

UPPER OLENEKIAN (SPATHIAN) AMMONOIDS FROM CHIOS (LOWER TRIASSIC, GREECE): TAXONOMY AND STRATIGRAPHIC POSITION.

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Abstract. On the Greek island of Chios, Lower Triassic sections have delivered rich ammonoid faunas from red limestones of the Hallstatt facies. Here, we present a palaeontological description of Spathian ammonoids, which have been collected during two field campaigns by Italian-German teams (Assereto et al. 1980; Gaetani et al. 1992). The ammonoid associations are composed of Ceratitida and Phylloceratida, each order containing species of the Noritaceae, Hedenstroemiaeae, Xenodiscaceae, Dinaritaceae, Pinacocerataceae, Phyllocerataceae, Ptychitaceae, Ussuritaceae and Megaphyllitaceae. Long ranging genera, e.g. *Procamnites* and *Leiophyllites*, are present as well as endemic ones, e.g. *Chiotites*, which occurs exclusively in the Lower Triassic of Chios. The ammonoid association is indicative of the *Prohungarites-Subcolumbites* zone sensu Kummel (1973a). The *haugi* zone, installed as uppermost Olenekian in North America, is not represented by ammonoids on Chios.

Riassunto. Le successioni di calcari rossi in facies di Hallstatt nel Triassico inferiore dell'isola di Chios (Grecia) hanno fornito una ricca fauna ad ammonoidi. In questo articolo sono descritte le faune ad ammonoidi di età Spathiana, raccolte durante due campagne di terreno effettuate da un gruppo di ricercatori Italiani e Tedeschi (Assereto et al. 1980; Gaetani et al. 1992). Le associazioni ad ammonoidi si compongono di Ceratitida and Phylloceratida, di cui sono rappresentate specie di Noritaceae, Hedenstroemiaeae, Xenodiscaceae, Dinaritaceae, Pinacocerataceae, Phyllocerataceae, Ptychitaceae, Ussuritaceae e Megaphyllitaceae. Sono presenti generi ad ampia distribuzione verticale come *Procamnites* e *Leiophyllites*, così come generi endemici quale *Chiotites*, che si rinviene solo nel Triassico inferiore di Chios. L'associazione ad ammonoidi è indicativa della zona a *Prohungarites-Subcolumbites* sensu Kummel (1973a). La zona ad *haugi*, considerata come Olenekiano terminale nel Nord America, non è rappresentata tra gli ammonoidi di Chios.

Introduction

Lower Triassic ammonoid faunas are very rare in the Mediterranean regions. The Chios occurrence was detected by Ktenas & Renz (1928, 1931) on Marathovouno Hill, west of the town of Chios (Figs. 1, 2).

There, the fossils are included in red limestones of the Hallstatt facies (Marmarotrapeza Formation). Renz & Renz (1948) published a palaeontological description of its ammonoids in a monograph. Bender (1970) was the first to collect fossils from measured sections (CM I, II, III) in order to establish coordinated ammonoid and conodont stratigraphies. This author recognized, moreover, that the Spathian beds are overlain by lowermost Anisian ones with ammonoids comparable with faunas of the so-called Hydaspien substage from the Himalayas and Timor. Furthermore, Jacobshagen & Tietze (1974) described an association of both Spathian and Lower Anisian ammonoids from a nearby section of Parthenis Hill. Based on those findings and new specimens from Bender's section CM II, Assereto (1974) proposed the Aegean as lowermost substage of the Middle Triassic and Marathovouno hill as its type locality. In 1975, a team of Italian and German geologists conducted by R. Assereto and V. Jacobshagen worked on Marathovouno Hill, measuring 6 sections (A-G, Fig. 2) and collecting fossils bed by bed with the aim to define the Olenekian/Anisian boundary on the base of ammonoids and conodonts. Their biostratigraphical results were presented by Assereto et al. (1980). Nicora (1977) published palaeontological descriptions of the conodonts found in these sections, and the Aegean ammonoids were described by Fantini Sestini (1981). To complete these investigations, a second field campaign was performed in 1989 by M. Gaetani and A. Nicora (Milano), V. Tselupidis (Athens) and V. Jacobshagen (Berlin) together with Milano students. Re-measuring and fossil collections were confined on crucial parts of the sections A, C, D, and G. Data concerning the Anisian part of the sections were published by Gaetani et al. (1992). Furthermore, research was extended to a section of the Parthenis area.

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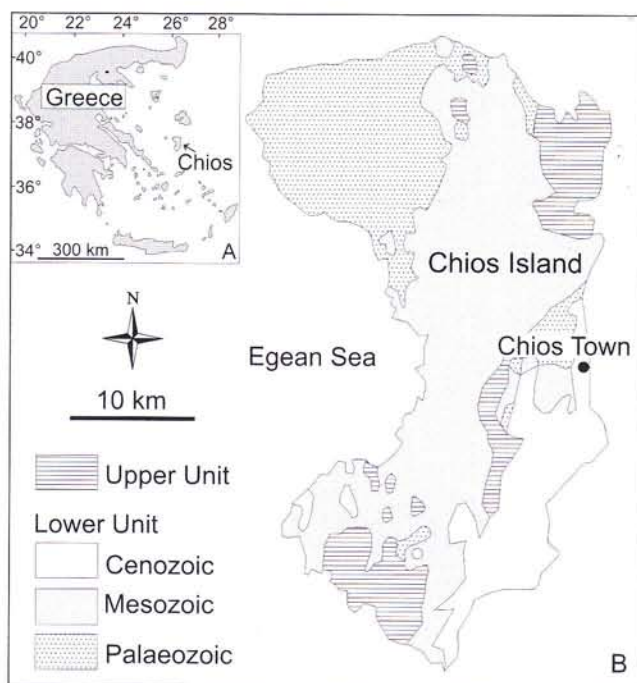


Fig. 1 - Chios Island (B) in the Aegean Sea west of mainland Greece (A).

The present paper is focussed on the taxonomy and the stratigraphic position of the Lower Triassic ammonoids collected during the two field campaigns of 1975 and 1989. Appendix 1 indicates the correlation between the section, the sample and numbering of the ammonoids. Appendix 2 quotes the ammonoids mentioned in Assereto et al. (1980) and Gaetani et al. (1992). However, due to the re-evaluation of the collection changes have been made concerning the determination of species and genera.

Geological framework

According to Besenecker et al. (1968, 1971) the island of Chios is composed of two main tectonic units (Fig. 1), which probably belong to the Pelagonian nappes (Jacobshagen 1986). The lower unit, once considered as autochthonous, shows at its base epizonal schists followed by a thick graywacke-slate sequence of Silurian - Carboniferous age (Besenecker et al. 1968; Zanchi et al. 2003). The latter is unconformably overlain by a Triassic succession, with a few occurrences of Jurassic limestones and, locally, Early Tertiary conglomerates on the top. The upper unit is preserved in some outliers, only. Its sequence starts with fossiliferous Upper Palaeozoic deposits that are covered by red elastics of Liassic age. Triassic rocks are missing in between, but a few small relics.

Our studies refer to the Triassic of the lower unit exposed in the vicinity of Chios town. Tietze (1969) mapped that area. Its sequence starts with a **Basal Formation** (Basale Serie, Besenecker et al. 1968) containing red conglomerates and sandstones that grade upward to

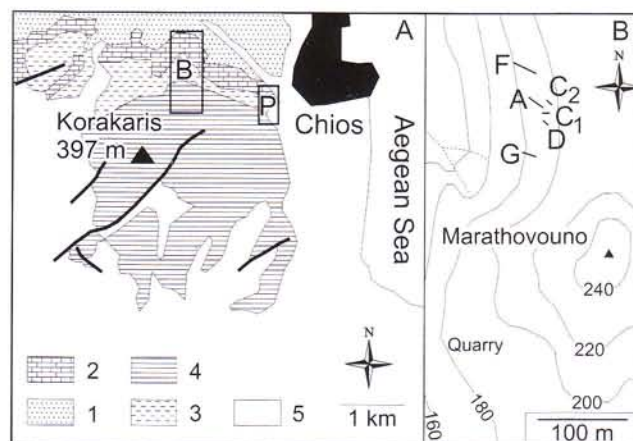


Fig. 2 - Geological map of the area west of Chios town (A), and the location of the sections measured by different authors. 1-Palaeozoic, 2-Basal Formation including Lower Carbonate Formation, 3-Variagated Formation, 4-Upper Carbonate Formation, 5-Cenozoic. P Location of Parthenis section.

bedded limestones, with late Olenekian (Spathian) bivalves and conodonts in their upper parts (Kauffmann 1978). To their top, but also laterally, the bedded limestones pass over to thick, unbedded limestones and dolomites of the **Lower Carbonate Formation** (Lower Carbonate Series; Tieftriadische Massenkalk und -dolomite, Besenecker et al. 1968), which have yielded some Spathian conodonts as well. It is composed of wackestones to packstones interfingering with bedded dolomites, showing ooids in places. In the surroundings of Chios town the above-mentioned **Marmarotrapeza Formation** (Kalk von Marmarotrapeza, Ktenas & Renz 1928) follows with a sharp contact. Red nodular limestones of the Hallstatt facies are typical, with ammonoids, filaments, rare foraminifers, and conodonts. The thickness usually does not exceed 15 m. To the west and north of Chios town it is absent or reduced in thickness. The formation straddles the Olenekian/Anisian boundary. At the Marathovouno hillock the Anisian part is confined to 2.0-3.50 m, but in other places it is even missing (e. g. in the Parthenis section of Gaetani et al. 1992). The Marmarotrapeza Fm. is overlain by the **Variagated Formation** (**Variagated Series**; Bunte Serie, Besenecker et al. 1968), a succession of red to purple slates and sandy marls with intercalations of limestones, radiolarites, conglomerates and tuffitic horizons, dated to an Anisian-Ladinian age by few conodont findings (Tietze 1969). It contains m-thick olistoliths of red limestones with Spathian and even Middle Anisian ammonoids and conodonts (Gaetani et al. 1992, see Fig. 2). West of Chios town, the Variagated Formation continues to an alternation of limestones and cherts, which yielded Middle Triassic and Carnian fossils (Tietze 1969). The Mesozoic sequence of the lower unit ends with the **Upper Carbonate Formation** with shallow-water limestones of Upper Triassic and Jurassic age, not to be considered here.

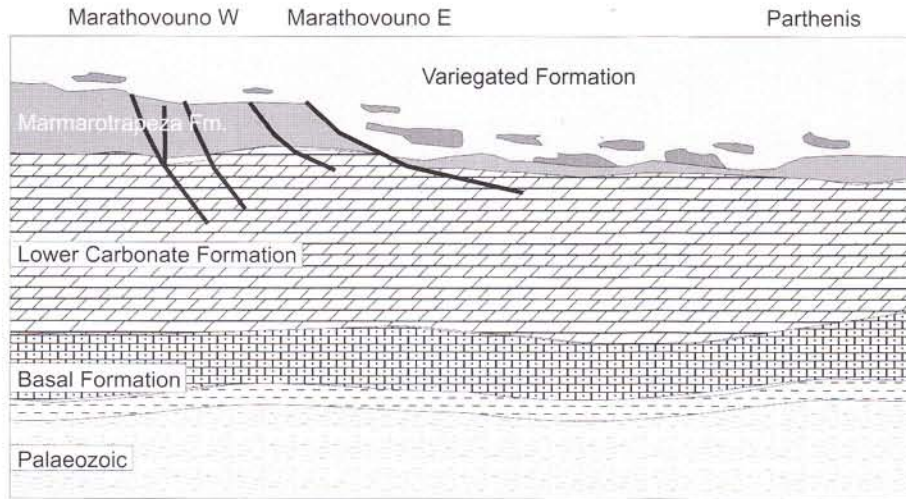


Fig. 3 - Sketch of the tectono-sedimentary evolution during the Triassic (modified after Gaetani et al. 1992). Not to scale.

