (ZEJSZNER), SAPUNOV, p. 139, Fig. 14/1, Pl. 41, fig. 2.
? 1981. *Aspidoceras rogoznicensis* (ZEUSCHNER), PARISHEV & NIKITIN, p. 70, Pl. 36, fig. 4.
1984. *Aspidoceras rogoznicense irregulare* nov. ssp., VIGH, Pl. I, fig. 4.
1985a. *Aspidoceras rogoznicense* (ZEUSCHNER), CHECA, p. 98, Fig. II.3.18-19, .21, Pl. 16, figs. 1-4.
1986. *Aspidoceras rogoznicense* (ZEUSCHNER), SARTI, p. 505, Pl. 6, fig. 1.A-B.
? 1989. *Aspidoceras rogoznicense* (ZEUSCHNER), FŐZY, Pl. 4, fig. 3.
1990. *Aspidoceras rogoznicense* (ZEUSCHNER), FŐZY, Pl. 2, figs. 4-6.
1998. *Aspidoceras rogoznicense* (ZEJSZNER), HOWARTH, p. 63, Pl. 10, fig. 1.
1999. *Aspidoceras rogoznicense* (ZEUSCHNER), CARACUEL & OLÓRIZ, Fig. 7.3.
2005. *Aspidoceras rogoznicense* (ZEUSCHNER), ÉNAY *et al.*, Fig. 4.1.

2015. *Aspidoceras* cf. *rogoznicense* (ZEUSCHNER), BERGER, p. 50, Fig. 27.
2018. *Aspidoceras rogoznicense* (ZEJSZNER), VAŠÍČEK *et al.*, p. 190, Fig. 3.C-D.

Material: Ten moderately preserved complete or fragmentary internal moulds (J 2020.110.1, 2020.259.1, 2020.271.1, 2020.273.1, and below).

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.120.1.	73.2	38.2	30.2	25.2	1.265	0.412	0.344
J 2020.143.1.	80.2	(36)	32.6	24.1	1.104	0.406	0.300
J 2020.255.1.	75.8	(40)	(27)	23.2	1.481	0.356	0.306
J 2020.283.1.	(101)	(45)	(44)	27.4	1.023	0.435	0.271
J 2020.334.1.	87.8	46.9	(36)	(27)	1.303	0.410	0.307
J 2020.346.1.	(72)	(32)	(27)	(21)	1.185	0.375	0.292

Description*.* Coiling rather involute, whorls inflated, always depressed or strongly depressed. Specimens represent phragmocone and body chamber. Coiling cadicone, cross section strongly depressed, always strongly wider then high. Umbilical wall high, vertical, smooth. Umbilical shoulder rounded. Flanks inflated, convex, short, ventral shoulder may exist, then rounded. Venter smooth. Strong, erected tubercles rise from the umbilical shoulder. There are 7-8 tubercles per half whorl. Below the midflank another row of tubercles appears that corresponds to the tubercles situated at the umbilical shoulder. These tubercles may overgrow to form short but wide ribs. Suture poorly preserved, but generally corresponds to the specimens of CHECA (1985a, Fig. II.3.21.A-D).

Remarks. Cross section of specimen J 2020. 110.1. is typical of this species: Besides the sculpture and ornamentation short, depressed, cadicone whorl sections characterise this species closely resembling the cross section of the internal whorls of specimen F.Gg.10.6 illustrated by CHECA (1985a, p. 102, Fig. II.3.18.A). Specimen J 2020.120.1. is almost identical with the specimen of ÉNAY *et al.* (2005, Fig. 4.1) and represents the inflated, strongly ornamented stock of the species. Whereas specimen J 2020.143.1 more resembles specimen F.Gg.10.6 of CHECA (1985a, Pl. 16, fig. 4) and represents the less pronounced, closely developed tuberculated stock. FŐZY (1989) figured a worn specimen with poorly preserved tubercles without cross section and description that raises ambiguity about its determination. The specimen of PARISHEV and NIKITIN (1981) has a wide umbilicus and distantly placed tubercles, which also raises questions about their determination. First record from the Mecsek Mountains.

Stratigraphic and geographic distribution*. Aspidoceras rogoznicense* has a long stratigraphic range from the uppermost Kimmeridgian (Beckeri Zone) to the lower Berriasian (Jacobi Zone). Geographically it has a global Tethysian distribution.

Subfamily Physodoceratinae SCHINDEWOLF, 1925
Genus *Orthaspidoceras* SPATH, 1925

Type species: Ammonites orthocera ORBIGNY, 1847

Orthaspidoceras cf. *ziegleri* CHECA, 1985a
(Fig. 10.A1-A2)

1878. *Aspidoceras liparum* OPPEL, HERBICH, p. 174, Pl. 16, fig. 1.
1985a. *Orthaspidoceras ziegleri* sp. nov., CHECA, p. 150, Fig. II.3.37-38, .43, Pl. 1, fig. 5; Pl. 28, figs. 1-3, Pl. 29, figs. 1-2.
1987. *O. ziegleri*, PAVIA *et al.*, p. 71. [in lit.]
1987. *Orthaspidoceras ziegleri*, CHECA, p. 273, Fig. 1.C
1993. *Orthaspidoceras ziegleri* CHECA, SARTI, p. 127. [in lit.]
1997. *Orthaspidoceras* gr. *ziegleri* CHECA, HANTZPERGUE *et al.*, p. 96. [in lit.]
2007. *Orthaspidoceras ziegleri*, CECCA & SAVARY, p. 511. [in lit.]

Material. Three poorly preserved and worn internal moulds (J 2020.98.1, and below).

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.93.1.	72.8	(30)	(35)	11.2	0.857	0.481	0.154
J 2020.116.1.	65.0	n.d.	(28)	12.3	n.d.	0.430	0.189

Description. Small and medium sized conchs representing phragmocone and part of the body chamber. Conch involute, umbilicus narrow and profound. Umbilical wall vertical, high, unsculptured. Umbilical shoulder is rounded. Flanks convex, converging, unsculptured. No ventral shoulder. Venter is rounded, smooth. Cross section compressed, usually higher than wide. At the umbilical shoulder short, wide, gentle tubercles rise. There are 9 tubercles per half whorl. Suture partly preserved. L and U deep, trifid, frilled. Cross section compressed.

Remarks. CHECA (1985a, p. 151) placed *A. liparum* non Oppel (HERBICH, 1878, Pl. 16, fig. 1) into his new species based on the more frequent periumbilical tubercles than *A. liparum*. His view is accepted here. This species is uncommon in the literature and the present paper is only the third to figure typical material. Number of tubercles on the last whorl usually varies between 8-11, herein we note 9. Specimen J 2020.116.1. is closest to K.M2.20.4 of CHECA (1985a, Pl. 28, fig. 2) and represents the larger umbilicated variety with finer tubercles. Due to the poor preservation none of the present specimens show the whole umbilicus, which causes uncertainty regarding the umbilical region. There are similarities with other species: *Physodoceras altenense* is superficially similar, however it has a narrower umbilicus with less well-developed tubercles. *Aspidoceras circumspinosum* has similar periumbilical tubercles, however those tubercles are spiny and sparsely placed. First record from Hungary.

