

Upper Toarcian – Middle Aalenian (Jurassic) Erycitinae SPATH (Ammonitina) from the Gerecse Mts, Hungary

Zoltán KOVÁ CS¹ & Barnabás GÉ CZY²

(with 12 figures, 4 tables and 13 plates)

The Upper Toarcian–Middle Aalenian sequences of the Gerecse Mts belong to the Mediterranean region of the Mediterranean–Caucasian Realm, bigger part of the Ammonoidea collected here are represented by the suborders Phylloceratina and Lytoceratina. In this paper the species belonging to the subfamily Erycitinae SPATH are documented as a contribution to the general taxonomic and biostratigraphic revision of the Ammonitina fauna. Considering the abundance and diversity of the subfamily, it was a dominant group in the Meneghinii to Opalinum Zones: during its acme Erycitinae formed 52% of the Ammonitina. Two genera, one subgenus and 15 species are represented by 117 determined specimens. Quantitative evaluation and problems of systematics are briefly discussed, genera and species are described. Introduction of two new taxa, *Cagliceras enigmaticum* n. sp. and *Erycites gerecsensis* n. sp. is designated.

Key words: Ammonitina, Erycitinae, *Cagliceras*, *Erycites*, Abbasitoides, Jurassic, Toarcian, Aalenian, Gerecse Mts, Hungary

Introduction

The present study is a contribution to the documentation and biostratigraphic and paleobiogeographic investigation of the Toarcian and Aalenian Ammonitina fauna of the Gerecse Mts. An extensive collecting work was carried out in five sections of the Gerecse Mts (Figure 1) between 1976–1982, by the staff of the Geological Institute of Hungary. (There are two sections at the Tölgyhát Quarry: „A” and „B”). The first quantitative, taxonomic and paleobiogeographic analyses of the Ammonoidea material were published by GÉ CZY (1984, 1985a, 1985b, 1990). Based on the latest results, GÉ CZY &

SZEN TE (2007) completed a detailed revision of the Middle Toarcian (Bifrons and Gradata Zones) Ammonitina fauna, and discussed its paleobiogeographic consequences. The aim of this paper is to provide quantitative and biostratigraphic evaluation as well as taxonomic documentation of specimens belonging to the Upper Toarcian – Middle Aalenian subfamily Erycitinae SPATH. The material is deposited in the Natural History Museum of the Faculty of Sciences of Eötvös Loránd University, Budapest.

¹ Department of Pedagogy, Liszt Ferenc University, H-1062 Budapest, Liszt Ferenc tér 2, Hungary.

E-mail: kiscell@freemail.hu

² Department of Palaeontology, Eötvös University, H-1117 Budapest, Pázmány Péter sétány 1/c, Hungary.

E-mail: szente@ludens.elte.hu

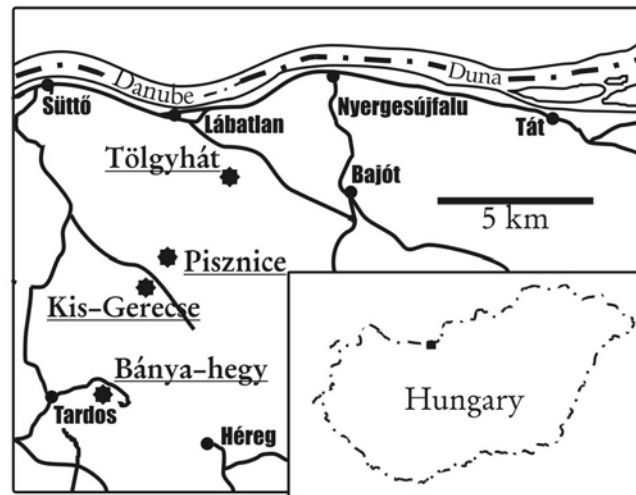


Figure 1. Toarcian – Aalenian sections in the Gerecse Mts.

Stratigraphy

Lithostratigraphy

A detailed lithological analysis of the Jurassic sequences of the Gerecse Mts was carried out by CSÁSZÁR et al. (1998). Accordingly, the Toarcian and Aalenian stages are characterised by the „Ammonitico Rosso marl” facies, which developed in two subfacies. The Kisgerecse Marl Formation is typical of the Toarcian (Tenuicostatum to Meneghinii Zones). It is thin-bedded, red nodular marl with variable carbonate and clay content. The Tölgyhát Limestone Formation appears in the Upper Toarcian, is dominating in the Aalenian, and it can be traced to the Humphresianum Zone of the Bajocian. This subfacies is a well-bedded, red, hard nodular limestone. Both lithostratigraphic units are rich in ammonoid assemblages, however the Upper Toarcian – Aalenian fauna mainly consists of poorly preserved inner casts.

Biostratigraphy

On the ground of the frequent and well-preserved ammonites, it was possible to demonstrate a detailed stratigraphic subdivision (subzones, horizons) in the succession of the Middle Toarcian of the Gerecse Mts (GÉCZY & SZENTE, 2007). As opposed to this, the rarity or lack of the index fossils (e.g. *Phlyseogrammoceras* BUCKMAN, *Pseudolioceras* BUCKMAN, *Osperlioceras* KRYMHOLZ, *Pleydellia* BUCKMAN, *Leioceras* HYATT), as well as the poor state of preservation provide only a limited opportunity for zone- or subzone-level ammonite stratigraphy of the Upper Toarcian (GÉCZY, 1984:383) and the Middle Aalenian. However, one of the most important upshots of the first examinations was that the Upper Toarcian biostratigraphic subdivision of the Northwest European region can be

applied to an Ammonitina fauna representing the Mediterranean region. Detailed correlations of the two regions were discussed by GÉCZY (1984, 1985a, 1990). Recent work has resulted in the taxonomic and stratigraphic revision of the Upper Toarcian – Middle Aalenian ammonite assemblages. Consequently, it seems evident, that the biozones proposed by ELMÍ et al. (1997), CONTINI et al. (1997) and PAGE (2003) are acceptable for the subdivision of sections in the Gerecse Mts as well (Tables 1-4).

Upper Toarcian biozones

Thouarsense Zone

The base of this zone coincides with the first appearance of *Grammoceras thouarsense* (D'ORBIGNY) or *Pseudogrammoceras bingmanni* (DENCKMANN). The zone can be demonstrated from 4 sections (Pisznice, Kis-Gerecse, Bánya-hegy, Tölgyhát „A”) with an average thickness of 120 cm. The fauna consists of Phylloceratina (49%), Lytoceratina (15%), and Ammonitina (36%). The following taxa are described from the Thouarsense Zone:

Polyplectinae: *Polyplectus discoides* (ZIETEN)

Phymatoceratidae: *Mouterdeiceras masciadrii* (PELOSIO), *M. viticola* ELMÍ et RULLEAU, *M. escherilobatum* (GÉCZY), *Denckmannia tumefacta* BUCKMAN

Grammoceratinae: *Grammoceras thouarsense* (D'ORBIGNY), *G. andax* BUCKMAN, *Pseudogrammoceras subfallaciosum* BUCKMAN, *P. bingmanni* (DENCKMANN), *P. subregale* PINNA, *P. placidum* BUCKMAN, *P. pachu* BUCKMAN, *P. differens* (ERNST), *P. mediterraneum* GOMEZ et RIVAS

Paroniceratinae: *Paroniceras sternale* (BUCH in D'ORBIGNY), *Oxyparoniceras telemachi* (RENZ)

Hammatoceratinae: *Geczyceras bonarellii* (PARISCH et VIALE), *G. porcarellaense* (BONARELLI).

Speciosum Zone

The zone is defined by the first occurrence of *Pseudolillia emiliana* (REYNÈS). It can be demonstrated from 4 sections (Pisznice, Kis-Gerecse, Bánya-hegy, Tölgyhát „A”) with an average thickness of 98 cm. The fauna consists of Phylloceratina (51%), Lytoceratina (21%), and Ammonitina (28%). The following taxa are documented from the Speciosum Zone:

Polyplectinae: *Polyplectus discoides* (ZIETEN)

Phymatoceratidae: *Mouterdeiceras* sp.

Grammocerotinae: *Pseudogrammoceras subfallaciosum* BUCKMAN, *P. cotteswoldia* BUCKMAN, *P. pedicum* BUCKMAN, *P. differens* (ERNST), *Pseudolillia emiliana* (REYNÈS), *P. murvillensis* MAUBEUGE

Hammatoceratinae: *Hammatoceras insigne* (SCHÜBLER in ZIETEN), *H.* aff. *semilunatum* (QUENSTEDT), *H. capuccinum* BUCKMAN, *H. pachu* (BUCKMAN), *Geczyceras speciosum* (JANENSCH), *G. bonarellii* (PARISCH et VIALE), *G. porcarellaense* (BONARELLI), *G. perplanum* (PRINZ), *Crestaites victorii* (BONARELLI), *C. meneghinii* (BONARELLI), *C. goyi* (MARTINEZ), *C. raricostatus* (GÉCZY)

Erycitinae: *Cagliceras crassiventris* (MERLA), *C. picenum* (MERLA), *C. elaphum* (MERLA), *C. enigmaticum* n. sp.

Meneghinii Zone

The base of this zone coincides with the first appearance of species belonging to the genus *Dumortieria* HAUG. The zone can be demonstrated from 4 sections (Pisznice, Kis-Gerecse, Bánya-hegy, Tölgyhát „A”) with an average thickness of 100 cm. The fauna consists of Phylloceratina (60%), Lytoceratina (22%), and Ammonitina (18%). The following taxa are described from the Meneghinii Zone:

Dumortieriinae: *Dumortieria meneghinii* (ZITTEL), *D. taramellii* (FUCINI), *D. stricta* PRINZ, *D. evolutissima* PRINZ, *D. evolutissima multicostata* GÉCZY

Hammatoceratinae: *Geczyceras perplanum* (PRINZ), *Crestaites victorii* (BONARELLI), *Planammatoceras tenuinsigne* (VACEK), *P.* sp. aff. *planinsigne* (VACEK), *Pseudammatoceras* sp.

Erycitinae: *Cagliceras elaphum* (MERLA), *C. crassiventris* (MERLA), *C. robustum* (MERLA), *C. rotundiformis* (MERLA), *Erycites ovatus* GÉCZY, *Erycites barodiscus* GEMMELLARO.

Aalensis Zone

The base of the zone is defined by the first occurrence of genera *Pleydellia* or *Cotteswoldia* BUCKMAN. The zone can be demonstrated from 3 sections (Pisznice, Kis-Gerecse, Tölgyhát „A”) with an average thickness of 101 cm. The fauna consists of

Phylloceratina (73%), Lytoceratina (14%), and Ammonitina (13%). The following taxa represent the Aalensis Zone:

Polyplectinae: *Polyplectus discoides* (ZIETEN)

Dumortieriinae: *Dumortieria meneghinii* (ZITTEL), *D. stricta* PRINZ, *Catullocheras dumortieri* (THIOLLIÈRE in DUMORTIER), *C. pannonica* (GÉCZY), *Pleydellia laevigata* (HANTKEN in PRINZ), *Pleydellia* sp. aff. *particostata* BUCKMAN, *Cotteswoldia subcompta* (BRANCO), *Pleydellia* sp.

Hammatoceratinae: *Planammatoceras* sp. aff. *planinsigne* (VACEK), *P. tenuinsigne* (VACEK), *Planammatoceras* sp., *Bredya subinsignis* (OPPEL), *Pseudammatoceras brancoi* (PRINZ)

Erycitinae: *Cagliceras elaphum* (MERLA), *C. rotundiformis* (MERLA), *C. robustum* (MERLA), *C. costulosum* (MERLA), *Erycites ovatus* GÉCZY, *E. barodiscus* GEMMELLARO, *E. subquadratus* GÉCZY, *Erycites gerecsensis* n. sp.

Aalenian biozones

Opalinum Zone

The base of this zone coincides with the first appearance of the genus *Leioceras*. The zone can be demonstrated from 4 sections (Pisznice, Kis-Gerecse, Tölgyhát „A”, Tölgyhát „B”) with an average thickness of 93 cm. The fauna consists of Phylloceratina (64%), Lytoceratina (14%), and Ammonitina (22%). The following taxa are documented from the Opalinum Zone:

Dumortieriinae: *Tmetoceras* sp., *Catullocheras* sp.

Leioceratinae: *Leioceras* sp. aff. *comptum* (REINECKE), *Leioceras* sp.

Hammatoceratinae: *Planammatoceras tenuinsigne* (VACEK), *P. planinsigne* (VACEK), *Bredya* sp., *Ceccaites sieboldi* (OPPEL), *Csernyeiceras verpillierense* (ROMAN et BOYER), *Planammatoceras* sp., *Pseudammatoceras* sp.

Erycitinae: *Cagliceras elaphum* (MERLA), *C. robustum* (MERLA), *Erycites fallifax* ARKELL, *E. ovatus* GÉCZY, *E. barodiscus* GEMMELLARO, *E. intermedius* HANTKEN in PRINZ, *E. subquadratus* Géczy, *Abbasitoides modestus* (VACEK).

Murchisonae Zone

The zone is indicated by the first occurrence of species belonging to genera *Ancolloceras* BUCKMAN, *Staufenia* POMPECKJ or *Brasilia* BUCKMAN. The zone can be demonstrated from 4 sections (Pisznice, Kis-Gerecse, Tölgyhát „A”, Tölgyhát „B”) with an average thickness of 112 cm. The fauna consists of Phylloceratina (75%), Lytoceratina (17%), and Ammonitina (8%). The following taxa represent the Murchisonae Zone:

Dumortieriinae: *Tmetoceras scissum* (BENECKE)

Leioceratinae: *Staufenia sinon* (BAYLE), *S. noszkyi* (GÉCZY), *Ancolloceras* sp.

Graphoceratinae: *Ludwigia murchisonae* (SOWERBY), *L. obtusiformis* (BUCKMAN), *Ludwigia* sp., *Brasilia* sp.

Hammatoceratinae: *Planammatoceras kochi* PRINZ, *Pseudammatoceras spinosum* (HANTKEN in PRINZ), *P. rugatum* (BUCKMAN), *Ceccaites sieboldi* (OPPEL), *C. sieboldi stenomphalum* (PRINZ), *Accardia* sp. aff. *lorteti* (DUMORTIER), *Planammatoceras* sp., *Pseudaptetoceras* sp.

Erycitinae: *Erycites intermedius* HANTKEN in PRINZ, *E. fallifax* ARKELL, *E. ovatus* GÉCZY, *Erycites* sp. aff. *reussi* (HAUER), *Abbasitoides modestus* (VACEK)

Strigoceratinae: *Strigoceras praenuntium* (BUCKMAN)

Oppeliinae: *Bradfordia* sp.

Concavum Zone

It is not possible to demonstrate this zone with certainty. On the basis of its Ammonitina assemblage, the bed 21 of Tölgyhát „B” section belongs to the Murchisonae Zone, whereas bed 18 belongs to the Discites Zone (Cresta & Galácz, 1990:167). However, the material of beds 19-20 (*Phylloceras* sp., *Lytoceras* sp.) does not allow us to prove the presence of the Concavum Zone. Beds 47-49 of the Pisznice section with a fauna consisting of *Graphoceras?* sp., *Pseudaptetoceras* sp., *Phylloceras* sp., *Lytoceras* sp. probably belong to the Concavum Zone, although the exact determination of the zone requires more collecting work.

A general evaluation of the Ammonitina fauna

The present statistical summary takes notice of the unpublished preliminary reports compiled by GÉCZY forthwith after the collecting work (GÉCZY, 1976, 1977, 1978, 1979, 1980, 1981) as well as the recent revision of the ammonite material.

The pure Mediterranean character of the Toarcian ammonoid fauna of the Gerecse Mts was circumstantially described by GÉCZY (1984, 1985a, 1985b) and GÉCZY & SZENTE (2007). Considering the whole material, Phylloceratina and Lytoceratina form 64% in the Thouarsense Zone, and their ratio reached 92% in the Murchisonae Zone. Furthermore, the Ammonitina assemblage shows a remarkable taxonomic affinity to the Upper Toarcian – Middle Aalenian faunas of Italy and Greece (GÉCZY, 1990).

In the Gerecse Mts the Upper Toarcian – Middle Aalenian Ammonitina are represented by two superfamilies, Hildocerataceae HYATT and Hammatocerataceae SCHINDEWOLF. The family Dactylioceratidae HYATT (superfamily Eoderocerataceae SPATH), which had been persistent during the Early and Middle Toarcian, became extinct at the end of the Clausus Subzone. The majority of taxa present in the Thouarsense Zone (Polyplectinae, Paroniceratinae, Grammocerotinae, Phymatoceratidae) belonged to the Hildocerataceae (88%), although the Hammatocerataceae had started its progressive expansion. The stratigraphically oldest representative of the family Hammatoceratidae, i.e. the genus *Rarenodia* VENTURI appears in the Bifrons Subzone, then it is the Gradata Zone when the earliest species belonging to the genus *Geczyceras* [*G. costatum* (GABILLY) and *G. clausum* (GABILLY)] turn up. The latter genus represents the subfamily Hammatoceratinae in the Thouarsense Zone as well. A striking evolutionary change occurred in the Speciosum Zone: percentage of Hildoceratidae and

Phymatoceratidae was reduced to 25%, while the ratio of the Hammatoceratinae and Erycitinae increased to 75% (Figure 2). The Speciosum Zone is characterised by the 70% superiority of Hammatoceratinae genera (*Geczyceras*, *Hammatoceras*, *Crestaites*). From the Meneghinii Zone to the uppermost Murchisonae Zone the Hammatocerataceae (Hammatoceratinae, Erycitinae, Dumortieriinae, Leioceratinae, Graphoceratinae) prevails over the fauna. Genus *Dumortieria* dominates the Meneghinii Zone with 52%, whereas the subfamily Erycitinae shows the same percentage in the Aalensis Zone.

In addition to the ascendancy of genus *Leioceras*, the Hammatoceratinae (*Planammatoceras*, *Pseudammatoceras*, *Bredyia*, *Csernyeiceras*) form 32% of the whole fauna in the Opalinum Zone. Considering the Gerecse ammonite assemblage, the genus *Csernyeiceras* GÉCZY is restricted to this chronozone, its number of specimens (76) constitutes almost half (49%) of the hammatoceratids. The Murchisonae Zone is characterised by the dominance of genera representing subfamilies Leioceratinae and Graphoceratinae (*Staufenia*, *Ancolioceras*, *Ludwigia*, *Brasilia*) with a proportion 60% on the one hand, and by the regression of Hammatoceratinae on the other. It is the Bradfordensis Subzone when the earliest taxa of the superfamily Haplocerataceae Zittel (*Strigoceras praenuntium*, *Bradfordia* sp.) appear. Comparing the Gerecse ammonites with other Aalenian faunas, the remarkably low number of the genus *Tmetoceras* Buckman in the Gerecse Mts (6 specimens, 1.3%) is worth mentioning. The Erycitinae can be first documented from the Speciosum Zone. They became diverse and abundant from the Meneghinii Zone, dominate the Aalensis Zone, then show a decline in the Murchisonae Zone and finally disappear from the assemblage (Figure 3).

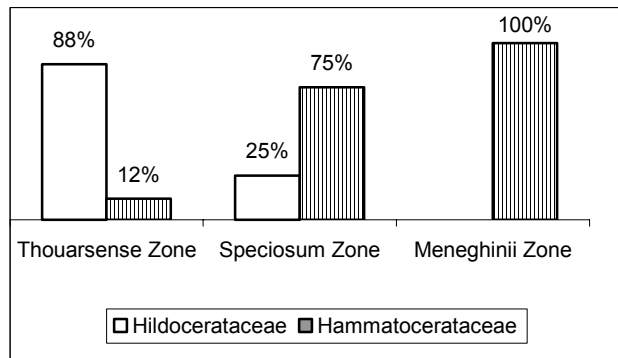


Figure 2. Ratio of superfamilies Hildocerataceae and Hammatocerataceae in the Upper Toarcian

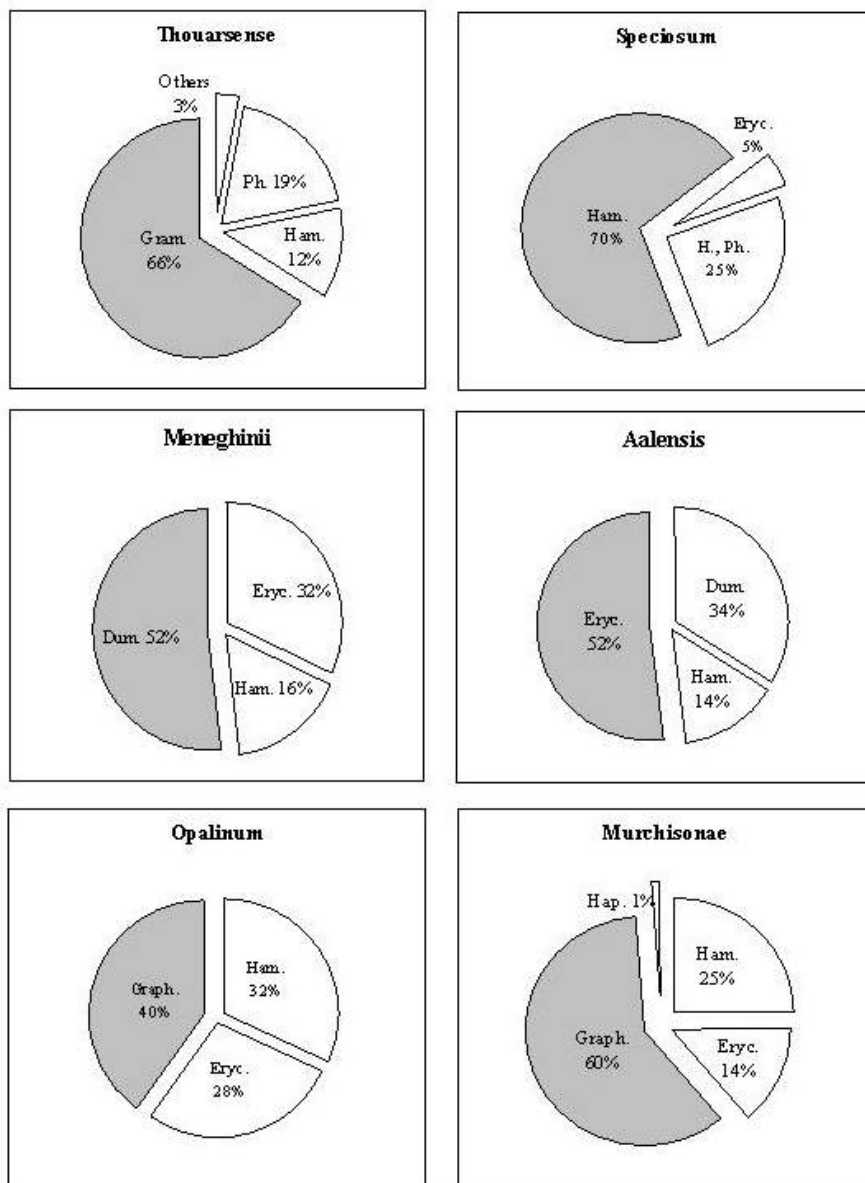


Figure 3. Proportions of Ammonitina families and subfamilies in the Upper Toarcian – Middle Aalenian (Dum. – Dumortieriinae, Eryc. – Erycitinae, Gram. – Grammocerotinae, Graph. – Graphoceratidae, H. – Hildoceratidae, Ham. – Hammatoceratinae, Hap. – Haplocerataceae, Ph. – Phymatoceratidae).

Systematics and phylogeny

SUPERFAMILY Hammatocerataceae SCHINDEWOLF, 1964

Genus *Erycites* was introduced by GEMMELLARO (1886). GÉCZY (1966:86-87) gave a detailed research history of the genus, thus it seems sufficient to summarize the results of the last forty years. One of the most important changes considered the taxonomic position of the genus. Having accepted ARKELL's interpretation (ARKELL, 1957:254) GÉCZY placed *Erycites* in the superfamily Hildocerataceae. Meanwhile an alternative taxonomic reconstruction was proposed by SCHINDEWOLF (1964) on the ground of analyses of the suture-line character, above all the structure of the U lobe of numerous taxa included previously in the Hildocerataceae. SCHINDEWOLF (l.c.) paid particular attention to the significant differences, and suggested a new superfamily-taxon name for the group: the Hammatocerataceae. According to him, families Hammatoceratidae (Hammatoceratinae, Dumortieriinae), Paroniceratidae, Tmetoceratidae, Oppeliidae, Phlycticeratidae) can be classified within the Hammatocerataceae. However, due to the absence of a general consensus concerning the methodology of classification (diverse interpretations of the importance of shell morphology, suture configuration, stratigraphic range and paleobiogeographic distribution by various authors), there was no agreement on the validity of the new superfamily (see TINTANT & MOUTERDE, 1981:87, MOYNE & NEIGE, 2004:115). Some authors, with slight rectification, accepted SCHINDEWOLF's conception and also regarded *Erycites* as belonging to the Hammatocerataceae (SCHLEGELMILCH, 1976, 1985, TINTANT & MOUTERDE, 1981, VENTURI, 1982, 1999, VENTURI & FERRI, 2001, RULLEAU et al., 2001, MYCZYNSKI, 2004). Without recognition of the Hammatocerataceae, WESTERMANN (1993:196) emphasized that the family Phymatoceratidae – including the subfamily Hammatoceratinae (DONOVAN et al., 1981, PAGE, 2008) – was „unusually broadly defined” and its revision would be required. In VENTURI's papers (2001, 2004) it is discussed that – considering the suture-line and shell morphology – remarkable differences can be demonstrated between the Hildocerataceae and the Hammatocerataceae, therefore the validity of the latter should be acknowledged.

An integrated analysis of the Jurassic – Cretaceous Ammonitida shell structure was carried out by KVANTALIANI et al. (1999). The variability of shell features concerning the suture-line character, the morphology, the sculpture and the inner structure during the ontogenesis was circumstantially treated. Accordingly, the Toarcian – Aalenian Ammonitina

phylogenetic links can be established as follows (KVANTALIANI et al., 1999:150-150):

- Eoderoceratoidea → Hildoceratoidea → Sonniniidea
- Eoderoceratoidea → Hammatoceratoidea → Stephanoceratoidea

RULLEAU et al. (2001:51-60) rendered a detailed interpretation of the Toarcian – Aalenian Hammatocerataceae phylogeny. Accordingly, beside morphological evidences there is a phylogenetic proof for the validity of the superfamily. Recognition of the Hammatocerataceae makes possible to connect those families (Hammatoceratidae, Erycitidae, Graphoceratidae, Sonniniidae) which are invariably regarded as ancestors of all Middle Jurassic ammonite families. It seems a plausible hypothesis for all authors that each Bajocian Ammonitina taxon descended from those families, which otherwise should be placed within the Hammatocerataceae (e.g. DONOVAN et al., 1981, SANDOVAL et al., 2000). According to CALLOMON (1984:147), genus *Erycites* gave rise to subfamilies Otoitinae MASCKE and Stephanoceratinae NEUMAYR, and the following lineages were presented by WESTERMANN (1993, 1995) for the Middle Aalenian – Lower Bajocian:

- Hammatoceratinae *Planammatoceras*, *Csernyeiceras* → Strigoceratidae
- Hammatoceratinae → (independently of Strigoceratidae) Haplocerataceae (Bradfordiinae, Oppeliinae)
- Erycitinae: *Abbasites* BUCKMAN → Otoitidae: *Docidoceras cylindroides* BUCKMAN
- Erycitinae: *Erycites gonionotus* BENECKE, *Abbasitoides modestus* → Stephanoceratinae: *Riccardiceras longalvum* (VACEK)

WESTERMANN's conception agrees well with those of RULLEAU et al. (2001), MOYNE & NEIGE (2004:120-121) and MOYNE et al. (2004:515). Furthermore it was completed with the presumable connection between genus *Tmetoceras* and the superfamily Spirocerataceae HYATT by CALLOMON (1980:263), PAGE (1993:217) and ROUGET et al. (2004:510).