The Lower and Middle Triassic sequence reflects a Tethyan evolution which took place in an extensional regime (Fig. 3, Gaetani et al. 1992; Stampfli et al. 1991; Stampfli et al. 2002). It started with a transgressive event at its beginning and the following formation of a subtidal

to peritidal carbonate platform (Lower Carbonate Formation). The Hallstatt facies of the Marmarotrapeza Fm. points to downwarping of the platform and strong subsidence. The equivalent sedimentation ended diachronously. The Variegated Formation on top, deposited in a marine

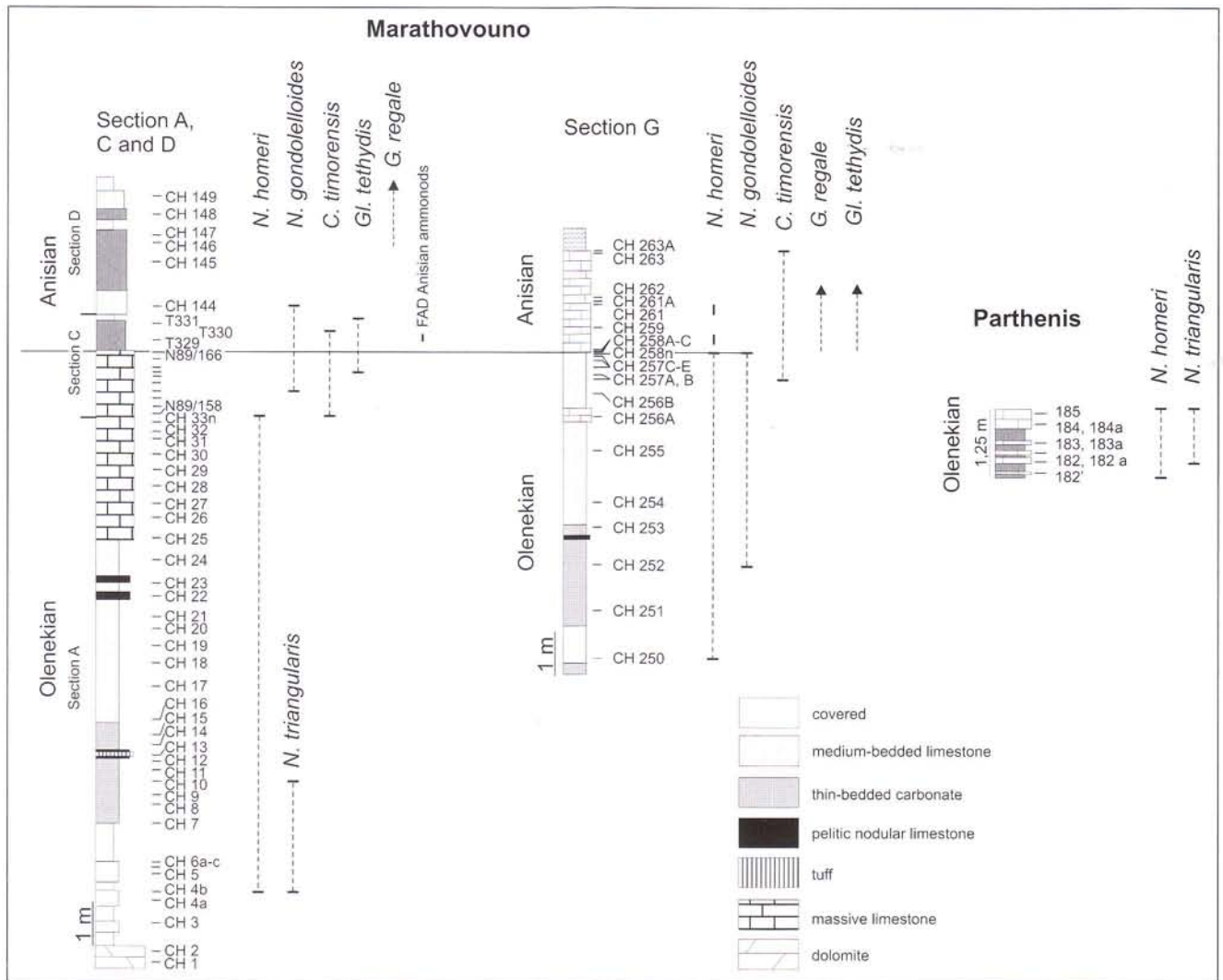


Fig. 4 - Sections A, C and D, G and Parthenis with main lithologies indicated. N-Neospathodus, C-Chiosella, Gl-Gladigondolella, Ng-Neogondolella, FAD-first appearance date.

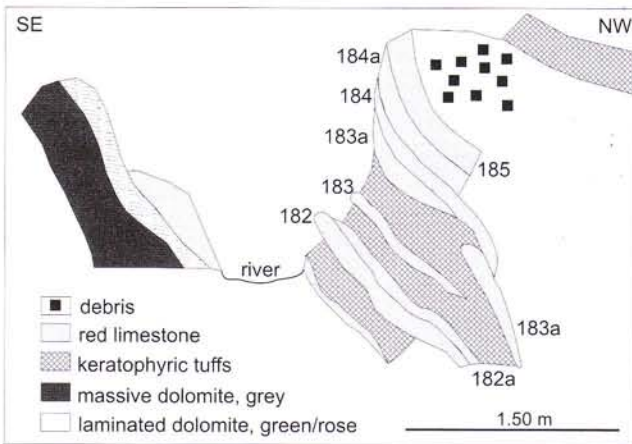


Fig. 5 - Parthenis section with sample locations.

environment deeper than the underlying carbonates, covered a palaeorelief. Synsedimentary reworking occurred on its slopes as indicated by the olistoliths and conglomerates mentioned.

The stratigraphic sections

Marathovouno Hill is located west of the town of Chios (Fig. 2). All sections were measured at its western slope. Bender (1970) had considered only three sections (CM I - III). Later on, Assereto et al. (1980) and Gaetani et al. (1992) treated nearly the same ones, but for precision's sake they choose different labels (A-G), which are used also here. Their locations are marked in Fig. 2. The correlation between the sections of Bender and Assereto et al. is as follows: CM I of Bender corresponds to G, CM II to A+C+D, and CM III to F.

The sections A+C+D form a rather continuous and complete profile of the Marmarotrapeza Fm., although some thin horizons are not exposed. Section A had been proposed for the Olenekian/Anisian boundary by Assereto (1974) and described in Assereto et al. (1980). This section (Fig. 4) starts with thick-bedded dolomites of the Lower Carbonate Formation that are overlain by the Marmarotrapeza Formation. Mainly reddish, medium-bedded limestones occur, with pelitic-limonitic crusts either parallel to the bedding planes or in the interior of the beds. Within these limestones two layers of thin-bedded nodular limestones are intercalated, furthermore some tuffitic layers. At the top of section A pink recrystallized limestone is exposed. The sections C and D are not described here in detail, because they contain only Anisian fossils.

Section G (Fig. 4) is not complete. Nevertheless, the two thin-bedded nodular limestone horizons and the pink layer mentioned allow the lithostratigraphic correlation with A. Fissures are developed within three horizons, the lower set penetrating the underlying sequence down to about 4 m.

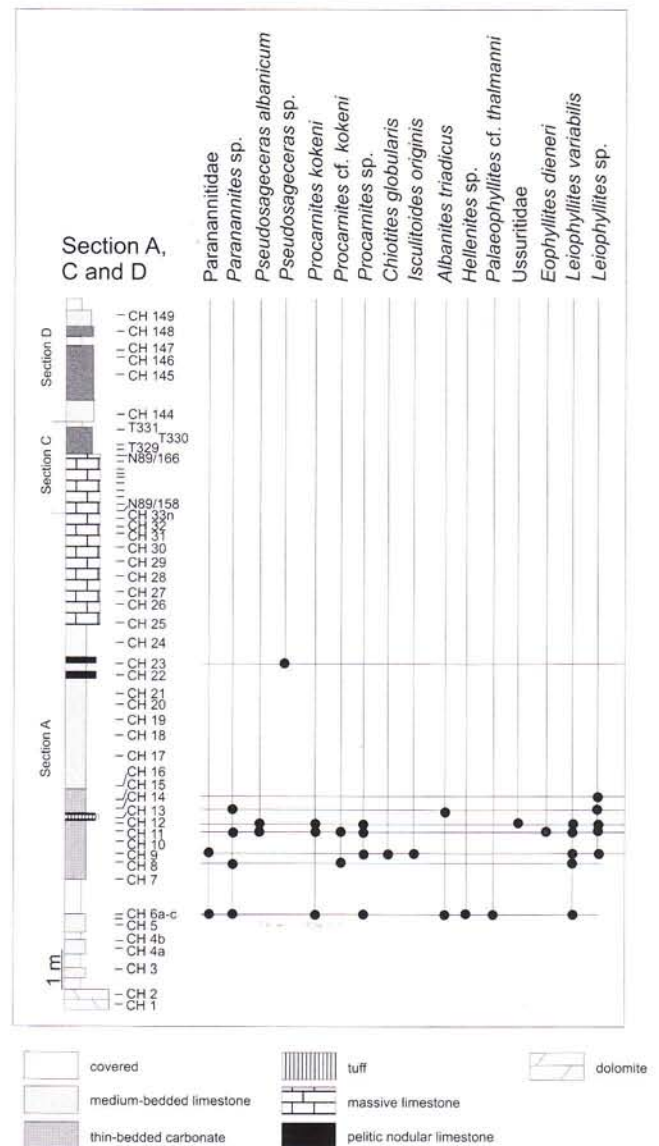


Fig. 6 - Sections A with ammonoid distribution.

The sections B and F are not considered here, because they did not deliver ammonoids, but only conodonts of Spathian and Anisian age together with some foraminifers (Gaetani et al. 1992).

From Parthenis Hill, Tietze (1969) already described a section of the Marmarotrapeza Fm., which is exposed in a quarry. Our ammonoid collection comes from a section (Fig. 4, 5) measured in a small creek, lying about 100 m south of that quarry (Gaetani et al. 1992). Here, the Marmarotrapeza Formation does not exceed 2 m and lies on a partly dolomitized slumped body, m-thick, of nodular limestones. It is very rich in ammonoids, especially in its uppermost 15 cm, ending with a 2 cm thick ferro-manganesiferous layer. In that section folding may have caused local deformations, which might have affected the boundary to the Variegated Formation on top.

Distribution of ammonoids in the sections

Ammonoid occurrences within the sections A, G, and Parthenis are shown in Figs. 6-8. Section A contains 7 levels of ammonoids predominantly in its lower and middle part within thin- to medium-bedded limestones. The association of the lowermost level is composed of *Paranannites*, *Procarnites*, *Hellenites*, *Albanites*, *Palaeophyllites* and *Leiophyllites*. The overlying samples include *Pseudosageceras*, *Chiotites*, *Isculitoides*, and *Eophyllites*. The thick-bedded part of the Marmarotrapeza Formation is barren. In the upper part of section C and in section D Anisian ammonoids and conodonts are well-documented (Gaetani et al. 1992).