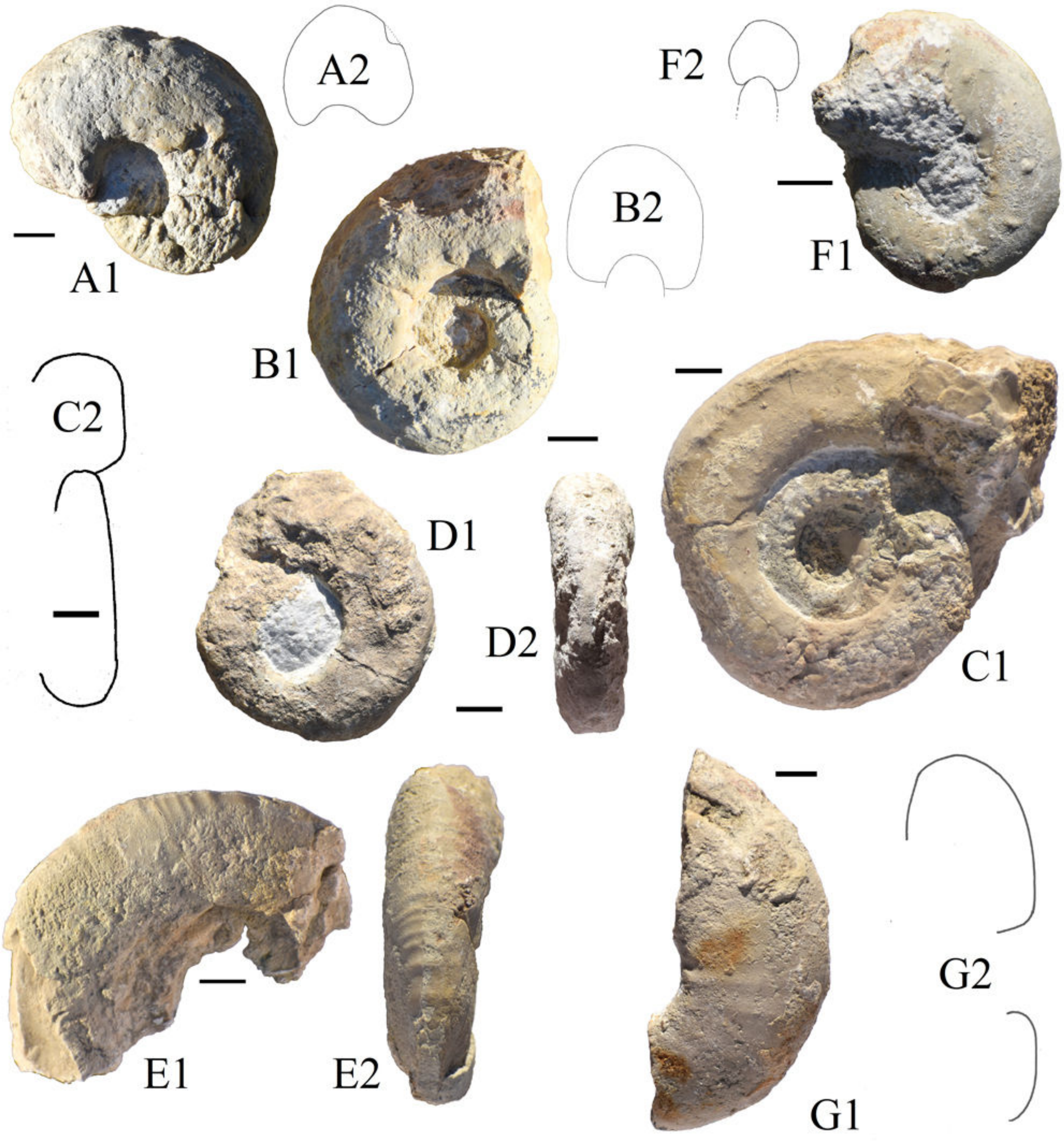


Figure 10: Upper Kimmeridgian-lower Tithonian ammonoids from Zengővárkony, Mecsek Mountains, Hungary. A. *Orthaspidoceras* cf. *ziegleri* CHECA, 1985a, specimen J 2020.116.1. A1. lateral view; A2. cross-section of specimen J 2020.98.1. B. *Physodoceras wolfi* (NEUMAYR, 1873c), specimen J 2020.89.1. B1. lateral view; B2. cross-section. C. *Pseudowaagenia acanthomphala* (ZITTEL, 1870), specimen J 2020.146.1. C1. lateral view; C2. cross-section. D. *Pseudowaagenia haynaldi* (HERBICH, 1868), specimen J 2020.191.1. D1. lateral view; D2. ventral view. E. *Pseudowaagenia inerme* ÉNAY, 2018, specimen J 2020.570.1. E1. lateral view; E2. ventral view. F. *Pseudowaagenia micropla* (OPPEL, 1863), specimen J 2020.153.1. F1. lateral view; F2. cross-section. G. *Simaspidoceras bucki* CHECA, 1985a, specimen J 2020.186.1. G1. lateral view; G2. cross-section. Scale bars indicate 1 cm.

Stratigraphic and geographic distribution. *Orthaspidoceras ziegleri* has a limited stratigraphic distribution in the Kimmeridgian from the Herbichi to the basal Cavouri zones. It occurs in the Mediterranean and Submediterranean Provinces of the Tethysian Faunal Realm.

Genus *Physodoceras* HYATT, 1900

Type species. *Ammonites circumspinosus* QUENSTEDT, 1849

Physodoceras wolfi (NEUMAYR, 1873)

(Fig. 10.B1-B2)

1873. *Aspidoceras Wolfi* nov. sp., NEUMAYR, p. 195 [55], Pl. 38, fig. 5.

1878. *Aspidoceras Wolfi* NEUMAYR, HERBICH, p. 170 [152].
1878. *Aspidoceras Báthori* nov. sp., HERBICH, p. 170 [152], Pl. 19, fig. 4.a-b.
1878. *Aspidoceras Deáki* nov. sp., HERBICH, p. 175 [157], Pl. 14-15, fig. 2.
1886. *Aspidoceras Deaki* HERB., PAVLOW, p. 76, Pl. 3, figs. 2.a-d, 3.a-b, 4.a-b.
1963. *Aspidoceras (Pseudowaagenia) bathori* HERBICH, GEYER p. 191, Pl. 17, fig. 1.
1970. *Aspidoceras* (*Aspidoceras*) aff. *wolfi* NEUMAYR, BERNOULLI & RENZ, p. 598, Pl. 6, fig. 1.a-b.
1985a. *Physodoceras wolfi* (NEUMAYR), CHECA, p. 134, Figs. II.3.30-31, .33, Pl. 24, fig. 5; Pl. 25, figs. 1-4.
1994. *Ph. wolfi* (NEUMAYR), SCHLEGELMILCH, p. 128, Pl. 69, fig. 4.
1999. *Physodoceras wolfi*, SARTI, p. 326, Fig. 11.E-H.
2007. *Physodoceras* cf. *wolfi* (NEUMAYR), CECCA & SAVARY, p. 537, Fig. 12.A.
2011. *Physodoceras wolfi* (NEUMAYR), FŐZY *et al.*, p. 417, Fig. 2.1-2.

Material. One poorly preserved and worn internal mould from mixed debris and soil.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.89.1.	72.0	(36)	(31)	20.5	1.161	0.431	0.285

Description. Small sized, moderately preserved, rather compressed phragmocone conch of typical aspidoceratid coiling. Two whorls are visible. Umbilicus rather wide, deep. Umbilical wall deep, smooth, vertical. Umbilical shoulder rounded. Flanks convex, converging. No ventral shoulder. Venter rounded, smooth. Cross section subcircular. From the umbilical shoulder short, gentle tubercles rise. There are 7 tubercles on the last half whorl. Except for these tubercles no other sculpture is preserved. Neither suture nor aperture seen.

Remarks. When NEUMAYR (1873, p. 195) established this species he clearly stated that it is a *'strongly inflated and entirely smooth form'* as well seen on his original plate. Five years later, when HERBICH set up his new species (*A. bathori* and *A. deaki*), he collected from the same locality as NEUMAYR. HERBICH was clear and strictly followed the view of NEUMAYR regarding this species to nominate his new species based on peri-umbilical tubercles. His view was followed by PAVLOW (1886). Comparable morphospecies include *Schaireria neumayri* CHECA, 1985a, and *S. fluegeli* ZEISS, 1994. The holotype of the latter is a plaster cast taken from an imprint of a large sized specimen. *S. fluegeli* has strongly erected tubercles ending in spines that originated from the umbilical shoulder. The other species is *S. neumayri* CHECA, 1985a. Morphologically these species are similar, however *S. neumayri* have smaller, and less well-developed peri-umbilical tubercles than *S. fluegeli*.

Presently this species is considered to subsume the other sculptured forms with a peri-umbilical row of tubercles. The content of this species (*P. wolfi*) is shifting from CHECA (1985a) to D'ARPA and MELÉNDEZ (2002). It would be worthwhile to make a new collection at the type locality, to morphologically discriminate these species (*P. bathori*, *P. deaki*, *P. wolfi*) following the original view of NEUMAYR. Specimen Ch.G12.R (CHECA, 1985a, Pl. 24, fig. 6) represents the sculpture of *P. wolfi* sensu NEUMAYR, while L.38/5 (CHECA, 1985a, Pl. 25, fig. 4) is NEUMAYR's refigured holotype. These two specimens represent *P. wolfi* according to the original species concept of NEUMAYR. The other specimens of CHECA (1985a, Pl. 24, fig. 5; Pl. 25, figs. 1-3) reveal the peri-umbilical tubercles that vary in strength, number, and placement along the umbilical shoulder. Regarding the other figured specimens, SCHLEGELMILCH (1994) copied NEUMAYR's original plate, while the specimens of CECCA and SAVARY (2007), and FŐZY *et al.* (2011) represent the smooth varieties, reflecting the original species concept of Neumayr. First record from the Mecsek Mountains.