The genus *Csernyeiceras* discussed by GÉCZY (1966:162, 1967:221) and CALLOMON & CHANDLER (1994:26) seems to have an uncertain phylogenetic position. The genus has recently been included in the revised subfamily Phlycticeratinae SPATH by SCHWEIGERT et al. (2000) and SCHWEIGERT et al. (2007). Accordingly, the following phylogenetic link was suggested for the Upper Toarcian – Aalenian times: Phlycticeratinae: *Esericeras*, *Phlyseogrammoceras* → *Csernyeiceras* → *Phlycticeras* → Strigoceratinae BUCKMAN: *Strigoceras praenuntium* However, the validity of the superfamily-taxon Hammatocerataceae remained controversial. Some

authors placed *Erycites* in the superfamily Stephanocerataceae NEUMAYR (WESTERMANN & RICCARDI, 1979:115), or classified the erycid group and the Hammatoceratinae within the Hildocerataceae (DONOVAN et al., 1981, WESTERMANN & RICCARDI, 1985:18, LINARES & SANDOVAL, 1996:288, GÉCZY & SZENTE, 2007, PAGE, 2008). The Hammatocerataceae was also ignored by PAGE (1993, 2008) and ROUGET et al. (2004) in their taxonomic summary. According to MOYNE & NEIGE (2004), it is worth emphasizing two facts recognized by all authors. On one hand, the hammatoceratid and erycid groups had appeared at almost the same time in the Middle Toarcian and ranged parallel with one another to the uppermost Aalenian, on the other, both groups played an essential role in the Middle Jurassic Ammonitina phylogeny.

The necessity of a general revision of the Jurassic Ammonitina systematics seems obvious for several authors (PAGE, 1993, 2008, WESTERMANN, 1993, VENTURI & FERRI, 2001, RULLEAU et al., 2001, MOYNE & NEIGE, 2004, 2007). In the present study SCHINDEWOLF's taxonomic scheme is considered to be acceptable. On the basis of the similarities concerning the morphology, the suture-line, the close stratigraphic range, and the phylogenetic relationship, it attributes an important position to the Hammatocerataceae, i.e. as the ancestral stock of the Middle Jurassic Ammonitina connecting the Hildocerataceae and the Stephanocerataceae.

FAMILY Erycitidae SPATH, 1928

The „Erycitidae” morpheme first appeared in SPATH's work (1928:74): „Sonninidae are also often confused with certain Ludwigids (*Bredyia*) and even offshoots of Lytoceratids (Erycitidae)”. However, instead of „Erycitidae”, the *Erycites* or the Erycidid forms were used discussing the *Erycites*, *Abbasites*, *Ambersites* group by the author in his later works (SPATH, 1931, 278-280, 1936:11-12). Nevertheless, on the basis of priority, it is SPATH who has recently been considered as the author of the family Erycitidae.

ARKELL (1957:267) did not regard the Erycitidae SPATH, 1928 as a valid taxon, therefore he classified genera *Erycites* and *Abbasites* within the Hammatoceratidae. This systematic conception were accepted by GÉCZY (1966), DEZI & RIDOLFI (1978), TINTANT & MOUTERDE (1981), SCHLEGELMILCH (1985), VENTURI (1981, 1982, 1994, 1999), SCHWEIGERT (1996), and VENTURI & FERRI (2001). The genus *Erycites* was included in the family Phymatoceratidae by DONOVAN et al. (1981) and CALLOMON & CHANDLER (1994), although this classification was not acknowledged by most authors.

The Erycitidae SPATH family name was re-introduced by WESTERMANN & RICCARDI (1972:93). It was first considered as a family within the Stephanocerataceae (WESTERMANN & RICCARDI,

1979:114-115) including two subfamilies: Erycitinae SPATH: *Erycites*, *Abbasites*, *Abbasitoides* and Podagrosiceratinae subfam. nov.: *Podagrosiceras* MAUBEUGE et LAMBERT, *Arkelloceras* FREBOLD, (?) *Ermoceras* DOUVILLÉ, ?*Torrensia* STURANI. Later the family was placed into the Hildocerataceae (WESTERMANN & RICCARDI, 1985:18), and the Podagrosiceratinae was completed with new genera *Sphaerocoeloceras* JAWORSKI and *Westermanniceras* (RICCARDI, 2001). From the 1990s on, the Erycitidae has been assumed to be a valid family, and it was frequently used e.g. by WESTERMANN, 1993, GOY et al., 1995, LINARES & SANDOVAL, 1996, and RICCARDI, 2001. After the excellent study of RULLEAU et al., 2001, a professional consensus has been established regarding the use of the taxon (VENTURI, 2004, MOYNE & NEIGE, 2004, BECAUD et al., 2005, PALLINI et al., 2005).

SUBFAMILY Erycitinae SPATH, 1928

Diagnosis

Medium- or small-sized shell with either an erycidid, or a gradually growing evolute coiling. In the first case the sphaerocone and depressed inner whorls become more evolute and compressed during the ontogenesis. Whorl-section is depressed, subcircular or oval-shaped. A weakly developed keel or a smooth band forms a ventral interruption of the ribbing that disappears gradually in the last phylogenetic period of the subfamily (*Abbasites*, *Ambersites*, *Abbasitoides*). Ribs branch at the lower third or at the half of the whorl-height without tubercles, and fade away on the venter. Erycidid suture-line: E and ES are weakly developed, L is long, broad and ramified, LS is broad and well-developed, U is divided and oblique. Macroconch and microconch forms of several Aalenian genera have been assumed by some authors:

LINARES & SANDOVAL (1989, 1996):

- *Erycites fallifax* ARKELL – *Spinammatoceras pugnax* (VACEK) (m)

- *Spinammatoceras tenax* (VACEK) (M) – *S. schindewolfi* LINARES et SANDOVAL (m)

- *Malladaites pertinax* (VACEK) (M) – *M. vaceki* LINARES et SANDOVAL (m)

- *Haplopleuroceras subspinatum* (BUCKMAN) – ? – *H. inaequalicostatum* GERARD

WESTERMANN (1993:204, 1995:114):

- *E. fallifax* – *E. punctum* (VACEK)

- *Abbasitoides modestus* (VACEK) – “*Coeloceras pumilus*” VACEK

(The Gerecse material does not seem to provide the opportunity for a detailed research on the sexual dimorphism of the Erycitinae.)

Distribution

The Erycitinae is typical of the Upper Toarcian – Aalenian of Europe, North Africa, Caucasus, Iran, Alaska, Thailand, Tibet and New Zealand(?),

however, most species are known from the Mediterranean region (SATO, 1961, 1975, GÉCZY, 1966, NUTSUBIDZE, 1966, BRAUN & JORDAN, 1976, IMLAY, 1984, IMLAY & DETTERMAN, 1973, WESTERMANN, 1980, WESTERMANN et al., 2000, SEYED-EMAMI, 1967, 1971, SEYED-EMAMI et al., 2006, YIN, 2006). A fragmentary *Erycites* sp. was also recorded by MAUBEUGE & LAMBERT (1955, pl. 1, fig. 7) from Argentina, but according to WESTERMANN & RICCARDI (1985:18): „the late Toarcian and Aalenian Erycitinae are unknown in the Andean Province, but an offshoot of the long-ranging *Erycites*, near the root of *Abbasites*, probably gave rise to the endemic Andean *Podagrosiceras*...”

Remarks

Genus *Erycites* and subgenus *Abbasites* (= *Ambersites*) were classified within the subfamily Hammatoceratinae by ARKELL (1957:267). It was recognized by ELMI (1963), GÉCZY (1966), DEZI & RIDOLFI (1978), SCHLEGELMILCH (1985), SCHWEIGERT (1996), VENTURI (1981, 1982, 1994, 1999), VENTURI & FERRI (2001), although the close relationship of genera *Erycites*, *Abbasites* and *Ambersites* was emphasized by LELIÉVRE (1960:35), ELMI (1963:104) and GÉCZY (1966:87). DONOVAN et al. (1981:147) considered *Abbasites* as a genus within the family Otoitidae.

The „Erycitinae” taxon name was first used by WESTERMANN (1964, fig. 14). The Erycitinae SPATH, 1928 subfamily-taxon was erected on the ground of the Erycitidae (SPATH, 1928:74) by WESTERMANN & RICCARDI (1972:93). The validity of the subfamily was accepted by WESTERMANN & RICCARDI (1985), WESTERMANN (1993), CALLOMON & CHANDLER (1994), LINARES & SANDOVAL (1996) and CRESTA (1997). The following genera and subgenera were placed in the Erycitinae by RULLEAU et al. (2001): “*Erycites* GEMMELLARO, *E. (Abbasitoides)* GÉCZY, *Abbasites* BUCKMAN, *A. (Ambersites)* BUCKMAN, *Malladaites* LINARES et SANDOVAL, *Spinammatocheras* SCHINDEWOLF, *Haplopleuroceras* BUCKMAN, *Cagliceras* gen. nov.”. A new endemic genus from Iran, *Shahrudites* SEYED-EMAMI became recently included within the subfamily by SEYED-EMAMI et al. (2006). Genera *Cagliceras* RULLEAU et ELMI, 2001, *Erycites* GEMMELLARO, 1886, and *Abbasitoides* GÉCZY, 1966 can be documented from the Gerece assemblage.

Papers published after the “Csernye-monograph” (GÉCZY, 1966) show a general agreement in the *Erycites* research, that integrated analyses of the shell morphology, the suture-line characters and the stratigraphic range must be taken into consideration. Works of PINNA (1968), DEZI & RIDOLFI (1978) and VENTURI (1981, 1994) are obviously characterised by this synthetic methodology. The study OF DEZI & RIDOLFI (however, the detailed species-level stratigraphic range is missing from the work) has a

further significance for the examination of the Hungarian Ammonitina fauna, because specimens presented by the authors prove a markedly close relationship with the Hungarian material. It was CRESTA (1997) who first figured the erycitid specimens of the Gemmellaro-collection, and having revised them he designated the lectotypes of *E. sutneri* and *E. barodiscus*. Moreover, the subfamily was discussed by RULLEAU (1996) and CALLOMON & CHANDLER (1994).

Phylogeny of the Erycitinae

The early history of the subfamily was studied by VENTURI (1975, 1981). Accordingly, the earliest representative of the Hammatocerataceae, i.e. *Rarenodia latecosta* VENTURI, which derived from the Phymatoceratidae, appeared in the Toarcian Falciferum Zone (cf. MOYNE & NEIGE, 2004:117). It can be thought of as the ancestor of *Praerycites* VENTURI, which turned up in the Bifrons Zone. Despite controversial details (e.g. presumed identity of *Praerycites civitellense* VENTURI and *Hammatoceras costatum* GABILLY, see CRESTA et al., 1989:93), it seems a plausible hypothesis that all genera of the Hammatoceratinae radiating at the end of the Gradata Zone (*Geczyceras*, *Hammatoceras*, *Crestaites*) are direct descendants of *Rarenodia* and *Praerycites* (VENTURI & FERRI, 2001, RULLEAU et al., 2001, MOYNE & NEIGE, 2004). As the exact phylogenetic interpretation of *Praerycites* needs more research, it has been recently assumed that the Hammatoceratinae gave rise to the Erycitinae characterised by specific erycitid suture configuration. The earliest species belonging to the genus *Cagliceras* (*C. picenum*, *C. enigmaticum* n. sp., *C. elaphum*) occurred in the Speciosum Zone. The close relationship between the two subfamilies can be well demonstrated. Some taxa have striking morphological resemblance with different suture-line structures (*Cagliceras enigmaticum* n. sp. – *Crestaites victorii*, *Cagliceras costulosum* – *Geczyceras porcarellaense*), while other species can evidently be regarded as transitional forms (*Erycitoides howelli* (WHITE), *E. personatiformis* GÉCZY, *E. szontaghi* PRINZ, *Cagliceras enigmaticum* n. sp.). The acme of *Cagliceras* is proved in the Upper Toarcian and around the Toarcian-Aalenian boundary.

The descendant of *Cagliceras* is the genus *Erycites*, which appeared in the uppermost Toarcian and flourished in the Aalenian stage. According to WESTERMANN (1964:66, 1993:198), the genus can be divided into two groups: the *Erycites fallifax* – *Abbasites* group is characterised by a sphaerocone, involute coiling, whereas the *Erycites gonionotus* – *Abbasitoides* group is marked by a serpentine, planulate shell. Having created the genus *Malladaites*, LINARES & SANDOVAL (1986, 1996) proposed the following phylogenetic links of the Aalenian

Erycitinae: *E. fallifax* → *Spinammatoceras tenax* → *Malladaites pertinax* → *Haplopleuroceras subspinatum*. CALLOMON & CHANDLER (1994:21) assumed that three radiations of *Erycites* can obviously be discerned. The first one occurred in the Scissum Zone with the separation of genera *Spinammatoceras* → *Malladaites* → *Zurcheria*. The second and the third radiations took place in the Murchisonae Zone, with the appearance of *Abbasites* and *Abbasitoides*. *Abbasites* is invariably thought of as the ancestor of the Otoitidae (*Docidoceras*, *Emileia*) and the Stephanoceratidae, while *Abbasitoides*, according to WESTERMANN (1995:109) can be regarded as the earliest representative of that branch which leads to the Stephanoceratinae (*Stephanoceras* [*Docidoceras*] *longalvum* VACEK).

Having recognized the latter interpretation, it would be possible to reconstruct a more exact lineage of both the subcadicone *Docidoceras cylindroides* and the serpenticone *Riccardiceras* (type-spec. *Coeloceras longalvum* VACEK) (cf. DIETZE et al., 2001). SANDOVAL et al. (2001:32) established the following links: *Abbasitoides* → *Riccardiceras* → Stephanoceratidae: *Mollistephanus*, and Erycitinae: *Abbasites* → Otoitidae: *Docidoceras* → *Emileia*, *Otoites*; however, the authors included *Riccardiceras* within the Otoitidae. Phylogeny of the genus *Mollistephanus* Buckman has recently been treated by CHANDLER & DIETZE (2004). In RICCARDI's paper (2001) it is considered that the origin of the subfamily Podagrosiceratinae typical of the Andean Province can be traced in genera *Abbasites* or *Abbasitoides*.

Systematic palaeontology

Abbreviations

The following abbreviations are used in this study:

E – subfamily Erycitinae

Sections: P – Pisznice, B – Bányahegy, G – Kis-Gerecse, TA – Tölgyhát „A”, TB – Tölgyhát „B”

Number of bed and capitals for indication the specimens found in the same bed.

(e.g. EP84B – specimen B belonging to the subfamily Erycitinae, Pisznice section, bed 84)

Abbreviations of dimensions

D – diameter, H – whorl-height, h – H/D, W – whorl-width, w – W/H, U – umbilical-width, u – U/D

Genus *Cagliceras* RULLEAU et ELMÍ, 2001

Type species: *Erycites elaphus* MERLA, 1934

The type species (MERLA, 1934, p. 25, pl. 4, fig. 5) was designated by RULLEAU & ELMÍ (RULLEAU et al., 2001:76).

Diagnosis

Medium-sized form with a gradually growing, evolute coiling. Umbilicus is wide and moderately deep. Whorl-section is either oval-shaped or subcircular. Ventral keel is weakly developed on the inner whorls and disappears during the ontogenesis. Strong ribbing persisting throughout the shell is interrupted on the venter. Tubercles are not characteristic. Erycitid suture-line: short E lobe, long and ramified L lobe, divided and oblique U lobe.

Remarks

The genus was created by RULLEAU & ELMÍ (RULLEAU et al., 2001:76) including erycitid taxa with specific morphological features and of Upper Toarcian range. The group was mainly described by MERLA (1934), and the significant differences from the former *Erycites* species were already emphasized by him (MERLA, 1934:22-23, 28-29). Accordingly, the new Toarcian erycitids differ

from *E. fallax* (BENECKE) and *E. reussi* (HAUER) by having more evolute coiling and relatively compressed whorl-section. The plausible separation of the group was first suggested by VENTURI (1994:348), however, without a proposal of a new taxon name („*Erycites*” gr. *elaphus*, „*Erycites*” gr. *costulosus*, „*Erycites*” gr. *picenus*).

Five species were placed in the genus by RULLEAU & ELMÍ (l.c.): *C. elaphum* (MERLA), *C. rotundiformis* (MERLA), *C. robustum* (MERLA), *C. crassiventris* (MERLA) and *C. picenum* (FOSSAMANCINI). In the present study it is considered that on the ground of morphology and stratigraphic range, three further erycitid species could be included within the genus: *C. costulosum* (MERLA), *C. enigmaticum* n. sp. and *C. banffyi* (PRINZ). *C. banffyi* has been hitherto known from Úrkút with one example (GÉCZY, 1965:26) and from Csernye with two examples (GÉCZY, 1966:94).

Distribution

According to RULLEAU et al. (l.c.), *Cagliceras* is typical of the Meneghinii and Aalensis Zones. However, the extended stratigraphic range of the genus has been well-documented (see below). It is known from the Upper Toarcian – Lower Aalenian of the western Tethys. Most species seem to be restricted to the Mediterranean region, only two

taxa have been recorded from the Submediterranean region: *C. elaphum* (Germany: SCHWEIGERT, 1996, France: CASSEL, 1997) and *C. picenum* (France: RULLEAU, 1996). One taxon, *C. cf. robustum* (MERLA) has been described from Iran (SEYED-EMAMI, 1967). In the Gerecse Mts, the earliest representatives of *Cagliceras* occurred in the Speciosum Zone, the genus flourished during the Meneghini and Aalensis Zones, and disappeared in the Opalinum Zone.

Cagliceras elaphum (MERLA, 1934)

(Pl. 1, fig. 1-2, 3, Pl. 2, fig. 1, Pl. 3, fig. 1, 2)

- 1867-1881 *Ammonites reussi* HAUER, MENEGHINI, p.56, pl. 15, fig. 1
 1934 *Erycites elaphus* n. sp., MERLA, p. 25, pl. 4, fig. 5
 ?1965 *Erycites elaphus pannonicus* n. subsp., GÉCZY, p. 25, fig. 4, pl. 4
 1966 *Erycites elaphus* MERLA, GÉCZY, p. 97, fig. 82, pl. 28, fig. 4, pl. 42, fig. 3
 1967 *Erycites elaphus* MERLA, BARBERA, p. 304, pl. 6, fig. 2
 1968 *Erycites elaphus* MERLA, PINNA, p. 27, pl. 3, fig. 12
 1968 *Erycites elaphus* MERLA, GÉCZY, p. 128, pl. 4, p. 129, pl. 5, fig. 1
 1969 *Erycites elaphus* MERLA, PINNA, pl. 5, fig. 11
 1978 *Erycites elaphus* MERLA, DEZI & RIDOLFI, p. 51, fig. 73-74
 1994 „*Erycites*” *elaphus* MERLA, VENTURI, pl. 6, fig. A, pl. 7, fig. 10
 1995 *Erycites elaphus* MERLA, GOY et al., p. 102, pl. 13, fig. 2-4
 1996 *Erycites elaphus* MERLA, SCHWEIGERT, pl. 4, fig. 1
 2001 „*Erycites*” *elaphus* MERLA, VENTURI & FERRI, p. 233, fig. f-g

Material: 32 internal moulds of different state of preservation

Dimensions:

specimen	D	H	h	W	w	U	u
EP84A	144	36	25%	32	89%	78	54%
EP92	140	34	24%	28	82%	72	51%
EG18A	138	32	23%	30	94%	74	53%
EP88	128	31	24%	22	71%	68	53%
EB11	128	30	23%	20	66%	69	54%
EP84B	114	30	26%	24	80%	60	52%
EP95A	110	29	26%	25	86%	60	54%

Description

Medium-sized, evolute form with a wide and moderately deep umbilicus. No umbilical edge is present. The flanks are convex, both the ventrolateral shoulder and the venter are rounded. The body chamber is slightly higher and more compressed, but – except on two examples – wider

than the penultimate whorl. The ventral keel is thin and weakly developed. The inner whorl-section is wide-oval, while the section of the body chamber is high-oval with maximum width at the lower third of the flank. The ornamentation is characterised by strong ribbing persisting up to the peristome. Short, thick, moderately prorsiradiate primary ribs emerge on the umbilical wall, their width and intercostal space are equal. The primaries grow up into pseudotubercles on several examples. The primaries become sharper, more widely spaced and more prorsiradiate on the body chamber, and the furcation zone moves up to the mid-flank. Detailed numbers of primary and secondary ribs on the last whorls of three of the examples: EP85: 27 – 75, EP81B: 28 – 61, EP95A: 33 – 75. The primaries branch into 2 or 3, rarely 4 secondary ribs at the lower third of the lateral walls. The thinner, prorsiradiate secondaries bend forward, and fade away close to the keel. The secondaries tend to be less developed on the body chamber. The length of the body chamber is 4/5 of the last whorl. The projected, oblique peristome is followed by a shallow constriction. The suture-line structure shows erycitic characters with short E and long, broad L. The L is placed close to the venter. The first lateral saddle is broad and ramified. The U2 and U3 being oblique point to the tip of the L (Figure 4)



Figure 4. Suture-line of *Cagliceras elaphum* (MERLA) (ETA24)

Remarks and comparisons

Despite the variability of the whorl-section discussed here, other features show a good agreement with MERLA's holotype (MERLA, 1934, pl. 4, fig. 5).

Due to its wide range, numerous examples are figured in the literature. It was DONOVAN (1958:58) who first emphasized the intraspecific variability of *C. elaphum*, and his observation can be proved by the materials described in various papers, as well as by the Gerecse examples. Body chambers of two specimens (EP85, EP90) are not wider than the penultimate whorl, furthermore slight variability in the ornamentation and in the whorl-section has also been detected in the material. It is worth mentioning that rather

different cross-sections have been documented in the literature. A high-oval section was described by MERLA (1934:25), a wide, highly-arched oval section was published by PINNA (1968), a wide, high, subcircular-subquadrangular section can be found at GÉCZY (1966), and a subcircular section was figured by VENTURI (1994). As for the Gerecse material, flanks of the example EG18A are flattened, so its whorl-section is considerably subquadrangular (D: 138, H: 32, W: 30). However, on the ground of the stability of other specific characteristics, the variability of the sections should be assumed a pure individual divergence. Consequently, in the present paper it is regarded that the subcircular section of *Erycites elaphus pannonicus* GÉCZY, 1965 (which otherwise shows close affinity to specimens of DEZI & RIDOLFI, 1978) is merely an individual feature, so the validity of this subspecies is not proved. Due to the imperfect state of preservation, it appears difficult to give a detailed interpretation of the *Erycites* aff. *elephas* [sic!] MERLA figured by EBLI (1997:39, fig. 7).

Main specific differences between *C. elaphum* and other Erycitinae taxa can be demonstrated as follows. *C. crassiventris* is a subserpenticone form with a less developed ribbing and a narrow-oval whorl-section. *C. rotundiformis* is characterised by a wider venter, a finer ornamentation and a regularly subcircular section. *C. costulosum* is a slightly more involute form with a dense and rectiradiate ribbing. *Erycites reussi* is characterised by a moderately evolute, depressed coiling with sharper ribs. *E. barodiscus* is a remarkably robust form with broader whorls and coarse sculpture. *C. elaphum* also differs from *Crestaites victorii* by being less strongly ribbed with short primaries.

Distribution

Italy – Valdobbia: Jurense Zone (MERLA, 1934:25), Meneghinii Zone (DONOVAN, 1958:37), Val Maone, Vallone S. Giuliano: Lower Aalenian (BARBERA, 1967:305), Alpe Turati: Upper Toarcian (VENZO, 1952:116, PINNA, 1968:28), Monte Catria and M. Nerone: Meneghinii Zone (CRESTA, 1994:115), San Severo: Meneghinii Zone (VENTURI, 1994:348), Colle d'Orlando: Meneghinii Zone (PARISI et al., 1998:22)

Spain – Colomera: Upper Toarcian (LINARES & RIVAS, 1971:195), Cerro Méndez 2. sect.: Reynesi Zone (GARCIA-GÓMEZ et al., 1994:216), Cordilleras Béticas: Reynesi Zone, Mallorca: Pseudoradiosa Zone, Aalensis Zone (GOY et al., 1995:103)

France – Gard: Gruneri Subzone (CASSEL, 1997:165)

Germany – Reutlingen: Levesquei Zone (SCHWEIGERT, 1996:6)

Hungary – Csernye: Upper Toarcian – Lower Aalenian (GÉCZY, 1966: 97), Gerecse Mts: uppermost Speciosum Zone – middle Opalinum Zone

Cagliceras crassiventris (MERLA, 1934)
(Pl. 2, fig. 2, Pl. 4, fig. 3-4)

1934 *Erycites crassiventris* n. sp., MERLA, p.26, pl. 4, fig. 1

1967 *Erycites crassiventris* MERLA, BARBERA, p. 304, pl. 6, fig.1

1978 *Erycites crassiventris* MERLA, DEZI & RIDOLFI, p. 53, fig. 77-78

Material: 8 relatively well-preserved internal casts and one fragmentary specimen

Dimensions:

specimen	D	H	h	W	w	U	u
EP95B	146	34	23%	28	82%	80	55%
EB15A	124	28	22%	20	71%	67	54%
EP97D	124	30	24%	18	60%	74	60%

Description

Medium-sized, subserpenticone form with a narrow and high venter. The umbilicus is wide and shallow without umbilical margin. The flanks are gently convex on the phragmocone, and become compressed on the last whorl. The ventrolateral shoulder is rounded. On the venter of the inner whorls a weakly developed keel can be traced. The cross-section is somewhat wide-oval at the phragmocone, while the body chamber has a high, compressed, narrow-oval section, with maximum thickness at the lower third. The ornamentation consists of strong primary and more weakly developed secondary ribs. The primaries rising on the umbilical wall are rectiradiate on the inner whorls and become distant and slightly prorsiradiate on the body chamber. Their width and intercosta are of the same size. The primaries either bifurcate or rarely trifurcate at the lower third of the whorl. The thin secondary ribs curve forward and fade away close to the carina. The body chamber occupies the entire last whorl. The projected peristome is followed by a shallow and markedly oblique constriction. There is another radial, shallow constriction on the body chamber as well. The sutures are characterised by the specific ramified erycitid lobes, with a long and moderately wide L and a well-developed LS1. E is short and narrow, its length is 1/3 of the L. ES is divided by a relatively long and narrow accessory lobe. The presence of a significantly well-developed and oblique auxiliary saddle was already noted by MERLA. The U lobes are divided

and also oblique, the U2 points at the tip of the L (Figure 5).



Figure 5. Suture-line of *C. crassiventris* (MERLA) (EB15A)

Remarks and comparisons

Erycites crassiventris is a relatively rare species. For this reason, it was not regarded as a valid taxon by DONOVAN (1958:58), who considered it as only a more compressed and more evolute variation of *Erycites elaphus*. As opposed to this, studies of BARBERA (l.c.) and DEZI & RIDOLFI (l.c.), as well as the present paper can demonstrate again marked differences between the two taxa, consequently the validity of both species appears to be well-established.

Despite the obvious affinity between *C. crassiventris* specimens of the Gerecse material and MERLA's holotype (MERLA, 1934:26), there are noteworthy differences in size and ornamentation. One of the main morphological features of the holotype is the length of the body chamber, which is 5/4 of a whorl. However, this size has not been confirmed in the later publications. BARBERA (1967, pl. 6, fig. 1) documented a one-whorl long body chamber, while the specimens figured by DEZI & RIDOLFI (1978:53, fig. 77-78) bear body chambers only of 2/3 whorl length. As we saw, the body chamber of the adult example EP95B occupies a whole whorl. In addition to this, the disornamented body chamber was regarded by MERLA as a specific characteristic of the taxon. This morphological feature has been confirmed neither. The sculpture remains of the same style both on the phragmocone and on the body chamber of specimens figured by BARBERA (l.c.) and DEZI & RIDOLFI (l.c.). The Gerecse material displays the same characteristic. A well-preserved specimen (EB15A) possessing only half of the body chamber, however, resembles well the holotype. Its ornamentation becomes suddenly less developed on the phragmocone, at the half of the penultimate whorl, and tends to fade on the body chamber.

In view of the coiling, the whorl-section and the sculpture the *Erycites* cfr. *fallifax* ARKELL figured by DEZI & RIDOLFI (1978, p. 52, fig. 75) may represent a *C. crassiventris* specimen.