Section G contains 3 levels of ammonoids. *Arianites* (*Meropella*) exclusively belongs to level 252. *Eogymnites*, *Eophyllites* and *Sulioticerases* are present in the upper level, only, whereas *Leiophyllites*, *Procarnites kokeni* and *Pseudosageceras albanicum* occur in all levels.

The Parthenis section delivered a variable fauna. *Hellenites*, *Leiophyllites* and *Procarnites* are widespread. The upper part is characterised by *Columbites*, *Chioceras*, *Epiceltites*, and ?*Dieneroceras*. The middle part contains *Pseudoprosphingites*, *Albanites* and *Dinarites*.

Stratigraphic interpretation of the assemblages

The ammonoid associations of our sections largely correspond to the faunas described by Arthaber (1908, 1911) and Germani (1997) from Albania and by Renz & Renz (1947, 1948) from Chios. They form part of the highly diverse Tethyan fauna with several cosmopolitan as well as endemic elements (Kummel 1973b; Tozer 1981a) and are attributed to the *Subcolumbites* - *Prohungarites* zone sensu Kummel (1973a), in agreement with Assereto et al. (1980) and Gaetani et al. (1992).

Stratigraphic subdivision of the Lower Triassic and the definition of the Olenekian/Anisian boundary is discussed since a long time (Tozer 1967, 1971, 1978, 1993; Wang 1985; Kozur 1992; Salvador 1994; Muttoni et al. 1994, 1995). 4 major zones are differentiated by Kummel (1973a) for the Lower Triassic in order to allow wide correlation between the major marine Lower Triassic occurrences in the Tethys, the Pacific and the circum-arctic Realm, namely from bottom to top the *Otoceras* - *Ophiceras* zone, the *Gyronites* - *Prionolobus* zone, the *Owenites* - *Anasibirites* zone, and the above-mentioned *Subcolumbites*-*Prohungarites* zone. In northern America, the (*Neopopanoceras*) *haugi* zone on top of the latter is regarded to represent an independent zone in the latest Olenekian. It is correlated with the Siberian *spiniplicatus* zone and the *subrobustus* zone of e.g. British Columbia (Bucher 1989; Dagys & Weitschat 1993; Dagys 1997). Sequences of the Tethys have, till now, never delivered clear representatives of the *haugi* zone or possible cor-

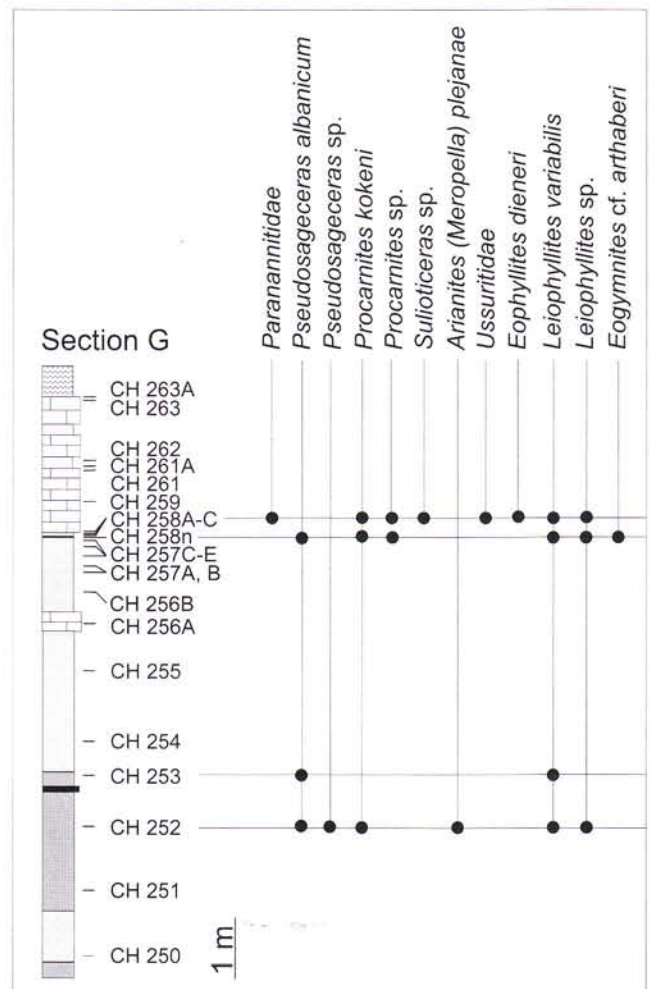


Fig. 7 - Section G with ammonoid distribution. Legend compare to fig. 6.

relatives. Orchard (1995) revised the *Neospathodus* conodont suite attributing former *Gondolella timorensis* juv. (Nogami) to *Neospathodus gondolelloides* Orchard and e.g. specimens of *Neospathodus homeri* (Bender) to *Neospathodus symmetricus* Orchard, both revisions influencing the conodont scheme of Chios. Tentatively the revised nomenclature was used in Fig. 4, but a final decision about the distribution of *Neospathodus symmetricus* versus *homeri* and *Neospathodus gondolelloides* versus *Chiosella timorensis* has yet to be made. Orchard (1995) considered the conodont succession of the Spathian to be composed of five associations. The *Subcolumbites*-*Prohungarites* beds are characterized by *Neospathodus homeri* (Bender), *Neospathodus triangularis* (Bender), *Neospathodus symmetricus* Orchard, and *Neospathodus brochus* Orchard. *Neospathodus triangularis* together with specimens of *Hellenites?* sp., *Olenekoceras?* sp., and various species of *Columbites* are characteristic for the upper Olenekian of South Primorye as well (Zakharov et al. 2002). Ammonoids of the *Neopopanoceras haugi* zone of Nevada are associated with *N. symmetricus*, few *Neogondolella* and uncommon *N. brochus*. Specimens of *Neogondolella* together with *Chiosella timor-*

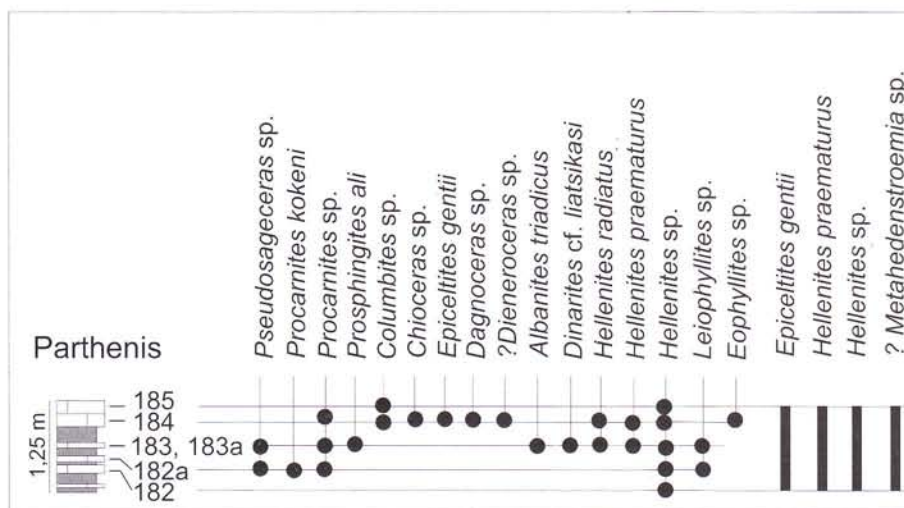


Fig. 8 - Section Parthenis with ammonoid distribution. Legend compare to fig. 6.

ensis (Nogami) become common in the Lower Anisian; then *Neospathodus* is absent. Following Orchard (1995) the conodont succession in Chios is marked by a further horizon containing *Neospathodus gondolelloides* (Bender) below the Anisian assemblages. Therefore regarding the faunal succession in the Tethys, the *Subcolumbites* – *Prohungarites* zone cannot be considered as the latest Spathian zone. The topmost part of the section A does not contain ammonoids, whereas only conodonts of the *Neospathodus* suite are indicative of the Spathian (Muttoni et al. 1994, 1995; Orchard 1995). Almost the same situation is reported from Albania (Germani 1997). The appearance of *Chiosella timorensis* below *Neospathodus gondolelloides* and the overlap of both forms in section A, C and D as well as in section G has to be re-evaluated. The ammonoid assemblage in the condensed horizon (CH 258n) consists of long ranging forms. Gaetani et al. (1992) have already pointed out that the first appearance date of *Chiosella timorensis* (Nogami) and *Gladigondolella tethydis* (Huckriede) are distinctly below the first Aegean ammonoids, whereas *Neogondolella regale* (Mosher) was, on the contrary, found even about 2.50 m above the first Aegean ammonoids in Chios section A. For the Chios section A, Gaetani et al. (1992) correlated the thick-bedded part of the Marmarotrapeza Formation with the *haugi* zone, on the base of conodonts. Furthermore, they considered the possibility that the *Subcolumbites* – *Prohungarites* zone could be in parts correlative with the *subrobustus* zone in the Canadian Arctic and British Columbia. However, that can not be decided at the moment. Higher up, in the sections C and D, the base of the Anisian is preferentially defined with the first appearances of *Paradanubites*, *Japonites*, *Aegeiceras* and *Paracrochordiceras* which are correlative with the *welteri* beds of Nevada (Bucher 1989). Similar associations were found in Oman (Tozer & Calon 1990) and Romania (Gradinaru 1991) at the base of the Anisian.

Systematic Palaeontology

In the following palaeontological descriptions the taxonomy from order to genus level was adopted from Tozer (1981b). The Treatise (Arkell et al. 1957) and Shevryev (1986) proposals were consulted. The description of specimens was made using the following abbreviations: D (mm) = diameter, H (mm) = maximum height in D, h (mm) = minimum height in D, W (mm) = width in H, w (mm) = width in h, U (mm) = umbilicum width in D, H/W = degree of compression in H, U/D = degree of involution in D.

Grinding exposed the suture lines, in most cases not complete. They are drawn from the venter to the periumbilical margin. The elements identified are the ventral lobe, the first lateral saddle, the first lateral lobe, and the second lateral saddle and so on to the umbilicus lobe. Our ammonoid material is stored in the collection of the Naturhistorisches Forschungsinstitut, Museum für Naturkunde der Humboldt Universität zu Berlin, Invalidenstr. 43, D-10099 Berlin, Germany. The total number of each specimen is indicated, followed by the new inventory numbers of the specimens (5001-5230) together with the abbreviation "MB-C", used for Museum für Naturkunde der Humboldt Universität zu Berlin, Cephalopoden. Appendix A contains the cross-correlation between inventory numbers of ammonoids, sections, samples and the primary ammonoid numbers.