Stratigraphic and geographic distribution. Although *Physodoceras wolfi* is a rare species, it has a long stratigraphic range and wide geographic distribution. It is reported from the Kimmeridgian Bimammatum to the Acanthicum zones in the Submediterranean, Subboreal and Mediterranean Provinces.

Genus *Pseudowaagenia* SPATH, 1931

Type species: *Aspidoceras haynaldi* HERBICH, 1868

Pseudowaagenia div. sp.

Material. Seven fragmentary and poorly preserved internal moulds (J 2020.448.1-454.1, and below).

Remarks. Apart of the poor preservation, these specimens may belong to some different *P.* species. But lacking complete whorls, a specific assignment is unwise.

Pseudowaagenia acanthomphala (ZITTEL, 1870)

(Fig. 10.C1-C2)

1870. *Aspidoceras acanthomphalus* ZITT., ZITTEL, p. 79, Pl. 5, fig. 4.A-B.
1878. *Aspidoceras microplum* OPPEL, HERBICH, p. 172, Pl. 14-15, fig. 4.
1931. *Pseudowaagenia carpathica*, sp. nov., SPATH, p. 621, Pl. 123, fig. 5.a-c.
1966. *Aspidoceras* (*Pseudowaagenia*) *serbicum* n. sp., ANĐELKOVIĆ, p. 81, Pl. 21, fig. 2; Pl. 22, fig. 2; Pl. 25, fig. 5.
1978. *Aspidoceras* (*Pseudowaagenia*) *acanthomphalum acanthomphalum* (ZITTEL), OLÓRIZ, p. 316, Pl. 26, figs. 4-5.
1985a. *Pseudowaagenia acanthomphala* (ZITTEL), CHECA, p. 127, Fig. II.3.25-26, .28-29, Pl. 23, figs. 1-4.
1989. *Pseudowaagenia acanthomphala* (ZITTEL), FŐZY, Pl. 3, fig. 5.
1993. *Pseudowaagenia acanthomphala* (ZITTEL), SARTI, p. 130, Pl. 27, fig. 3.
1993b. *Pseudowaagenia acanthomphala* (ZITT.), FŐZY, p. 199. [in lit.]
1999. *Pseudowaagenia acanthomphala* (ZITTEL), CARACUEL & OLÓRIZ, Fig. 7.9.

2011. *Pseudowaagenia acanthomphala* (ZITTEL), FŐZY *et al.*, Fig. 3.4-.5.

Material: Eight internal moulds, one specimen from the quarry floor amongst debris, others from mixed debris and soil.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.90.1.	24.8	(8)	10.5	(9)	0.762	0.423	0.363
J 2020.145.1.	73.3	(19)	23.4	32.5	0.812	0.319	0.443
J 2020.146.1.	86.4	20.6	(25)	38.6	0.824	0.289	0.447
J 2020.260.1.	90.6	21.4	(27)	(45)	0.793	0.298	0.497
J 2020.261.1.	70.6	(18)	(21)	32.7	0.857	0.297	0.463
J 2020.272.1.	70.5	(25)	(28)	(25)	0.893	0.397	0.355
J 2020.332.1.	94.4	(23)	(28)	(47)	0.821	0.297	0.498
J 2020.455.1.	101.2	(21)	(30)	47.2	0.700	0.296	0.466

Description. Small and medium sized specimens representing septate phragmocones and body chambers. Coiling evolute, one to three whorls visible. Umbilicus wide and shallow. Umbilical wall high, smooth and vertical on the inner whorls, while shallow and oblique on the outer whorls. Umbilical shoulder not rounded in the inner and fairly rounded on the last whorl. On the umbilical shoulder of inner whorls, fine tubercles emerge that are elongated rectoradiately. There are 14-16 tubercles per half whorl on the inner whorls. Tubercles become less frequent toward the body chamber and usually disappear beyond the last septum. Otherwise, tubercles become fainter and are located farther apart. Flanks smooth, parallel or convex, unsculptured. On the last whorl, close to the aperture and beyond the last septum, fine ribs emerge from the tubercles and travel through the flanks, crossing the venter continuously as HERBICH (1878, p. 140 – Hungarian version) noted. Cross section rounded rectangular, compressed. Suture not seen.

Remarks. CHECA (1985a, p. 129) included *Aspidoceras (Pseudowaagenia) serbicum* n. sp. of ANĐELKOVIĆ (1966, p. 81) in this species based on homologous phenotypic characters and the stratigraphic revision of its locus typicus by SAPUNOV and ZIEGLER (1976, p. 28). The *Aspidoceras microplum* of HERBICH (1878, p. 172, Pl. 14-15, fig. 4) was also included in this species by CHECA (1985a, p. 127) based on its phenotypic characters, and his opinion is accepted here. FŐZY *et al.* (2011, Fig. 3.4-.5) refigured the specimen of FŐZY (1989, Pl. 3, fig. 5) in better quality. Specimen J 2020.146.1 is closest to F.G23.11.8 of OLÓRIZ (1978, Pl. 26, fig. 4) whereas specimen J 2020.145.1. is closer to specimen M.1631/b illustrated by ANĐELKOVIĆ (1966, Pl. 21, fig. 2).

Microconchs with well developed lappets have been reported rarely among aspidoceratine ammonites (*e.g.*, SCHERZINGER *et al.*, 2018, Fig. 3.A, .C), therefore even in the case of numerous specimens the macro- or microconchs are difficult to recognize.

Stratigraphic and geographic distribution. *Pseudowaagenia acanthomphala* is reported from the upper Kimmeridgian (Cavouri to Beckeri zones) from the western Tethys (Mediterranean Province) and adjacent territory (Submediterranean Province).

Pseudowaagenia cf. *haynaldi* (HERBICH, 1868)

(Fig. 10.D1-D2)

1868. *Ammonites Haynaldi* HERB. nov. sp., HERBICH, p. 33.
1873. *Aspidoceras Haynaldi* HERBICH, NEUMAYR, p. 194 [54], Pl. 42, fig. 3.a-b.
1876. *Ammonites Haynaldi* HERBICH, DUMORTIER & FONTANNES, p. 122, Pl. 17, fig. 4, Pl. 18, figs. 2-3.
1878. *Aspidoceras Hajnaldi* HERBICH, HERBICH, p. 137, Pl. 14-15, fig. 1.A-B.
1931. *Pseudowaagenia haynaldi* (HERBICH MS), SPATH, p. 621, Pl. 91, fig. 1.a-b; Pl. 118, fig. 11.
1935. *Pseudowaagenia* cf. *haynaldi* HERB., VADÁSZ, p. 62. [in lit.]
1936. *Aspidoceras haynaldi* HERBICH, BESAIRIE, p. 132, Pl. 9, fig. 2.
1978. *Aspidoceras* (*Pseudowaagenia*) *haynaldi haynaldi* (HERBICH), OLÓRIZ, p. 308, Pl. 27, fig. 1.
1985a. *Pseudowaagenia haynaldi* (HERBICH), CHECA, p. 126, Fig. II.3.25, .27, Pl. 21, figs. 7-10
1999. *Aspidoceras* (*Pseudowaagenia*) cf. *haynaldi* (HERBICH), FATMI & ZEISS, p. 87, Pl. 24, fig. 2.
2018. *Aspidoceras* (*Pseudowaagenia*) *haynaldi*, ÉNAY, p. 77, Pl. 1, fig. 8.

Material. One internal mould.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.191.1.	50.7	21.7	(21)	(13)	1.033	0.414	0.256

Description. Small sized conch representing the phragmocone and partial body chamber. Umbilicus wide, shallow. Umbilical wall short, vertical, unsculptured. Umbilical shoulder rounded. Flanks parallel, unsculptured. No ventral shoulder, venter rounded, smooth. Cross section high oval, with flattened flanks. Sculpture consists of fine, distantly spaced short tubercles at the umbilical shoulder. Tubercles only seen on last half whorl.

Remarks. HERBICH (1868, p. 33) introduced this new species with only a short qualifying remark: '*Perarmatus* family, *next to* A. *eucyphus* OPP. *but definitely differs. From grey marl at Gyilkos-kő.*' NEUMAYR (1873, Pl. 42, fig. 3.a-b) refigured the original specimen of HERBICH, that reveals a wide umbilicus and a row of fine peri-umbilical tubercles, showing 10 of them on the last half whorl. According to the analysis of CHECA (1985a, p. 127) this species shows characters transitional between *P. micropla* and *P. acanthomphala*, however there is strong subjectivity between different authors when describing internal whorls and juvenile stages. The specimen MNHN. F.J07898 of BESAIRIE (1936) has 7 tubercles on the last half whorl distributing the same fine radial ribbing as the holotype figured by NEUMAYR (1873). These characters are only poorly preserved on the collected specimen.