Distribution

Italy – Montagna della Rossa: Upper Aalenian (MERLA, 1934:27), Fonte S. Giglio: Meneghinii Zone (DONOVAN, 1958:38), Sella dei due Corni: Lower Aalenian (BARBERA, 1967:304), Monte Catria and M. Nerone: Aalensis Zone (CRESTA, 1994:115)

Spain – Sierra Sagra: Upper Aalenian(?) (FOUCAULT, 1971:143)

Hungary – Gerecse Mts: Speciosum and Meneghinii Zones

Cagliceras robustum (MERLA, 1934)

(Pl. 5, fig. 4)

1934 *Erycites robustum* n. sp. MERLA, p. 25, pl. 2, fig. 6 a-b, pl. 3, fig. 7

1966 *Erycites* cf. *robustum* MERLA, GÉCZY, p. 97, fig. 83, pl. 28, fig. 1

1967 *Erycites* cf. *robustum* MERLA, SEYED-EMAMI, 1967, p. 98, pl. 3, fig. 13

1978 *Erycites robustum* MERLA, DEZI & RIDOLFI, p. 50, fig. 69-72

Material: 4 internal moulds of mediocre preservation

Dimensions:

specimen	D	H	h	W	w	U	u
EG18B	104	30	29%	30	100%	54	52%
EP89A	90	26	29%	24	92%	47	53%
EP88B	90	26	29%	26	100%	46	51%

Description

Medium-sized form of moderately evolute coiling with a wide and gradually deepening umbilicus. There is no edge between the umbilical and lateral walls. The flanks are convex, the venter is low and broadly arched. There is a low, thin, weakly developed carina in the middle of the ventral part. The whorl-section of the inner whorls is subcircular, becoming wide-oval on the last whorl. Its maximum width is a little below the medium whorl-height. The ornamentation consists of strong primary and finer secondary ribs. The primaries emerge from the umbilicus, and develop into radially elongated, projected nodes with concave intercosta at the lower third of the flank. Their width and interspace are of the same size. The example EP88B bears 24 primary ribs on the last whorl. The primaries bifurcate at the lower third on the inner whorls, while the furcation

points lie at the half of the flank on the last whorl. The thinner secondaries are slightly prorsiradiate. They bend forward on the venter and fade away close to the keel. Intercalary ribs appear between the secondaries on the last whorl. No whole body chambers are preserved. The suture-line shows an erycitid character. The length of the weakly developed E is 1/3 of the relatively wide and long L, the umbilical lobes are oblique. The LS1 is significantly ramified, the well-developed auxiliary saddle is also oblique and asymmetrical.

Remarks and comparisons

The example EP88B figured here seems to agree well with MERLA's type (1934, pl. 2, fig. 6). The characteristic bullate sculpture makes *C. robustum* easily distinguishable from other *Cagliceras* species.

Distribution

Italy – Montagna della Rossa: Upper Toarcian (MERLA, 1934:26), Alpe Turati: Upper Toarcian (VENZO, 1952:116)

Iran – Kerman: Upper Toarcian (SEYED-EMAMI, 1967:98)

Portugal – *C. cf. robustum*: Sao Gíao: Mediterranean Subzone (ELMI et al., 2007:119)

?Spain – *Erycites cf. robustum*: Maranchón: Aalenian (GOY & ALFÉREZ, 1974:2)

Hungary – Csernye: Upper Toarcian (GÉCZY, 1966:98), Gerecse Mts: Meneghinii to Opalinum Zones

Cagliceras rotundiformis (MERLA, 1934)
(Pl. 5, fig. 1, 3)

1934 *Erycites rotundiformis* n. sp., MERLA, p. 24, pl. 3, fig. 6

1966 *Erycites cf. rotundiformis* MERLA, GÉCZY, p. 99, fig. 85, pl. 28, fig. 2, pl. 42, fig. 5

1968 *Erycites rotundiformis* MERLA, PINNA, p. 30, pl. 2, fig. 23, pl. 3, fig. 1

? 1978 *Erycites* cfr. *rotundiformis* MERLA, DEZI & RIDOLFI, p. 55, fig. 81

Material: 4 internal casts of mediocre preservation

Dimensions

specimen	D	H	h	W	w	U	u
EG41A	93	28	30%	28	100%	43	46%
EG31B	80	27	33%	24	89%	35	44%
EG38A	78	25	32%	25	100%	34	43%

Description

Medium-sized, evolute, gradually growing shell. The umbilicus is wide and deep, the

umbilical wall steep and convex. There is neither umbilical margin nor ventrolateral edge. The flanks are rather convex, the ventral part is broad, low and rounded. The whorl-section is subcircular with maximum width at the mid-flank. No whole body chambers are preserved. The ornamentation consists of regular, well-developed ribbing interrupted on the venter by a wide smooth band. The ribbing style is continuous throughout the shell. Straight, radiate primary ribs rise on the umbilical wall, their width and intercosta are equal-sized. The primaries reaching the lower third of the flanks become gently broader, and trifurcate a little under the mid-whorl position without any tubercles. The last whorl bears 28 primaries. The less developed secondary ribs are slightly flexuous. The secondaries bend forward on the venter, and fade away in the middle. The erycitid suture-line is characterised by a short E with 1/3 length of the L. The asymmetric L is narrow, long and ramified. The trunk of the first lateral saddle is considerably narrow. The auxiliary saddle is well-developed, its height is about 2/3 of the LS1. The U lobe is divided and oblique, the U2 points at the tip of the L (Figure 6).



Figure 6. Suture-line of *C. rotundiformis* (MERLA) (ETA23B)

Comparisons

The Gerecse examples are well comparable with both the holotype (MERLA, 1934:24, pl. 3, fig. 6) and the specimen presented by PINNA (1968, pl. 2, fig. 23, pl. 3, fig. 1). It is worth mentioning that those three whorl-sections described by MERLA, PINNA and GÉCZY (1966:99, fig. 85) seem to show slight differences which can be, however, considered as intraspecific variability. As opposed to this, the section of the *E. cfr. rotundiformis* figured by DEZI & RIDOLFI (1978: p. 55, fig. 81) appears significantly different from that of the holotype by having flattened lateral walls and a highly-arched ventral area.

The sculpture style and the cross-section make *C. rotundiformis* well distinguishable from the similar taxa. *C. robustum* bears bullate primary

ribs, while *C. costulosum* is more finely ribbed. The primaries of *C. elaphum* are shorter and prorsiradiate branching at the lower third of the flank. The section of the latter is high-oval on the last whorl. *C. rotundiformis* was already compared with *E. reussi* by MERLA (1934:24), accordingly, the latter is characterised by a more depressed section, a coarser ribbing and a symmetric L lobe.

Distribution

Italy – Valdorbia, Cagli: Jurese Zone (MERLA, 1934:24), Alpe Turati: Meneghinii Zone (PINNA, 1968:31), M. La Pelosa: Erbaense Zone (P. sternale Subzone) – Meneghinii Zone (NICOSIA & PALLINI, 1978:268), Monte Catria and M. Nerone: Meneghinii Zone (CRESTA, 1994:115)

Spain – Zegri Norte: Opalinum Zone (GARCIA-GÓMEZ et al., 1994:217)

Hungary – Csernye: Upper Toarcian – Lower Aalenian (GÉCZY, 1966:100), Gerecse Mts: Meneghinii and Aalensis Zones

Cagliceras costulosum (MERLA, 1934) (Pl. 6, fig. 1, 2)

- 1934 *Hammatoceras costulosum* n. sp., MERLA, p. 13, pl. 1, fig. 3-4
 1968 *Erycites costulosus* (MERLA), PINNA, p. 29, pl. 2, fig. 5
 1978 *Erycites costulosus* (MERLA), DEZI & RIDOLFI, p. 46, fig. 58-63
 1994 „*Erycites*” gr. *costulosus* (MERLA), VENTURI, pl. 6, fig. c
 1995 *Geczyceras costulosum* (MERLA), GOY et al., p. 100, pl. 12, fig. 1

Material: 2 internal casts of medium state of preservation

Dimensions

specimen	D	H	h	W	w	U	u
EP84C	92	26	28%	22	84%	45	49%
EP84D	71	22	31%	18	82%	35	49%

Description

Medium-sized form with moderately evolute coiling. The umbilicus is slightly narrow and deep on the inner whorls becoming gradually wider during the ontogenesis. The umbilical wall is low, both the umbilical and the ventrolateral margins are rounded. The flanks are gently convex, the venter is slightly high and rounded with a thin, smooth intersection in the middle. The cross-section is high-oval with maximum width at the lower third. The last whorl is somewhat compressed, although it remains wider than the penultimate whorl. The ornamentation is

characterised by moderately strong primary and weakly developed secondary ribs. The primaries emerging from the umbilical margin are rectiradiate. They are dense on the inner whorls with equal width and space, but become more widely spaced on the last whorl. There are 28 primary and 84 secondary ribs on the last whorl of the example EP84C. The primaries regularly trifurcate at the lower third of the flanks. The thin secondaries are curved gently forward on the inner whorls, while they are radiate on the last whorl. Having reached the ventral interruption without fading they suddenly terminate. No whole body chambers are preserved. Although the suture-lines are not visible in all details, the structure of the characteristic erycitid lobe can be observed. The length of the weakly developed E is 1/3 of the relatively narrow L, the lateral saddle is broad, and the U is oblique.

Remarks and comparisons

MERLA (1934:13) classified the new species within the genus *Hammatoceras*. As opposed to this, PINNA (1968:29) – having accepted GÉCZY’s proposal (1966), which emphasized the priority of the suture-line analysis rather than that of the morphological features in distinguishing *Erycites* and *Hammatoceras* – revised the original classification, and, based on the suture structure, placed the taxon in *Erycites*. However, the taxonomic interpretation remained uncertain. In three later papers, without any explication, the species was referred to again as a taxon belonging to the Hammatoceratidae: *H. costulosum* MERLA (ELMI et al., 1974, pl. 4, fig. 3), *Geczyceras costulosum* (PETTINELLI et al., 1997, pl. 3, fig. 6, but *Hammatoceras* [sic!] *costulosum* MERLA, 1934, p. 109), and *Geczyceras costulosum* (MERLA) (GOY et al. 1995, pl. 12, fig. 1). For the coiling style, the sculpture (e.g. absence of the hammatoceratid umbilical tubercles), and, above all, for the specific suture configuration, it appears better supported to classify the taxon within the Erycitinae. Furthermore, as the main morphological features and the stratigraphic range correspond to the criteria of *Cagliceras*, in the present study the species is considered as a member of the latter genus.

The morphological affinity is very close between the example EP84C figured here and MERLA’s holotype (1934:13, pl. 1, fig. 3-4), as well as specimens presented by DEZI & RIDOLFI (1978:46, fig. 58-63). In view of the small size (D: 41) the *Erycites costulosus* figured by PINNA (1968, pl. 2, fig. 5) seems to be a fragmentary specimen preserving only the more involute inner whorls. On the other hand, the *Geczyceras costulosum* presented by GOY et al. (1995, pl. 12,

fig. 1) slightly differs from the holotype by possessing somewhat less evolute shell as well as coarser ribbing. The *Hammatoceras* aff. *costulosum* figured by ELMI et al. (1974, pl. 4, fig.3) shows more significant differences. It is characterised by an involute shell with narrow umbilicus, by long primary ribs and subtriangular whorl-section. The example rather resembles *Geczyceras porcarellaense* (BONARELLI, 1899) in morphology, but the suture-line is unknown. Due to the imperfect state of preservation, it seems uncertain to give an exact interpretation of either the *Geczyceras costulosum* figured by PETTINELLI et al. (1997) or the *Erycites costulosus* presented by VENTURI (1981, pl. 1, fig. 8).

A detailed comparison between *H. costulosum* and *H. porcarellaense* were already described by MERLA (1934:13). Accordingly, there are specific differences between the two forms. The whorl-section of *H. porcarellaense* is wider oval, its ribbing is prorsiradiate with secondaries emerging from umbilical tubercles, and its suture-line shows a specific hammatoceratid structure. Considering other similar taxa, *C. costulosum* differs from *C. elaphum* by possessing radiate and fine ribbing, it differs from *C. rotundiformis* by having oval-shaped whorl-section, and it differs from *C. robustum* by having no bullate ribbing.

Distribution

Italy – Montagna della Rossa: Jurense Zone (MERLA, 1934:13), Fontana Longarino: Jurense Zone (MAXIA, 1943:97), Alpe Turati: Upper Toarcian (VENZO, 1952:116, PINNA, 1968:30), M. La Pelosa: Meneghinii Zone (NICOSIA & PALLINI, 1977:268), M. Subasio: Erbaense Zone (VENTURI, 1981:88), Monte Nerone: “Erbaense” Zone (CECCA et al., 1990:96), Speciosum Zone (CRESTA, 1994:115), Passo del Furlo: Meneghinii Zone (VENTURI, 1994:348)

Spain – Mallorca: Pseudoradosa Zone, Aalensis Zone (GOY et al., 1995:98-100)

?France – *H. sp. aff. costulosum* MERLA: Dome de Remollon: Jurense Zone (GARIEL, 1961:704)

Hungary – Gerecse Mts: Aalensis Zone

Cagliceras picenum (FOSSA-MANCINI, 1915)
(Pl. 4, fig. 1-2, Pl. 5, fig. 2)

1867-1881 *Ammonites insignis* SCHÜBLER, MENEGHINI, p. 56, pl. 13, fig. 2

1914 *Hammatoceras picenum* n. sp., FOSSA-MANCINI, p. 73

1934 *Erycites picenus* (FOSSA-MANCINI), MERLA, p. 28, pl. 4, fig. 3-4

1969 *Erycites picenus* (FOSSA-MANCINI), PINNA, pl. 5, fig. 4

1978 *Erycites picenus* (FOSSA-MANCINI), DEZI & RIDOLFI, p. 48, fig. 64-65

1994 „*Erycites*” gr. *picenus* (FOSSA-MANCINI), VENTURI, pl. 7, fig. 2-3

1996 *Erycites* aff. *picenus* (FOSSA-MANCINI), RULLEAU, p. 6, pl. 21, fig. 4

1997 *Praerycites picenus* (FOSSA-MANCINI), PETTINELLI et al., pl. 3, fig. 4

2001 „*Erycites*” *picenus* (FOSSA-MANCINI), VENTURI & Ferri, p. 233, fig. h-m

Material: 5 internal moulds of mediocre state of preservation

Dimensions

specimen	D	H	h	W	w	U	u
EG54	86	22	25%	20	91%	44	51%
EB15B	80	21	26%	20	95%	47	58%

Description

Medium-sized, evolute form with a gradually growing shell, and a wide and slightly deep umbilicus. Both the umbilical edge and the ventrolateral shoulder are rounded, the lateral walls are convex. The venter is moderately high and rounded. A well-defined, thin and low carina is present on the ventral part. The cross-section is wide-oval, approximately subcircular. The last whorl being not compressed is wider than the penultimate. Regular, coarse ribbing persists on the whole coiling, and consists of short, radiate primary ribs that rise on the umbilical slope with the same width and interspace. The primaries become slightly thicker, and bifurcate on the lower third of the flanks. The thinner, sharp and moderately sigmoid secondary ribs bend forward on the venter and, alternating on the two sides, reach the keel. The example EG53A bears 38 secondaries on the last half whorl. The apertural part is missing on all specimens. The suture-lines are poorly preserved, however the length of the E, which is about half of the L, can be observed.

Remarks and comparisons

The specimens figured in the literature show a striking resemblance, apart from those of DEZI & RIDOLFI (1978:48, fig. 64-65), which gently differ from the holotype by bearing some trifurcating ribs. The agreement between the Gerecse examples and the holotype designated by FOSSA-MANCINI (1915:73) is also very close.

Both MERLA (1934:28) and GÉCZY (1966:121) draw particular attention to the morphological affinity of *C. picenum* and *Erycites gonionotus* (BENECKE). According to GÉCZY, the specific differences can be summarised by the position of the bifurcation points, by the presence of the

intercalatory ribs and by the suture-line structures. Furthermore, the stratigraphic range of these taxa is also different. Contrary to *C. picenum* ranging in the Upper Toarcian, *E. gonionotus* has been recorded from the Murchisonae Zone of the Mediterranean region.

Distribution

Italy – Montagna della Rossa: Upper Toarcian (FOSSA-MANCINI, 1915:237), Cagli: Toarcian Stage (MERLA, 1934:29), Valdorbia: Insigne Zone (CRESTA et al., 1989:91), Valdorbia, F. Burano: Erbaense Zone (VENTURI, 1994:348), Monte Catria and M. Nerone: Speciosum Zone (CRESTA, 1994:115), Umbria-Marchean Basin: Gradata Zone (PETTINELLI et al., 1995:108)

Spain – Cerro Méndez 2. sect.: Reynesi Zone (GARCIA-GÓMEZ et al., 1994:216)

Portugal – Alvaizere: *D. levesquei* Zone – *P. aalensis* Zone (MOUTERDE & RUGET, 1967:163)

France – Belmont: *Pseudoradosa* Zone (RULLEAU, 1996, pl. 6)

Hungary – Gerecse Mts: Speciosum Zone

Cagliceras enigmaticum n. sp.
(Pl. 6, fig. 3-4, Pl. 7, fig. 1, 2-3)

1978 *Erycites* aff. *picenus* (FOSSA-MANCINI), DEZI & RIDOLFI, p. 49, fig. 66-68

1978 *Erycites* n. sp?, DEZI & RIDOLFI, p. 58, fig. 86-87

?1996 *Hammatoceras* sp., RULLEAU, pl. 20, fig. 3

Holotype: EP98 (Pl. 7, fig. 2-3), paratypes: EP97C, EB16 (Pl. 6, fig. 3-4, Pl. 7, fig. 1)

Derivation of name: The name refers to the unusual morphology, which presents a combination of the erycitid and hammatoceratid characters.

Type horizon: Speciosum Zone

Type locality: Pisznicze quarry near Süttő,

Gerecse Mts

Material: 3 internal casts of mediocre preservation

Dimensions

specimen	D	H	h	W	w	U	u
EP98	105	24	23%	20	83%	55	52%
EP97C	100	25	25%	22	88%	55	55%
EB16	100	25	25%	20	80%	55	55%

Diagnosis

Subserpenticone, compressed, gradually growing shell with nearly radiate, broad constrictions. Weakly developed carina, wide and shallow umbilicus, oval-shaped section. Coarse,

regularly bifurcating ribbing without tubercles. Eryciticid suture-line.

Description

Medium-sized, subserpenticone form with gradually growing whorls. The umbilicus is wide and shallow without umbilical margin. The flanks are gently convex, almost flattened, the ventrolateral edge is rounded. The venter is narrow and slightly convex with a thin and low keel. The whorl-section is oval-shaped, its maximum thickness is at the lower third of the flank. The bigger parts of the body chambers are present on two examples, apertures are missing. There are at least two moderately deep and straight constrictions on the lateral side of the body chamber. The constrictions wider than the interval of two primary ribs are radial or slightly prorsiradiate. The first is placed at 15-45 mm from the last chamber, the second is at 1/3 or a half whorl. The ornamentation characteristic on the whole shell consists of coarse ribbing without tubercles. Thick, radiate primary ribs emerge on the umbilical wall, and regularly bifurcate at the lower third of the flank. The width of the primaries is the same as the intercostal space on the phragmocone, but the ribs become widely spaced on the body chamber. There are 37 primaries on the last whorls of both the holotype and the paratype EB16. The gently thinner secondary ribs are moderately sinuous and they curve forward on the venter. Having reached the keel alternating on the two sides, the secondaries terminate. No intercalatories are present. Due to the slightly corroded surface, the suture-line is not visible in all details, however some parts of the lobes can be traced. The length of the E is about 2/5 of the long and ramified L, the external saddle is less developed than the lateral saddle, and the U lobe is divided and oblique.

Remarks

The new species combines the specific morphological features of two related subfamilies, the Hammatoceratinae and the Erycitiinae. On the basis of the suture-line structure the species could be classified within the latter subfamily; in view of the size, the ornamentation and the coiling style it may belong to the genus *Cagliceras*. One of the main characteristics of the new taxon is the relatively wide and deep constriction that occurs repeatedly on the shell. This kind of constriction, which otherwise is typical of *Crestaites victorii* (HAHN, 1910:387), appears frequent not only on hammatoceratid, but also on erycitid forms of the Italian material described by DEZI & RIDOLFI (1978:10, 58). According to the authors, the constriction should be regarded as a specific

characteristic of a new taxon, which, however, was not introduced in their study.

The especially rare *C. enigmaticum* n. sp. is probably a connecting form that relates the early hammatoceratid *Geczyceras* and *Crestaites* to their presumed collateral descendant, the early erycitid *Cagliceras*. Thus the species seems to fill a gap between *Crestaites victorii* and *Cagliceras picenum*. By reason of the biostratigraphic evaluation of the Mediterranean Ammonitina faunas in various papers, the coeval range of the first representatives of the latter genera in the lower Upper Toarcian can be noted as a well-established fact (Italy: Erbaense Zone: VENTURI, 1994, PETTINELLI et al., 1997, Insigne Zone: CRESTA, 1994, CRESTA et al., 1989, Hungary, Gerecse Mts: Speciosum Zone: GÉCZY, 1985a, 1985b, and see: BECAUD et al., 2005). The bed-by-bed occurrences of the Hammatocerataceae taxa in the Upper Toarcian Gerecse material show the same results (Tables 1-2).

Comparisons

C. enigmaticum is very close in size and style of coiling to *Geczyceras perplanum*, but the latter bears lateral tubercles as a specific distinctive feature. *C. picenum* is also a strikingly similar form, but differs from *C. enigmaticum* by having a wide-oval or subcircular cross-section and by the lack of constrictions.

Though *Crestaites victorii* possesses a more robust shell, it is significantly similar in morphology to *Cagliceras enigmaticum*. *Crestaites victorii* was thoroughly investigated by BONARELLI (1899), HAHN (1910), FOSSAMANCINI (1914), GÉCZY (1965), PINNA (1968), DEZI & RIDOLFI (1978), ELMI & RULLEAU (1991), and MARTINEZ (1992). The whorl-sections, the sculptures (shape of ribbing, absence of tubercles at the furcation points) and the constrictions of both forms show close resemblance. Furthermore, the sutures are also similar, the lobe structure of *C. victorii* with short E and narrow L is close to that of the Erycitinae (GÉCZY, 1965:21, 1966:64, MARTINEZ, 1992:96). On the other hand, there are considerable differences between the two taxa in the coiling style and the ornamentation. *C. victorii* is characterised by a slightly more involute shell with h: 27-33% as well as wider whorls. *Cagliceras enigmaticum* is more finely ribbed with regular bifurcation, and the intercalatory ribs can be traced on the inner whorls of *Crestaites victorii* are absent.

On the ground of the size, the shape, the ribbing and the presence of constrictions, the agreement between the *Hammatoceras* sp. figured by RULLEAU (1996, pl. 20, fig. 3) and the holotype of *C. enigmaticum* is markedly close, however the

suture-line of the former specimen is unknown. This example was recorded from the Pseudoradiosa Zone, as both *Cagliceras* and *Crestaites* appear later in the Submediterranean than in the Mediterranean region: both genera seem to be typical of the uppermost Toarcian in the French material (ELMI & RULLEAU, 1991, RULLEAU, 1996, RULLEAU ET AL., 2001, BECAUD et al., 2005), however a *Hammatoceras* aff. *victorii* was recorded from the Bingmanni Subzone by Beaud (2006:37).

Distribution

Italy – Monte Carcatora: ?Sternale Subzone – Meneghinii Subzone (DEZI & RIDOLFI, 1978, pl. 1)

?France – Belmont: Pseudoradiosa Zone (RULLEAU, 1996, pl. 20)

Hungary – Gerecse Mts: Speciosum Zone

GENUS *Erycites* GEMMELLARO, 1886

Type species: *Erycites fallifax* ARKELL, 1957

The holotype of *Erycites fallifax* (*Ammonites fallax*, BENECKE, 1865, pl. 6, fig. 1) as the type species of genus *Erycites* was designated by ARKELL (1957, p. L267, fig.308.3).

Diagnosis

Medium-sized form with subcadione, wide-oval, subcircular, subquadrangular or oval-shaped whorl-section. Either gradually growing, moderately evolute or erycitid coiling. The latter is characterized by sphaerocone and depressed inner whorls becoming more evolute and compressed on the body chamber. Either weakly developed carina or smooth band on the venter. Coarse or weaker, branching ribbing with ventral interruption. Erycitid suture-line: short E, weakly developed external saddle, long, widely ramified L, broad lateral saddle, divided and oblique U.

Distribution

The genus is typical of the Upper Toarcian – Aalenian of Europe, but its more extended horizontal range has also been well-documented. *E. fallifax*, *E. f. excavatus*, *E. gonionotus*, *E. baconicus*, *E. cf. involutus*, *E. personatiformis*, *E. banffyvi* and *E. telegdirothi* are recorded from North Africa (GARDET & GÉRARD, 1946:27-35, Lelièvre, 1960:37, DUBAR et al., 1971:401, ELMI, 1986: 232-233, SADKI, 1996:127), however the presence of the latter two species in Africa needs more evidence. *E. fallifax*, *E. tenax* and *E. barodiscus* are known from the Caucasus (see KRYMHOLZ, 1961:108-109, NUTSUBIDZE, 1966:150-151), and *E. barodiscus* from the

Crimea as well (IPPOLITOV et al., 2008). Furthermore, a single *E.cf. fallifax* is recorded from Thailand (BRAUN & JORDAN, 1976:27), as well as an ?*E. aff. fallifax* from New Zealand (WESTERMANN et al., 2000:45). The taxon also occurs in Iran, *E. brevispira* MERLA and *E. spathi* n. sp. were described by SEYED-EMAMI (1967:98-99, 1971:36), and *E. aff. sphaeroconicus* BUCKMAN by SEYED-EMAMI et al. (2008:255). The genus is also documented from the Aalenian of Tibet (YIN, 2006:223).

The Csernye material is immensely rich in erycitid specimens. Beside those that have recently been classified within *Cagliceras*, numerous other *Erycites* taxa were also presented by GÉCZY (1966) as follows: *E. reussi* HAUER, *E. cf. leptoplocus* VACEK, *E. intermedius* HANTKEN in PRINZ, *E. retrorsicostatus* HANTKEN in PRINZ, *E. baconicus* HANTKEN in PRINZ, *E. telegdirothi* PRINZ, *E. partschi* PRINZ, *E. involutus* PRINZ, *E. szontaghi* PRINZ, *E. fallifax fallifax* ARKELL. The author introduced several new taxa: *E. personatiformis* n. sp., *E. telegdirothi amplius* n. subsp., *E. telegdirothi prorsicostatus* n. subsp., *E. mousterdei* n. sp., *E. subquadratus* n. sp., *E. reussi cestiferiformis* n. subsp., *E. ovatus* n. sp., *E. ovatus? rogeri* n. subsp., *E. fallifax excavatus* n. subsp., *E. fallifax flexuosus* n. subsp., *E. fallifax arkelli* n. subsp.

The recent revision of the Gerecse material made it possible to describe the following species: *E. ovatus* GÉCZY, *E. intermedius* HANTKEN in PRINZ, *E. fallifax* ARKELL, *E. sp. aff. reussi* (HAUER), *E. barodiscus* GEMMELLARO, *E. subquadratus* GÉCZY, *E. gerecsensis* n. sp.. Furthermore, a single *E. sp. aff. telegdirothi amplius* GÉCZY has been recently presented from the Kis-Teke-hegy section. In the Gerecse Mts the earliest representatives of *Erycites* (*E. ovatus*, *E. barodiscus*) occur in the upper part of the Meneghinii Zone, and the genus showing a noteworthy diversity persisted into the upper Murchisonae Zone.

Remarks

After the "Csernye-monograph" (GÉCZY, 1966) the genus was thoroughly examined by PINNA (1968), DEZI & RIDOLFI (1978), VENTURI (1981, 1994) and PALLINI et al. (2005). These studies rendered excellent contributions to the detailed knowledge of the evolutionary lineage and the Mediterranean stratigraphic range of *Erycites*. In the 1990s, a new species, *Erycites exulatus* sp. nov. was created by CALLOMON & CHANDLER (1994), however its validity was rejected by CRESTA (1997, 2002). Having been erected the genus *Cagliceras* by RULLEAU & ELMI (2001), the stratigraphic range of *Erycites* has been

restricted to the uppermost Toarcian Aalensis Zone and the Aalenian Stage.