Described ammonoids:

1. *Sulioticeras* sp.
2. *Paranannites* sp.
3. *Pseudoprosphingites ali* (Arthaber, 1911)
4. *Chioceras mitzopouloi* Renz and Renz, 1947
5. *Chioceras* sp.
6. *Iscolitoides originis* (Arthaber, 1911)
7. *Chiotites globularis* Renz and Renz, 1947
8. *Albanites triadicus* (Arthaber, 1911)
9. *Pseudosageceras albanicum* (Arthaber, 1911)
10. *Pseudosageceras* sp.
11. *Dinarites cf. liatsikasi* Renz and Renz, 1947
12. *Dagnoceras* sp.
13. *Columbites* sp.
14. *Hellenites praematurus* (Arthaber, 1911)
15. *Hellenites radiatus* Renz and Renz, 1947
16. *Hellenites* sp.
17. *Epiceltites gentii* Arthaber, 1911
18. *Procarnites kokeni* (Arthaber, 1908)

19. *Procarnites* cf. *kokeni*
20. *Procarnites* sp.
21. *Eogymnites* cf. *arthaberi* (Diener, 1915)
22. *Eophyllites dieneri* (Arthaber, 1908)
23. *Eophyllites* sp.
24. *Palaeophyllites* cf. *steinmanni* Welter, 1922
25. *Arianites* (*Meropella*) *plejanae* Renz and Renz, 1947
26. *Leiophyllites variabilis* (Spath, 1934)
27. *Leiophyllites* sp.

Doubtful attributions are:

28. ?*Dieneroceras* sp.
29. ?*Metabedenstroemia* sp.

Class **Cephalopoda** Cuvier, 1797

Subclass **Ammonoidea** Zittel, 1884

Order **Ceratitida** Hyatt, 1884

Superfamily **Xenodiscaceae** Frech, 1902

Family **Xenoceltitidae** Spath, 1930

Genus *Sulioticeras* Tozer, 1994

Type species: *Xenodiscus sulioticus* Arthaber, 1911

Sulioticeras sp.

Pl. 1, fig.3; Fig. 9

Material. 1 specimen; MB-C 5109.

Description. The evolute form has a rounded venter. Ribbing may have been present, but is not clearly preserved on the inner part. The suture line is not completely exposed. Two relatively broad lateral lobes are present. The first lateral lobe is internally curved.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5109	5.22	2.09	1.55	1.69	1.04	1.58	1.23	0.30

Discussion. Due to the bad preservation of this specimen, the characteristic sculpture with ribbing on the internal part and a smooth body chamber can not be detected. Therefore a species attribution is not possible. The specimen differs from *Preflorianites garbinus* (Renz and Renz, 1947) by the form of its venter. It clearly resembles the morphology of *Sulioticeras*. The preserved part of the suture line resembles the one *Preflorianites sulioticus* (Arthaber, 1911) depicted by Kummel (1969). Tozer (1994) attributed it to the species *Sulioticeras sulioticum* Arthaber, 1911.

Occurrence. Olenekian forms are known from the *Subcolumbites* fauna of Albania and Chios.

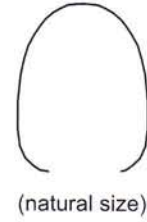


Fig. 9 - Whorl section of *Sulioticeras* sp. (MB-C 5109).

Superfamily **Noritaceae** Karpinski, 1889

Family **Paranannitidae** Spath, 1930

Genus *Paranannites* Hyatt and Smith, 1905

Type species: *Paranannites aspenensis* Hyatt and Smith, 1905

Paranannites sp.

Pl. 1, figs. 2, 4; Fig. 10

Material. 12 specimens; MB-C 5001, MB-C 5003, MB-C 5004, MB-C 5007, MB-C 5008, MB-C 5010, MB-C 5014, MB-C 5015, MB-C 5051, MB-C 5056, MB-C 5098, MB-C 5147

Description. Conchs are involute. The umbilicus is deep. Whorl sections are globular to subglobular, compressed with occasional constrictions. The ventral shoulders are rounded. The suture lines are simple, consisting of two rounded saddles, and a main lobe. MB-C 5056 shows a serrated lobe, which may be typical and may allow a comparison with *Paranannites mediterraneus* or *Paranannites mediterraneus* var. *media*.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5001	2.89	1.25	1.03	0.9	0.82	0.61	1.38	0.21
MB-C 5003	3.01	1.31	1.15	1.22	1.04	0.55	1.07	0.18
MB-C 5004	2.33	1.06	0.94			0.33		0.14
MB-C 5007	2.81	1.55	1.03	0.93		0.23	1.66	0.08
MB-C 5008	2.28	1.13	1.11			0.04		0.01
MB-C 5010	2.77			1.05	1			
MB-C 5015	1.49							
MB-C 5056	1.69							
MB-C 5098	2.41	1.32	0.75	1.01	0.62	0.34	1.30	0.14
MB-C 5147	1.19	0.6	0.43	0.63	0.46	0.59	0.16	0.13

Discussion. The morphology and the suture lines are characteristic for the genus *Paranannites*. Constrictions are present in MB-C 5147. Species of *Paranannites* are distinguished according to their whorl section, wideness of umbilicus, and sculpture. According to Kummel & Erben (1968), *Paranannites aspenensis* Hyatt and Smith marks a gradational complex including *Paranannites columbianus*, *Paranannites compressus*, *Paranannites pertenuis*, *Paranannites cottreai*, *Paranannites ptychoides* and *Paranannites aspenensis*. Even the suture lines were regarded to be conspecific by these authors. Arthaber (1911) established *Paranannites mediterraneus* for the European area, which shows constrictions and a slightly different suture line. Renz & Renz (1948) found the Chios fauna with *Paranannites mediterraneus*, its variation var. *media*, *Paranannites chionensis*, *Paranannites aspenensis* var. *europaea* and *Paranannites compressus*. Kummel (1969) included all these species into *Arnautoceltites mediterraneus* (Arthaber) with *Paranannites mediterraneus* Arthaber, 1911, as type species.

Occurrence. *Paranannites* is known almost worldwide: Nevada and Idaho in U.S. (Hyatt & Smith 1905; Kummel & Steel 1962), Kwangsi (Chao 1959), Afghanistan (Kummel & Erben 1968), *Subcolumbites* faunas of Albania and Chios (Arthaber 1911; Renz & Renz 1947, 1948; Assereto et al. 1980; Gaetani et al. 1992, Germani 1997), Siberia, Madagascar (Kummel 1973b) and Japan (Bando 1964a, b). The genus is confined to the *Prohungarites* zone.

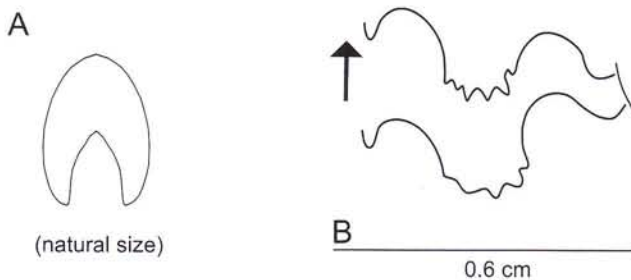


Fig. 10 - Whorl section (A MB-C 5098) and suture line (B MB-C 5056) of *Paranannites* sp.

Genus *Pseudoprosphingites* Shevyrev, 1995

Type species: *Prosphingites globosus* Kiparisova, 1947

Pseudoprosphingites ali (Arthaber, 1911)

Fig. 11

- 1911 *Prosphingites ali* Arthaber, p. 252, pl. 22, figs. 6, 7.
 1915 *Prosphingites ali* - Diener, p. 233.
 1934 *Prosphingites ali* - Spath, p. 189, fig. 59g
 1969 *Prosphingites ali* - Kummel, p. 405, pl. 20, figs. 12, 13, text fig. 16
 1992 *Prosphingites ali* - Gaetani et al., p. 192.

Material. 1 specimen; MB-C 5180 (not measurable).

Description. A very small specimen, smooth, involute with a globular conch. The suture line is four-lobate with regularly rounded saddles. The first ventral lobe is deep, simple acute. The other ones show few internal truncations.

Discussion. The species attribution is based on the characteristic appearance of the suture line. The ones figured by Arthaber (1911) and Kummel (1969) allow a direct comparison. The suture line differs from *Zenoites helena* Renz and Renz, 1948, showing a denticulated third saddle amongst four. The truncations of the lobes are more pronounced than in *Zenoites helena* sensu Kummel (1969). Other species of *Pseudoprosphingites* show much more irregularities along the basal parts of the lobes, and a flattening of the suture line.

Occurrence. Specimens of *P. ali* were described from the *Subcolumbites* fauna of Kçira, Albania. The genus *Pseudoprosphingites* is known also from the Caucasus (Shevyrev 1995), Primorye region (Kiparisova 1961) and China (Chao 1959).

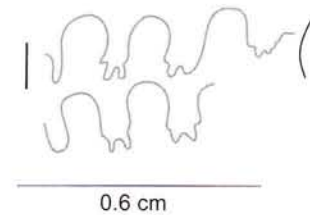


Fig. 11 - Suture line of *Pseudoprosphingites ali* (Arthaber) (MB-C5180).

Genus *Chioceras* Renz and Renz, 1947

Type species: *Chioceras mitzopouloi* Renz and Renz, 1947

Chioceras mitzopouloi Renz and Renz, 1947

Pl. 1, fig. 1

- 1947 *Chioceras mitzopouloi* Renz and Renz, p. 60, p. 74.
 1947 *Chioceras mitzopouloi* var. *meridionalis* Renz and Renz, p. 10.
 1948 *Chioceras mitzopouloi* Renz and Renz, p. 37, pl. 12, figs. 3-3b, 6-6a, 9-9a, 13.
 1947 *Chioceras mitzopouloi* var. *meridionalis* Renz and Renz, p. 38, pl. 12, figs. 8-8b.
 1969 *Chioceras mitzopouloi* Kummel, p. 446, text fig. 26.
 1980 *Chioceras mitzopouloi* - Assereto et al., p. 724.
 1992 *Chioceras mitzopouloi* - Gaetani et al., p. 187, text fig. 4.

Material: 1 specimen; MB-C 5230

Description: The evolute specimen is well preserved. It is smooth and shows a pronounced keel. Accompanying furrows are not present. The umbilical and ventral shoulders are rounded. A suture line is not exposed.

Discussion: The keel and whorl section allows an attribution to the species *Chioceras mitzopouloi*. Moreover the specimen closely resembles *Chioceras mitzopouloi* var. *meridionalis* as depicted by Renz and Renz (1948).

Occurrence: *Chioceras mitzopouloi* was described from Chios (Renz and Renz 1947, 1948; Assereto et al. 1980; Gaetani et al. 1992).

Chioceras sp.

Material. 1 specimen; MB-C 5202 (not measurable).

Description. The fragmentary, probably evolute specimen shows a keel. The whorl section is depressed, cadicone. The umbilical shoulder is rounded.

Discussion. The whorl section and the presence of the keel support an attribution to the genus *Chioceras*.

Occurrence. The genus is known only from the *Subcolumbites* fauna of Chios.



(natural size)

Fig. 12 - Whorl section *Isculitoides originis* (Arthaber) (MB-C 5021).