Stratigraphic and geographic distribution. *Pseudowaagenia haynaldi* is reported from the upper

Kimmeridgian (Acanthicum to Beckeri zones) mainly from the Submediterranean Province with occasional occurrences in the Mediterranean Province and from the northern Tethys, however stray individuals are also reported from the Indo-Malagasy Province.

Pseudowaagenia inerme Énay, 2018

(Fig. 10.E1-E2)

2018. *Aspidoceras* (*Pseudowaagenia*) *inerme* n. sp., Énay, p. 78, Pl. 1, figs. 9-10; Pl. 2, figs. 2-3.

Material. One poorly preserved internal mould.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.570.1.	n.d.	24.1	(29)	(41)	0.831	n.d.	n.d.

Description. Medium sized conch representing phragmocone and body chamber. Coiling evolute, two whorls seen, inner whorls lost. Umbilicus wide, shallow. Umbilical wall short, vertical, smooth. Umbilical shoulder rounded. Flanks convex, converging. No ventral shoulder. Venter rounded, smooth. Cross section compressed, high oval. Fine radial folds rise at midflank to become prorsiradiate on upper flank and cross the venter continuously. Thirteen folds are seen on the better-preserved ventral part, however there are more that are lost to the poor preservation. Folds are unequal and randomly placed. Neither suture not aperture apparent.

Remarks. Our Hungarian specimen is comparable to the holotype illustrated by Énay (2018, Pl. 1, fig. 9.a-c, FSL 341349): By comparison their cross section, fine ribbing and rate of coiling are nearly identical. But the collected specimen has poorer preservation and therefore fewer folds are discernible. First record from Hungary.

Stratigraphic and geographic distribution. Upper Kimmeridgian Beckeri Zone, Jura Mountains, France.

Pseudowaagenia micropla (Oppel, 1863)

(Fig. 10.F1-F2)

1863. *Ammonites microplus* Opp., Oppel, p. 218, Pl. 58, fig. 4.a-b.

1877. *Ammonites* (*Aspidoceras*) *microplus* Oppel, Favre, p. 63, Pl. 7, fig. 4.

non 1878 *Aspidoceras microplum* Oppel, Herbich, p. 172, Pl. 14-15, fig. 4. [=*P. acanthomphala*]

1878. *Aspidoceras microplum* Opp., Gemmellaro, p. 248, Pl. 15, fig. 11.

1879. *Aspidoceras microplum* Oppel, Fontannes, p. 92, Pl. 12, figs. 11-13.

1931. *Pseudowaagenia micropla* (Oppel), Spath, p. 622, Pl. 122, fig. 3.a-c.

1966. *Aspidoceras* (*Pseudowaagenia*) *microplus* (Oppel), Anđelković, p. 80, Pl. 30, fig. 5.

1978. *Aspidoceras* (*Pseudowaagenia*) *microplum* (Oppel), Olóriz, p. 313, Pl. 27, fig. 2.

1984. *Aspidoceras* (*Pseudowaagenia*) cfr. *microplum* (Oppel), Rossi, p. 109, Pl. 34, fig. 2.

1985a. *Pseudowaagenia micropla* (Oppel), Checa, p. 116, Fig. II.3.24, .27, Pl. 21, figs. 2-6.

1986. *Aspidoceras* (*Pseudowaagenia*) *microplum* (Oppel), Sarti, p. 506, Pl. 6, fig. 2.

1987. *Pseudowaagenia micropla* (Oppel), Pavia *et al.*, Pl. 3, fig. 3.

Material. Four internal moulds (J 2020.359.1, and below).

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.153.1.	50.7	19.6	(21)	(13)	0.933	0.414	0.256
J 2020.205.1.	(57)	(18)	(22)	(13)	0.818	0.368	0.228
J 2020.590.1.	53.8	24.3	(23)	(17)	1.056	0.427	0.316

Description. Poorly preserved small sized conchs representing the phragmocone. Umbilicus moderate, shallow. Suture, aperture not seen. Umbilical wall short, smooth and oblique. Umbilical shoulder rounded. Flanks converge, smooth. No ventral shoulder, venter smooth and rounded. Cross section is high oval. Fine tubercles rise at the umbilical shoulder. There are 11, tiny, pearl-like peri-umbilical tubercles on the last whorl. Exactly on midflank, another row of small tubercles is occasionally apparent. If present, they usually number 5 on the last whorl. Rarely, some of the tubercles are radially elongated toward the upper flank. In some cases, very fine, radial ribs rise on the upper flank from some of the midflank tubercles and travel radially toward the venter. Venter poorly preserved; sutures and aperture not apparent.

Remarks. Intraspecific variability within this species lays in the changing number and dimensions of periumbilical tubercles on the last whorl (it is 13 for Oppel, 12 for Checa [1985a, Pl. 21, fig. 3], 8 noted by Favre and Spath, 6 by Rossi) and presence/absence and numbers of midflank tubercles as thoroughly discussed and documented by Checa (1985a). Specimen J 2020.205.1. is closer to the holotype of Oppel (1863, Pl. 58, Fig. 4.a-b), the only differences are that the type specimen has more periumbilical nodes with a more slender cross section. Whorl section of our specimen is closest to specimen F.G12.6.8 of Checa (1985a, Fig. II.3.24.C) representing the attenuated variety of the species. Specimen J 2020.153.1. is closest to specimen M54 (1950 I 97) of Checa (1985a, Pl. 21, fig. 6), the only difference is that the Hungarian specimen has 5 tubercles on the midflank of the last half whorl, while it is 6 for M54; otherwise they are comparable. First record from Hungary.

Stratigraphic and geographic distribution. *Pseudowaagenia micropla* has a long stratigraphical range from the Bimammatum to the Acanthicum zones of the Kimmeridgian in the western Tethys (Mediterranean Province) and adjacent territories (Submediterranean Province).

Genus *Simaspidoceras* Spath, 1925

Type species. *Aspidoceras argobbae* Dacqué, 1905

Simaspidoceras bucki Checa, 1985a

(Fig. 10.G1-G2)

1985a. *Simaspidoceras bucki* sp. nov., Checa, p. 175, Fig. II.3.42, .45-47, Pl. 36, figs. 1-2; Pl. 37, figs. 1-2.

1987. *Simaspidoceras bucki* Checa, Pavia *et al.*, Pl. 7, fig. 1.

Material. One half whorl of an internal mould from mixed debris and soil.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.186.1.	89.6	(40)	(42)	(21)	0.952	0.469	0.234

Description. Fairly preserved, middle sized conch fragment representing both body chamber and phragmocone. Umbilicus wide, shallow. Umbilical wall oblique, smooth. Umbilical shoulder rounded. Flanks convex, converging, smooth. No ventral shoulder. Venter rounded, smooth, flat. Cross section rounded triangular. At the umbilical shoulder, occasional, not regular, gentle, short tubercles rise. Tubercles continue in short, wide, gentle ribs ending above the midflank. Four fine ribs seen on half whorl. Upper flank and venter smooth, ribs disappear. Suture, aperture not seen.

Remarks. In the evolutionary summary of the aspidoceratine CHECA and OLÓRIZ (1987, Fig. 3) described this species as *'development of wide, expanded at the lateroventral portion, ribs.'* The present specimen corresponds well with this description being closest to specimen F.X.3 of CHECA (1985a, Pl. 36, fig. 2) with even and finer tubercles and ribbing. The closest morphospecies is *Simaspidoceras bauschi* CHECA, 1985b (*op. cit.*, Pl. 1; specimen BSP 1980 XV 13) having stronger umbilical tubercles, wider ribs of significantly bigger size. PAVIA *et al.* (1987, Pl. 7, fig. 1.a-b) published a specimen with stronger ribbing and tubercles. Cross section of the collected specimen is closest to specimen F.G2.22.11 of CHECA (1985a, Fig. II.3.42.C), however the Hungarian example is more compressed, which is a decisive character for the species (CHECA, 1985b, p. 24). First record from Hungary.

Stratigraphic and geographic distribution. *Simaspidoceras bucki* has a limited stratigraphic distribution in the Kimmeridgian (Herbichi to Acanthicum zones). Geographically it rarely occurs in the Mediterranean (Italy) and the Submediterranean Provinces (Spain, Hungary) and it is abundant in the Indo-Malagasy Province (Yemen, Somalia, Kenya, Malagasy) as noted by ÉNAY and HOWARTH (2019).