Erycites ovatus Géczy, 1966

(Pl. 8, fig. 1, 2-3, Pl. 9, fig. 1, 4, Pl. 10, fig. 3)

1966 *Erycites ovatus* n. sp., GÉCZY, p. 104-105, fig. 91, pl. 30, fig. 1, pl. 42, fig. 10

Material: 15 relatively well-preserved internal moulds

Dimensions

specimen	D	H	h	W	w	U	u
EP78A	125	34	27%	25	73%	59	47%
EP83B	114	29	25%	24	82%	54	47%
EG9	114	31	27%	24	77%	52	45%
EP64B	114	33	29%	24	73%	50	44%
EP78B	112	34	30%	24	70%	52	46%
EP79A	110	34	31%	24	70%	45	41%
EG7A	106	29	27%	18	62%	48	45%

Description

Medium-sized, evolute shell with a moderately deep umbilicus on the inner whorls becoming gradually wider and shallower during the ontogeny. The height and width of the whorls grow gradually, thus the body chamber is also higher and wider than the penultimate whorl. The umbilical wall is steep and convex on the phragmocone, while low and less convex on the body chamber. Both the umbilical and the ventrolateral margins are rounded. The flanks on the inner whorls are convex becoming flattened on the body chamber. The venter is broad, low and rounded on the phragmocone, while high and narrow on the last whorl without any keel. The inner cross-section is wide-oval with maximum width at the umbilical margin, while the section is highly-arched oval on the body chamber with maximum width at the lower third of the flank. The length of the body chamber is 3/4 of a whorl. The peristome is strikingly prorsiradiate with a projected edge and a shallow constriction behind. The ornamentation is characterized by weakly developed, prorsiradiate ribbing. The primary ribs rise from the umbilical wall on the phragmocone, and trifurcate at the lower third of the whorl with equal width and intercosta. On the body chamber primaries emerge from the umbilical edge, and become twice as widely spaced as their intervals. There are about 27 thick primaries on the last whorl. The fine secondary ribs are straight and prorsiradiate, and fade away close to the ventrolateral shoulder. Secondaries are hardly visible on the body chamber. On the whole, the

suture-line has an erycitid character, apart from the length of the E lobe, which is half of the L. The structures of the external saddles, the broad and ramified L lobes, and the oblique U lobes show great similarity in the entire *E. ovatus* material. However, on the ground of the constructions of the first lateral and the auxiliary saddles the sample can be divided into two groups. In the first group (EP83D, ETA25B, EP79A, EG31C) the bases of the saddles are broad and gently widely placed (Figures 7, 8), while in the second (EG9, EP79B) group the saddles have almost the same base (Figure 9). The latter resembles the suture-line of the holotype (GÉCZY, 1966: pl. 42, fig. 10).



Fig. 7. *Erycites ovatus* GÉCZY (EG31C)



Fig. 8. *Erycites ovatus* GÉCZY (EP83D)



Fig. 9. *Erycites ovatus* GÉCZY (EG9)

Comparisons

The Gerecse examples show sufficient agreement with GÉCZY's holotype (1966, pl. 30, fig. 1), however, slight intraspecific morphological variabilities relating to the style of the coiling, the whorl-section, and the suture-line configuration can be traced as well.

The shell form of *E. ovatus* is similar to that of *E. intermedius*, but there are noteworthy differences in the sculpture, and in the presence of the ornamentation on the body chamber. *E. ovatus* closely resembles *E. fallifax* by having an umbilicus becoming gradually wider, a ribbing becoming widely spaced on the body chamber, and a highly-oval section. The two taxa differ in the size, in the cross-section of the penultimate whorl, and in the suture construction. The L lobe of *E. fallifax* is less developed and less ramified. The diameter of an adult *E. fallifax* is never more than 100 mm, and its section of the penultimate whorl is more depressed than that of *E. ovatus*. Above all, as the major specific difference, the body chamber of the latter is always wider than the penultimate whorl.

E. ovatus shows the nearest affinity to *E. sutneri* GEMMELLARO, 1886 – there is an undoubted relationship between the two taxa. Their sizes are about the same, whorls are compressed, ornamentations are almost identical, suture-lines are very similar ($E = 1/2 L$). However, several specific morphological differences can be measured in the average dimensions and the whorl-sections.

Specimens of the two species with the same diameters differ from each other in the ratio of U/D and W/H.

1. The coiling of *E. ovatus* is slightly more evolute:

- the average U/D of *E. sutneri*: 0.395
- the average U/D of *E. ovatus* of Csernye: 0.426, of Gerecse: 0.457

2. The whorl-section of the inner whorl is depressed on *E. sutneri* (CRESTA, 1997:44, fig. 13/G, 2002:198), while it is compressed on *E. ovatus* (GÉCZY, 1966:105).

3. The section of the body chamber of *E. ovatus* is more compressed:

- the average W/H of the Csernye examples: 0.68, of the Gerecse examples: 0.71
- the average W/H of *E. sutneri*: 0.795

Remarks

The taxon has only been cited three times in the literature, without any photos (PINNA, 1968:33-34, pl. 2, fig. 27: *E. cf. ovatus* GÉCZY, LINARES & RIVAS, 1971:194: *Erycites* sp. gr. *E. ovatus* (GÉCZY), CECCA et al., 1990:101: *E. aff. ovatus* Géczy). Furthermore, the cross-section

figured by Pinna differs from the holotype by being wide oval-shaped, consequently, it rather resembles *E. sutneri*.

Based on the close morphological affinities between the two forms, as well as on the lack of reliable citations, CRESTA considered *E. ovatus* GÉCZY as the junior synonymy of *E. sutneri* GEMMELLARO (CRESTA, 1997:42, 2002:199). However, the Gerecse material with its numerous well-preserved specimens ensures an excellent possibility for an exact comparison of the discussed taxa. The result does verify the fact that the morphological differences are specific ones, thus in the present paper *E. ovatus* is regarded as a valid taxon.

Distribution

Hungary – Csernye: Upper Toarcian – Lower Aalenian (GÉCZY, 1966:105), Gerecse Mts: Meneghinii to Murchisonae Zones

E. sutneri is known from the Lower Aalenian of various localities in the Apennines (CRESTA, 1997:42).

Erycites barodiscus GEMMELLARO, 1886 (Pl. 10, fig. 1, 2, Pl. 11, fig. 3)

1874 *Ammonites gonionotus* (BENECKE), DUMORTIER, p. 267, pl. 56, fig. 5-7

1886 *Hammatoceras (Erycites) barodiscus*, GEMMELLARO, p. 206

? 1935 *Erycites gonionotum* BENECKE, ROMAN, pl. 1, fig. 8

1966 *Hammatoceras (Erycites) fallax* BENECKE, NUTSUBIDZE, p. 150, pl. 35, fig. 1

1994 *Erycites exulatus* sp. nov., CALLOMON & CHANDLER, p. 22, pl. 1, fig. 1-2, pl. 2, fig. fig. 1-2

1994 *Erycites* aff. *exulatus* sp. nov., CALLOMON & CHANDLER, p. 23, pl. 1, fig. 4

1996 *Erycites barodiscus* GEMMELLARO, RULLEAU, p. 6, pl. 25, fig. 1-2, 3-4

1997 *Erycites barodiscus* GEMMELLARO, CRESTA, p. 42, p. 43, fig. 12, p. 44, fig. 13/F, pl. 3, fig. 1, 2, 5

2001 *Erycites barodiscus* GEMMELLARO, RULLEAU et al., pl. 27, fig. 6

2002 *Erycites barodiscus* GEMMELLARO, CRESTA, p. 196-197, fig. 129

2005 *Erycites barodiscus* GEMMELLARO, PALLINI et al., p. 17, pl. 9, fig. 2, 4, pl. 16, fig. 7

2008 *Erycites barodiscus* GEMMELLARO, IPPOLITOV et al., p. 46, fig. 1

Material: 18 internal casts of different state of preservation

Dimensions

specimen	D	H	h	W	w	U	u
ETA11A	126	36	28%	34	94%	58	46%

specimen	D	H	h	W	w	U	u
EP69A	124	31	25%	30	97%	65	52%
EG19	114	37	32%	32	86%	45	40%
ETA5	108	34	31%	32	94%	56	52%
ETA10	88	28	32%	26	93%	38	43%

Description

Medium-sized form with moderately evolute coiling. The umbilicus is narrow and deep on the inner whorls, becoming wider and shallower on the last whorl. The umbilical walls are strikingly convex on the phragmocone and more flattened on the body chamber without umbilical margin. The flanks of the inner whorls are considerably convex, becoming moderately rounded on the last whorl. No ventrolateral edge is present. The venter is broad, low and convex with a narrow, smooth band in the middle. The whorl-section is either depressed subcircular or wide-oval on the phragmocone, and wide-oval on the body chamber with maximum width at the mid-flank. The last whorl is always wider than the penultimate one. The length of the body chamber is about 3/4 of a whorl. The projected, oblique peristome is followed by a wide, deep and also oblique constriction. The ornamentation consists of coarse ribbing persisting throughout the shell. Thick, slightly prorsiradiate primary ribs emerge on the umbilical wall branching into 2-3 secondaries at mid-height. The primaries become more prorsiradiate and widely spaced on the body chamber with concave interspace. The example EG19 bears 27 primary ribs on the last whorl. The secondaries are covered by the whorls on the phragmocone. The thinner secondary ribs bend gently forward and die out in the middle of the ventral part, alternating on the two sides. Intercalatories rarely appear on the body chamber. The suture-line is characterised by erycitid structure: the E is short with length 1/3 of the long, broad and ramified L, the U lobe is divided and strongly oblique (Figure 10).



Figure 10. Suture-line of *E. barodiscus* GEMMELLARO (ETA11A)

Remarks

In 1886 GEMMELLARO introduced two taxa, *Hammatoceras (Erycites) sutneri* and *H. (Erycites) barodiscus*, however, without figures and indication of the exact stratigraphic range (1886:205-206). None of them was later cited in the literature. Owing to these insufficiencies, a new species, *Erycites exulatus* sp. nov. was proposed by CALLOMON & CHANDLER (1994:22) based on a strikingly similar form from Dorset. Having made a detailed revision of the Gemmellaro-collection, *Erycites exulatus* was still considered as a junior synonymy of *E. barodiscus*, consequently its validity was rejected by CRESTA (1997). The author designated the lectotypes of both Gemmellaro species, and first figured the specimens (l.c.). After CRESTA's paper the original taxon names have been commonly accepted (RULLEAU, 1996, RULLEAU ET AL., 2001, CRESTA, 2002, COX & SUMBLER, 2002, PALLINI et al., 2005).

A robust specimen of *E. fallax* BENECKE was figured by NUTSUBIDZE from the Caucasus (1966, pl. 35, fig. 1). It significantly differs from the other presented *E. fallax* (pl. 33, fig. 4), which seems to agree well with the holotype of *E. fallifax*. The diameter (D: 106) of the first example is larger than the typical size of *E. fallifax* (D<100), moreover the ratio of the last whorl is very close to that of *E. barodiscus* (H: 27, W: 33 [corrected by us!]), as the body chamber is wider than the phragmocone. By reason of the sculpture and the style of coiling, in the present study it is considered that the presence of *E. barodiscus* in the Caucasus can be documented by NUTSUBIDZE's *Erycites* example figured on pl. 35, fig. 1.

Comparisons

The specific morphological features of most Gerecse specimens are well consistent with those of the lectotype designated by CRESTA (1997, p. 43, fig. 12), however, some of them show intraspecific variability. The last whorl of the example EP69 is as wide as the penultimate, while the example EG19 (Pl. 10, fig. 1) with a moderately involute coiling and thinner, radiate, well-defined primaries resembles the *E. gonionotus* figured by ROMAN (1935, pl. 1, fig 8).

The cadicone inner whorls of *E. barodiscus* and *E. fallifax* are similar, however, the two taxa differ in other characteristics. *E. barodiscus* is a more robust form with larger size (adult D>100), and with the body chamber being always wider than the phragmocone. Furthermore, *E. fallifax* is less strongly ribbed on the body chamber. *E. sutneri* differs from *E. barodiscus* by having

slightly more involute coiling and narrower, high-oval whorl-section with less developed ornamentation. *Cagliceras elaphum* is also a similar form in size, but it is characterised by narrower whorls and a high-oval section, and it bears shorter primary and finer secondary ribs.

Distribution

Italy – Monte Erice: Lower Aalenian (CRESTA, 1997:43), Apennines: Toarcian – Aalenian boundary (CRESTA, 2002:197)

Great-Britain – Burton Cliff, Dorset: Scissum Zone (CALLOMON & CHANDLER, 1994:23, CALLOMON & COPE, 1995:67, COX & SUMBLER, 2002:37)

Georgia – North Caucasus: Lower Aalenian (NUTSUBIDZE, 1966:151)

Ukraine – Crimea: Aalensis Zone (IPPOLITOV et al., 2008:43)

France – La Verpillière, Veyras: Upper Lias (DUMORTIER, 1867:267), Veyras: Murchisonae Zone (ROMAN, 1935), Belmont: Aalensis Zone (RULLEAU, 1996, pl. 25), Saint-Quentin: Lugdunensis Subzone or Opalinum Zone (RULLEAU et al., 2001, pl. 27)

Hungary – Gerecse Mts: Meneghinii to Opalinum Zones

Erycites subquadratus GÉCZY, 1966 (Pl. 12, fig. 3-4)

1966 *Erycites subquadratus* n. sp., GÉCZY, p. 95, p. 96, fig. 81, pl. 27, fig. 1-2, pl. 42, fig. 1-2

1968 *Erycites subquadratus* GÉCZY, GÉCZY, p. 127, pl. 3

1996 *Erycites* aff. *subquadratus* GÉCZY, RULLEAU, p. 6, pl. 26, fig. 1-2

Material: 2 internal moulds of moderate preservation

Dimensions

specimen	D	H	h	W	w	U	u
ETA11B	115	31	27%	32	103%	56	49%
EG25	114	31	27%	31	100%	56	49%

Description

Medium-sized form with evolute coiling and an umbilicus growing gradually wider. The umbilical wall is steep and convex on the phragmocone, becoming less convex on the last whorl. The flanks are convex on the inner whorls, but become flattened on the body chamber with a rounded ventrolateral shoulder. The venter is broad, low and slightly convex bearing a ventral smooth band. The cross-section of the inner whorls is wide-oval, but it becomes subquadrangular on the last coiling. The maximum thickness of the section lies a little below the mid-flank. The last whorl bearing a body chamber of

3/4 whorl length is wider than the penultimate. There is a deep and oblique constriction behind the projected peristome. The ribbing persists to the peristome, and consists of well-developed, radial primary ribs that branch into 2 or 3 secondaries. The primaries become prorsiradiate and widely spaced on the body chamber. The example ETA11B bears about 26 primaries on the last whorl. The thinner secondary ribs curve moderately forward, and reach the intersection alternating on the two sides. The suture structure is erycitid with short E, long and ramified L, divided and oblique U.

Remarks and comparisons

Erycites subquadratus n. sp. was created on the ground of 8 specimens by GÉCZY in 1966. It shows striking similarities to the lectotype of *E. barodiscus* figured by CRESTA (1997). Having revised the Csernye and the Gerecse materials, *E. subquadratus* and *E. barodiscus* appear closely allied species, although not identical. Both taxa have some common morphological features (e.g. size, style of coiling, sculpture, suture-line), but *E. subquadratus* differs from *E. barodiscus* in at least a major specific characteristic. The latter bears convex flanks on the body chamber with wide-oval whorl-section, while the section of *E. subquadratus* is markedly subquadrangular. This difference already emphasized by RULLEAU (1996) is a specific one, therefore the validity of *E. subquadratus* seems to be well-established.

The *E. barodiscus* and the *E. subquadratus* examples documented from France by RULLEAU (1996, pl. 25, fig. 1-4, pl. 26, fig. 1-2) slightly differ from the types by possessing broader whorls.

Distribution

France – Belmont: Aalensis Zone (RULLEAU, 1996)

Spain – *Erycites* sp. cf. *E. subquadratus* GECZY: Zegri Sur: Lower Aalenian (LINARES & RIVAS, 1971:192), Cerro Méndez 2. sect.: Opalinum Subzone (GARCIA-GÓMEZ et al., 1994:216), *E. aff. subquadratus* GECZY: Coll de Port: Opalinum Zone (FAURE & ALMERAS, 2006:650)

Portugal – *Cagliceras* aff. *subquadratum* (GÉCZY): Sao Giao: Reynesi Subzone (ELMI et al., 2007:120)

Hungary – Csernye: Upper Toarcian, Gerecse Mts: Aalensis and Opalinum Zones

Erycites gerecsensis n. sp.
(Pl. 12, fig. 1-2)

Holotype: EG31A

Derivation of name: The name refers to the type locality.

Type locality and horizon: Kis-Gerecse quarry near Süttő, Gerecse Mts, bed 31, Aalensis Zone

Material: a single well-preserved internal mould

Dimensions

specimen	D	H	h	W	w	U	u
EG31A	110	32	29%	28	87%	53	48%

Diagnosis

Erycitid coiling, wide and shallow umbilicus. Venter broad and rounded with smooth band. Whorl-section wide-oval on the phragmocone, oval-shaped on the body chamber. Coarse, trifurcating ribbing with tubercles at the furcation points on the last whorl. Erycitid suture-line structure.

Description

Medium-sized, moderately evolute shell, with a robust, erycitid coiling. The umbilicus is narrow and deep on the inner whorls, while shallow and wide from the penultimate whorl. The flanks are convex on the phragmocone, becoming less rounded on the body chamber. Neither umbilical, nor ventrolateral edges are present. The ventral part is broad and convex with a narrow, smooth band in the middle. The cross-section is wide-oval on the inner whorls, while oval-shaped on the body chamber. The last whorl is as wide as the penultimate. The length of the body chamber is 3/4 of a whorl. The ribbing persists on the entire shell and consists of well-defined, thick and radiate primaries that emerge on the umbilical wall and trifurcate at the lower third of the flank. The primary ribs develop into projected, elongated tubercles with concave intercosta on the body chamber. The example bears 19 widely spaced primaries on the last whorl. Intercalatory ribs appear irregularly between the secondaries that curve forward on the venter, and alternately fade away in the middle. The aperture is missing, but the wide, deep and prorsiradiate constriction behind the peristome is preserved. The suture-line is the same as that of *E. barodiscus*.

Remarks

The example figured here seems to be close to the lectotype of *E. barodiscus* (in CRESTA, 1997:43, fig. 12) in its size and suture-line structure, but it markedly differs in the style of coiling and the ornamentation. The body chamber of *E. barodiscus* is always wider than the penultimate whorl, and the cross-section is slightly depressed wide-oval. On the other hand, the

section of the body chamber of *E. gerecsensis* n. sp. is higher oval-shaped, because the last whorl is not wider than the penultimate. Furthermore, the example is more rarely ribbed with radial, tubercular primaries branching at the lower third, which is not typical of *E. barodiscus* (see CRESTA, 1997:42). The specimen resembles the *E. barodiscus* figured by RULLEAU (1996, pl. 25, fig. 1-2), which also bears nodular primaries, however, trifurcating at the mid-height of the flank.

E. barodiscus, *E. subquadratus* and *E. gerecsensis* n. sp. all possess more robust and larger shell than that of the usual erycitid forms. Considering the morphology and the stratigraphic range, the three taxa appear closely allied species.

Distribution

The specimen comes from the Aalensis Zone (bed 31, Kis-Gerecse section). It is associated with *Dumortieria stricta*, *Cagliceras rotundiformis* and *Erycites ovatus*.

Erycites intermedius HANTKEN in PRINZ, 1904 (Pl. 13, fig. 1, 5)

- 1904 *Erycites Schafarziki* nov. sp., PRINZ, p. 93, pl. 17, fig. 2
 1904 *Erycites intermedius* nov. sp. HANTKEN msc., PRINZ, p. 94, pl. 16, fig. 1, pl. 38, fig. 3
 1921 *Erycites partschi* PRINZ, BUCKMAN, Vol. III, pl. 246, fig. 1
 1925 *Erycites intermedius* HANTKEN und PRINZ, 1904, RENZ, p. 195, pl. 3, fig. 4
 1966 *Erycites intermedius* HANTKEN in PRINZ, 1904, GÉCZY, p. 92-94, fig. 78-79, pl. 25, fig. 1, 4, pl. 26, fig. 1, pl. 41, fig. 13-15
 1968 *Erycites intermedius* HANTKEN in PRINZ, 1904, PINNA, p. 26, pl.3, fig.3, pl.2 n.t., fig.18
 1978 *Erycites intermedius* HANTKEN in PRINZ, 1904, DEZI & RIDOLFI, p. 54, fig. 79-80
 2001 *Erycites (Erycites) intermedius* HANTKEN in PRINZ, 1904, RULLEAU et al., pl. 27, fig. 5
 2008 *Erycites intermedius* HANTKEN in PRINZ, 1904, MARIOTTI et al., p. 6, fig. 5/a

Material: 6 poorly preserved and 3 relatively well-preserved internal casts

Dimensions

specimen	D	H	h	W	w	U	u
ETB32	122	36	30%	26	72%	51	42%
ETB30B	92	28	30%	?		42	45%

Description

Medium-sized, moderately evolute form with a wide, gradually deepening umbilicus. The umbilical wall is low and gently convex, both the umbilical and the ventrolateral margins are

rounded. The flanks are slightly convex. The ventral part is low and broad on the phragmocone, becoming a little higher and narrower on the body chamber. The venter is divided by a smooth band in the middle. The whorl-section of the inner whorls is wide-oval growing highly arched on the last whorl with maximum width at the lower third. No whole body chambers are preserved. The ornamentation is characterised by a regular, coarse ribbing. The primary ribs emerging on the umbilical wall are straight and prorsiradiate. Their intercostal spaces are gently wider than the rib-thickness. The primaries are rursiradiate and also more widely spaced on the body chamber. The primary ribs trifurcate at the mid-flank. The less developed secondaries are straight and prorsiradiate on the phragmocone, becoming curved forward on the last whorl. Alternating on the two sides, they fade away in the middle of the venter. The example ETB32 bears 33 primaries on the last whorl. Due to the corroded surfaces the suture-lines are not visible in all details, but the specific erycitid configurations can be traced. The length of the E lobe is half of the broad L. The saddles being less developed resemble that of *E. fallifax*, U2 and U3 are markedly oblique.

Remarks and comparison

From the Upper Aalenian sequences of the Bakony Mts three new *Erycites* species with resembling morphology were introduced by PRINZ (1904: 83-85): *E. Partschi* nov. sp., *Erycites Schafarziki* nov. sp., *E. intermedius* nov. sp. Hantk. msc.. *E. schafarziki* PRINZ was reclassified as *E. intermedius* by GÉCZY (1966:93) on the ground of the identical sizes, shapes, sculptures and suture-lines of the two holotypes (see PRINZ, 1904, pl.17, fig.2 refigured by GÉCZY, 1966, pl. 26, fig. 1).

The Gerecse examples show close agreement with the holotype (GÉCZY, 1966: pl. 25, fig. 4).

Cagliceras elaphum is one of the nearest forms to *E. intermedius*. DONOVAN (1958:58) drew particular attention to the striking similarities of the two taxa in morphology. However, GÉCZY (1966: 93, 97) and PINNA (1968:26) gave a detailed description of the specific features making distinguishable the taxa, respectively. The validity of *E. intermedius* was again confirmed by DEZI & RIDOLFI (1978:54), GOY et al. (1995:103), RULLEAU et al. (2001, pl. 27, fig. 5), and the revision of the Gerecse material has yielded the same results. The major morphological differences can be observed in the coiling style, in the sculpture and the suture-line. *C. elaphum* is characterised by a more evolute shell (H/D of *C. elaphum*: 23-26%, H/D of *E. intermedius*: 30-32%), as well as short and thick, almost tubercled

primary ribs that branch on the lower third, while primaries of *E. intermedius* are longer, furcating at the middle of the flanks. Proportion of E and L lobes is 1/3 on *C. elaphum*, while it is 1/2 on *E. intermedius*, and the lateral saddle on the latter is less developed. *E. partschi* PRINZ is another close form to *E. intermedius*, however, it differs in the coiling style, the whorl-section and the ornamentation. *E. partschi* has a somewhat more evolute shell with narrower whorl, shallow umbilicus, flattened flank, and sharp umbilical edge. Furthermore, it is densely and finely ribbed with weakly developed umbilical tubercles (PRINZ, 1904:83). One of the Gerecse examples, ETB30A gently resembles *E. partschi*, it might be a transitional form. Its sculpture style is like that of *E. intermedius*, but it bears a steep, flat, disornamented umbilical wall with margin only on the body chamber.

Distribution

Italy – Monti Martani: Toarcian (PINNA, 1968:26), Gorgo a Cerbara: Murchisonae Zone (Haugi Subzone) (KÄLIN & URETA, 1987:505), Monte Catria and M. Nerone: Fallifax and Klimakomphalum Biozones (CRESTA, 1994:115), Caloveto: Opalinum Zone (MARIOTTI et al., 2008:5), *E. schafarziki*: Aalenian (RENZ, 1923:268)

Greece – Kap, EPIRUS: Opalinum – Murchisonae Zones (RENZ, 1910:598), Korfu: Lower Dogger (RENZ, 1910:587, 1925:195)

Austria – Nordtirol: Murchisonae Zone (FISCHER, 1969:106)

France – La Verpillière: Opalinum Zone (RULLEAU et al., 2001: pl. 27, fig. 5)

Great Britain – Horn Park Quarry, Dorset: Bradfordensis Subzone (BUCKMAN, 1921: pl. 246), Murchisonae Zone (CALLOMON & CHANDLER, 1990:94, COX & SUMBLER, 2002:50)

Hungary – Csernye: Upper Aalenian (GÉCZY, 1966:94), Gerecse Mts: Opalinum and Murchisonae Zones

Erycites sp. aff. *reussi* (HAUER, 1856)
(Pl. 13, fig. 3-4)

1856 *Ammonites Reussi*, HAUER, p. 50, pl. 20, fig. 1-3

1904 *Erycites reussi* HAUER, PRINZ, p. 85

? 1915 *Hammatoceras Reussi* (HAUER), PRINCIPI, p. 446

1934 *Erycites* cfr. *Reussi* HAUER, MERLA, p. 23, pl. 2, fig. 5

? 1960 *Erycites* cf. *reussi* HAUER, LELIEVRE, p. 36, pl. 7, fig. 1

1963 *Erycites reussi* (HAUER), KOTTEK, p. 126

1966 *Erycites reussi* (HAUER), GÉCZY, p. 100, fig. 86, pl. 28, fig. 5, pl. 42, fig. 6

1978 *Erycites* cfr. *reussi* (HAUER), DEZI & RIDOLFI, p. 56, fig. 83-84

Material: a single well-preserved internal mould

Dimensions

specimen	D	H	h	W	w	U	u
EG6	68	24	35%	30	125%	27	40%

Description

Medium-sized form with moderately evolute coiling and gradually growing whorls. The umbilicus is deep and slightly wide, the umbilical wall is low and rounded. Neither umbilical nor ventrolateral margin is characteristic. The flanks are significantly convex. The venter is low and broadly rounded, with a weakly developed carina. The whorls are depressed (H/W: 80%), the maximum width lies a little below the mid-height. No body chamber is preserved. The ornamentation consists of moderately strong ribbing. The radiate primary ribs rising from the umbilical wall bifurcate at the upper third of the flank. There are 25 primaries on the last whorl. The thinner secondary ribs are first rectiradiate, then bend slightly forward, and reaching the keel fade away. Intercalatories appear on the upper third of the flank. The suture-line is characterised by a short E, a gently asymmetrical, long and ramified L, and well-developed and oblique U₂, U₃. The high accessory saddle somewhat differs from that of the typical erycetid lobe structure (Figure 11).



Figure 11. Suture-line of *E. sp. aff. reussi* (HAUER) (EG6)

Remarks and comparisons

Regarding the morphology and the suture construction the Gerecse example is close to the type (HAUER, 1856:50, pl. 20, fig. 1-3), but slight differences are observable in the ribbing and the whorl-section.

The similar taxa clearly differ in morphology from *E. reussi*. Having narrower whorls, the cross-section of *E. baconicus* is subcircular, while it is

subquadrangular on *E. barodiscus*, which, otherwise, has prorsiradiate ribbing. *E. reussi* was compared to *E. rotundiformis* by MERLA (1934:24). Accordingly, the latter is more finely ribbed, and its section is never depressed. The *Erycites* (*Erycites*) aff. *sphaeroconicus* figured by RULLEAU et al. (2001, pl. 28, fig.2) resembles *E. reussi* in the coiling style and the sculpture, but it differs from the latter by having less depressed cross-section.