Genus *Isculitoides* Spath, 1930

Type species: *Isculites originis* Arthaber, 1911

***Isculitoides originis* (Arthaber, 1911)**

Pl. 1, figs. 5, 7, 10; Fig. 12

- 1911 *Isculites originis* Arthaber, p. 259, pl. 23, figs. 1-10.
- 1915 *Isculites originis* - Diener, p. 157.
- 1928 *Isculites originis* - C. Renz, p. 155.
- 1934 *Isculitoides originis* - Spath, p. 198, pl. 14, figs. 2a-d, text figs. 59b, c.
- 1947 *Isculites antiglobulus* - Renz and Renz, p. 60, p. 74.
- 1947 *Isculites globulus* - Renz and Renz, p. 60, p. 74.
- 1947 *Isculites globulus-originis* - Renz and Renz, p. 60.
- 1948 *Isculites globulus* - Renz and Renz, p. 34, pl. 14, figs. 10-10c, 4-4a, 5-5a, 8-8b, 11-11b.
- 1948 *Isculites antiglobulus* - Renz and Renz, p. 35, pl. 13, figs. 1-1a, 10-10a, 2-2a, 3-3a, 5-5a, 8-8a.
- 1948 *Isculites originis* - Renz and Renz, p. 33, pl. 13, figs. 7-7a, 9-9a, 11-11a, 12-12b, pl. 14, figs. 6-6a, 9-9a.
- 1948 *Isculites globulus-antiglobulus* - Renz and Renz, p. 35, pl. 13, figs. 4-4a, pl. 14, figs. 7-7a.
- 1948 *Isculites globulus-originis* - Renz and Renz, p. 35, pl. 13, figs. 6-6a, pl. 14, figs. 1-1a, 2-2a, 3-3a.
- 1969 *Isculitoides originis* - Kummel, p. 413, pl. 5, figs. 1-10, pl. 6, figs. 1-6, text figs. 18-20.
- 1980 *Isculitoides originis* - Assereto et al., p. 724, p. 725.
- 1992 *Isculitoides originis* - Gaetani et al., p. 187, text fig. 4.

Material. 3 specimens; MB-C 5021, MB-C 5025, MB-C 5031.

Description. Specimens are involute, globose to subglobose with rounded venters. The whorl section of MB-C 5021 is slightly higher than the other two. Due to grinding the outer surface is not preserved.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5021	2.03	1.11	0.91	1	0.95	0.01	1.11	
MB-C 5025	1.57	0.78	0.64	1.01	0.96	0.15	0.77	0.09
MB-C 5031	1.73	1.03	0.6		1.08	0.1		0.05

Discussion. Arthaber (1911) showed a variety of conchs of *Isculites originis*. Kummel (1969) documented the gradational transitions between species and "Formenreihen", then differentiated by Renz and Renz (1947, 1948). The higher whorl section of MB-C 5021 resembles *Isculites globulus-originis* Renz and Renz, the other two *Isculites globulus* Renz and Renz. The conchs are closely comparable to *Chiotites*.

Occurrence. Species of *Isculitoides* are generally recognized in Chios, Albania, Timor, British Columbia, Nevada, southeastern Idaho, Kwangsi/China, and Primorye region of Siberia. *Isculitoides originis* was described from the *Subcolumbites* fauna of Chios and Albania as well as from the *Prohungarites* fauna of Timor.

Genus *Chiotites* Renz and Renz, 1947

Type species: *Prospingites (Chiotites) globularis* Renz and Renz, 1947

***Chiotites globularis* Renz and Renz, 1947**

Pl. 1, figs. 6, 8, 9; Fig. 13

- 1947 *Chiotites globularis* Renz and Renz, 1947, p. 60, p. 74.
- 1947 *Prospingites (Chiotites) superglobosus* - Renz and Renz, p. 60, p. 74.
- 1948 *Chiotites globularis* - Renz and Renz, p. 40, pl. 15, figs. 9-9c
- 1948 *Prospingites (Chiotites) superglobosus* - Renz and Renz, p. 41, pl. 15, figs. 7-7b, 10.
- 1969 *Chiotites globularis* - Kummel, p. 420, text fig. 10.
- 1980 *Chiotites globularis* - Assereto et al., p. 725.
- 1992 *Chiotites globularis* - Gaetani et al., p. 187, text fig. 4.

Material. 7 specimens; MB-C 5020, MB-C 5022, MB-C 5023, MB-C 5027, MB-C 5028, MB-C 5029, MB-C 5032.

Description. Typical globose conchs, relatively small and very involute. Whorls with rounded shoulders and broad venter. Umbilicus is deep.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5020	1.86							
MB-C 5022	1.42	0.55	0.44	1.3	1.03	0.43	0.42	
MB-C 5023	2.03	1.25	0.77	1.41	1.38	0.01	0.88	0.004
MB-C 5027	2.19			1.65	1.63			

MB-C 5028	1.95	1.07	0.66	1.44	1.38	0.22	0.74	0.11
MB-C 5029	1.57	0.94	0.63	1.05	0.99	0	0.89	
MB-C 5032	1.1	0.84		1.27		0.26	0.66	

Discussion. Two species were assigned to *Chiotites* by Renz and Renz (1947): *Chiotites globularis* and *Chiotites superglobosus*. The latter differs by an increase in thickness, only. Kummel (1969) stated a gradational transition in whorl-dimensions between both groups and combined them into the species *Chiotites globularis* Renz and Renz, 1947. Our material does not allow a differentiation either.

Occurrence. The genus and species derived from the *Subcolumbites* fauna of Chios.



(natural size)

Fig. 13 - Whorl section *Chiotites globularis* Renz and Renz (MB-C 5022).

Family Noritidae Karpinsky, 1889

Genus *Albanites* Arthaber, 1908

Type species: *Pronorites triadicus* Arthaber, 1908

***Albanites triadicus* (Arthaber, 1908)**

Pl. 1, figs. 11, 12; Pl. 2, fig. 1; figs. 14, 15

- 1908 *Pronorites triadicus* Arthaber, p. 264, pl. 11, figs. 4a-c.
 1911 *Anasibirites* cf. *dichotomus* - Arthaber, p. 255.
 1911 *Aspidites hasserti* - Arthaber, p. 249, pl. 21, fig. 16.
 1911 *Dagnoceras komanum* - Arthaber, p. 242, pl. 21, fig. 11.
 1911 *Pronorites triadicus* - Arthaber, p. 204, pl. 17, figs. 8, 9.
 1911 *Pseudosibirites* cf. *dichotomus* - Arthaber, p. 254, pl. 22, fig. 8.
 1915 *Dagnoceras komanum* - Diener, p. 115.
 1915 *Meekoceras (Koninckites) hasserti* - Diener, p. 198.
 1915 *Pronorites triadicus* - Diener, p. 231.
 1915 *Sibirites* cf. *dichotomus* - Diener, p. 255.
 1928 *Pronorites triadicus* - C. Renz, p. 155.
 1934 *Albanites triadicus* - Spath, p. 275, fig. 95.
 1934 *Dagnoceras komanum* - Spath, p. 269, p. 275.
 1947 *Anasibirites gracilis* - Kiparisova, p. 164, pl. 39, figs. 3,4, text figs. 60, 61.
 1947 *Pronorites orientalis* - Renz and Renz, p. 62.
 1947 *Pronorites reicheli* - Renz and Renz, p. 62, p. 79.
 1947 *Pronorites triadicus* - Renz and Renz, p. 61.
 1948 *Pronorites reicheli* - Renz and Renz, p. 88, pl. 15, figs. 1-1c.
 1948 *Pronorites triadicus* - Renz and Renz, p. 84, pl. 14, figs. 14-14b.
 1968 *Albanites gracilis* - Shevryev, p. 119, pl. 6, fig. 7, pl. 7, fig. 1.
 1969 *Albanites triadicus* - Kummel, p. 477, pl. 17, figs. 1, 2.
 1980 *Albanites* cf. *triadicus* - Assereto et al., p. 725.
 1992 *Albanites* cf. *triadicus* - Gaetani et al., p. 187, text fig. 4.
 1992 *Albanites triadicus* - Gaetani et al., p. 192, pl. 15, fig. 3.

Material. 5 specimens; MB-C 5005, MB-C 5012, MB-C 5056, MB-C 5172, MB-C 5228

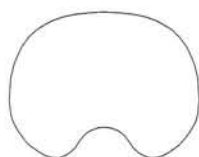
Description. Specimen MB-C 5012 and MB-C 5056 are involute, the latter with an apparently flatter venter. The ventral and the umbilical shoulders are rounded. MB-C 5005 and MB-C 5228 are more evolute, MB-C 5228 with a rounded venter, and a deep umbilicus with subvertical wall. MB-C 5005 shows a sharper ventral shoulder and a flatter venter than the other. The ornamentation is not preserved. Suture lines are well preserved in specimen MB-C 5228. Saddles are rounded, the middle one is generally inclined towards the umbilicus. Lobes are incised at the bottom. The middle one is the deepest. Lobe bases climb up again towards the umbilicus.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5005	6.03	2.57	1.83	1.93	1.36	1.63	1.33	0.27
MB-C 5012	2.66	1.35	0.76					0.20
MB-C 5056	3.44	1.83	1.07	1.21	0.7	0.54	1.51	0.15
MB-C 5228	4.44	1.96	1.29			1.19		0.26

Discussion. Several species were differentiated originally, according to differences in ornamentation, the degree of compression, and small differences in suture lines. Arthaber (1911) showed an involute specimen with flat venter as *Albanites triadicus* and a more evolute one with a flat venter as *Albanites arbanus* with minor differences in the suture line, only. Renz and Renz (1948), however, depicted a more evolute specimen of *Albanites triadicus* with a flat venter. The *A. arbanus* specimens and allies are characterized by a higher whorl section in comparison with *A. osmanicus* and *A. triadicus*. Kummel (1969) assorted them all together into the gradational complex of *Albanites triadicus*. The morphological variability of our specimens is obvious. Germani (1997) separated *A. arbanus* on behalf of his subrectangular shape from *A. osmanicus* with a more subquadrate shape.

Occurrence. The species is known from the *Subcolumbites* faunas of Afghanistan (Kummel, 1968a), Albania, and Chios (Renz & Renz 1947, 1948), and the *Probungarites* fauna of Timor. The genus is also known from Guizhou province, China (Wang 1978). Balini et al. (2000) reviewed the ammonoids and conodonts of the Lower Triassic of Dolnaya section, Mangyshlak, West Kazakhstan. *Albanites* occurs together with *Tirolites*, *Procolumnites*, *Dinarites*, and rare *Columbites*. They characterise the *Procolumnites* beds. The Early Triassic age is also indicated by various species of *Neospathodus* (i.e. *N. homeri*) and *Neogondolella*.



(natural size)

Fig. 14 - Whorl section of *Albanites triadicus* (Arthaber) (MB-C 5228).

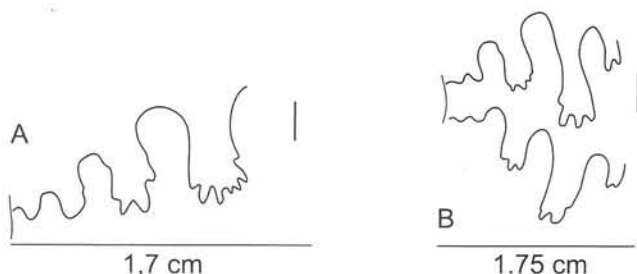


Fig. 15 - Suture lines of *Albanites triadicus* (Arthaber) (A MB-C 5096, B MB-C 5228).