Genus *Hybonoticeras* BREISTROFFER, 1947

Type species. *Ammonites Hybonotum* OPPEL, 1863

Hybonoticeras pressulum (NEUMAYR, 1871b)

(Fig. 11.A1-A2)

1871b. *Asp. pressulum* nov. sp., NEUMAYR, p. 25.
1873. *Aspidoceras pressulum* NEUMAYR, NEUMAYR, p. 201 [61], Pl. 37, figs. 2-3.
1878. *Aspidoceras Verestoicum* nov. sp., HERBICH, p. 181 [163], Pl. 14-15, fig. 3.
1935. *Pseudowaagenia* cf. *pressulum* NEUM., VADÁSZ, p. 62. [in lit.]
1959. *Hybonoticeras pressulum* (NEUMAYR), BERCKHEMER & HÖLDER, p. 20, Fig. 2, Pl. 1, figs. 6, 8; Pl. 2.
? 1963. *Hybonoticeras* cf. *pressulum* (NEUMAYR), PACHUCKI, p. 3, Pl. 1, fig. 6.
1978. *Hybonoticeras pressulum* (NEUMAYR), BARTHEL & SCHAIRER, p. 18, Pl. 2, figs. 4-7.
1978. *Hybonoticeras* (*Hybonoticeras*) *pressulum pressulum* (NEUMAYR), OLÓRIZ, p. 355, Pl. 32, fig. 5.
1984. *Hybonoticeras pressulum* (NEUMAYR), VERMA & WESTERMANN, p. 75, Pl. 19, fig. 1.
1984 *Hybonoticeras* (*Hybonoticeras*) *pressulum verestoicum* (HERBICH), ROSSI, p. 118, Pl. 34, figs. 1, 4.
1989. *Hybonoticeras pressulum* subsp. B BERCKHEMER & HÖLDER, MALINOWSKA, Pl. 5, fig. 7.
1991. *Hybonoticeras pressulum* (NEUMAYR), KRISHNA & PATHAK, p. 11, Pl. 1, fig. 1; Pl. 2, fig. 4.
1993. *Hybonoticeras pressulum* (NEUMAYR), SARTI, p. 132, Pl. 28, fig. 1.A-B.
1995. *Hybonoticeras pressulum* (NEUMAYR), FŐZY, p. 138, Pl. 22, figs. 6, 8.
1996. *Hybonoticeras pressulum* (NEUMAYR), SCHWEIGERT *el al.*, p. 353, Fig. 3.a-b.
1999. *Hybonoticeras* sp. gr. *pressulum* (NEUMAYR), CARACUEL & OLÓRIZ, p. 586, Fig. 6.6.
2013. *Hybonoticeras pressulum* (NEUMAYR), FŐZY & SCHERZINGER, p. 188, Pl. 10, figs. 2-3.

Material. 15 fragmentary, poorly preserved specimens of internal moulds from old collection (MBFSz) and from mixed debris and soil (J 2087, J 2020.95.1, 96.1, 229.1, 251.1-254.1, 294.1, 296.1, 331.1, 591.1 and below).

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2088	70.1	21.4	24.2	28.5	0.884	0.345	0.406
J 2020.262.1.	75.4	(13)	(25)	(35)	0.520	0.332	0.464
J 2020.271.1.	88.3	21.1	(26)	(37)	0.812	0.294	0.419

Description. Medium sized conch, however estimation of the whorl fragments indicates that the diameter of the entire conch was up to 20 cm representing both body chambers and phragmocones. Coiling evolute, however only one crushed specimen has one entire whorl but none of them show preserved inner whorls. Cross section rounded trapezoidal, compressed. Umbilicus wide, shallow. Umbilical wall steep, vertical, smooth. Umbilical shoulder rounded; flanks slightly converge. Ventral shoulder rounded. Venter bears a longitudinal shallow groove. At the umbilical shoulder strong, pronounced, vertically placed spines appear on early growth stages. Later the spines become slightly rectoradiate and give rise to smooth, falcoid ribs that cross the flank. Suture not seen.

Remarks. Due to the poor preservation and lack of the early growth stages of inner whorls, the juvenile bituberculate stage (sensu SCHWEIGERT *et al.*, 1996, p. 354) is not evident for us. *H. pressulum* is very close to *P. acanthomphala* the only difference is the absence/presence of the ventral groove as remarked upon by SCHWEIGERT and SCHLAMPP (2020, p. 30). The species palaeontological designation involving the missing holotype and erroneously designated lectotype has been excellently discussed by SCHWEIGERT *et al.* (1996, p. 354), as well as morphologically inseparable *Hybonoticeras verestoicum* (HERBICH), which is included in *H. pressulum* by these authors. Their view is accepted and followed here, although there is some dissent from those authors who continue to recognize separate and independent species (*e.g.*, OLÓRIZ & VILLASEÑOR, 1999; BOUGHDIRI *et al.*, 2009; GRIGORE, 2011). However, some etymological remarks are worthy of mention here. NEUMAYR (1871b) collected his specimen at Gyilkos-kő in Nagy-Hagymás Mountains, and from the same bed, HERBICH (1878) collected his specimen described as *Aspidoceras verestoicum*. The original Hungarian phrase *'Veres-tó'* means red lake in English (in Romanian Lacul Roşu) referring to the lake in neighborhood of Gyilkos-kő. The locality is referred to as Lacul Roşu in the recent Romanian literature. Specimens J 2020.95.1 and 2020.96.1 are most comparable to the specimen of NEUMAYR (1873, Pl. 37, fig. 3.a-b) representing the big sized, smooth stage of ontogeny with elongated umbilical tubercles and ventral groove. PACHUCKI (1963) reported a specimen with strong, S-shaped prorsiradiate ribs that fall out of specific variation with this species, rendering the designation as ambiguous.

Stratigraphic and geographic distribution. *Hybonoticeras pressulum* has a limited stratigraphic range in the upper Kimmeridgian (Beckeri Zone), however it has a wide geographical distribution throughout the entire Tethys.

Superfamily incertae sedis
Ammonite gen. et sp. ind.
(Fig. 11.B1-B2)

Material. Two poorly preserved internal moulds (J 2020.136.1, 2020.217.1) from mixed debris and soil.

Dimensions.

specimen	D	Wb	Wh	U	Wb/Wh	Wh/D	U/D
J 2020.136.1.	85.9	(23)	(28)	(31)	0.821	0.326	0.361

Descriptions.

Specimen J 2020.136.1. (Fig. 11.B2). The early whorls of this specimen superficially resemble to Simoceratidae (?*Volanoceras*) however the outer whorls are either lost or dissolved and fractured.

Specimen J 2020.217.1. (Fig. 11.B1). The whorl fragment refers to an involute, coarsely ribbed specimen with no recognized affinity.

Remarks. Preservation of these specimens are so poor, that even suprageneric assignment is dubious. On the other hand, they are interesting and present such features that may refer to rare/not yet described taxa, therefore they are included in this study.

Other faunal elements

Although ammonites dominate the assemblage, other faunal elements also occur. Belemnites are present, as well as aptychi. Regarding the occurrence of aptychi it is remarkable that aptychi in the most cases are found fossilized together with *Taramelliceras*. Solitary aptychi are rare (Table 2). Belemnites are always worn and fragmented specimens that may refer to reworking. Other faunal elements are extremely rare.

Aptychi. Table 2 summarizes the recognized aptychi that represent two of the seven aptychi types of PARENT *et al.* (2014), *i.e.*, lamellaptychi and laevaptychi. This is not surprising because *Lamellaptychus* are associated with haploceratoids, while *Laevaptychus* with aspidoceratoids. These ammonite groups dominate the Zengővárkony assemblage (61%). It is remarkable that *Strigogranulaptychus* was not collected, however it is associated with perisphinctoids that have a total share of 31.5% in the ammonite assemblage. On the other hand, it is noteworthy that *Praestriaptychus*, which is typical of perisphinctoids are mainly known from clayey facies (Mikhail ROGOV personal comm.). VADÁSZ (1935, p. 62-62) listed a *Laevaptychus latus* (PARKINSON, 1811), a *Lamellaptychus* sp. and a *Punctaptychus*? *punctatum* (VOLTZ, 1837). These records are partly confirmed by our observations (Fig. 11.C-D). In the case of *Lamellaptychus*, a species was recognized: *L.* sp. aff. *murocostatus* TRAUTH, 1938 (Fig. 11.D) being the first record from the Mecsek Mountains. NAGY (1971) listed other species: *Punctaptychus* cf. *punctatus* (VOLTZ), *Aptychus crassicauda* QUENSTEDT, and *Lamellaptychus beyrichi* (OPPEL). These data are not confirmed by our findings.