Distribution

Austria – Königsbach, Adneth, Thurnberg, Hochleitengraben, Ammergau (HAUER, 1856:60)

Italy – Monti Martani, M. Subasio: Upper Lias (PRINCIPI, 1915:447), Montagna della Rossa, Cagli: Jurensis Zone (MERLA, 1934:24), Alpe Turati: Upper Toarcian (VENZO, 1952:116)

Greece – Epirus: Upper Lias (RENZ, 1910:566), Argolis: Lower Dogger (KOTTEK, 1963:126)

?Morocco – Krendegg: Bradfordensis Subzone (LELIÈVRE, 1960:37)

Hungary – Csernye: Toarcian Stage (GÉCZY, 1966:101), Gerecse Mts: lower Murchisonae Zone

Erycites fallifax ARKELL, 1958

(Pl. 11, fig. 1, 2)

1865 *Ammonites fallax*, BENECKE, p. 171, pl. 6, fig. 1-3

1886 *Hammatoceras fallax* BENECKE, VACEK, p. 93, pl. 15, fig. 1-9

1904 *Erycites fallax* BENECKE, PRINZ, p. 89, pl. 25, fig. 1

1923 *Erycites fallax* BENECKE, ROMAN & BOYER, p. 31, fig. 23, pl. 6, fig. 1

1934 *Erycites fallax* (BENECKE), MERLA, p. 28

1935 *Erycites fallax* BENECKE, ROMAN, p. 15, pl. 1, fig. 7

1957 *Erycites fallifax*, ARKELL, p. L267, fig.308.3

1966 *Erycites fallifax fallifax* ARKELL GÉCZY, p. 106-109, pl. 30, fig. 2, 4, pl. 31, fig. 1, pl. 43, fig. 1

1966 *Hammatoceras (Erycites) fallax* BENECKE, NUTSUBIDZE, p. 151, pl. 33, fig. 4

1976 *Erycites* cf. *fallifax* ARKELL, BRAUN & JORDAN, p. 27, p. 28, fig. 5, pl. 3, fig. 8

1988 *Erycites fallifax* ARKELL, LINARES et al., pl.1, fig. 8

1990 *Erycites fallifax* ARKELL, CECCA et al., pl. 2, fig. 2

1993 *Erycites fallifax* ARKELL, ELMI & RULLEAU, pl. 2, fig. 3-4

1994 *Erycites fallifax* ARKELL, GARCIA-GÓMEZ et al., pl. 1, fig. 13

1994 *Erycites* cf. *fallifax* ARKELL, CALLOMON & CHANDLER, p. 21-22, pl. 1, fig. 1-3

1996 *Erycites fallifax* ARKELL, RULLEAU, p. 11, pl. 37, fig. 1-2

1997 *Erycites fallifax* ARKELL, CRESTA, p. 44, fig. 13/H

1997 *Erycites fallifax* ARKELL, CASSEL, pl. 8, fig. 1

2000 *Erycites fallifax* ARKELL, HENRIQUES, pl. 1, fig. 1

2005 *Erycites fallifax* ARKELL, PALLINI et al., p. 17, pl. 9, fig. 1

Material: 9 internal casts of different state of preservation, and 3 fragments

Dimensions

specimen	D	H	h	W	w	U	u
ETA4	92	21	23%	20	95%	49	53%
EP61	90	25	27%	22	88%	43	48%

Description

Medium-sized, erycitid form with sphaerocone inner coiling. The umbilicus is narrow and deep on the phragmocone, becoming wider on the body chamber. The umbilical wall is steep and convex on the inner whorls, and less rounded on the last whorl. The flanks are convex on the phragmocone, becoming slightly flattened on the body chamber. The venter of the last whorl is narrow, high and rounded without ventral keel. The cross-section of the inner whorl is wide-oval, while it is high-oval on the body chamber with maximum thickness at the lower third of the flank. The last whorl, being more compressed, is as wide as the penultimate, or a little narrower than that. The length of the body chamber is 4/5 of a whorl. The moderately projected peristome is prorsiradiate with a shallow constriction behind. The ornamentation is characterised by a weakly developed ribbing. Thin primary ribs rise from the umbilicus, their interspace are wider than the rib-width on the inner coiling. The primary ribs branch into 2 or 3 secondaries at the mid-flank. The secondaries are covered on the phragmocone. The primaries grow stronger and are straight and prorsiradiate on the body chamber. The example ETA4 bears 26 primaries on the last whorl. The less developed and prorsiradiate secondaries fade away in the middle of the ventral part. The suture-line shows a slightly simpler erycitid character. The length of E is half of the broad L. The lateral saddles are widely divided by U2. The U lobes are oblique (Fig. 12).



Fig. 12. Suture-line of *E. fallifax* ARKELL (ETA4)

Remarks and comparisons

As type species had not been designated by BENECKE, it was done by ARKELL (1957:267, fig.308.3) designating BENECKE's fig. 1 (BENECKE, 1865, pl. 6) as the holotype of *E. fallifax*. According to CALLOMON & CHANDLER (1994:22), the size of the holotype is smaller than the average taxon size. Moreover, *E. fallifax* appears to show intraspecific variabilities, consequently, there are significant differences in the size, the coiling style, the section and the sculpture between the specimens figured in the literature. GÉCZY (1966: 106-112) made an attempt at solving this problem on the basis of the Csernye erycitid material containing 88 well-preserved, adult *E. fallifax* specimens. The author reclassified the taxon introducing four new subspecies: *E. fallifax fallifax* Arkell, 1957, *E. fallifax excavatus* n. subsp., *E. fallifax flexuosus* n. subsp., *E. fallifax arkelli* n. subsp., however, this classification has not been accepted in the literature.

The Gerecse sample is also characterised by intraspecific variabilities. While the examples EP61 and ETB39 agree well with the holotype, the examples ETA4 and ETAF1 differ from that in morphology. The latter two are larger forms with less sphaerocone inner coiling, less convex flanks on the body chamber and more prorsiradiate ribbing. The two specimens are close in morphology to *E. fallifax excavatus* GÉCZY, but they bear more widely spaced ribbing, and less developed keel. The fragmentary ETB29A is also similar to the latter subspecies by having narrower whorls and less convex flanks, but differs in the sculpture as well.

Distribution

E. fallifax is typical of the Opalinum and Murchisonae Zones of Europe (Italy, Spain, Portugal, France, Great Britain, Germany, Greece – GÉCZY, 1966:108, CALLOMON & CHANDLER, 1994:21, PALLINI et al., 2005:17), as well as it is known from North Africa (ELMI, 1986:233, SADKI, 1996:127), from the Caucasus (KRYMHOLZ, 1961, NUTSUBIDZE, 1966), Thailand (BRAUN & JORDAN, 1976), North America and ?New Zealand (WESTERMANN, 1980, WESTERMANN et al., 2000, HUDSON, 2003). In Hungary the species has been documented from the Aalenian of Csernye (GÉCZY, 1966:108), and it is typical of the Opalinum and Murchisonae Zones of the Gerecse assemblage.

Subgenus *Abbasitoides* GÉCZY, 1966

Type species: *Coeloceras modestum* VACEK, 1886

The type species (VACEK, 1886, p. 100, pl. 17, fig. 4-6) was designated by GÉCZY (1966:115).

Diagnosis

Small-sized, subserpenticone form with gradually growing coiling and wide umbilicus. The whorl-section is subcircular, the ribbing is weakly developed without tubercles. No keel is present, the venter is divided by a smooth band. Erycitid suture-line with short E, long, ramified L, divided, oblique U.

Remarks

The last period of the phylogeny of Erycitinae is characterised by the gradually reduced size of the shell. *Malladaites*, *Abbasites*, *Ambersites* and *Abbasitoides* are all small-sized forms. Only the latter taxon can be investigated from the Hungarian erycitid materials, furthermore, comparing to the Csernye sample (29 specimens), the occurrence of *Abbasitoides* (2) has not been considerable in the Gerecse assemblage.

The close resemblance of *C. modestum* and the *Erycites* group was already emphasized by VACEK (1886:100) and PRINZ (1904:100), and both authors regarded the former taxon as the direct ancestor of the stephanoceratids. The species was classified later within *Docidoceras* by ARKELL (1956:177) and LELIÈVRE (1960:47). The erycitid character of the suture-line, as well as the phylogenetic importance of *C. modestum* was underlined by WESTERMANN (1964). Based on the suture construction and the ventral interruption of the ribbing, GÉCZY (1966:115) distinguished the taxon from the genera *Coeloceras* and *Docidoceras*, and placed it into *Erycites*. Moreover, having created the new subgenus *Abbasitoides*, GÉCZY regarded it as a taxonomically independent group: *Erycites (Abbasitoides) modestus* (VACEK), *E. (Abbasitoides) modestus crassornatus* n. subsp., *E. (Abbasitoides) modestus compressus* (PRINZ).

The morphological similarity of *A. modestus* and *Docidoceras planulatum* BUCKMAN was also noted by GÉCZY, however, without reclassification of the latter. (The taxonomic position of *D. planulatum* has been recently discussed by CHANDLER & DIETZE (2004:223). Accordingly, *Mollistephanus planulatus* (BUCKMAN) appears to be a connection form between *Riccardiceras* and *Mollistephanus* as the earliest representative of the latter genus.)

Distribution

The subgenus is known from the Aalenian of Europe and North Africa.

Abbasitoides modestus (VACEK, 1886)
(Pl. 9, fig. 2-3, Pl. 13, fig. 2)

- 1886 *Coeloceras modestum* n. sp., VACEK, p. 100, pl. 17, fig. 4-6
 1904 *Coeloceras modestum* VACEK, PRINZ, p. 100, PL.25, FIG. 3
 1923 *Coeloceras modestum* VACEK, RENZ, pl. 12, fig. 10
 1964 *Erycites* (n. subgen.?) *modestus* (VACEK), WESTERMANN, pl. 6, fig. 8
 1966 *Erycites (Abbasitoides) modestus* (VACEK, 1886), GÉCZY, p. 116-117, fig. 102, pl. 33, fig. 1, pl. 44, fig. 5
 1970 *Erycites (Abbasitoides) modestus* (VACEK), FISCHER, p. 602, pl. 4, fig. 7
 1988 *Abbasitoides modestum* (VAC.), LINARES et al., pl. 2, fig. 4
 1990 *Stephanoceras (Abbasitoides) modestum* (VACEK), CALLOMON & CHANDLER, pl. 1, fig. 2
 1990 *Stephanoceras (Abbasitoides) aff. modestum* (VACEK), CALLOMON & CHANDLER, pl. 1, fig. 3-4
 1995 *Abbasitoides modestus* (VACEK), WESTERMANN, p. 114, pl. 17, fig. 4
 2001 *Erycites (Abbasitoides) modestus* (VACEK), RULLEAU et al., pl. 29, fig.3-4

Material: two poorly preserved internal moulds

Dimensions

specimen	D	H	h	W	w	U	u
ETB30B	43	14	32%	14	100%	21	49%
ETA7	35	12	34%	12	100%	14	40%

Description

Small-sized, subserpenticone form with a wide and shallow umbilicus. The coiling is gradually grown, the last whorl is wider than the penultimate. The flanks are convex without umbilical and ventrolateral margins. The venter is broad and rounded, the whorl-section is subcircular with maximum width at the mid-height. The ornamentation consists of fine ribbing, which persists throughout the whorls. The primaries emerging from the umbilicus bifurcate at the mid-flank. The secondaries that first bend slightly backward, curve forward on the venter, and fade away in the middle. They alternate with a narrow smooth band between them. The example ETB30 bears 32 ribs on the outer part of the last half whorl. Although the body chamber of the latter specimen is preserved, its exact length cannot be observed due to the corroded surface. The simple peristome is slightly projected, without constriction. Due to the state of preservation, the suture-line is not visible.

Remarks and comparison

The classification of the species has been controversial. The taxon was regarded as belonging to *Stephanoceras*, as the microconch of

„*Stephanoceras*” (M) *longalvum* (VACEK) by CALLOMON & CHANDLER (1990). It was also considered as the earliest representative of the Otoitidae as *Stephanoceras (Abbasitoides) modestum* by PAGE (1993:217). As opposed to this, based on the suture-line structure, the ventral interruption and the simple aperture, WESTERMANN (1964, 1995) has always regarded *A. modestus* as a small-sized erycitid macroconch.

Both Gerecse specimens, as well as the Csernye material are slightly larger than the holotype (VACEK, 1886:100, pl. 17, fig. 4-6). The example ETB30B (Pl. 9, fig. 2-3) being a more evolute form resembles the Csernye sample and the specimen figured by CALLOMON & CHANDLER (1990, pl. 1, fig. 3), while the example ETA7 (Pl. 13, fig. 2) having narrower umbilicus is closer to the type and the specimens figured by RULLEAU et al. (2001, pl. 29, fig. 3-4) and CALLOMON & CHANDLER (1990, pl. 1, fig. 2).

Distribution

Italy – Cap San Vigilio: Lower Dogger (VACEK, 1886:100), Valdorbia: Murchisonae Zone (BONARELLI, 1893), Fonte Caldarene, Cesi, Terni: Lower Dogger (RENZ, 1923:268), Gorgo a Cerbara: Murchisonae Zone (Haugi Subzone) (KÄLIN & URETA, 1987:505) Monte Nerone: Murchisonae Zone (CECCA et al., 1990, CRESTA, 1996), Fallifax Biozone (CRESTA, 1994:115), Opalinum – Murchisonae Zones (CALLOMON et al., 1995), Colle d’Orlando: Murchisonae Zone (Parisi et al., 1998:23), Mt. Magaggiaro: Lower Aalenian (PALLINI et al., 2005)

Spain – Cordilleras Béticas: Comptum Subzone – Concavum Subzone (LINARES et al., 1988, HENRIQUES et al., 1996:145), Cuenca Ibérica: Murchisonae Biozone (FERNÁNDEZ-LÓPEZ & GÓMEZ, 1990:75), Sierra de San Pedro: Murchisonae Zone (LINARES & SANDOVAL, 1992:96), Sierra de Ricote: Comptum Subzone – Murchisonae Zone (GARCIA-GÓMEZ et al., 1994:213), Cerro Méndez 2. sect.: Comptum Subzone – Murchisonae Zone (GARCIA-GÓMEZ et al., 1994:216), Zegri Norte: Opalinum – Murchisonae Zones (GARCIA-GÓMEZ et al., 1994:217), Llaberia: Aalenian (FERNÁNDEZ-LÓPEZ et al., 1998:215)

Austria – Nordtirol, Scheibelberg II: Murchisonae Zone (FISCHER, 1970:602)

Portugal – North Lusitanian Basin: Bradfordensis Subzone (HENRIQUES, 1995:231)

Greece – Leukas (Anavrysada) (RENZ, 1906:753)

Great Britain – Chideock: Murchisonae Zone and Subzone, Horn Park: Concavum Zone and Subzone, Formosum Subzone (CALLOMON & CHANDLER, 1990)

France – La Roche, La Verpillière: Haut-Atlas Central: Concavum Zone (SADKI, 1996:127)
 Bradfordensis Subzone (RULLEAU et al., 2001)
 Morocco – Krendegg: Murchisonae Zone (LELIEVRE, 1960:47), Almou-Abtouri: Murchisonae Zone (DUBAR et al., 1971:402),
 Hungary – Csernye: Upper Aalenian (GECZY, 1966:117), Gerecse Mts: Opalinum and Murchisonae Zones

Evaluation of the Erycitinae of the Gerecse fauna

246 specimens are classified within the subfamily Erycitinae from the Gerecse assemblage. In spite of the mediocre or poor state of preservation of inner casts in the „Ammonitico Rosso marl” facies, 47% of the specimens can be identified on species level. Two genera, one subgenus, 15 species could be distinguished by 117 determined specimens.

Meneghinii to the uppermost Opalinum Zones, with a percentage of 52% in the Aalensis Zone (Figure 3). Its highest diversity can be proved from the Aalensis and Opalinum Zones with 8 species. The numbers of the erycidid species and specimens are plotted in Figure 13.

Cagliceras elaphum ranging from the uppermost Speciosum to the middle Opalinum Zones form the largest part of species with 32 specimens. *Erycites ovatus* and *E. barodiscus* also have a long range of four zones. Four taxa are restricted to only one zone: *Cagliceras picenum* and *C. enigmaticum* (Speciosum Zone), *C. costulosum* and *E. gerecsensis* n. sp. (Aalensis Zone), *Erycites* sp. aff. *reussi* (Murchisonae Zone). The ratio of the subfamily decreased in the Murchisonae Zone, only two taxa show gradual progression (*E. fallifax*, *E. intermedius*). Due to the uncertain presence of the Concavum Zone, the Erycitinae cannot be documented from the Upper Aalenian. Zonal changes of the numbers of specimens of the five most common taxa are plotted in Figure 14.

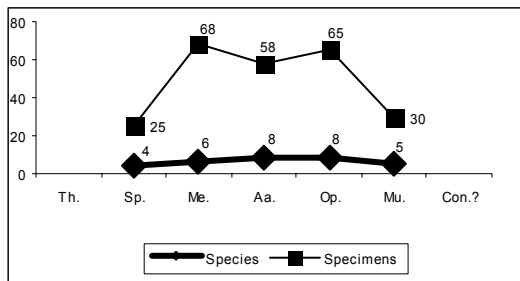


Figure 13. Change of number of the Erycitinae species and specimens (Speciosum to Murchisonae Zones)

Considering the entire fauna in the Upper Toarcian–Middle Aalenian, the erycidids form a significant part of the material from the

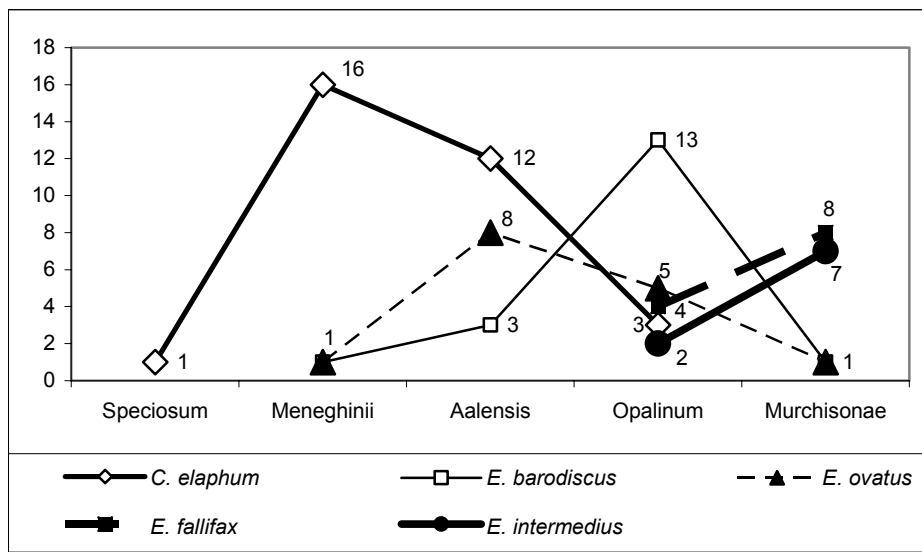


Figure 14. Numbers of *Cagliceras elaphum* (MERLA), *Erycites barodiscus* GEMMELLARO, *E. ovatus* GÉCZY, *E. fallifax* ARKELL, and *E. intermedius* HANTKEN in PRINZ (Speciosum to Murchisonae Zones) in the Gerecse sections

If the Csernye fauna is compared to that of the Gerecse Mts, it is important to underline the fact that the Csernye section is under-represented by the Middle – Upper Toarcian sequences (GÉCZY, 1966). Consequently, the 311 erycitid specimens described by GÉCZY were mainly Aalenian Erycitinae taxa. 181 specimens represent the *Erycites fallifax* group, while the Upper Aalenian *E. intermedius* (46), *E. partschi* (11) and specimens belonging to the subgenus *Abbasitoides* (29) also formed a significant part in the whole material. The diversity and number of the Upper Toarcian erycitid taxa (*Erycites elaphus*: 1, *E. sp. cf. robustus*: 1, *E. sp. cf. rotundiformis*: 1), and the number of species flourishing around the Toarcian–Aalenian boundary (*E. subquadratus*: 8, *E. ovatus*: 3) was markedly low. The quantitative distinction of the two faunas can be explained by the different ages of the successions, because the taxonomical and morphological affinities are strikingly close between the two assemblages, e.g. they have 9 taxa in common, and the high diversity of the subfamily in both regions is also worth mentioning. On the other hand, the proportion of the Erycitinae is closer to the data published from Italy and Portugal. The subfamily forms the highest ratio in the Ammonitina fauna from the upper Opalinum Zone (*Csernyeiceras verpillierense* biozone) to the lower part of the Murchisonae Zone (*Abbasitoides modestus* biozone) (GÉCZY, 1967:258).

The diversity of the Gerecse erycitids is in accordance with that of the Lower – Middle Aalenian succession at San Vigilio (CALLOMON et al., 1995). However, on the basis of the published data from different European Aalenian localities, the average diversity of other coeval faunas seems to be lower, 2-6 erycitid species per zone

(CALLOMON & COPE, 1995, CRESTA, 1996, HENRIQUES, 1995, 2000, PARISI et al., 1998). LINARES et al. (1988) documented 9 taxa from the Murchisonae Zone in the Betic Cordillera, more species (11) are known only from Csernye (GÉCZY, 1966). Regarding the stratigraphic distribution, as well as the change in diversity and in proportions of the subfamilies, the Gerecse material differs from those of Italy and Portugal. In the Gerecse Mts the Erycitinae reached its highest proportion in the entire fauna as early as the Aalensis Zone, and it shows a gradual decline from the Opalinum Zone, with only 14% in the Murchisonae Zone (Figure 3). In Italy, on the other hand, the subfamily forms 56% in the Opalinum Zone, and 23% in the Murchisonae Zone at Gorgo a Cerbara (see KÄLIN & URETA, 1987), its acme occurred in the Murchisonae Zone at Colle d'Orlando (PARISI et al., 1998), and it flourished in the Lower – Middle Aalenian of the Umbria Marche Apennines (CRESTA, 1994, 1996). In Portugal, the Erycitidae is not typical of the Opalinum Zone of the North Lusitanian Basin, it appears only in the Bradfordensis Subzone (14%), reaches 28% in the Concavum Subzone and shows a decline with 15% in the Limitatum Subzone (HENRIQUES, 1995:232, and see HENRIQUES et al., 1995). The abundance of the subfamily is similar at the Zambujal de Alcaria section, where it forms 4% in the Opalinum Zone, 10% in the Bradfordensis Zone and 12% in the Concavum Zone (HENRIQUES, 2000:90).

A full-scope quantitative, taxonomic and paleobiogeographic evaluation of the Upper Toarcian – Aalenian Ammonitina material of the Gerecse Mts, including other subfamilies as well, requires more revisionary research, which is in progress.

Acknowledgements

The authors are grateful to the following for professional help and advice: András GALÁ CZ and István SZENTE (Eötvös Loránd University, Budapest), László KORDOS (Geological Institute of Hungary), Klára KISDY (Pázmány Péter Catholic

University, Piliscsaba), Gemma MARTINEZ GUTIÉRREZ and Soledad URETA GIL (Universidad Complutense Madrid), Federico VENTURI (Università degli Studi di Perugia), and Marc BÉCAUD (Lyon).

References

- ARKELL W.J. 1956: Jurassic Geology of the World, pp. 806, Edinburgh
- ARKELL W.J. 1957: Mesozoic Ammonoidea – In: MOORE R.C. (editor): Treatise on Invertebrate Paleontology, Part L, Mollusca 4, Cephalopoda, Ammonoidea, p. 80-471, Kansas and New York
- BARBERA C. 1967: Ammoniti Giurassici del Gran Sasso e dell'Aquilano – Atti dell'Accademia delle Scienze Fisiche e Matematiche Ser. 3, Vol. 6, p. 227-313, Napoli
- BECAUD M., RULLEAU L. & ELMI S. 2005: Le renouvellement des faunes d'ammonites à la limite Toarcien moyen – Toarcien supérieur dans les

- domaines du nord-ouest de l'Europe et de la Téthys occidentale – Bulletin de la Société Géologique de France 176/1, p. 23-35, Paris
- BENECKE E.W. 1865: Über Trias und Jura in den Südalpen – Geognostische-paläontologische Beiträge 1, pp. 205, München
- BONARELLI G. 1899: Le Ammoniti del „Rosso Ammonitico” descritte e figurate da Giuseppe Meneghini – Bullettino della Società Malacologica Italiana 20, p. 198-219, Pisa
- BRAUN, E. (VON) & JORDAN R. 1976: The Stratigraphy and Paleontology of the Mesozoic Sequence in the Mae Sot Area in Western Thailand – Geologisches Jahrbuch, Reihe B 21, p. 5-51, Hannover
- BUCKMAN S.S. 1921: Type Ammonites 4 – In: BUCKMAN S.S. (1909-1930): Type Ammonites, Vol. 1-7, 790 pl., London
- CALLOMON J.H. 1980: Dimorphism in Ammonoids – In: The Ammonoidea (ed. M.R. HOUSE & J.R. SENIOR) Systematics Association Spec. Vol. 18, p. 257-273, Acad. Press, London, New York
- CALLOMON J.H. 1984: A Review of the Biostratigraphy of the Post-Lower Bajocian Jurassic Ammonites of Western and Northern North America – In: Jurassic – Cretaceous Biochronology and Paleogeography of North America (ed.: G.E. WESTERMANN), Geological Association of Canada Special Paper 27, p. 143-174
- CALLOMON J.H. & CHANDLER R.B. 1990: A review of the ammonite horizons of the Aalenian – Lower Bajocian Stages in the Middle Jurassic of Southern England – Memorie Descrittive della Carta Geologica d'Italia, 40, p. 85-112
- CALLOMON J.H. & CHANDLER R.B. 1994: Some early Middle Jurassic ammonites of Tethyan affinities from the Aalenian of southern England – Palaeopelagos, Special Publication 1, p. 17-40
- CALLOMON J.H., CRESTA S. & PAVIA G. 1995: A revision of the classical Aalenian succession in the Middle Jurassic of San Vigilio, Lake Garda, Northern Italy – Geobios, Mém. Spéc., 17, p. 103-110, Lyon
- CALLOMON J.H. & COPE J.C.W. 1995: The Jurassic Geology of Dorset – Field Geology of the British Jurassic (P.D. TAYLOR ed.), p. 51-103, Geological Society London
- CASSEL Y. 1997: Évolution géodynamique de la marge cévenole entre Saint-Ambroix et Aduze (Gard septentrional) de l'Hettangien au Bajocien inférieur – Documents des Laboratoires de Géologie Lyon 144, pp. 313, Lyon
- CECCA F., CRESTA S., PALLINI G. & SANTANTONIO M. 1990: Il Giurassico di Monte Nerone (Appennino marchigiano, Italia Centrale): biostratigrafia, litostratigrafia ed evoluzione paleogeografica – In: Atti II Convegno Int. „Fossili, Evoluzione, Ambiente” (ed. PALLINI G.), p. 63-139
- CHANDLER R.B. & DIETZE V. 2004: New data on the Lower Bajocian (Middle Jurassic) ammonite genus *Mollistephanus* Buckman, 1921 from southern England – Proceedings of the Geologists' Association 115, p. 221-234
- CONTINI D., ELMI S., MOUTERDE R. & RIOULT M. 1997: Aalénien – In: CARIOU E. & HANTZPERGUE P. (eds.): Biostratigraphie du Jurassique ouest-européen et méditerranéen – Bulletin du Centre des Recherches, Elf Explor. Prod. Mém. 17, p. 37-40, Pau Cedex
- COX B.M. & SUMBLER M.G. 2002: British Middle Jurassic Stratigraphy – Geological Conservation Review, Vol. 26, pp. 508
- CRESTA S. 1994: Distribution stratigraphique des Hammatoceratidae au Toarcien et Aalénien des Apennins d'Ombrie Marches (Italie) – In: Proceedings of 3rd International Meeting on Aalenian and Bajocian Stratigraphy (ed. CRESTA S. & PAVIA G.), Miscellanea 5, Servizio Geologico Nazionale, p. 113-115, Roma
- CRESTA S. 1996: Aalenian Ammonite Biostratigraphy in Northern Apennines (Italy) – GeoResearch Forum Vols. 1-2, p. 135-138
- CRESTA S. 1997: Hammatoceratidi aaleniani di Monte Erice (Sicilia occidentale, Italia) – Bollettino del Servizio Geologico d'Italia, 114 (1995), p. 27-56, Roma
- CRESTA S. 2002: *Erycites sutneri* GEMMELLARO, 1886, *Erycites barodiscus* GEMMELLARO, 1886 – In: Revision of Jurassic ammonites of the Gemmellaro collections, Quaderni del Museo Geologico „G.G. Gemmellaro”, coord. PAVIA G. & CRESTA S.), p. 196-199, Palermo
- CRESTA S. & GALÁ CZ, A. 1990: Mediterranean basal Bajocian ammonite faunas. Examples from Hungary and Italy – Memorie Descrittive della Carta Geologica d'Italia 40, p. 165-198
- CRESTA S., PALLINI G. & VENTURI F. 1989: Jurassic ammonite assemblages in the Valdorbia section – In: Stratigrafia del Mesozoico e Cenozoico nell'area Umbro – Marchigiana, Memorie Descrittive della Carta Geologica d'Italia (ed. CRESTA S., MONECHI S. PARISI G.), 39, p. 89-94
- CSÁSZÁR G., GALÁ CZ A. & VÖRÖS A. 1998: Jurassic of the Gerecse Mountains, Hungary: facies and Alpine analogies (in Hungarian) – Földtani Közlemény 128/2-3, p. 397-435, Budapest
- DEZI R. & RIDOLFI S. 1978: Fauna Ammonitica del Toarciano Superiore di Monte Carcator (Cingoli-Marche) – Tip. Litocompagnucci, pp. 73, Macerata
- DIETZE V., CHANDLER R.B., SCHWEIGERT G. & Auer W. 2001: New Stephanoceratids (Ammonitina) from the Lower Bajocian of Bruton (Somerset, S England) and Achdorf (Wutach area, SW Germany) – Stuttgarter Beiträge zur Naturkunde, Ser. B, 312, pp. 21, Stuttgart
- Donovan D.T. 1958: The Ammonite Zones of the Toarcian (ammonitico rosso facies) of Southern Switzerland and Italy – Eclogae Geologicae Helvetiae 51, p. 33-60, Basel
- DONOVAN D.T., CALLOMON J.H. & HOWARTH M.K. 1981: Classification of Jurassic Ammonitina – In: The Ammonoidea (ed. M.R. HOUSE & J.R. SENIOR) Systematics Association Spec. Vol. 18, p. 101-155, Acad. Press, London and New York
- DUBAR G., ELMI S., MOUTERDE R. & RUGET-PERROT Ch. 1971: Divisions et limites de l'Aalénien (sud-est de la France et quelques régions Meridionales) – In: Colloque du Jurassique a Luxembourg 1967,