Superfamily Sagecerataceae Hyatt, 1884

Family Sageceratidae Hyatt, 1900

Genus *Pseudosageceras* Diener, 1895

Type species: *Pseudosageceras multilobatum* Noetling, 1905

***Pseudosageceras albanicum* (Arthaber, 1908)**

Pl. 2, figs. 2, 3; Figs. 16, 17

- 1908 *Sageceras albanicum* Arthaber, p. 281, pl. 13, figs. 1a-1c.
- 1911 *Sageceras albanicum* - Arthaber, p. 203, pl. 17, figs. 4, 5.
- 1915 *Sageceras albanicum* - Diener, p. 249.
- 1928 *Sageceras albanicum* - C. Renz, p. 155.
- 1934 *Pseudosageceras albanicum* - Spath, p. 56, fig. 6b.
- 1947 *Sageceras albanicum* - Renz and Renz, p. 62.
- 1948 *Sageceras albanicum* - Renz and Renz, p. 94, pl. 16, figs. 5-5a, 10-10a.
- 1969 *Pseudosageceras albanicum* - Kummel, p. 363, pl. 21, figs. 5, 6.
- 1980 *Pseudosageceras cf. albanicum* - Assereto et al., p. 725.
- 1992 *Pseudosageceras albanicum* - Gaetani et al., p. 187, text fig. 4, p. 190.

Material. 6 specimens, MB-C 5060, MB-C 5070, MB-C 5130, MB-C 5138, MB-C 5144, MB-C 5149, MB-C 5151.

Description. The lanceolate conchs show a flat, angular venter and a small to closed umbilicus. Suture lines are characterized by several lobes and rounded saddles. The main lobe is threefold with a middle higher part. The connecting line of the lobe endings seems to be variable.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5060	3.66	2.27	1.22	0.73	0.46	0.17	3.10	0.04
MB-C 5130	2.86	1.71	0.91	0.5	0.38	0.24	3.42	0.08

Discussion. Species differ from *P. drinense* by a usually flat venter, from *P. pasquayi* and *P. multilobatum* by the relatively regular suture line.

Occurrence. *Subcolumbites* fauna of Albania and Chios.



(natural size)

Fig. 16 - Whorl section of *Pseudosageceras albanicum* (Arthaber) (MB-C 5060).

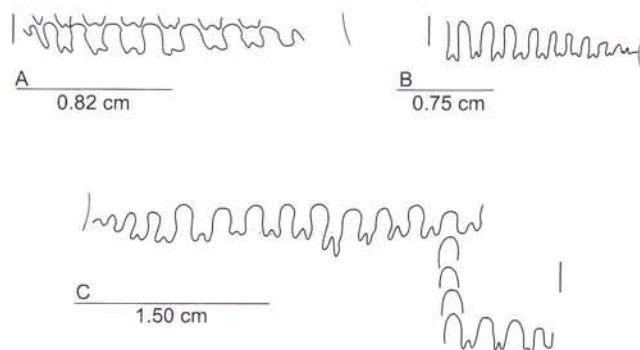


Fig. 17 - Suture lines of *Pseudosageceras albanicum* (Arthaber) (A MB-C 5070, B MB-C 5149, C MB-C 5151).

***Pseudosageceras* sp.**

Pl. 2, fig. 4; Fig. 18

Material. 7 specimens; MB-C 5088, MB-C 5124, MB-C 5135, MB-C 5148, MB-C 5170, MB-C 5189.

Description. The specimens are not well preserved. They are characterized by involute and lanceolate conchs. MB-C 5124 and MB-C 5135 show a closed umbilicus and an acute center. MB-C 5170 and MB-C 5189 has a closed umbilicus as well, but the venter is narrow and flat at its top. Incomplete suture lines show several adventitious and auxiliary lobes.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5135	1.53	0.8	0.54	0.3	0.23	0.19	2.66	0.12

Discussion. The preservation of the specimens does not allow a distinct species attribution. Out of the

five *Pseudosageceras* species, *P. drinense* is characterised by an acute venter, so that MB-C 5124 and MB-C 5135 might be comparable with it. The others show affinities to *P. albanicum*.



Fig. 18 - Suture line of *Pseudosageceras* sp. (MB-C 5148).

Superfamily Dinaritaceae Mojsisovics, 1882

Family Dinaritidae Mojsisovics, 1882

Genus *Dinarites* Mojsisovics, 1882

Type species: *Ceratites dalmatinus* Hauer, 1865

Dinarites cf. liatsikasi Renz and Renz, 1947

Pl. 2, fig. 5; Fig. 19

1947 *Dinarites liatsikasi* Renz and Renz, p. 60, p. 75.

1948 *Dinarites liatsikasi* - Renz and Renz, p. 49, pl. 1, fig. 3.

1969 *Dinarites liatsikasi* - Kummel, p. 510, text fig. 40.

1990 *Dinarites* cf. *liatsiasi* - Gaetani et al., p. 192.

Material. 1 specimen; MB-C 5178 (not measurable).

Description. The fragmentary specimen shows a rectangular whorl section with rounded ventral shoulders and a relatively flat top. Primary ribs, slightly prorsiradiate with a forward turn crossing the ventral shoulder, then crossing the venter. A suture line is not visible.

Discussion. Renz and Renz (1947, 1948) described *Dinarites liatsikasi* and figured a specimen quite similar to ours. It differs clearly from *Dinarites dalmatinus* (Hauer, 1865) by the ornamentation.

Occurrence. *Dinarites liatsikasi* occurs only in the *Subcolumbites* fauna of Chios.



Fig. 19 - Whorl section of *Dinarites* cf. *liatsikasi* (MB-C 5178).

Genus *Dagnoceras* Arthaber, 1911

Type species: *Dagnoceras nopcsanum* Arthaber, 1911

Dagnoceras sp.

Fig. 20

Material. 1 specimen; MB-C 5210 (not measurable).

Description. An involute specimen. Only one flank is preserved, the other one is worn. The grinded flank is flat, the ventral shoulders are angular, and the narrow venter itself seems to be arched. The suture line consists of a deep lateral lobe, which shows deep denticulations at its base. The ventral side of the lobe is still denticulate and ends in a narrow irregular first lateral saddle.

Discussion. The genus is characterized by the prominent denticulated first lateral lobe. The suture line resembles the one of *Dagnoceras ellipticum* Chao, 1959. But a narrow first lateral saddle is present as well. Kummel (1969) expressed his opinion that due to grinding the suture lines of *Dagnoceras* may appear simple. For that reason sutural differences between *Dagnoceras* and *Metadagnoceras* may be not that important. Morphology of the conch is comparable.

Occurrence. In addition to Albania, *Dagnoceras* is known from Timor, China, and Pakistan (Kummel 1966, Guex 1978), and from Iran (Tozer 1972).

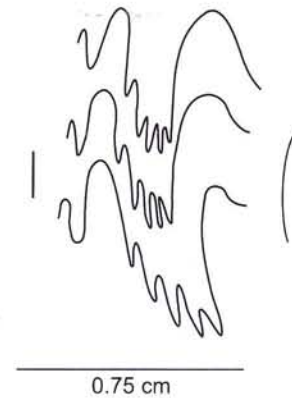


Fig. 20 - Suture line of *Dagnoceras* sp. (MB-C 5210).

Family Columbbitidae Spath, 1934

Genus *Columbites* Spath, 1930

Type species: *Columbites parisiannus* Hyatt and Smith, 1905

Columbites sp.

Pl. 2, fig. 6; Fig. 21

Material. 2 specimens; MB-C 5203, MB-C 5220 (both not measurable).

Description. These two fragments show a subquadrate compressed whorl section. They are moderately evo-

lute. A keel is missing. The ventral shoulders are rounded, the umbilicus is deep, its shoulder rounded as well. Ribs turn forward crossing the ventral shoulder and the venter. Ornamentation is missing on MB-C 5220. Relics of a suture line are present. The outline of the lobe is almost without denticulation. The saddles are well rounded. The umbilical saddle is less high than the ventral one.

Discussion. The whorl section, the venter without keel, and the ribbing are comparable to both *Columbites* and *Subcolumbites* type ammonoids. The latter displaying a regular fine ribbing in the types of the *Subcolumbites perrinismithi*-group and rib bundling along with coarser ribs in the *Subcolumbites dusmani*-group. Both share an intense denticulation of the lobe bases. As rib bundling is not displayed, ornamentation is accentuated and lobe bases are almost not denticulated. An attribution to the *Columbites* suite is preferred herein.

Occurrence. The genus is known from Idaho, U.S. (Kummel 1969; Hyatt and Smith 1905), Mangyshlak, West Kazakhstan (Astakhova 1960a, b; Kiparisova 1961, Balini et al. 2000), and Primorye, Far East (Astakhova 1960a, b; Kiparisova 1961). Kummel (1969) questioned further descriptions from Siberia. From the Chios and Albania sites only *Subcolumbites* is recorded frequently (Arthaber 1911; Renz and Renz 1947, 1948; Germani 1997).

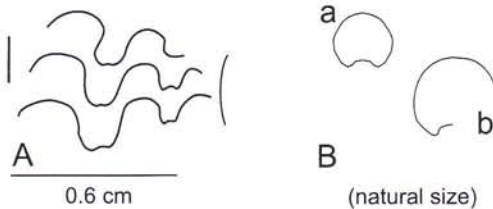


Fig. 21 - Suture line (A) and whorl sections (B) of *Columbites* sp. (a MB-C 5203, b MB-C 5220).

Genus *Hellenites* Renz and Renz, 1947

Type species: *Tropiceltites praematurus* Arthaber, 1911

***Hellenites praematurus* (Arthaber, 1911)**

Pl. 2, figs. 7, 8, 8, 10; Fig. 22

- 1911 *Tropiceltites praematurus* Arthaber, p. 268, pl. 24, figs. 9a-b
- 1911 *Tropiceltites* ? *praematurus* - Arthaber, p. 269, pl. 24, figs. 10a-b
- 1915 *Tropiceltites* ? *praematurus* - Diener, p. 300, nn.
- 1928 *Tropiceltites praematurus* - C. Renz, p. 155, nn.
- 1947 *Hellenites praematurus* - Renz and Renz, p. 60, p. 75, nn.
- 1947 *Hellenites praematurus* var. *aegeaica* - Renz and Renz, p. 60, nn.
- 1947 *Hellenites trikkalinoi* - Renz and Renz, p. 60, p. 75, nn.
- 1947 *Hellenites trikkalinoi* var. *graeca* - Renz and Renz, p. 60, nn.
- 1948 *Hellenites praematurus* - Renz and Renz, p. 44, pl. 2, figs. 3-3a, 7-7a
- 1948 *Hellenites praematurus* var. *aegeaica* - Renz and Renz, p. 45, pl. 2, figs. 6-6b, 8-8b, 9-9a
- 1948 *Hellenites trikkalinoi* - Renz and Renz, p. 46, pl. 2, figs. 1-1a, 2-2b, 4-4b

- 1948 *Hellenites trikkalinoi* var. *graeca* - Renz and Renz, p. 46, pl. 2, figs. 5-5b
- 1959 *Hellenites* cf. *praematurus* - Chao, p. 145, pl. 41, figs. 1, 2
- 1969 *Hellenites praematurus* - Kummel, p. 512, pl. 7, figs. 1-4, text fig. 43
- 1980 *Hellenites praematurus* - Assereto et al., p. 725, nn.
- 1992 *Hellenites praematurus* - Gaetani et al., p. 192, pl. 15, fig. 1, nn.