Table 2: Aptychi from the Zengővárkony upper Jurassic locality: Dimensions, orientation of valves, and accompanying fossils.

specimen	Taxon	orientation of valve	Dimensions	accompanying fossils
J 2020.92.2	*Aptychus* sp. ind.	right, inside	L: - mm; S: - mm; Lat: 17 mm.	Ataxioceratidae gen. et sp. ind.
J 2020.161.1	*Laevaptychus latus*	left, outside	L: - mm; S: 29 mm; Lat: 24.7 mm.	no
J 2020.221.1	*Lamellaptychus* sp.	left, outside	L: 9.3 mm; S:8.7 mm; Lat: 4.2 mm.	*Taramelliceras* sp.
J 2020.221.2	*Lamellaptychus* sp.	right, outside	L: 8.6 mm; S: 7.7 mm; Lat: 3.8 mm.	*Taramelliceras* sp.
J 2020.230.1	*Lamellaptychus murocostatus*	left, outside	L: - mm; S: 47 mm; Lat: 26 mm.	no
J 2020.244.1	*Laevaptychus latus*	right, inside	L: - mm; S: 47 mm; Lat: 27 mm.	no
J 2020.257.1	*Lamellaptychus murocostatus*	left, outside	L: 53.7 mm; S: 48.4 mm; Lat: 23 mm.	no
J 2020.258.1	*Laevaptychus latus*	left, outside	L: 59 mm; S: 48 mm; Lat: 39 mm.	no
J 2020.277.2	*Lamellaptychus* sp.	left, outside	L: 39 mm; S: 32 mm; Lat: 17 mm.	*Taramelliceras* sp.
J 2020.293.1	*Laevaptychus latus*	right, outside	L: 65 mm; S: 58.9 mm; Lat: 38.1 mm.	no
J 2020.303.1	*Lamellaptychus* sp.	left, outside	L: 36 mm; S: 32 mm; Lat: 21 mm.	Ataxioceratidae gen. et sp. ind.
J 2020.339.3	*Lamellaptychus* sp.	left, outside	L: 28 mm; S: 23 mm; Lat: 11 mm.	*Taramelliceas pugile*

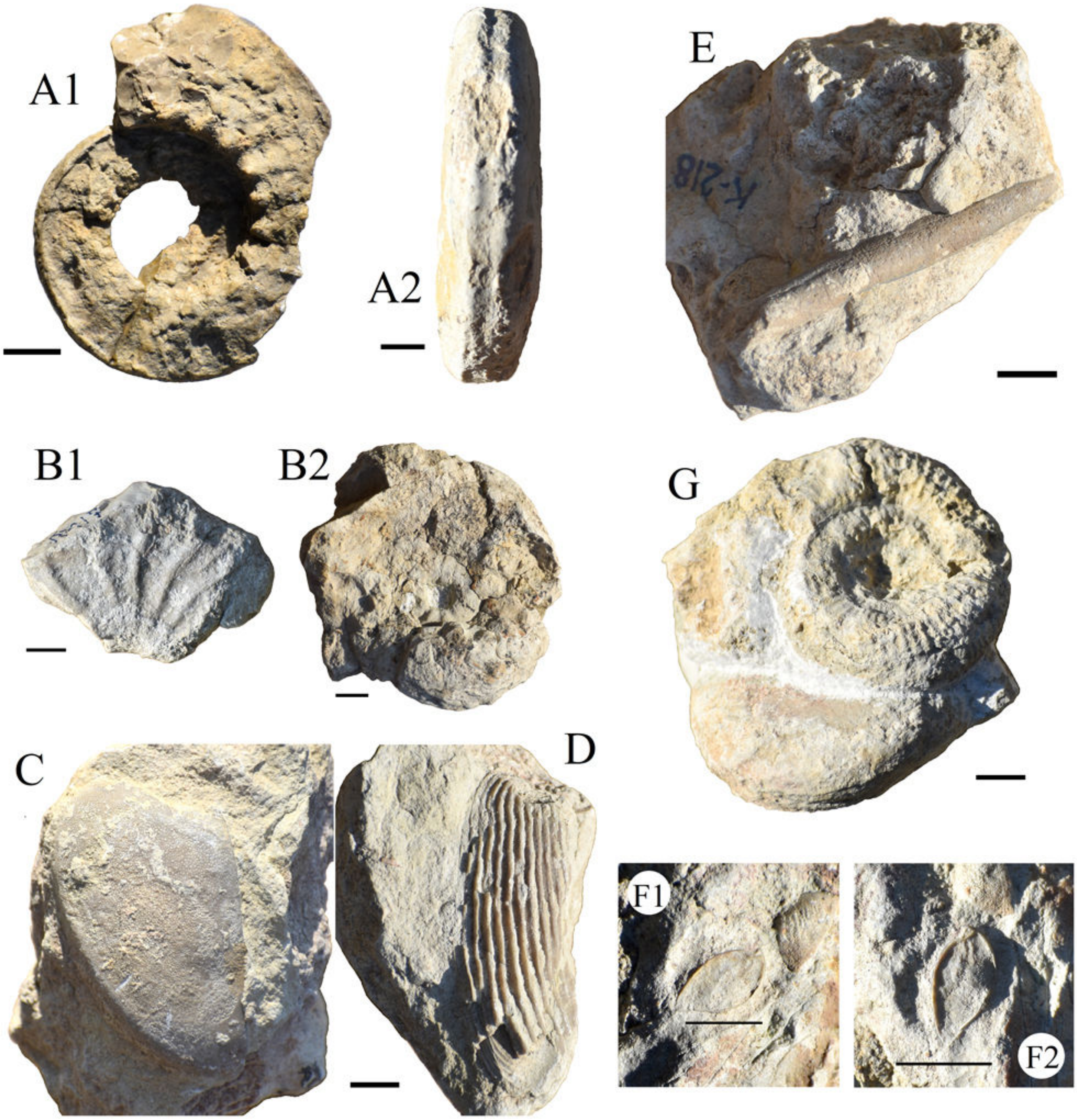


Figure 11: Upper Kimmeridgian-lower Tithonian ammonoids, aptychi, belemnites, and brachiopods from Zengővárkony, Mecsek Mountains, Hungary. A. *Hybonoticeras pressulum* (NEUMAYR, 1873), specimen J 2088. A1. lateral view; A2. ventral view of specimen J 2020.271.1. B. Undetermined ammonites from mixed debris and soil. B1. lateral view of specimen J 2020.217.1; B2. whorl fragment, specimen J 2020.136.1. C-D. Aptychi from mixed debris and soil. C. *Laevaptychus latus* (PARKINSON, 1811) left valve, convex; specimen J 2020.258.1; D. *Lamellaptychus* aff. *murocostatus* TRAUTH, 1938, possibly right valve, specimen J 2020.257.1. E. Belemnite guard resembling to *Hibolithes semisulcatus* MÜNSTER, 1830. Specimen J 2020.162.1. F1.-F2. Kimmeridgian brachiopod. Weathered, small, double-valved specimen, J 2020.244.3. L= 12 mm; H= 6 mm. G. Examples of condensed accumulation of ammonites. Specimens J 2020.174.1-2, a phylloceratid and a perisphinctid ammonites. Scale bars indicate 1 cm.

Belemnites. Poorly preserved belemnite guards are also collected (J 2020.159.1, 160.1, 162.1, 256.1, 304.2, 490.2). The figured specimen (Fig. 11.ED) most probably a *Hibolithes semisulcatus* MÜNSTER.

Brachiopods. A Kimmeridgian brachiopod from the Mecsek Mountains (J 2020.244.3) is recorded as a weathered small sized specimen fossilized together with an aptychus and a *Taramelliceras* sp. (Fig. 11.F1-F2).