- Memoires du Bureau de Recherches Géologiques et Minières 75, p. 397-410, Paris
- DUMORTIER E. 1874: Études paléontologiques sur les dépôts jurassiques du Bassin du Rhone. T. IV.: le Lias supérieur (ed. F. Savy), p. 1-252, Paris
- EBLI O. 1997: Sedimentation und Biofazies an passiven Kontinentalrändern: Lias und Dogger des Mittelabschnittes der Nördlichen Kalkalpen und des frühen Atlantik (DSDP site 547B, offshore Marokko) – Münchner Geowissenschaftliche Abhandlungen Reihe A 32, pp. 256, München
- ELMI S. 1963: Les Hammatoceratinae (Ammonitina) dans le Dogger inférieur du Bassin Rhodanien – Travaux du Laboratoire de Géologie n.s. 10, pp. 144, Saint-Étienne
- ELMI S. 1986: Corrélations biostratigraphiques et mégaséquentielles dans le jurassique inférieur et moyen d'Oranie comparaisons avec les régions voisines – Revue de la Faculté des Sciences de Marrakech, Section Sciences de la Terre 183, p. 225-247, Marrakech
- ELMI S., ATROPS F. & MANGOLD C. 1974: Les Zones d'Ammonites du Domérien – Callovien de l'Algérie occidentale – Documents des Laboratoires de Géologie de la Faculté des Sciences de Lyon 61, pp. 83, Lyon
- ELMI S. & RULLEAU L. 1991: Le Toarcien des Carrières Lafarge (Bas-Beaujolais, France): cadre biostratigraphique de référence pour la région lyonnaise – Geobios, 24/3, p. 315-331
- ELMI S. & RULLEAU L. 1993: Le Jurassique du Beaujolais Méridional, bordure orientale du Massif Central, France – Geobios, M.S. 15, p. 139-155
- ELMI S., RULLEAU L., GABILLY J. & MOUTERDE R. 1997: Toarcien In: CARIOU E. & HANTZPERGUE P. (eds.): Biostratigraphie du Jurassique ouest-européen et méditerranéen – Bulletin du Centre des Recherches, Elf Explor. Prod. Mém. 17, p. 25-36, Pau Cedex
- ELMI S., MOUTERDE R., ROCHA R.B. & RULLEAU L. 2007: Une succession de référence pour le Toarcien Moyen et Supérieur: les «Margas calcárias de Sao Gíao» dans les environs de Cantanhede (sous-bassin nord lusitanien, Portugal) – Ciências da Terra (UNL) 16, p. 113-133, Lisboa
- FAURÉ PH. & ALMÉRAS Y. 2006: Le Dogger de la partie orientale des Pyrénées franco-espagnoles (Aude, France et Haute-Catalogne, Espagne) – Revue de Paléobiologie, 25/2, p. 643-670, Genève
- FERNÁNDEZ-LÓPEZ S. & GÓMEZ J.J. 1990: Facies aalenienses y bajocienses, con evidencias de emersión y carstificación, en el sector central de la Cuenca Ibérica. Implicaciones paleogeográficas – Cuadernos de Geología Ibérica 14, p. 67-111, Madrid
- FERNÁNDEZ-LÓPEZ S., AURELL M., GARCIA JORAL F., GÓMEZ J.J., HENRIQUES M.H.P., MARTÍNEZ G., MELÉNDEZ G. & SUÁREZ VEGA L.C. 1998: La Plataforma de Tortosa (Cuenca catalana) durante el Jurásico Medio: unidades litoestratigráficas, paleogeografía y ciclos ambientales – Cuadernos de Geología Ibérica 24, p. 185-221, Madrid
- FISCHER R. 1969: Roten Ammonitenkalk und Radiolarit aus dem unteren Dogger der Kammerker (Nordtirol) – Mitteilungen Bayerische Staatssammlung für Paläontologie und historische Geologie 9, p. 93-116, München
- FISCHER R. 1970: Ammoniten aus dem Aalenium der nördlichen Kalkalpen – Neues Jahrbuch für Geologie und Paläontologie 10, p. 585-604, Stuttgart
- FOSSA-MANCINI E. 1914: Osservazioni critiche sugli „Hammatoceras” – Atti della Società Toscana di Scienza Naturali Proc. verb. 23, p. 59-86, Pisa
- FOSSA-MANCINI E. 1915: Lias e Giura nella Montagna della Rossa – Atti della Società Toscana di Scienza Naturali Mem. 30, p. 220-247, Pisa
- FOUCAULT A. 1971: Le jurassique dans la partie orientale des zones externes des Cordillères Bétiques: le Prébétique et le Subbétique de Cazorla à Huéscar – Cuadernos Geologia Ibérica 2, p. 137-156, Madrid
- GARDET G. & GÉRARD C. 1946: Contribution à l'étude paléontologique du Moyen-Atlas Septentrional – Notes et Mémoire du Service Géologique du Maroc 64, pp. 88, Laval
- GARCIA-GÓMEZ R., JIMÉNEZ A.P., LINARES A., RIVAS P. & Sandoval J. 1994: The Toarcian-Aalenian boundary in the Betic Cordillera (Southern Spain) – Geobios, M.S. 17, p. 211-222
- GARIEL O. 1961: Le Lias du Dome de Remollon (Haute-Alpes) – In: Colloque sur le Lias français, Mémoires du Bureau de Recherches Géologiques et Minières 4, p. 697-706, Paris
- GÉCZY B. 1965: Hammatoceraten und Eryciten (Ceph.) aus dem Oberlias von Úrkút – Annales Universitatis Scientiarum Budapestinensis de Rolando Eötvös nominatae, Sectio Geologica 8 (1964), p. 17-34, Budapest
- GÉCZY B. 1966: Ammonides Jurassiques de Csernye, Montagne Bakony, Hongrie, Part I. (Hammatoceratidae) – Geologica Hungarica Series Palaeontologica 34, pp. 276, Budapest
- GÉCZY B. 1967: Ammonides Jurassiques de Csernye, Montagne Bakony, Hongrie, Part II. (excl. Hammatoceratidae) – Geologica Hungarica Series Palaeontologica 35, pp. 413, Budapest
- GÉCZY B. 1968: Deformed Jurassic Ammonoids from Úrkút (Bakony Mountains, Transdanubia) – Annales Universitatis Scientiarum Budapestinensis de Rolando Eötvös nominatae, Sectio Geologica 11 (1967), p. 117-132, Budapest
- GÉCZY B. 1976: Jelentés a nagypisznicsei aaleni ammonitesfaunáról – ELTE, pp. 34, Budapest
- GÉCZY B. 1977: Toarci ammonitesek Nagypisznicéről (Gerecse hegység) – ELTE, pp. 103, Bp.
- GÉCZY B. 1978: Előzetes jelentés a kis-gerecsei jura ammonitesek vizsgálatáról – ELTE, pp. 107, Bp.
- GÉCZY B. 1979: Előzetes jelentés a tölgyháti jura ammonitesekről – ELTE, pp. 83, Bp.
- GÉCZY B. 1980: Jelentés a tölgyháti köfajtó toarci – aaleni rétegeinek ammonitesfaunájáról – ELTE, pp. 71, Bp.
- GÉCZY B. 1981: Előzetes jelentés a Bánya-hegy (Gerecse hegység) toarci ammonitesfaunájáról – ELTE, pp. 71, Bp. (The reports are placed in the Databank of Hungarian Office for Mining and Geology.)

- GÉCZY B. 1984: Provincialism of Jurassic Ammonites, examples from Hungarian faunas – *Acta Geologica Hungarica* 27/3-4, p. 379-389, Budapest
- GÉCZY B. 1985a: Toarcian Ammonite Zones in the Gerecse Mountains, Hungary – In: *International Symposium on Jurassic Stratigraphy (Erlangen)* (ed. MICHELSEN O. & ZEISS A.) I, p. 218-226, Copenhagen
- GÉCZY B. 1985b: Toarcian ammonite zones in the Gerecse Mountains – *Földtani Közlöny* 1985, 115/4, p. 363-368, Budapest (in Hungarian)
- GÉCZY B. 1990: Palaeobiogeographic evaluation of Toarcian Ammonoidea in the Mediterranean and stable European regions – *Általános Földtani Szemle* 25, p. 231-249, Budapest (in Hungarian)
- GÉCZY B. & SZENTE I. 2007: Middle Toarcian Ammonitina from the Gerecse Mts, Hungary – *Acta Geologica Hungarica* 49/3, p. 223-252, Budapest
- GEMMELLARO G. 1886: Sul Dogger inferiore di Monte San Giuliano (Erice) – *Giornale di Scienze Naturali ed Economiche* 17 (1885-1886), p. 197-213, Palermo
- GOY A. & ALFÉREZ F. 1974: Algunas observaciones sobre la Bioestratigrafía del Lías de Maranchón (Guadalajara) – Publicado en COL-PA 25, pp. 3, Madrid
- GOY A., MARTÍNEZ G. & URETA S. 1995: Ammonitina (Hammatoceratidae) of the Toarcian and Aalenian in the Serra de Llevant (Isle of Mallorca, Spain) – *Hantkeniana* 1, p. 97-104, Budapest
- HAHN F.F. 1910: Geologie der Kammerker-Sonntagshorngruppe – *Jahrbuch der k.k. Geologischen Reichsanstalt* 60, p. 311-420, Wien
- HAUER R. 1856: Über die Cephalopoden aus dem Lias der Nordöstlichen Alpen – *Denkschriften der k. Akademie der Wissenschaften zu Wien Math.-Naturhist. Cl.* 11, Wien
- HENRIQUES M.H. 1995: Les faunes d'ammonites de l'Aalénien portugais: composition et implications paléobiogéographiques – *Geobios*, M.S. 18, p. 229-235
- HENRIQUES M.H. 2000: Aalenian of the Zambujal de Alcaria Section (Central Lusitanian Basin, Portugal) – *GeoResearch Forum* Vol. 6, p. 85-94
- HENRIQUES M.H., LINARES A., SANDOVAL J. & URETA M.S. 1995: The Aalenian in the Iberia (Betic, Lusitanian and Iberian Basins) – *GeoResearch Forum* Vols. 1-2, p. 139-150, Zurich
- HUDSON, N. 2003: Stratigraphy and correlation of the Ururoan and Temaikan Stage (Lower-Middle Jurassic, ?Sinemurian-Callovian) sequences, New Zealand – *Journal of the Royal Society of New Zealand*, 33/1, p. 109-147
- IMLAY R.W. 1984: Early and Middle Bajocian (Middle Jurassic) Ammonites from Southern Alaska – U.S. Geological Survey Professional Paper 1322, pp. 46, Washington
- IMLAY R.W. & DETTERMAN R.L. 1973: Jurassic Paleobiogeography of Alaska – Geological Survey Professional Paper 801, pp. 34, Washington
- IPPOLITOV A.P., TISCHENKO A.I., ROGOV M.A., ALEKSEEV A.S. & BECAUD M. 2008: On the record of boulder of Upper Toarcian limestone in the vicinities of Simpheropol and its implication for interpretation of geological structure of Mountain Crimea – *News in regional geology of Russia and adjacent areas. Material of Meeting*, p. 43-46, Moscow (in Russian)
- KÄLIN O. & URETA S. 1987: El Lias superior y el Dogger inferior en Gorgo a Cerbara (Apenino Central): Aspectos bioestratigráficos y sedimentológicos – *Estudios Geológicos* 43, p. 489-511, Madrid
- KOTTEK A. 1963: Die Ammonitenabfolge des griechischen Toarcien, pp. 157, Tuebingen
- KRYMHOLZ G. 1961: Lower and Middle Jurassic Ammonites of North-Caucasus, pp. 146, Leningrad (in Russian)
- KVANTALIANI I.V., LOMINADZE T.A., TOPCHISHVILI I.M.V. & SHARIKADZE M.Z. 1999: Systematics and Phylogeny of Mesozoic Ammonitida – *Georgian Academy of Sciences Geological Institute Proceedings*, New series 113, pp. 160, Tbilisi
- LELIÈVRE TH. 1960: Étude des Ammonites de l'Aalénien de deux gisements du Nord du Maroc – *Annales de la Societe Géologique du Nord* 80: 15-52, Lille
- LINARES A. & RIVAS P. 1971: Metacronia del ammonitico rosso liasico en la zona Subbética, Sector Central – *Cuadernos Geologia Ibérica* 2, p. 183-204, Madrid
- LINARES A. & SANDOVAL J. 1986: *Malladaites* nov. gen. et *Spinammatoceras* Hammatoceratidae, Ammonitina) de l'Aalénien de la zone Subbétique, Sud de l'Espagne – *Geobios* 19/2, p. 207-224, Lyon
- LINARES A. & SANDOVAL J. 1996: The genus *Haplopleuroceras* (Erycitidae, Ammonitina) in the Betic Cordillera, Southern Spain – *Geobios* 29/3, p. 287-305
- LINARES A., URETA M.S. & SANDOVAL J. 1988: Comparison between the Aalenian Ammonite associations from the Betic and Iberian Cordilleras: elements of correlation – In: *2nd International Symposium on Jurassic Stratigraphy*, pp. 193-208, Lisboa
- MARIOTTI N., SANTANTONIO M. & WEIS R. 2008: Aalenian – Early Bajocian Belemnite assemblage from Peri-Mediterranean Tethyan sediments (Calabria, Southern Italy) – *Geologica Romana* 40 (2007), p. 1-19, Roma
- MARTINEZ G. 1992: Hammatoceratinae (Ammonitina) del Toarciense Superior y Aaleniense en la Cordillera Iberica – *Universidad Complutense de Madrid*, pp. 331, Madrid
- MAUBEUGE P.L. & LAMBERT R. 1955: Sur quelques Ammonites aaléniennes d'Argentine – *Bulletin de la Société Belge de Géographie* 64, p. 620-624, Bruxelles
- MAXIA C. 1943: La serie liasica nei Monti Cornicolani e Lucretili (Preappennino Romano) – *Bollettino della Società Geologica Italiana* 62, p. 73-123, Roma
- MENEGHINI J. 1867-1881: Monographie des fossiles du calcaire rouge ammonitique (Lias supérieur) de Lombardie et de l'Apennin Central – In: *Stoppani A.: Paléontologie Lombarde*, 4 ser., pp. 242, Milan

- MERLA G. 1934: Ammoniti Giuresi dell'Appennino Centrale. II. Hammatoceratinae – *Palaeontographia Italica* 34 (1933): 1-29, Siena
- MOUTERDE R. & RUGET CH. 1967: Stratigraphie du Lias de la région d'Alvaizere – *Comunicações dos Serviços Geológicos de Portugal* 51, p. 153-168, Lisboa
- MOYNE S. & NEIGE P. 2004: Cladistic analysis of the Middle Jurassic ammonite radiation – *Geological Magazine* 141/2, p. 115-123
- MOYNE S. & NEIGE P. 2007: The space-time relationship of taxonomic diversity and morphological disparity in the Middle Jurassic Ammonite radiation – *Palaeogeography, Palaeoclimatology, Palaeoecology* 248, p. 82-95
- MOYNE S., NEIGE P., MARCHAND D. & THIERRY J. 2004: Répartition mondiale des faunes d'ammonites au Jurassique moyen (Aalénien supérieur à Bathonien moyen): relations entre biodiversité et paléogéographie – *Bulletin de la Société Géologique de France* 175/5, p. 513-523, Paris
- MYCZYNSKI R. 2004: Toarcian, Aalenian and Early Bajocian (Jurassic) ammonite faunas and biostratigraphy in the Pieciny Klippen Belt and the Tatra Mts, West Carpathians – *Studia Geologica Polonica* 123, pp. 131, Kraków
- NICOSIA U. & PALLINI G. 1978: Ammonites and calcareous nannoplankton of the Toarcian „rosso ammonitico” in the exposures of M. La Pelosa (Terni, Central Apennines, Italy) – *Geologica Romana* 16 (1977), p. 263-283, Roma
- NUTSUBIDZE K. 1966: Lower Jurassic fauna of Caucasus – *Geological Institute of Gruzija*, pp. 212, Tbilisi (in Russian)
- PAGE K.N. 1993: Mollusca: Cephalopoda (Ammonoidea: Phylloceratina, Lytoceratina, Ammonitina and Ancyloceratina) – In: *The Fossil Record* 2, (ed. BENTON M.J.), p. 213-227, London
- Page K.N. 2003: The Lower Jurassic of Europe: its subdivision and correlation – *Geological Survey of Denmark and Greenland Bulletin* 1, p. 23-59, GEUS
- Page K.N. 2008: The evolution and geography of Jurassic ammonoids – *Proceedings of the Geologists' Association* 119, p. 35-57
- PALLINI G., ELMI S. & GASPARINI F. 2005: Late Toarcian – Late Aalenian Ammonites Assemblage from Mt. Magaggiaro (Western Sicily, Italy) – *Geologica Romana* 37 (2003-2004), p. 1-66, Roma
- PARISI G., BALDANZA A., BENEDETTI L., MATTIOLI E., VENTURI F. & CRESTA S. 1998: Toarcian stratigraphy of the Colle d'Orlando section (Umbria, Central Italy, northern Apennine) – *Bollettino della Società Paleontologica Italiana* 37/1, p. 3-39, Modena
- PETTINELLI R., NOCCHI M. & PARISI G. 1997: Late Pliensbachian-Toarcian biostratigraphy and environmental interpretations in the Ionian Basin (Lefkas Island, Western Greece) as compared to the Umbria-Marchean Basin (Central Italy) – *Bollettino del Servizio Geologico d'Italia* 114 (1995): 97-158, Roma
- PINNA G. 1968: Ammoniti del Lias Superiore (Toarciano) dell'Alpe Turati (Erba, Como) – *Memorie della Società Italiana di Scienze Naturali* 17, Fasc. 1, p. 1-69, Milano
- PINNA G. 1969: Revisione delle ammoniti figurate da Giuseppe Meneghini nelle Tav. 1-22 della „Monographie des fossiles du calcaire rouge ammonitique” (1867-1881) – *Memorie della Società Italiana di Scienze Naturali* 18, Fasc. 1, pp. 16, Milano
- PRINCIPI P. 1915: Ammoniti del Lias superiore dei Monti Martani (Umbria) – *Bollettino della Società Geologica Italiana* 34., p. 429-468, Roma
- PRINZ Gy. 1904: Az északkeleti Bakony idősb jurakorú rétegeinek faunája – *M. Kir. Földtani Intézet Évkönyve* 15, p. 1-142, Budapest
- RENZ C. 1906: Die Entwicklung des Doggers im westlichen Griechenland – *Jahrbuch der k.k. Geologischen Reichsanstalt* 56, p. 745-758, Wien
- RENZ C. 1910: Stratigraphische Untersuchungen in griechischen Mesozoikum und Paläozoikum – *Jahrbuch der k.k. Geologischen Reichsanstalt* 60, p. 421-636, Wien
- RENZ C. 1923: Vergleiche zwischen dem südschweizerischen, apenninischen, und westgriechischen Jura – *Verhandlungen der Naturforschenden Gesellschaft* 34, p. 264-296, Basel
- RENZ C. 1925: Beiträge zur Geologie der Küstenregion von Epirus gegenüber der Insel Korfu – *Verhandlungen der Naturforschenden Gesellschaft* 36, p. 163-199, Basel
- RICCARDI A.C. 2001: The Podagrosiceratinae (Ammonitida) in the Upper Toarcian – Lower Bajocian (Jurassic) of Argentina – *Revue de Paléobiologie* (2000), vol. spéc. 8, p. 13-28, Genève
- ROMAN F. 1935: La fauna des minerais de fer des environs de Privas – *Travaux du Laboratoire de Géologie de la Faculté des Sciences de Lyon* 27, Mém. 23, pp. 52, Lyon
- ROMAN F. & BOYER P. 1923: Sur quelques Ammonites de la zone à „Ludwigia Murchisonae” du Lyonnais – *Travaux du Laboratoire de Géologie de la Faculté des Sciences de Lyon* 4, Mém. 4, pp. 47, Lyon
- ROUGET I., NEIGE P. & DOMMERGUES J.-L. 2004: L'analyse phylogénétique chez les ammonites: état des lieux et perspectives – *Bulletin de la Société Géologique de France* 175/5, p. 507-512, Paris
- RULLEAU L. 1996: Les Hammatoceratidae du Toarcien et de l'Aalénien de la région lyonnaise – *Section Geologie-Paleontologie du C.E. des Ciments Lafarge*, pp. 15, Lozanne
- RULLEAU L., ELMI S. & THÉVENARD B. 2001: Géologie et Paléontologie des dépôts ferrugineux du Toarcien et de l'Aalénien aux environs de Lyon – *Documents des Laboratoires de Géologie de la Faculté des Sciences de Lyon* 154, pp. 153, Lyon
- SADKI D. 1996: Le Haut-Atlas Central (Maroc). Stratigraphie et paléontologie du Lias Supérieur et du Dogger Inférieur – *Documents des Laboratoires de Géologie de la Faculté des Sciences de Lyon* 142, pp. 245, Lyon
- SANDOVAL J., LINARES A. & HENRIQUES M.H. 2001: The Middle Jurassic genus *Riccardiceras* (Otoitidae, Ammonitina) in the Westernmost Tethys: Betic

- Cordillera and Lusitanian Basin – Revue de Paléobiologie (2000) vol. spéc. 8, p. 29-44, Genève
- SATO T. 1961: Une Ammonite Aalénienne de la Région de Mae Sot, Thailand – Japanese Journal of Geology and Geography 32/1, p. 137-139, Tokyo
- SATO T. 1975: Marine Jurassic Formations and Faunas in Southeast Asia and New Guinea – Geology and Palaeontology of Southeast Asia 15, p. 151-189, Tokyo
- SCHINDEWOLF O.H. 1964: Studien zur Stammesgeschichte der Ammoniten – Abhandlungen der Mathematisch-Naturwissenschaftlichen Klasse Jahrgang 1963/6, pp. 219, Wiesbaden
- SCHLEGELMILCH R. 1976: Die Ammoniten des süddeutschen Lias, G. Fischer Verlag, pp. 212, Stuttgart – New York
- SCHLEGELMILCH R. 1985: Die Ammoniten des süddeutschen Doggers, G. Fischer Verlag, pp. 284, Stuttgart – New York
- SCHWEIGERT G. 1996: Seltene Ammoniten aus dem Opalinuston (Unter-Aalenium) des Schwäbischen Jura Baden-Württemberg) – Stuttgarter Beiträge zur Naturkunde, Ser. B, 244, p. 1-17, Stuttgart
- SCHWEIGERT G., DIETZE V. & BALLE T.H. 2000: Dimorphismus und Phylogenie der Ammonitengattung *Csernyeiceras* Géczy (Früher Mitteljura, Phlyticeratinae) – Stuttgarter Beiträge zur Naturkunde, Ser. B, 294, pp. 13, Stuttgart
- SCHWEIGERT G., DIETZE V., CHANDLER R.B. & MITTA V. 2007: Revision of the Middle Jurassic dimorphic ammonite genera *Strigoceras/Cadomoceras* (Strigoceratidae) and related forms – Stuttgarter Beiträge zur Naturkunde, Ser. B, 373, pp. 74, Stuttgart
- SEYED-EMAMI K. 1967: Zur Ammoniten-Fauna und Stratigraphie der Badamu-Kalke bei Kerman, Iran (Jura, oberes Toarcium bis mittleres Bajocium) – unpublished PhD thesis, pp. 180, München
- SEYED-EMAMI K. 1971: The Jurassic Badamu Formation in the Kerman region, with some remarks on the Jurassic stratigraphy of Iran – Geological Survey of Iran, Report 19, p. 1-80
- SEYED-EMAMI K., FÜRSICH F.T., WILMSEN M., CECCA F., MAJIDIFARD M.R., SCHAIRER G. & SHEKARIFARD A. 2006: Stratigraphy and ammonite fauna of the upper Shemshak Formation (Toarcian–Aalenian) at Tazareh, eastern Alborz, Iran – Journal of Asian Earth Sciences 28, p. 259-275
- SEYED-EMAMI K., FÜRSICH F.T., WILMSEN M., MAJIDIFARD M.R. & SHEKARIFARD A. 2008: Lower and Middle Jurassic ammonoids of the Shemshak Group in Alborz, Iran and their palaeobiogeographical and biostratigraphical importance – Acta Palaeontologica Polonica 53/2, p. 237-260, Warszawa
- SPATH L.F. 1927 -1933: Revision of the Jurassic Cephalopod fauna of Kacch (Cutch) – Palaeontologia Indica, n. s. 9/2, pp. 945, Calcutta
- SPATH L.F. 1936: On Bajocian Ammonites and Belemnites from Eastern Persia (Iran) – Palaeontologia Indica, n. s. 22/3, p. 1-21, Calcutta
- TINTANT H. & MOUTERDE R. 1981: Classification et phylogenese chez les Ammonites Jurassiques – In: International Symposium on “Concept and Method in Paleontology”, (ed. J. MARTINELL), p. 85-101, Barcelona
- VACEK M., 1886: Über die Fauna der Oolithe von Cap San Vigilio – Abhandlungen der k.k. Geologischen Reichsanstalt 12, p. 57-212, Wien
- VENTURI F. 1975: *Rarenodia* nuovo genere di ammoniti (sottofam. Hammatoceratinae Buckman 1887) del Toarciano inferiore „Rosso Ammonitico” umbromarchigiano – Bollettino della Società Paleontologica Italiana 14, p. 11-19, Modena
- VENTURI F. 1981: Hammatoceratinae, Buckman 1887, nel Toarciano medio „Rosso Ammonitico” umbromarchigiano – Bollettino della Società Paleontologica Italiana 20/1, p. 81-92, Modena
- VENTURI F. 1982: Ammoniti Liassici dell’Appennino Centrale – Tibergraph, Citta di Castello, pp. 104
- VENTURI F. 1994: Origine ed evoluzione di ammoniti Hammatoceratinae nel Toarciano umbromarchigiano – In: Palaeopelagos Special Publication 1, Fossili Evoluzione Ambiente, Atti 3. Convegno Pergola: p. 343-355, Roma
- VENTURI F. 1999: Ammonite fauna events and ecology, from the Late Sinemurian to the Early Bajocian – In: Palaeopagos Special Publication 3, Bioevents and Integrate Stratigraphy, p. 89-93
- VENTURI F. 2004: Posizione tassonomica degli Ammoniti Hammatocerataceae – Bollettino di Mineralogia e Paleontologia 6, Acqui Terme, p. 18-24
- VENTURI F. & FERRI R. 2001: Ammoniti Liassici dell’Appennino Centrale – Tibergraph, Citta di Castello, pp. 268
- VENZO S. 1952: Nuove faune ad Ammoniti de Domeriano-Aleniano dell’Alpe Turati e Dintorni (Alta Brianza) – Atti della Società Italiana di Scienze Naturali, 91, p. 95-123, Milano
- WESTERMANN G.E. 1964: Sexual-dimorphismus bei Ammonoideen und seine Bedeutung für die Taxonomie der Otoitidae – Palaeontographica Abt. A, 124/1-3, p. 33-73, Stuttgart
- WESTERMANN G.E. 1980: Ammonite Biochronology and Biogeography of the Circum-Pacific Middle Jurassic – In: The Ammonoidea (ed. M.R. HOUSE & J.R. SENIOR) Systematics Assoc. Spec. Vol. 18, p. 459-498, Acad. Press, London and New York
- WESTERMANN G.E. 1993: Global bio-events in mid-Jurassic ammonites controlled by seaways – In: The Ammonoidea (ed. M.R. HOUSE), Systematics Association Spec. Vol. 47, p. 187-226, Clarendon Press, Oxford
- WESTERMANN G.E. 1995: Mid-Jurassic Ammonitina from the Central Ranges of Irian Jaya and the origin of stephanoceratids – Hantkeniana 1, p. 105-118, Budapest
- WESTERMANN G.E. & RICCARDI A.C. 1972: Middle Jurassic Ammonoid fauna and biochronology of the Argentine-Chilean Andes Part I: Hildocerataceae – Palaeontographica Abt. A, 140/1-3, p. 1-116, Stuttgart

- WESTERMANN G.E. & RICCARDI A.C. 1979: Middle Jurassic Ammonoid fauna and biochronology of the Argentine-Chilean Andes Part II: Stephanocerataceae – *Palaeontographica Abt. A*, 164/4-6, p. 85-188, Stuttgart
- WESTERMANN G.E. & RICCARDI A.C. 1985: Middle Jurassic Ammonite evolution in the Andean Province and emigration to Tethys – In: *Sedimentary and evolutionary Cycles* (ed. Bayer, Seilacher), p. 6-34
- WESTERMANN G.E., HUDSON N. & GRANT-MACKIE J.A. 2000: Bajocian (Middle Jurassic) Ammonitina of New Zealand – *New Zealand Journal of Geology and Geophysics* 43, p. 33-57
- YIN J. 2006: Jurassic ammonites of the North Tibet – In: *Abstracts of talks and posters presented during 7. International Congress on the Jurassic System, SESSION 4: Integrated Stratigraphy*, p. 223-224, *Volumina Jurassica 4*, Warsaw

Table 1. Distribution of Ammonitina (Thouarsense to Murchisonae Zones), Kis-Gerecse section (not all beds lacking ammonite yield are marked).