Material. 15 specimens; MB-C 5179, MB-C 5188, MB-C 5190, MB-C 5193, MB-C 5195, MB-C 5196, MB-C 5197, MB-C 5208, MB-C 5209, MB-C 5212, MB-C 5214, MB-C 5215, MB-C 5217, MB-C 5224, MB-C 5225.

Description. The specimens are evolute with parallel flanks. The umbilical shoulder is rounded, but not accentuated. The ventral shoulder is rounded, the venter rounded to arched. A central keel is associated with two furrows. The ribs are rursiradiate till they reach the ventral shoulder. The ornamentation varies between extremely fine to coarse ribbing. The ribs curve forward significantly on the venter. The suture is composed of broad rounded saddles and relatively flat based, denticulated lobes.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5190	3.18	1.09	0.75			1.34		0.42
MB-C 5179	2.61	0.84	0.6		1.07	1.17		0.44
MB-C 5195	2.03	0.65	0.57	0.64	0.59	0.81	1.01	0.39
MB-C 5224	2.39	0.75	0.61			1.03		0.43

Discussion. The distinguishing feature between *Hellenites praematurus* and *Hellenites radiatus* is the character of the ribbing: rursiradiate in the first and radial in the latter species. Sutures are basically the same.

Occurrence. *Hellenites praematurus* occurs in the *Subcolumbites* faunas of Albania and Chios (Kummel 1969) as well as in Kwangsi, China (Chao 1959).

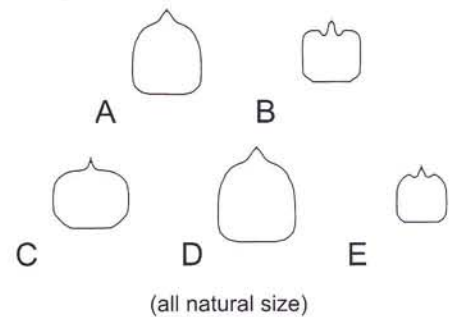


Fig. 22 - Whorl sections of *Hellenites* sp. (A MB-C 5162), *Hellenites praematurus* (Arthaber) (B MB-C 5195, C MB-C 5216, D MB-C 5190), and *Hellenites radiatus* Renz & Renz (E MB-C 5177).

***Hellenites radiatus* Renz and Renz, 1947**

Pl. 2, figs. 12, 13; Fig. 22

- 1947 *Hellenites (Pallasites) radiatus* Renz and Renz, p. 60, p. 75.

- 1947 *Hellenites (Pallasites) striatus* Renz and Renz, p. 60, p. 75.
 1947 *Hellenites (Pallasites) striatus* var. *densicostata* Renz and Renz, p. 60, p. 75.
 1948 *Hellenites (Pallasites) radiatus* - Renz and Renz, p. 47, pl. 2, figs. 12- 12b, 13-13b.
 1948 *Hellenites (Pallasites) striatus* - Renz and Renz, pl. 47, pl. 2, figs. 11-11a.
 1948 *Hellenites (Pallasites) striatus* var. *densicostata* - Renz and Renz, p. 48, pl. 2, figs. 10-10b.
 1959 *Hellenites* cf. *praematurus* - Chao, p. 145, pl. 41, figs. 3, 4.
 1969 *Hellenites radiatus* - Kummel, p. 514, text fig. 43.
 1992 *Hellenites radiatus* - Gaetani et al., p. 192, pl. 15, fig. 6.

Material. 3 specimens; MB-C 5177, MB-C 5213, MB-C5229.

Description. Evolute specimens with wide umbilicus and rounded umbilical shoulders. Flanks are parallel. The venter is arched. A keel with two associated shallow furrows is typical. Regularly spaced ribs are radial on the flanks and turn forward on the venter.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5177	1.99	0.69	0.56	0.69		0.74	1	0.37

Discussion. The typical radial ribbing, here preserved, is the distinguishing feature from *Hellenites praematurus*.

Occurrence. *Hellenites radiatus* is known from the Tobin Formation of Nevada, from Kwangsi, China, and from the *Subcolumbites* fauna of Chios.

Hellenites sp.

Pl. 2, fig. 11; Fig. 22

Material. 28 specimens: MB-C 5002, MB-C 5160, MB-C 5161, MB-C 5162, MB-C 5163, MB-C 5164, MB-C 5166, MB-C 5167, MB-C 5176, MB-C 5182, MB-C 5183, MB-C 5184, MB-C 5186, MB-C 5187, MB-C 5191, MB-C 5192, MB-C 5199, MB-C 5200, MB-C 5201, MB-C 5204, MB-C 5205, MB-C 5206, MB-C 5216, MB-C 5218, MB-C 5219, MB-C 5223, MB-C 5226, MB-C 5227.

Description. Fragmentary specimens, all evolute, with a keeled venter and ribbing.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5183	2	0.77	0.57	0.4		0.66	1.92	0.33
MB-C 5199	2.96							
MB-C 5218	3.36		1.1		0.82	2.26		0.67

Genus *Epichelites* Arthaber, 1911

Type species: *Epichelites gentii* Arthaber, 1911

Epichelites gentii Arthaber, 1911

Pl. 2, fig. 14; Fig. 23

- 1911 *Epichelites gentii* Arthaber, p. 268, pl. 24, fig. 8.
 1915 *Epichelites gentii* - Diener, p. 131.
 1928 *Epichelites gentii* - C. Renz, p. 155.
 1934 *Epichelites gentii* - Spath, p. 210, pl. 13, figs. 5a-d.
 1947 *Epichelites gentii* - Renz and Renz, p. 60.
 1948 *Epichelites gentii* - Renz and Renz, p. 43, pl. 1, figs. 9a-d.
 1969 *Epichelites gentii* - Kummel, p. 447, pl. 3, figs. 10, 11, pl. 35, figs. 6, 7, text fig. 26.
 1992 *Epichelites gentii* - Gaetani et al., p. 192, pl. 15, fig. 4.

Material. 2 specimens, MB-C 5211, MB-C 5222.

Description. The conch is evolute and shows an arched venter. Marked ribs are widely spaced, prorsiradate and falcoid, crossing the venter. A suture is missing.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5222	3.5	1.35	1.03	1.01	0.95	1.12	1.33	0.32

Discussion. The specimen closely resembles the ones described by Renz and Renz (1948) and Renz (1928) with widely spaced ribs.

Occurrence. *Epichelites gentii* is known from the Olenekian strata of Chios, Albania, and also from Idaho (Kummel 1969).

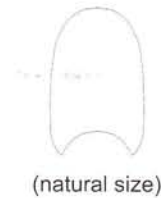


Fig. 23 - Whorl section of *Epichelites gentii* Arthaber (MB-C 5222).

Superfamily Megaphyllitaceae Mojsisovics, 1896

Family Procarnitidae Chao, 1959

Genus *Procarnites* Arthaber, 1911

Type species: *Parapopanoceras kokeni* Arthaber, 1908

Procarnites kokeni (Arthaber, 1908)

Pl. 3, figs. 1, 2, 3, 4, 5; Figs. 24, 25

- 1908 *Parapopanoceras kokeni* Arthaber, p. 259, pl. 11, figs. 1a-c, 2a-b.
 1911 *Procarnites kokeni* - Arthaber, p. 215, pl. 17, figs. 16, 17, pl. 18, figs. 1-5.
 1915 *Procarnites kokeni* - Diener, p. 228.
 1917 *Procarnites kokeni* - Diener, p. 167, pl. 1, figs. 4, 5.
 1928 *Procarnites kokeni* - C. Renz, p. 155.
 1934 *Procarnites kokeni* - Spath, p. 181, pl. 3, fig. 1.
 1947 *Procarnites kokeni* - Renz and Renz, p. 61.
 1947 *Procarnites kokeni* var. *evoluta* - Renz and Renz, p. 61.
 1947 *Procarnites kokeni* var. *panteleimonensis* - Renz and Renz, p. 61, p. 78.
 1948 *Procarnites kokeni* - Renz and Renz, p. 81, pl. 8, figs. 5, 6-6a, 7-7a, 8-8a, 9-9a, pl. 9, figs. 2-2a.

- 1948 *Procamnites kokeni* var. *evoluta* - Renz and Renz, p. 82, pl. 9, figs. 1-1a.
- 1948 *Procamnites kokeni* var. *panteleimonensis* - Renz and Renz, p. 82, pl. 8, figs. 3-3a, pl. 9 figs. 3-3a.
- 1966 *Procamnites kokeni* - Kummel, p. 390, pl. 2, figs. 10-13.
- 1968 *Procamnites kokeni* - Kummel, p. 493, pl. 1, fig. 16.
- 1968 *Procamnites kokeni* - Shevyrev, p. 190, pl. 15, fig. 6.
- 1969 *Procamnites kokeni* - Kummel, p. 391, pl. 12, figs. 1, 2, pl. 13, figs. 1-8.
- 1978 *Procamnites kokeni* - Wang, p. 167, pl. 2, figs. 15-19.
- 1979 *Procamnites kokeni* - Assereto et al., p. 724, p. 725.
- 1992 *Procamnites kokeni* - Gaetani et al., p. 187 (text fig. 4), p. 188, p. 190, p. 192, pl. 15, fig. 7.
- 1997 *Procamnites kokeni* - Germani, p. 276, pl. 1, figs. 3a-b, figs. 4a-e.

Material. 24 specimens; MB-C 5009, MB-C 5046, MB-C 5047, MB-C 5062, MB-C 5068, MB-C 5069, MB-C 5072, MB-C 5074, MB-C 5075, MB-C 5076, MB-C 5079, MB-C 5081, MB-C 5087, MB-C 5117, MB-C 5125, MB-C 5127, MB-C 5134, MB-C 5142, MB-C 5150, MB-C 5153, MB-C 5154, MB-C 5158, MB-C 5165, MB-C 5171.

Description. Involute forms, compressed with elliptical whorl section. The degree of compression and shape of the venter vary with the dimensions of the specimen. Smaller ones are usually less compressed with a rounded venter, than larger ones, which are more compressed with a narrowly rounded to acute venter. The flanks are always convex. The umbilicus is small with a subvertical wall. The suture line consists of several lobes and saddles, with an irregular denticulation reaching high up onto the flanks.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5009	4.38	2.25	1.82			0.31		0.07
MB-C 5046	1.84	0.96	0.59	0.58	0.43	0.29	1.65	0.15
MB-C 5047	2.39	1.12	1.07	0.59	0.44	0.2	1.89	0.08
MB-C 5062	1.77	0.93	0.65	0.61	0.47	0.32		
MB-C 5069	1.61	0.85		0.41		0.76	2.07	0.47
MB-C 5072	3.36	1.79	1.22	0.95	0.62	0.35	1.88	0.10
MB-C 5074	1.72	0.85	0.67	0.59	0.4	0.2	1.44	
MB-C 5075	2.17	1.04	0.91			0.22		0.10
MB-C 5076	3.33	1.88	1.32			0.13		0.03
MB-C 5079	1.48		0.58		0.35	0.9		0.60
MB-C 5081	1.54	0.81	0.55	0.5	0.36	0.18	1.62	0.11
MB-C 5087	2.19	1.12	0.78			0.29		0.13
MB-C 5088	1.85	1.02	0.65	0.64	0.43	0.18	1.59	0.09
MB-C 5117	2.04	1.15	0.72	0.69	0.51	0.17	1.66	0.08
MB-C 5125	3.13	1.7	1.2			0.23		0.07
MB-C 5127	5.22	2.75	1.11	1.73	1.15	1.36	1.58	0.26

MB-C 5134	1.45	0.78	0.49				0.18		0.12
MB-C 5142	2.75								
MB-C 5153	2.2	1.24	0.72	0.69	0.49	0.24	1.79	0.10	
MB-C 5158	4.04	2.22	1.47				0.35		0.08
MB-C 5165	6.3	3.27	2.11	1.63	0.97	0.92	2.00	0.14	
MB-C 5171	2.63	1.23	0.93				0.47		

Discussion. The specimens show minor morphological differences, only. They differ from *Procamnites acutus* Spath, 1930, in missing a sharp, narrow venter. *Procamnites skanderbegis* Arthaber, 1911, is described to be more compressed and inflated. However Germani (1997) took into consideration that it might be conspecific to *Procamnites kokeni*. Kummel (1969) included both into the species *Procamnites kokeni*.