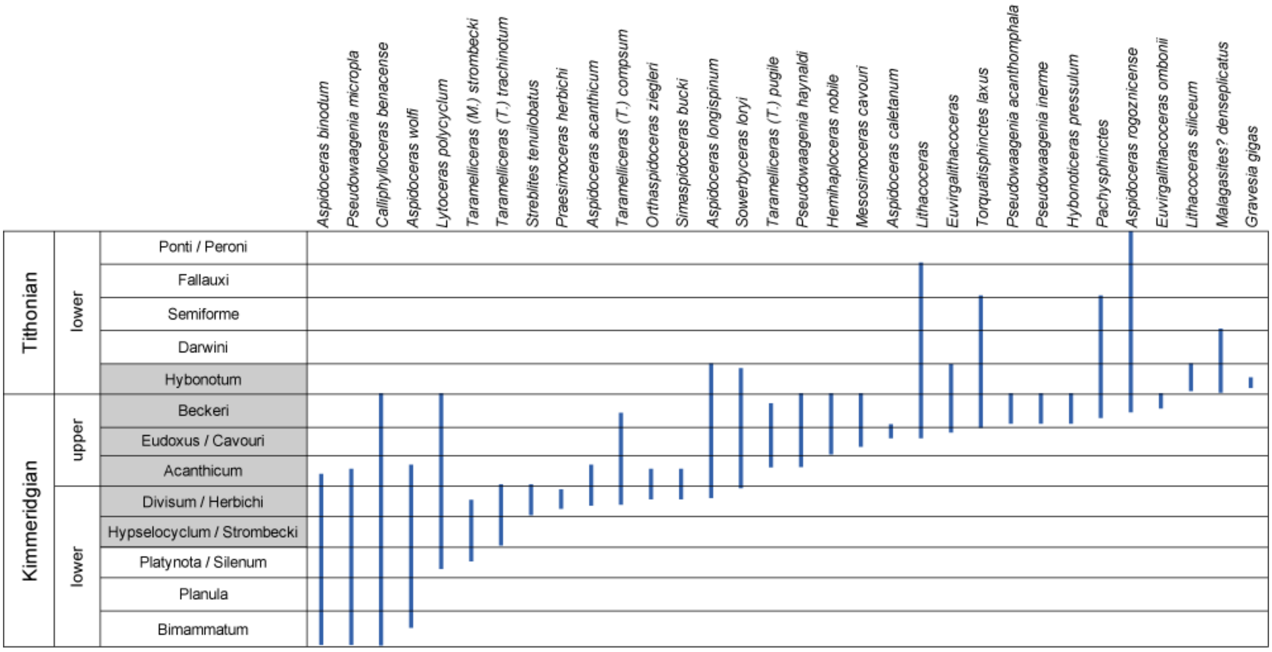


Figure 12: Stratigraphic distribution of the recognized taxa (species and genera). Compilation based on data from CHECA, 1985a; GRIGORE, 2000; IMLAY, 1981; OLÓRIZ, 1978; SAPUNOV, 1979; SARTI, 1993; ZIEGLER, 1977. Zonal subdivision according to HESSELBO *et al.* (2020) Mediterranean and Submediterranean ammonite zones applied.

5. Taphonomy

The studied material clearly shows the signals of prolonged surface weathering, with exposure resulting in abrasion and erosion. Therefore, analysis of the original taphonomic marks is difficult and needs a very optimistic albeit careful approach. It is also noteworthy that due to the absence of stratigraphic control all conclusions are time-averaged for the whole stratigraphic interval. Condensation or reworking is only surely recognized when the weathered cobbles are preserving more ammonites. Figure 11.G shows a nice example of certain condensation of ammonites, but specimens J 2020.324.1-2 are of two taramelliceratids. From the taphonomic point of view, the most interesting finding is the encrusting serpulid tube fossil, *Spiraserpula spirolinites* (Fig. 5.A). It is noteworthy, that serpulid and sabellid tube worms often encrusted the inner wall of cephalopods, usually nautilids (LUCI *et al.*, 2013) but ammonoids too (AGUIRRE-URRETA & RAWSON, 2010) as in our case. Later the shell was redeposited by storm agitation or marine mass movements into the basin, as RADWAŃSKA (2004) has demonstrated. The majority of ammonites are fragments, but this is probably due to later surficial erosion of the host rocks and not related to the primary reworking or multiple transportation.

6. Biostratigraphic considerations

The reported ammonite taxa in this study with known stratigraphic distributions from other localities is summarized in Figure 12. Based on the distributional data of the species to which we compare, this assemblage could represent six ammonite zones of the Kimmeridgian and the lower Tithonian. The standard Tethysian ammonite zones are applied here sensu WIERZBOWSKI *et al.* (2016), and HESSELBO *et al.* (2020).

6.1. KIMMERIDGIAN

Although the localities on the left bank of the Vasbányavölgy creek exposes a continuous sequence of Kimmeridgian strata, the present material did not contain elements from the Silenum Zone. Situated 25 m distant to the NE from the present locality there is an outcrop that corresponds to the wall of the abandoned small quarry and exposes the older part of the Kimmeridgian.

Lower Kimmeridgian Metahaploceras strombecki *Zone*

This zone was introduced by OLÓRIZ (1978) assigning *Taramelliceras* (*Metahaploceras*) *strombecki* as a zonal marker. The presence of some specimens of the zonal index in the assemblage clearly indicates the presence of this zone as the oldest possible age for the assemblage. It corresponds more or less to the standard Tethysian *Ataxioceras hypselocyclum* Zone.

Lower Kimmeridgian Praesimoceras herbichi *Zone*

This zone was introduced by SARTI (1993) for the Venetian Alps, Italy. According to SARTI (1993, p. 41) this is an assemblage zone of *Praesimoceras*, species of which are ubiquitous and abundant. The presence of some fairly preserved *Streblites tenuilobatus* and *Praesimoceras* cf. *herbichi* clearly indicate this zone. It corresponds to the standard Tethysian *Crussoliceras divisum* Zone.

Upper Kimmeridgian Aspidoceras acanthicum *(standard Tethysian) Zone*

upper Kimmeridgian species recognized at Zengővárkony, Mecsek Mountains, Hungary	Indo-Malagasy	Mediterranean Tethys								Submediterranean Tethys		Sub-Boreal
	Mombasa, Kenya	Gerecse, Hungary	Prérif, Rif, Morocco	Sicily, Italy	Veneto - Trentine, Italy	Mecsek Mountains, Hungary	Dacides, Southern Carpathians, Romania	Stara Planina, Serbia	Bulgaria	Bétic Cordilleras, Spain	Mt. Crussol, Ardèche, France	Normandy, France
Aspidoceras acanthicum	x	x	x		x	x	x	x		x	x	x
Aspidoceras binodum			x		x	x	x	x				
Aspidoceras caletanum						x						x
Aspidoceras rogoznicense		x	x	x	x	x			x	x		
Aspidoceras longispinum					x	x	x	x	x	x	x	
Calliphylloceras benacense	x		x	x	x	x						
Euvirgalithacoceras ombonii					x	x						
Hemihaploceras nobile			x			x	x	x	x	x	x	
Hybonoticeras pressulum	x	x	x	x	x	x			x	x	x	
Lytoceras polycyclum	x	x		x	x	x	x	x	x		x	
Mesosimoceras cavouri		x		x	x	x	x	x	x	x		
Orthaspidoceras ziegleri			x			x						
Physodoceras wolfi		x		x	x	x	x			x		
Pseudowaagenia acanthomphala				x	x	x				x		
Pseudowaagenia haynaldi				x	x	x				x	x	
Pseudowaagenia inerme						x					x	
Pseudowaagenia micropla					x	x		x		x	x	
Simaspidoceras bucki	x				x	x				x		
Sowerbyceras loryi			x	x	x	x	x	x	x			
Taramelliceras (Taramelliceras) compsum		x	x	x	x	x	x	x	x		x	
Taramelliceras (Taramelliceras) pugile			x	x	x	x	x	x	x	x	x	
Torquatisphinctes laxus				x	x	x	x					
Number of common species with the Mecsek Mountains	5	7	10	14	18	22	11	10	9	12	10	2

Figure 13: Palaeobiogeographic affinities of the late Kimmeridgian faunas compared to the Zengővárkony assemblage. Data based on CECCA and SAVARY (2007), CHECA (1985a), FŐZY *et al.* (2013), GRIGORE (2000), OLÓRIZ (1978), PAVIA *et al.* (1987), SARTI (1993), VERMA and WESTERMANN (1984).

This zone was introduced by NEUMAYR (1873) and emended in a modern sense by ZIEGLER (1964). It is only represented by some specimens of *A. acanthicum*. According to PAVIA *et al.* (1987) the zone is characterized by the FADs of *Aspidoceras longispinum* and *Ceratosphinctes rachistrophus*. The presence of these two referred *Aspidoceras* species acceptably indicates the presence of the Acanthicum Zone. All the other ammonites refer only partly to this zone.