BEDS	ZONES
<i>Pseudogrammoceras subfalaciosum</i> <i>Grammoceras thouarsense</i> <i>Geczyceras bonarellii</i> <i>Pseudobillia emiliana</i> <i>Geczyceras speciosum</i> <i>G. perplanum</i> <i>Crestaites victorii</i> <i>Cagliceras picenum</i> <i>Hammatocheras pachu</i> <i>Dumortieria meneghinii</i> <i>Cagliceras elaphum</i> <i>C. robustum</i> <i>C. crassiventris</i> <i>C. rotundiformis</i> <i>Planammatoceras sp.</i> <i>Erycites barodiscus</i> <i>Planammatoceras tenuisigne</i> <i>Pleydellia sp.</i> <i>Erycites ovatus</i> <i>E. gerecensis n. sp.</i> <i>E. subquadratus</i> <i>Leioceras sp.</i> <i>Tmetoceras sp.</i> <i>Csermyeiceras verpillierense</i> <i>Planammatoceras planinsigne</i> <i>Brasilia sp.</i> <i>Erycites sp. aff. reussi</i> <i>Ceccaites sieboldi</i> <i>Pseudammatoceras rugatum</i> <i>Ludwigia sp.</i> <i>Erycites fallifax</i>	Mu Op Aal Me Sp. Th
1	
4	
5	
6	
7	
8	
9	
10	
12	
15	
16	
17	
18	
19	
21	
22	
25	
31	
32	
33	
34	
37	
38	
39	
40	
41	
42	
43	
44	
45	
46	
47	
49	
50	
51	
52	
53	
54	
55	
56	
57	
58	
59	
60	
61	

Table 2. Distribution of Ammonitina (uppermost Gradata to Murchisonae Zones), Pisznice section (not all beds lacking ammonite yield are marked).

BEDS	ZONES
Gezyceras costatum	
G. clausum	
G. porcarellense	
Pseudogrammoceras bingmanni	
Grammoceras thoursense	
Gezyceras bonarellii	
G. speciosum	
Pseudolillia emiliana	
Crestaites victorii	
Gezyceras perplanum	
Crestaites meneghinii	
C. goyi	
Cagliceras enigmaticum n. sp.	
C. picenum	
C. crassiventris	
Hammatoceras insigne	
Cagliceras elaphum	
Dumortieria meneghinii	
Pleydellia laevigata	
Cagliceras robustum	
Planammatoceras sp.	
Cagliceras costulosum	
Erycites ovatus	
Pseudammatoceras brancoi	
Leioceras sp.	
Erycites intermedius	
E. barodiscus	
E. fallifax	
Cseryeiceras verpillierense	
Planammatoceras tenuisigne	
Ancoloceras sp.	
Ludwigia sp.	
Tmetoceras scissum	
Pseudaptotoceras sp.	
Graphoceras? sp.	

47		C.?
48		
49		
51		
52		
54		Mu
56		
57		
58		
60		
61		
62		Op
64		
68		
69		
70		
71		
75		
78		
79		
81		
83		Aal
84		
85		
86		
88		
89		
90		
92		
93		Me
94		
95		
96		
97		
98		
99		Sp.
100		
101		
102		
103		
104		
105		
106		
107		Th.
108		
109		
110		
112		Gr.

Table 3. Distribution of Ammonitina (Thouarsense to Murchisonae Zones), Tölgyhát „A” section (not all beds lacking ammonite yield are marked).

BEDS	ZONES
<i>Pseudogrammoceras</i> sp. <i>Grammoceras thouarsense</i> <i>Moutardeiceras viticola</i> <i>Geczyceras bonarelli</i> <i>Crestaites victorii</i> <i>Geczyceras</i> sp. <i>Dumortieria evolutissima</i> <i>Cagliceras elaphum</i> <i>Dumortieria stricta</i> <i>Erycites ovatus</i> <i>Planammatoceras tenuisigne</i> <i>Cotteswoldia subcompta</i> <i>Cagliceras rotundiformis</i> <i>Erycites barodiscus</i> <i>Pseudammatoceras</i> sp. <i>Bredya</i> sp. <i>Pleydella</i> sp. <i>Leioceras</i> sp. <i>Erycites subquadratus</i> <i>Ceccaites sieboldi</i> <i>Abbasitoides modestus</i> <i>Tmetoceras</i> sp. <i>Csernyeiceras verpillierense</i> <i>Erycites fallifax</i> <i>Planammatoceras planinsigne</i> <i>Ancolloceras</i> sp. <i>Ludwigia</i> sp.	1 2 3 4 5 7 11 12 14 15 16 17 21 23 24 25 26 30 32 35 38 39 47 49 50 51 66 73 78
	M
	Op
	Aa
	M
	Sp
	Th

Table 4. Distribution of Ammonitina (Opalinum to Murchisonae Zones), Tölgyhát „B” section.

BEDS	Subzones	ZONES
20		C.?
21		Br.
22		
23		
24		
25		
26		
27		
28		Mu
29		
30		Ha.
31		
32		
33		
34		Op
35		
36		
37		
38		
39		

Plates

(The specimens are coated with ammonium chloride, and are shown in natural size. The last chambers are marked by *.)

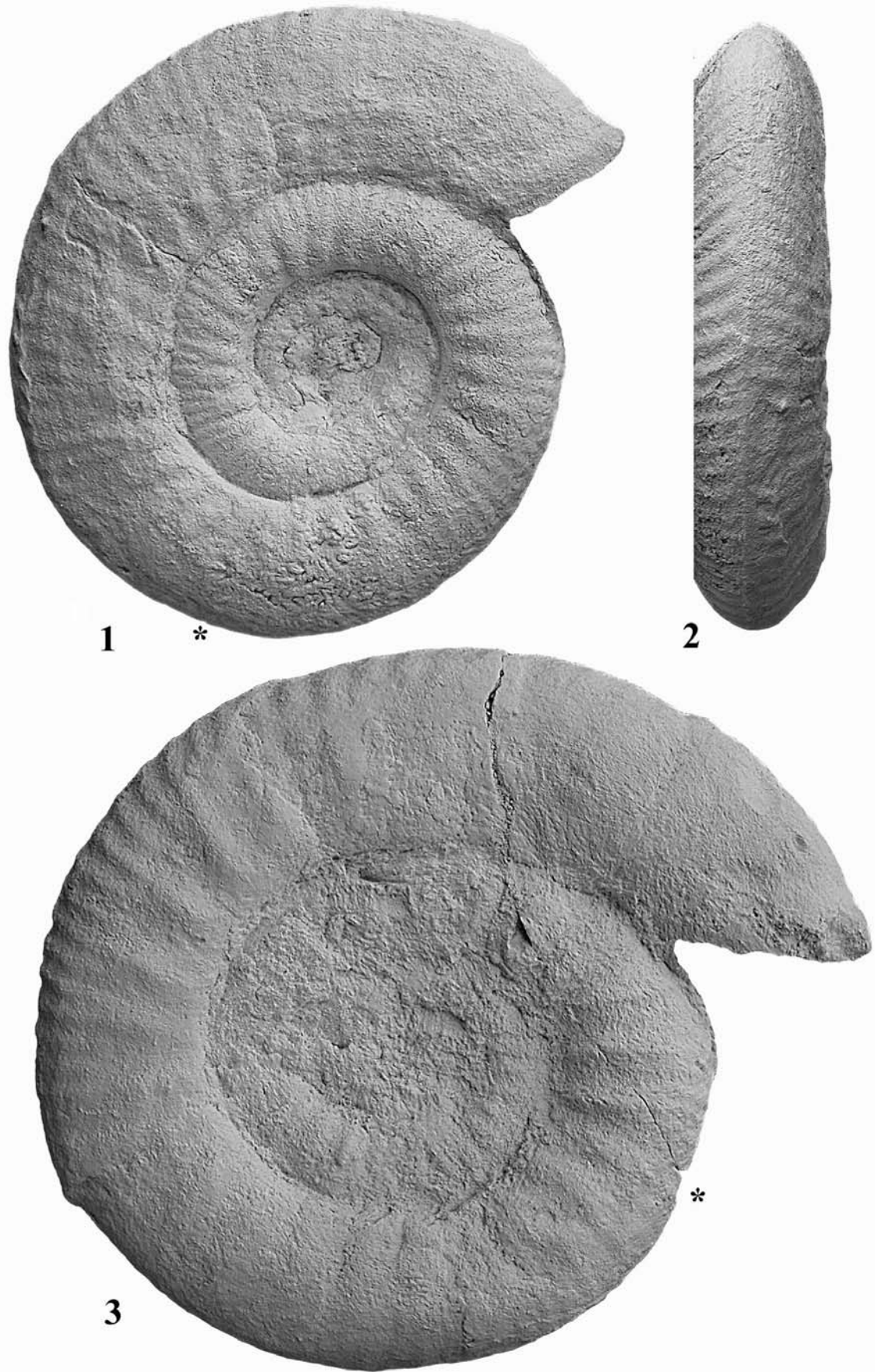


Fig. 1-2: *Cagliceras elaphum* (MERLA), EP95A, Speciosum Zone
Fig. 3: *Cagliceras elaphum* (MERLA), EG18A, Opalinum Zone



Fig. 1: *Cagliceras elaphum* (MERLA), EP84B, Aalensis Zone

Fig. 2: *Cagliceras crassiventris* (MERLA), EB15A, Speciosum Zone

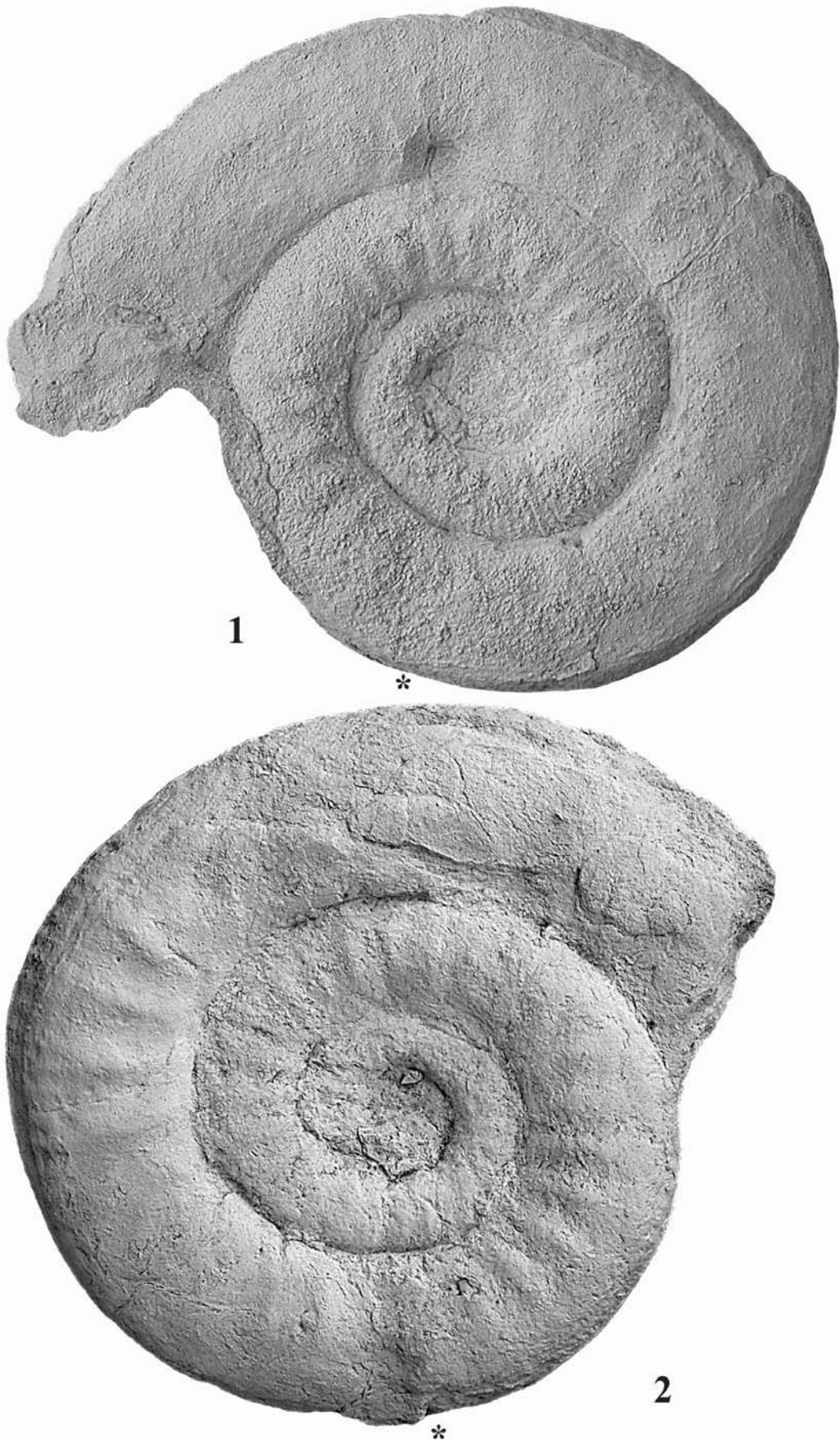


Fig. 1: *Cagliceras elaphum* (MERLA), EB11, Meneghinii Zone
Fig. 2: *Cagliceras elaphum* (MERLA), EP88, Aalensis Zone

Plate 4

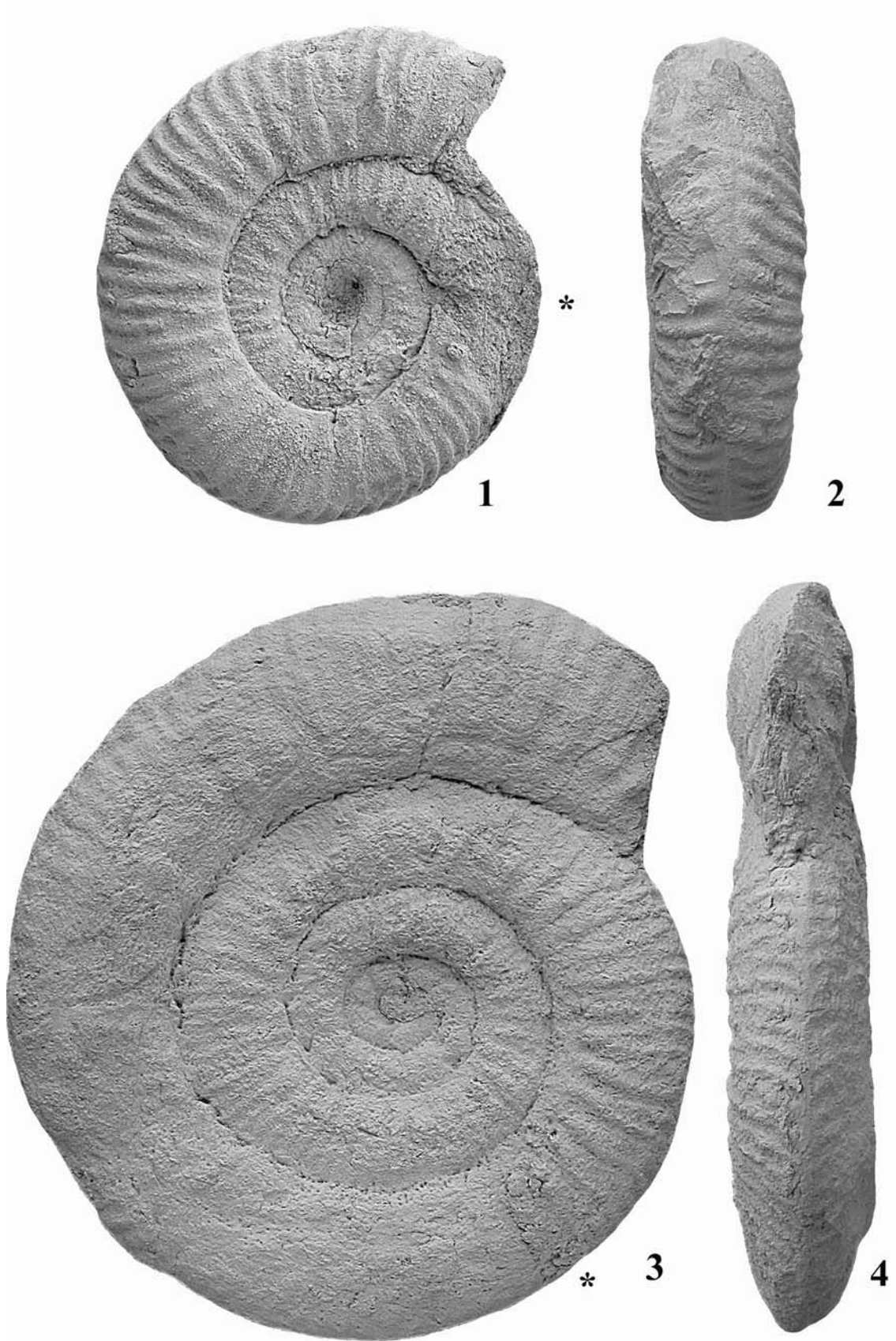


Fig. 1-2: *Cagliceras picenum* (FOSSA-MANCINI), EG54, Speciosum Zone
Fig. 3-4: *Cagliceras crassiventris* (MERLA), EP97D, Speciosum Zone

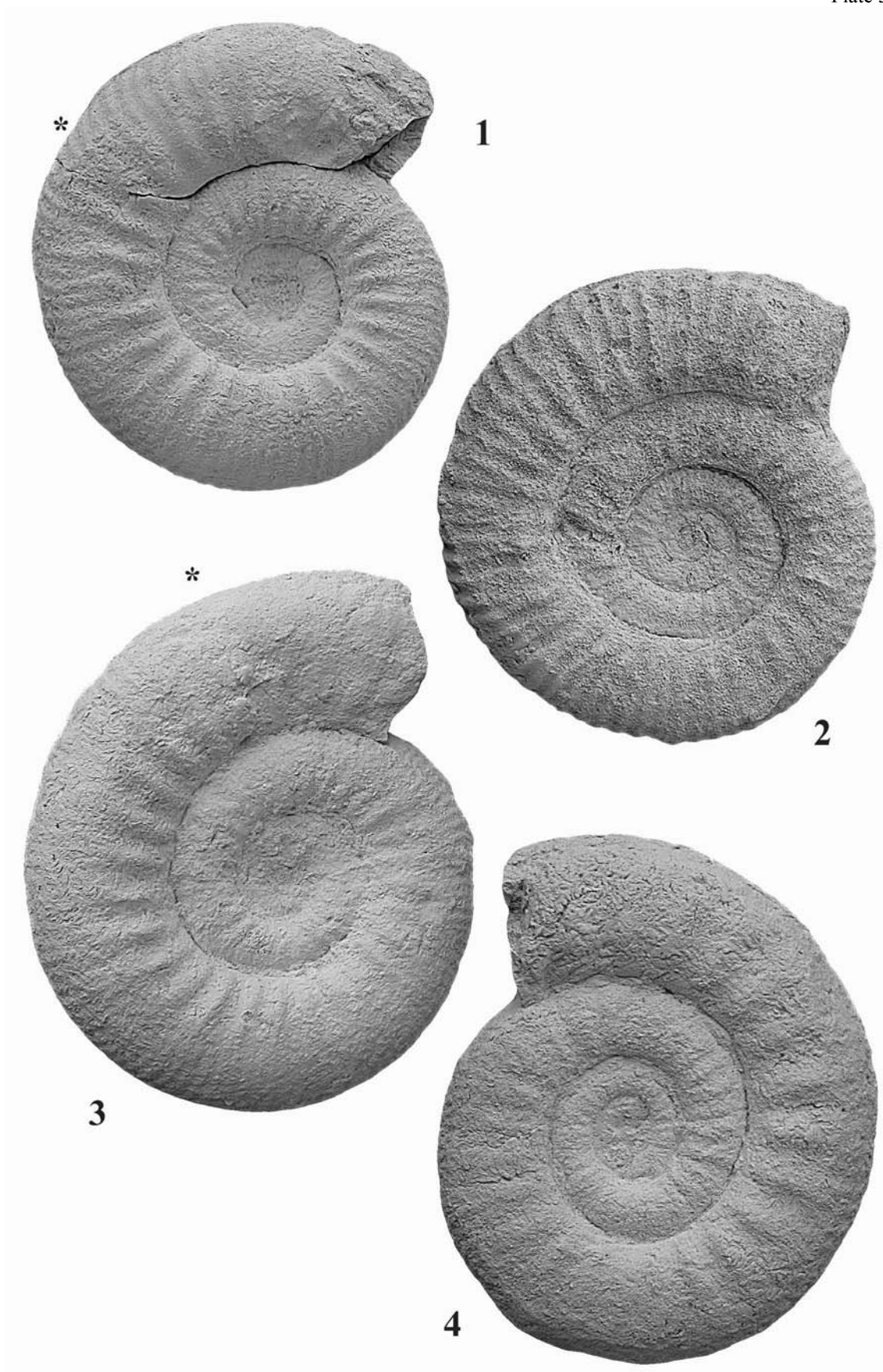


Fig. 1: *Cagliceras rotundiformis* (MERLA), EG38A, Meneghinii Zone
Fig. 2: *Cagliceras picenum* (FOSSA-MANCINI), EB15B, Speciosum Zone
Fig. 3: *Cagliceras rotundiformis* (MERLA), EG41A, Meneghinii Zone
Fig. 4: *Cagliceras robustum* (MERLA), EP88B, Aalensis Zone

Plate 6

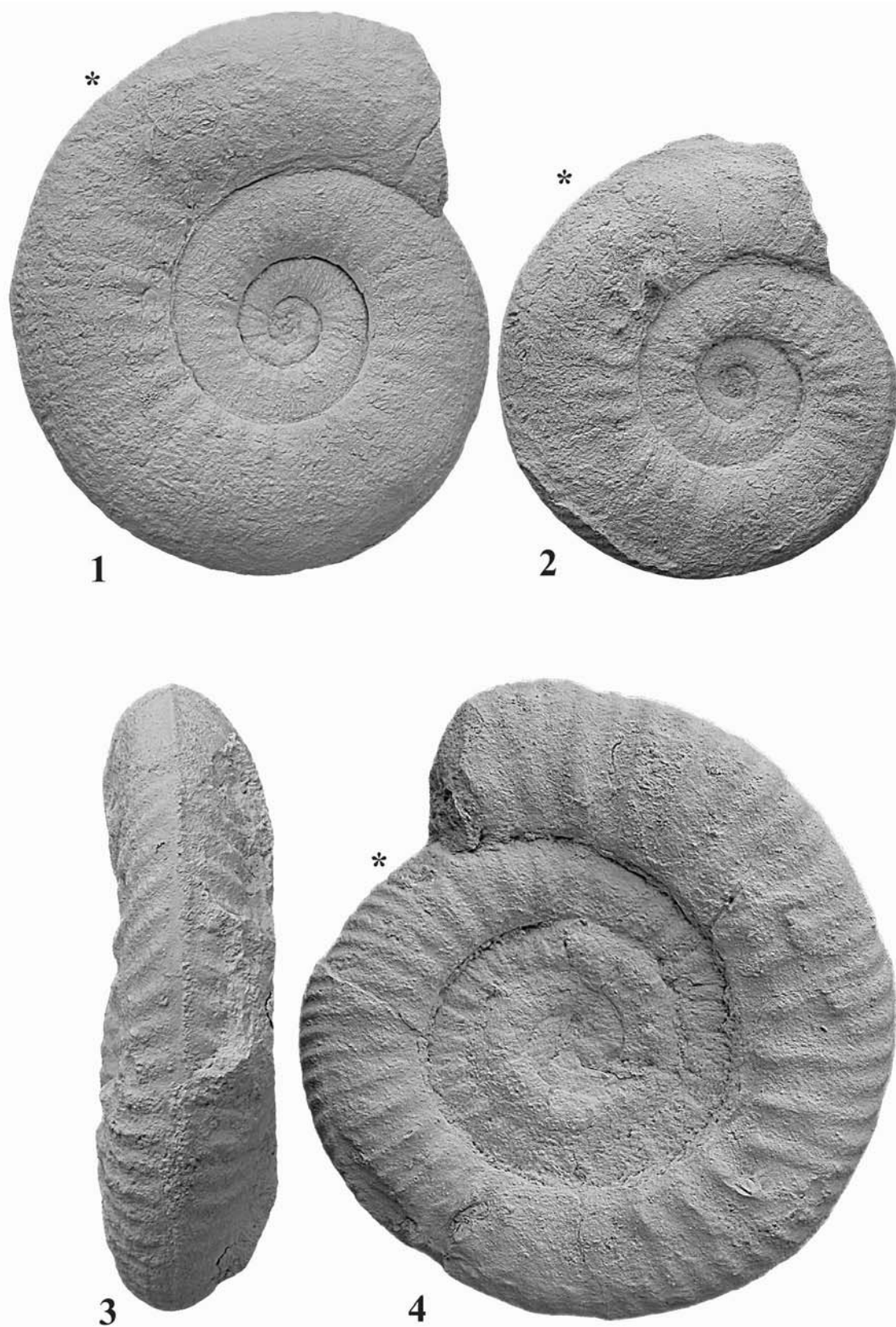


Fig. 1: *Cagliceras costulosum* (MERLA), EP84C, Aalensis Zone
 Fig. 2: *Cagliceras costulosum* (MERLA), EP84D, Aalensis Zone
 Fig. 3-4: *Cagliceras enigmaticum* n. sp., EP97C, Speciosum Zone