Upper Kimmeridgian Mesosimoceras cavouri *Zone*

The Cavouri Zone was introduced by OLÓRIZ (1978) as a taxon-range zone for the Submediterranean Province. *Mesosimoceras cavouri* FAD is at a somewhat higher level than the beginning of the zone, and appears in the Beckeri Zone. *Hemihaploceras nobile* also appears first in the Cavouri Zone. However, the presence of *Aspidoceras caletanum* supports the presence of the Cavouri Zone here. The ammonite species *A. caletanum* is a subzonal index species in the Submediterranean Faunal Province (HANTZPERGUE, 1989) and in South Germany as the middle subzone of the Eudoxus Zone. It is more or less equivalent to the standard Tethysian *Aulacostephanus eudoxus* Zone.

Upper Kimmeridgian Hybonoticeras beckeri *(standard Tethysian) Zone*

This zone was originally introduced by NEUMAYR (1873). Although the zonal marker ammonite was not revealed in our study, some other characteristic ammonites were collected: Only *Hybonoticeras pressulum* and *Pseudowaagenia acanthomphala* represent this zone. In addition the occurrence of the rare and newly described species, *Pseudowaagenia inerme* also strengthens the presence for the Beckeri Zone in the Zengővárkony area.

6.2. TITHONIAN

Lower Tithonian Hybonoticeras hybonotum *(standard Tethysian) Zone*

This zone was introduced by BENECKE (1866) by the FAD of its zonal marker species. Although *H. hybonotum* was not found, the Tithonian is surely indicated by the presence of *Silicisphinctes*, *Malagasites*, and *Gravesia*. Although *Aspidoceras rogoznicense* is generally considered a Tithonian species, it appears already in the Beckeri Zone, therefore its presence in this mixed fauna is not decisive for proving the Tithonian. Among Ataxioceratidae div. sp. there are certainly other stratigraphically important taxa, however the fragmentary and poorly preserved specimens did not allow a reliable designation. Further collecting can probably equivocally solve the question of the presence of younger Early Tithonian ammonites in this assemblage. The most interesting faunal element is the *Gravesia* aff. *gigas* that indicates the basal Tithonian, however in certain places in Germany it already appears in the upper Kimmeridgian (SCHWEIGERT, 1999). In the Franco-German Biome it also appears in the uppermost Kimmeridgian (Autissiodorensis Subzone, Autissiodorensis Zone: COPE & ETCHES, 2020). *G. gigas* is therefore a very important species for long-distance correlation (SCHWEIGERT, 2005).

Table 3: Ammonite suprageneric taxa (families) and specimen numbers of the Zengővárkony fauna examined in the present paper.

Taxa	Number of specimens	Percentage
Phylloceratidae	40	7.9
Lytoceratidae	22	4.3
Oppeliidae	170	33.6
Perisphinctidae	22	4.3
Ataxioceratidae	136	26.8
Aspidoceratidae	115	22.7
Superfamily incertae sedis	2	0.4
TOTAL	507	100.0

7. Palaeobiogeographical implications

Figure 13 summarizes the palaeobiogeographical affinities of the Zengővárkony Kimmeridgian ammonite fauna compared to some selected, mainly Tethysian localities. The late Kimmeridgian ammonite fauna of the Mecsek Mountains has a Mediterranean character based on qualitative comparison and being similar to the fauna of the Venetian Alps, northern Italy. It is noteworthy that the phylloceratid and lytoceratid specimens contribute only 12% to the total ammonite assemblage (Table 3). Other Mediterranean localities (Sicily, Serbia, Bulgaria, Dacides: Romania, and the Gerecse Mountains, Hungary) are similar too, however almost the same number of common species are recognized with the Submediterranean localities in SE France, and SE Spain. The most remarkable feature of the Mecsek late Kimmeridgian ammonite fauna is the slight influence of the Submediterranean Province, which is reflected in Figure 13 by *A. caletanum*, however, other Subboreal/Submediterranean elements are there, too: *Gravesia gigas* (for the earliest Tithonian) and *Pseudowaagenia inerme* for the late Kimmeridgian. It reflects the connections of the Mecsek "Zone" towards its original European roots inherited from the Triassic and Early Jurassic. Further collection may elucidate this recognized biogeographical connection deeper. The weak biogeographical similarities between the Mecsek Mountains and the geographically close Gerecse Mountains of the Transdanubian Middle Ranges are not surprising and strengthens the previous palaeogeographical reconstructions for the Jurassic (YILMAZ *et al.*, 1996; HINSBERGEN *et al.*, 2020). At this time the separation of the Tisza microplate or megaunit (including Mecsek tectonic unit) from stable Europe was an ongoing process by the Alpine Atlantic Ocean (GAWLICK & MISSONI, 2019) that may have filtered or decreased the chance of invasion of deep water phyllo- and lytoceratid ammonites to occupy this tectonic unit. Due to the shallower water depth the ecological conditions were not yet ideal to these deep-water cephalopods, however deepening basin later resulted the increase of phyllo- and lytoceratid ratio during the Early Cretaceous (BUJTOR, 1993). It is noteworthy that during the Late Oxfordian - Early Kimmeridgian the water depth was comparatively deep as demonstrated by BUJTOR and ALBRECHT (2021) on the existence of brachiopods (*Nucleata* and *Pygope*) preferred deep-water habitats.

Regarding the puzzling presence of ?*Malagasites denseplicatus* in the Mecsek Mountains as an element of the Indo-Madagascan Province, is more doubtful and perhaps unlikely. It is noteworthy that other faunal connections were present during the Kimmeridgian between these two regions as CASWELL (1958) has already presented. According to CASWELL (1958, p. 27): "The Kimmeridgian ammonite fauna of Kenya has more in common with that of Europe than that of India, a feature shared by the entire mollusk and brachiopod assemblage. Having only two, poorly preserved specimens, their real taxonomic relationships cannot be surely recognized".

8. Conclusions

The Kimmeridgian and early Tithonian ammonite dominated assemblage collected from scree and mixed soil and debris from the Kisújbánya Limestone Formation exposed at Zengővárkony (Mecsek Mountains, Hungary) provided 528 specimens of a poorly preserved but diverse, cephalopod dominated assemblage. It could represent the lower Kimmeridgian *Metahaploceras strombecki* and *Praesimoceras herbichi* zones, all the upper Kimmeridgian ammonite zones and the *Hybonoticeras hybonotum* Zone of the lower Tithonian. The fauna has a truly Mediterranean character (however phyllo- and lytoceratid specimens account for only 12% of the total collected ammonite assemblage) showing greatest affinities with the fauna of the Venetian Alps, Italy. Typical Submediterranean elements also occur either in the Kimmeridgian (*Aspidoceras caletanum*, *Pseudowaagenia inerme*) or in the lower Tithonian (*Gravesia* aff. *gigas*). These results strengthen the palaeogeographical position of the Tisza microplate/megaunit (including the Mecsek tectonic zone) along the northern margin of the Tethys close to its stable European original position at the beginning of the Jurassic. Later tectonic processes (continental rifting) have detached this microcontinent from stable Europe, however it remained accessible for both Mediterranenan and Submediterranean ammonite populations. Besides ammonites, a nautiloid species (*Pseudaganides strambergensis*) and a serpulid (*Spiraserpula spirolinites*) were also recognized as first records from the Mecsek Mountains. Our results highlight the importance of this long-time neglected ammonite fauna, that is diverse, interesting and provided many previously unknown taxa from the Mecsek Mountains let alone from the rest of Hungary. The faunal assemblage comprises 30 genera (out of which 15 are first records from the Mecsek Mountians) and 34 species (out of which 20 are first records from this region). Aptychi (*Laevaptychus latus*, and *Lamellaptychus murocostatus*) and a belemnite (*Hibolithes semisulcatus*) are also recognized. Although some data from old literature indicated further interesting ammonite species, only more field work can confirm them. This tectonic unit still hides interesting discoveries and will illuminate stunning palaeobiogeographical connections towards the Submediterranean region. Newly collected and very much interesting ammonite fauna of Late Oxfordian - Early Kimmeridgian is under analysis now also showing Mediterranean and Submediterranean ammonites that path the way to a quantitative analysis of the ammonite assemblages of the Mecsek Mountains through the Late Jurassic - Early Cretaceous. It seems to be plausible that the Mecsek tectonic zone could have provided a stepping stone in the distribution of ammonite faunas along the northern margin of the Tethys during the Upper Jurassic.

Author contributions

Study conception and design; analysis and interpretation of data; drafting of manuscript: L.B.

Acquisition of data: L.B., R.A., Cs.F., B.M., D.M., Á.M.

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