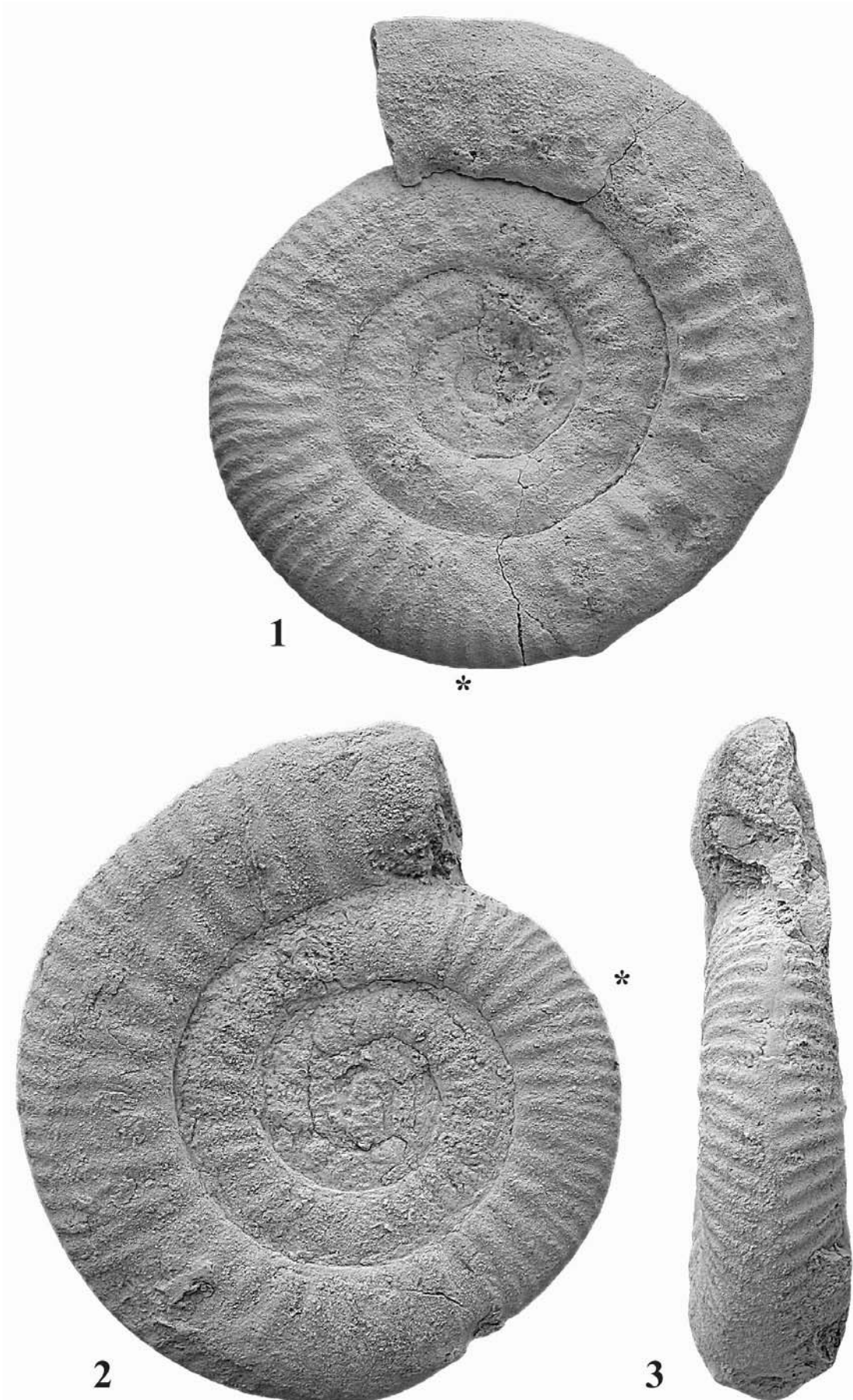


Fig. 1: *Cagliceras enigmaticum* n. sp., EB16, Speciosum Zone

Fig. 2-3: *Cagliceras enigmaticum* n. sp., holotype, EP98, Speciosum Zone

Plate 8

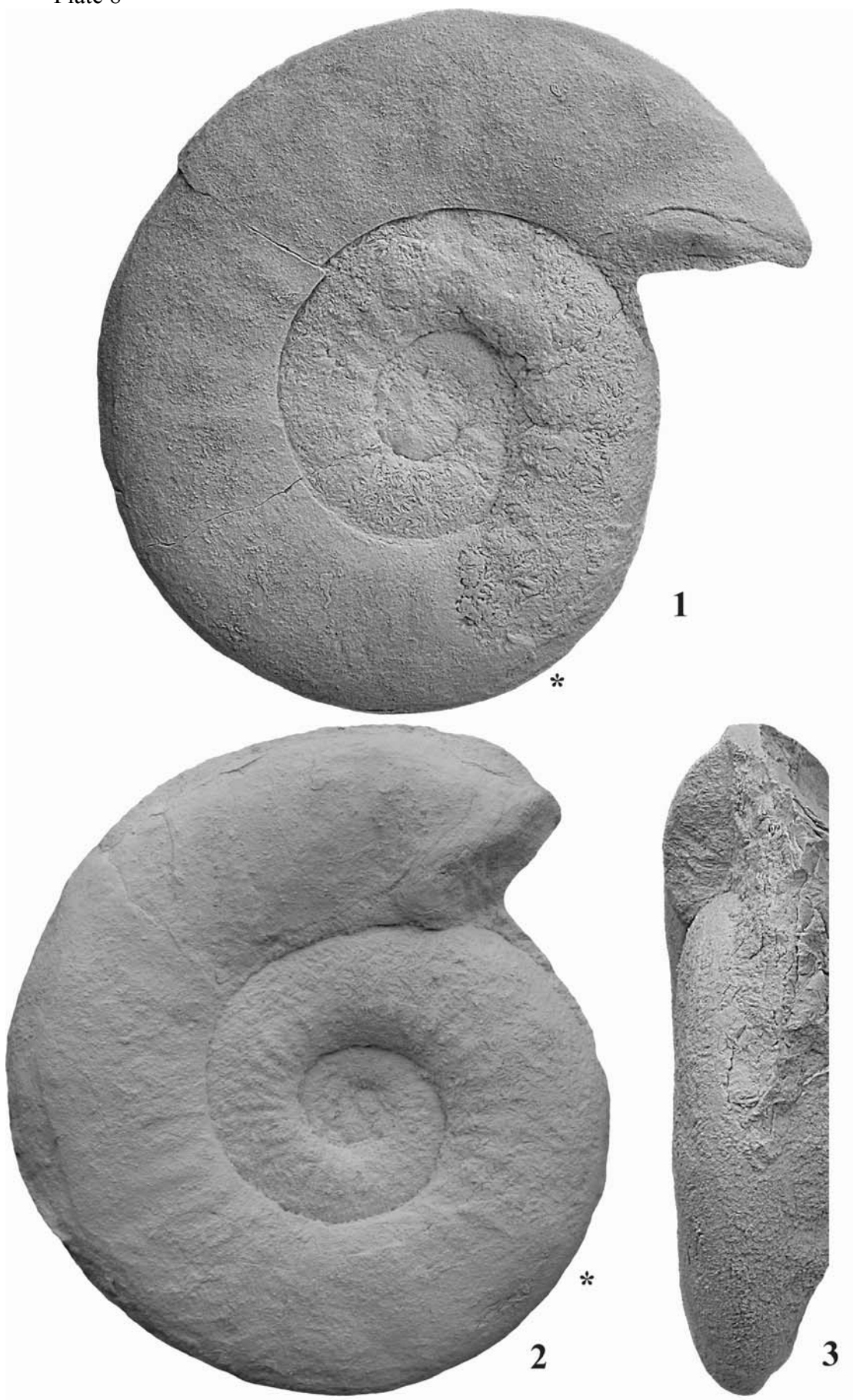


Fig. 1: *Erycites ovatus* GÉCZY, EP78A, Aalensis Zone

Fig. 2-3: *Erycites ovatus* GÉCZY, EG7A, Opalinum Zone

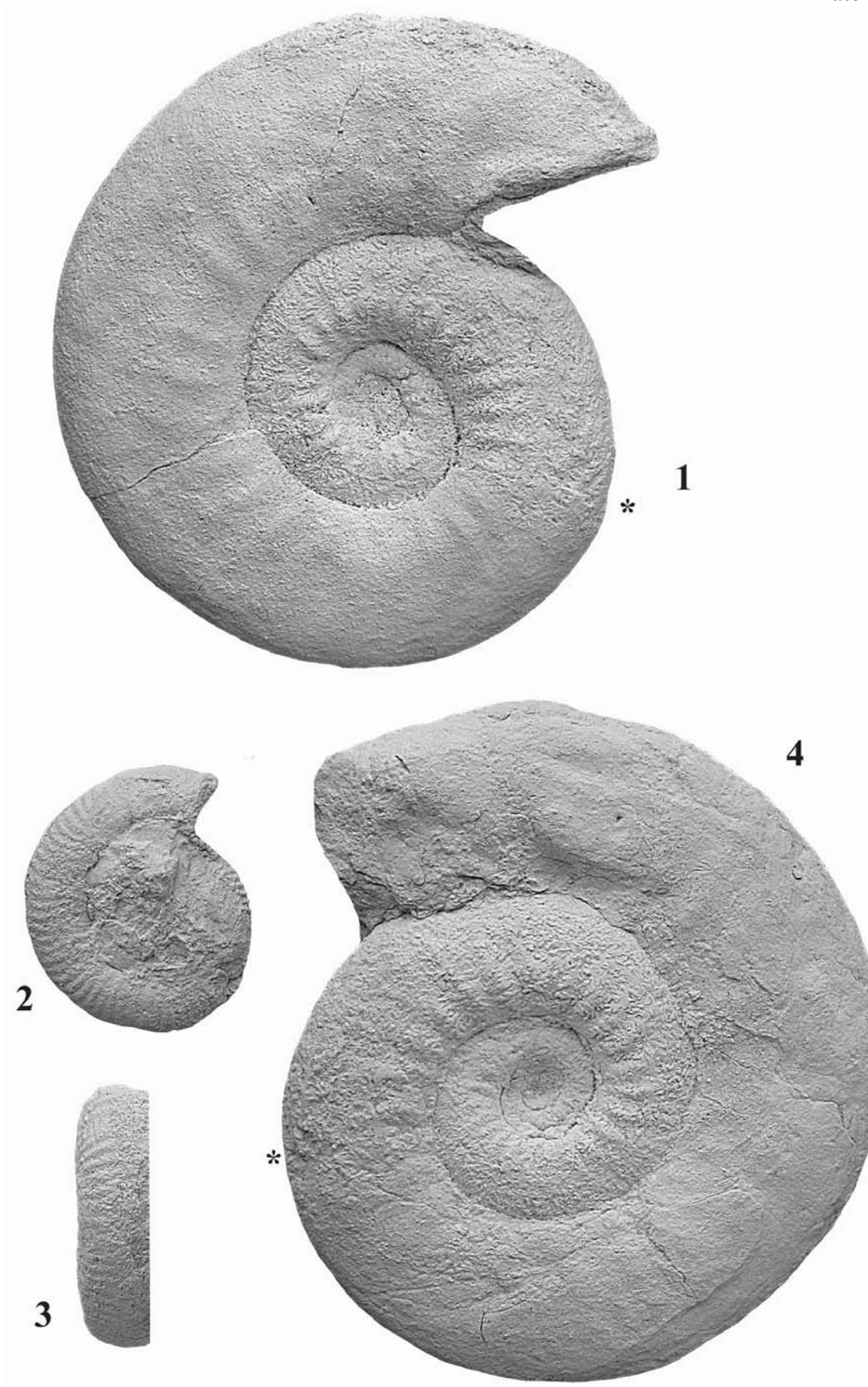


Fig. 1: *Erycites ovatus* GÉCZY, EP79A, Aalensis Zone

Fig. 2-3: *Abbasitoides modestus* (VACEK), ETB30B, Murchisonae Zone

Fig. 4: *Erycites ovatus* GÉCZY, EG9, Opalinum Zone

Plate 10

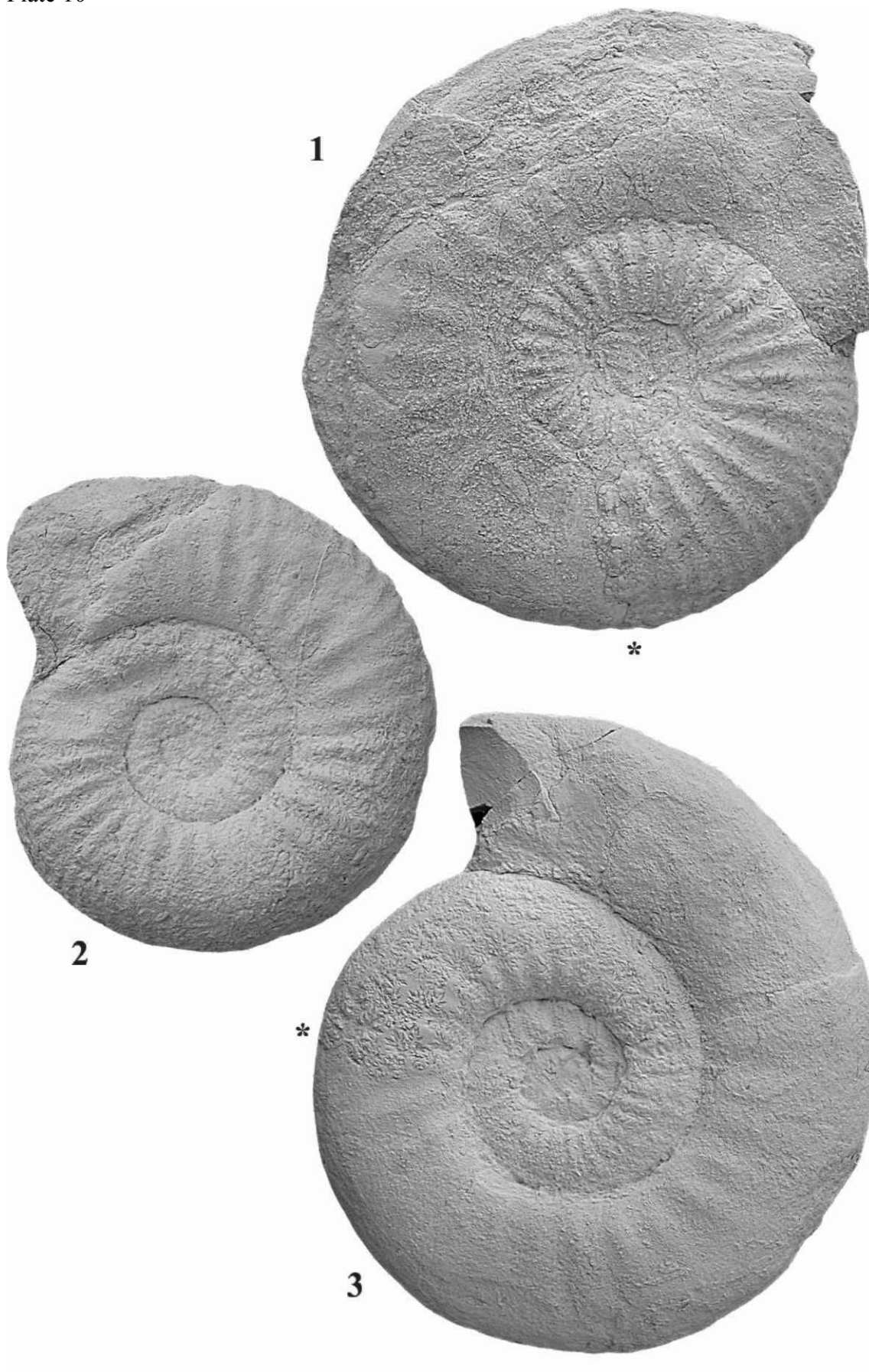


Fig. 1: *Erycites barodiscus* GEMMELLARO, EG19, Opalinum Zone

Fig. 2: *Erycites barodiscus* GEMMELLARO, ETA10, Opalinum Zone

Fig. 3: *Erycites ovatus* GÉCZY, EP83B, Aalensis Zone

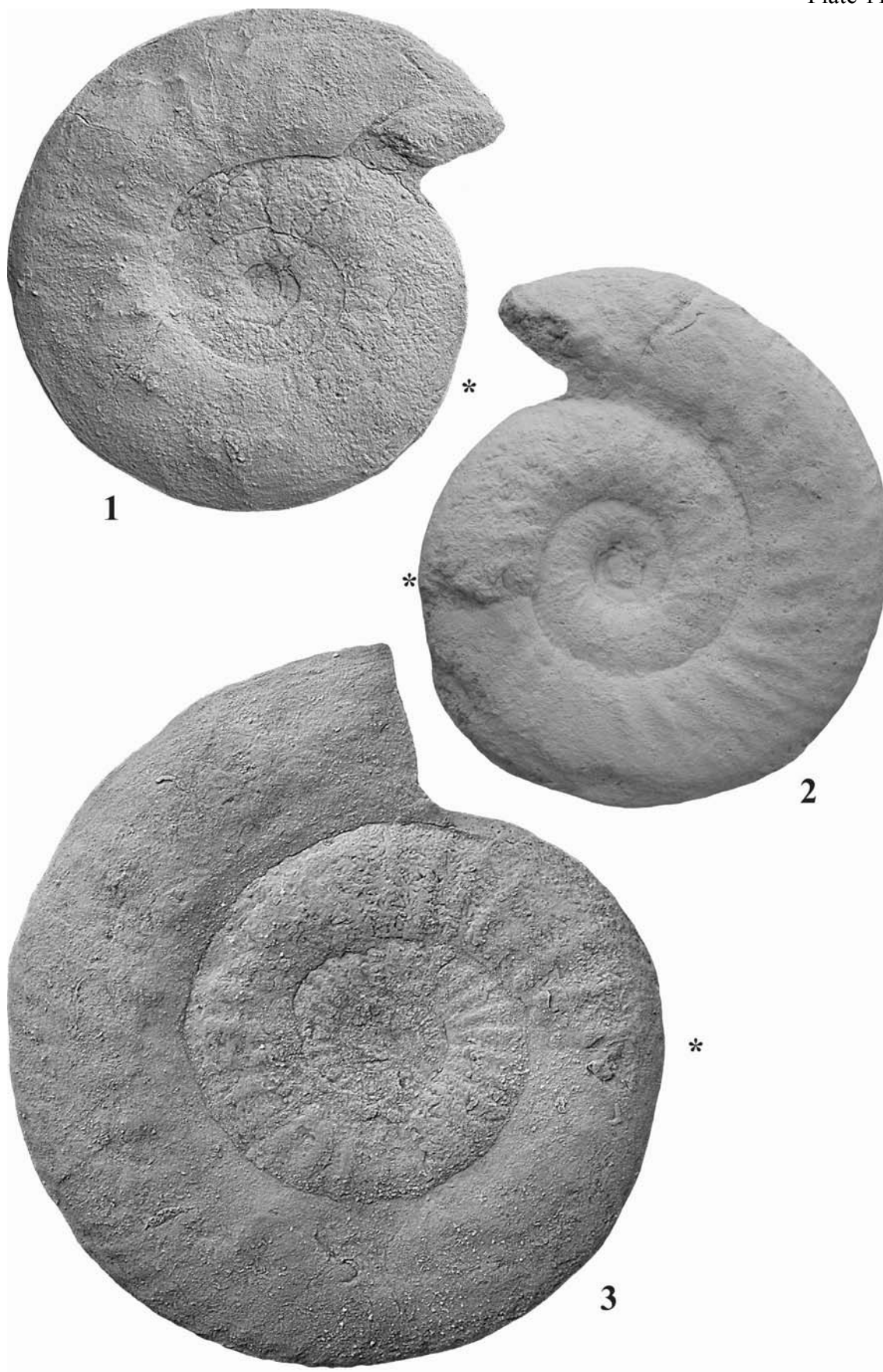


Fig. 1: *Erycites fallifax* ARKELL, EP61, Opalinum Zone

Fig. 2: *Erycites fallifax* ARKELL, ETA4, Opalinum Zone

Fig. 3: *Erycites barodiscus* Gemmellaro, EP69A, Opalinum Zone

Plate 12

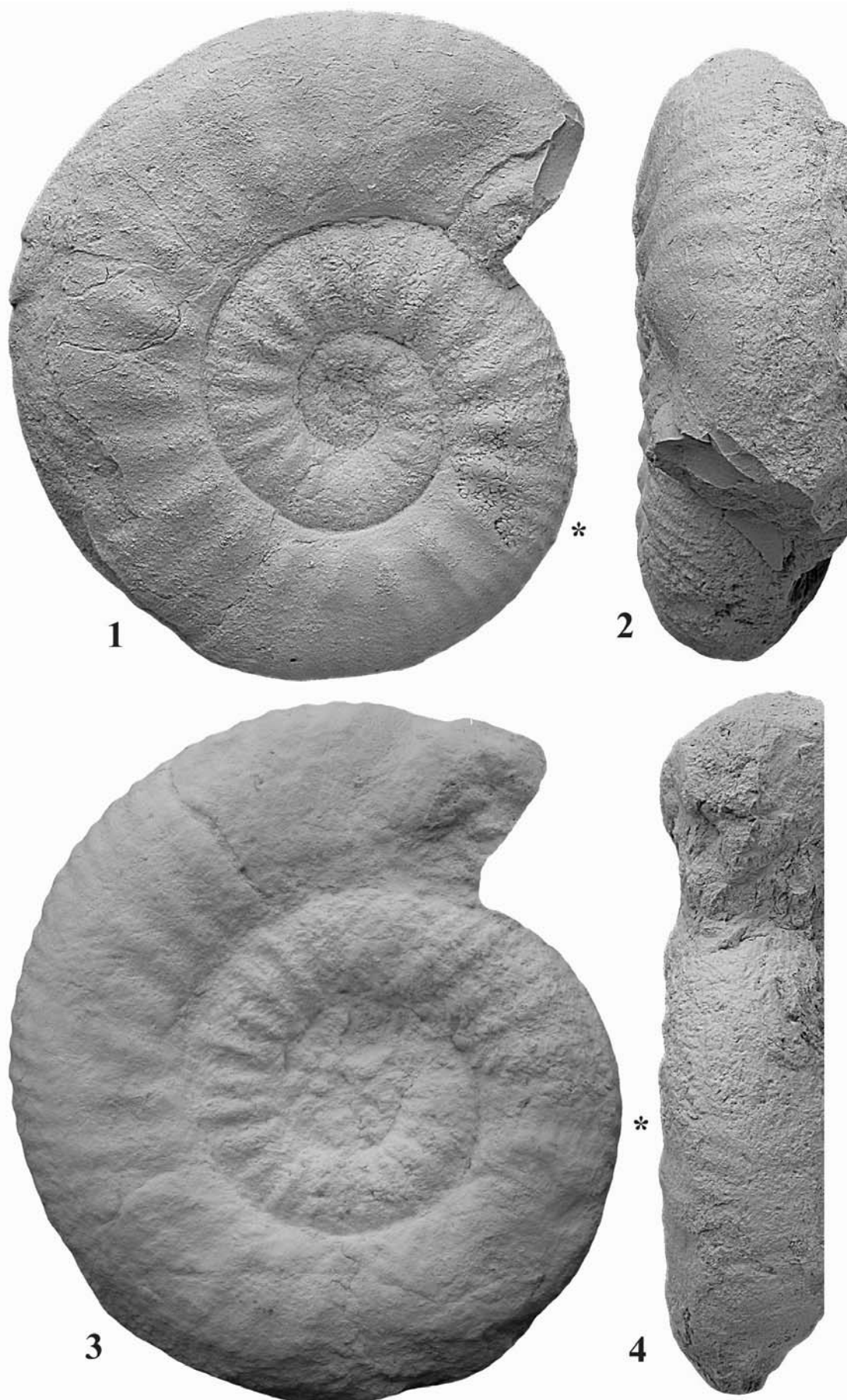


Fig. 1-2: *Erycites gerecsensis* n. sp., holotype, EG31A, Aalensis Zone
Fig. 2-3: *Erycites subquadratus* GÉCZY, ETA11B, Opalinum Zone

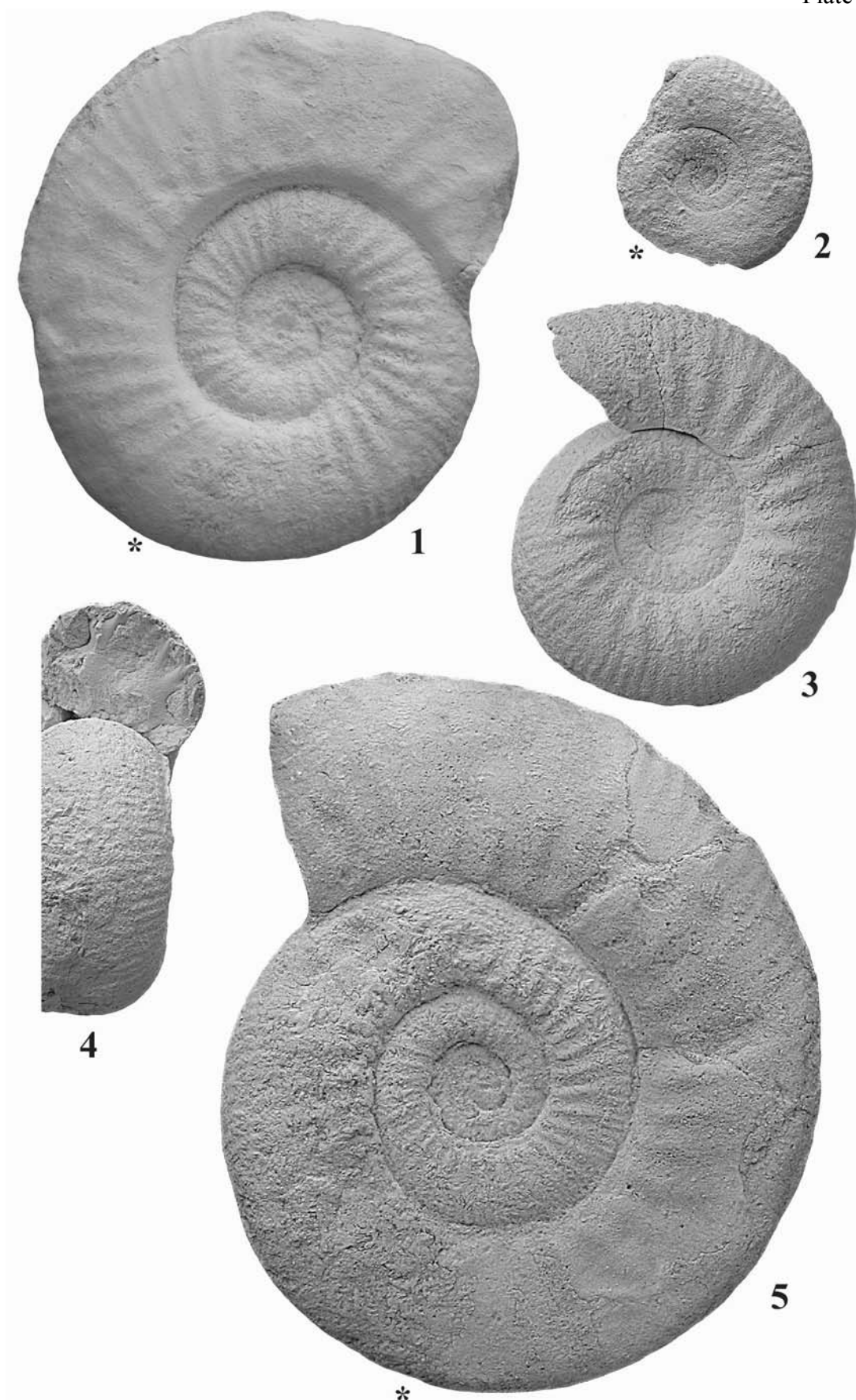


Fig. 1: *Erycites intermedius* HANTKEN in PRINZ, ETB30B, Murchisonae Zone
 Fig. 2: *Abbasitoides modestus* (VACEK), ETA7, Opalinum Zone
 Fig. 3-4: *Erycites* sp. aff. *reussi* (HAUER), EG6, Murchisonae Zone
 Fig. 5: *Erycites intermedius* HANTKEN in PRINZ, ETB32, Murchisonae Zone