Occurrence. *Procamnites kokeni* is a common element of the *Subcolumbites-Prohungarites* zone (Kummel 1973a, b) of Albania and Chios (Renz & Renz 1947, 1948; Assereto et al. 1980; Gaetani et al. 1992; Germani 1997). It is also known from the *Subcolumbites* faunas of Afghanistan (Kummel 1968a), from southern URSS (Shevyrev 1968), from Oman (Tozer & Calon 1990), from the *Prohungarites* fauna of Timor (Kummel 1968b) and from the *Procamnites-Leiophyllites* zone of China (Wang 1978). Balini et al. (2000) reported it from the Dolnapa section of Mangyshlak, West Kazakhstan.

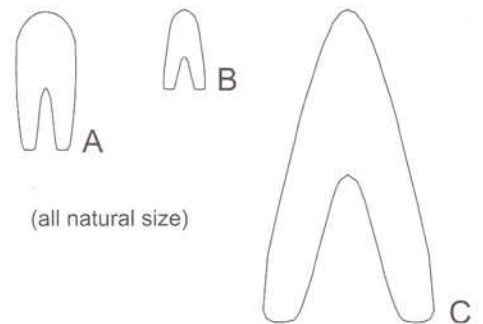


Fig. 24 - Whorl sections of *Procamnites kokeni* (Arthaber) (A MB-C 5072, B MB-C 5117, C MB-C 5118).

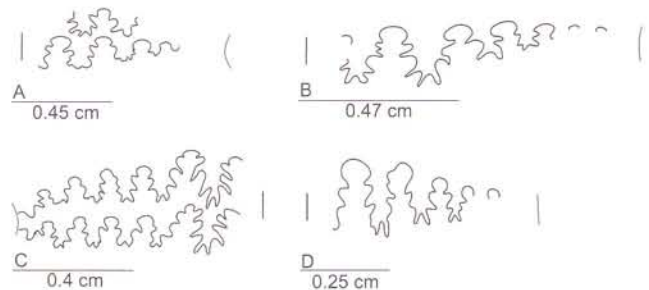


Fig. 25 - Suture lines of *Procamnites kokeni* (Arthaber) (A MB-C 5075, B MB-C 5079, C MB-C 5104, D MB-C 5154, E MB-C 5153, F MB-C 5171).

Procarnites cf. kokeni (Arthaber, 1908)

Material. 2 specimens; MB-C 5017, MB-C 5057.

Description. MB-C 5017 is a juvenile small specimen. The other one shows the typical morphology of the species. The suture is not well preserved, due to grinding.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5017	1.51	0.86	0.57	0.55	0.41	0.08	1.56	0.05
MB-C 5057	2.72	1.26	0.91	0.57		0.55	2.21	0.20

Procarnites sp.

Fig. 26

Material. 14 specimens; MB-C 5011, MB-C 5018, MB-C 5059, MB-C 5104, MB-C 5108, MB-C 5142, MB-C 5159, MB-C 5169, MB-C 5173, MB-C 5174, MB-C 5181, MB-C 5185, MB-C 5194.

Description. Specimens attributed to *Procarnites* sp. are preserved only fragmentary or deformed. It is still obvious that conchs are involute with convex flanks, and rounded to acute venters. Suture lines are partly preserved and exhibit the typical denticulated multi-element shape of the genus. MB-C 5104 show denticulation higher up onto the flanks than the others.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5059	1.91	1	0.7			0.21		
MB-C 5104	1.42	0.72	0.5	0.48	0.43	0.2	1.5	0.14
MB-C 5173	2.06	1.08	0.76	0.88	0.68	0.22	1.22	0.10
MB-C 5174	15.85	5.73	4.62			5.5		0.34

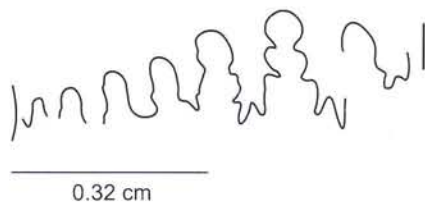


Fig. 26 - Suture line of *Procarnites* sp. (MB-C 5169).

Superfamily Pinacocerataceae Mojsisovics, 1879

Family Japonitidae Tozer, 1971

Genus *Eogymnites* Spath

Type species: *Japonites arthaberi* Diener, 1915

Eogymnites cf. arthaberi (Diener, 1915)

Pl. 3, fig. 6, 7; Fig. 27

- 1911 *Japonites sugriva* Diener var. Arthaber, p. 231, pl. 20, fig. 4.
 1915 *Japonites arthaberi* - Diener, p. 158.
 1969 *Eogymnites arthaberi* - Kummel, p. 517, pl. 21, figs. 1, 2, text fig. 45.
 1992 *Eogymnites arthaberi* - Gaetani et al., p. 190.

Material. 2 specimens; MB-C 5146, MB-C 5156.

Description. The specimen are evolute. The ventral and umbilical shoulders are rounded. The umbilical wall is deep and subvertical. The flanks are convex with the greatest width at the umbilical shoulder. The suture lines of the outer whorls are not preserved. On the inner part they exhibit denticulated lobes and saddles, but the suture lines are not complete.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5146	2.77	0.89	0.68			1.2		0.43

Discussion. The complicated suture line with denticulated lobes and saddles is characteristic, and favors an attribution to *Eogymnites arthaberi*.

Occurrence. *Subcolumbites* fauna of Albania.

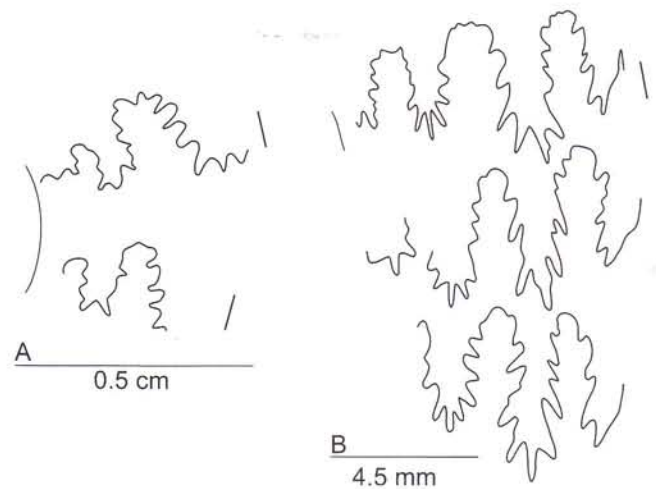


Fig. 27 - Suture lines of *Eogymnites arthaberi* (Diener) (A MB-C 5155, B MB-C 5156).

Order Phyllocerata

Superfamily Phyllocerataceae Zittel, 1884

Family Ussuritidae Hyatt, 1900

Genus *Eophyllites* Spath, 1930

Type species: *Monophyllites dieneri* Arthaber, 1908

Eophyllites dieneri (Arthaber, 1908)

(Pl. 3, figs. 8, 9)

- 1908 *Monophyllites dieneri* Arthaber, p. 288, pl. 13, figs. 3a-c.
 1908 *Monophyllites dieneri* var. Arthaber, p. 288, pl. 13, figs. 4a-c.
 1911 *Monophyllites dieneri* – Arthaber, . 234, pl. 20, figs. 5-8.
 1915 *Monophyllites dieneri* – Diener, p. 203.
 1930 *Eophyllites dieneri* – Spath, p. 89.
 1934 *Eophyllites dieneri* – Spath, p. 293.
 1948 *Monophyllites (Eophyllites) dieneri* var. *involuta* – Renz and Renz, p. 75, pl. 5, figs. 1a-b.
 1948 *Monophyllites (Schizophyllites) betilloni* – Renz and Renz, p. 76, pl. 4, figs. 8-8b.
 1948 *Monophyllites (Schizophyllites) betilloni* var. *evoluta* – Renz and Renz, p. 76, pl. 4, figs. 6-6a, pl. 5, figs. 2-2a, 4-4a, 6-6a.
 1969 *Eophyllites dieneri* – Kummel, p. 524, pl. 23, figs. 1-5.
 1980 *Eophyllites dieneri* – Assereto et al., p. 725.
 1992 *Eophyllites dieneri* – Gaetani et al., p. 187 (text fig. 4), p. 188.
 1997 *Eophyllites dieneri* – Germani, p. 282, pl. 1, fig. 8.

Material. 2 specimens; MB-C 5110, MB-C 5145.

Description. MB-C 5110 is evolute, discoidal with a rounded venter and rounded ventral shoulders. The umbilicus is wide, the umbilical shoulder becomes progressively more rounded towards the outer whorl preserved. The umbilical wall is subvertical and moderately deep. Weak growth lines are present on the flanks. MB-C 5145 is a very small specimen. The suture line exposes high rounded saddles, and denticulated lobes.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5110	3.27	1.06	0.84			1.37		0.41
MB-C 5145	1.12	0.52	0.27	0.37	0.28	0.33	1.40	0.29

Discussion. The species attribution is based on the suture line exposed on the small specimen and on the resemblance of the general morphology with the specimens figured and described by Renz & Renz (1948).

Occurrence. *Eophyllites* species are known from the *Subcolumbites-Probungarites* zone (sensu Kummel 1973a) of Albania (Arthaber 1908, 1911, Germani 1997) and Chios (Renz and Renz 1947, 1948; Assereto et al. 1980; Gaetani et al. 1992). The occurrence in China is not certain (Wang & He 1976; Germani 1997). It derived from *Albanites* beds of Iran (Tozer 1972) and from *Probungarites* beds of Timor (Spath 1934).

Eophyllites sp.

Fig. 28

Material. 1 specimen; MB-C 5198 (not measurable).

Description. A fragmentary specimen, evolute, with a broadly arched venter, and rounded ventral shoulders. The umbilicus is wide. The suture line consists of shallow wide denticulated lobes, divided by rounded saddles.

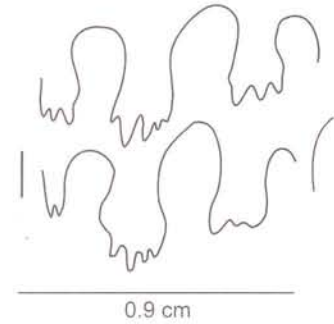


Fig. 28 - Suture line of *Eophyllites* sp. (MB-C 5198).

Genus *Arianites* Renz and Renz, 1947

Subgenus *Meropella* Renz and Renz, 1948

Type species: *Arianites (Meropella) plejanae* Renz and Renz, 1947

Arianites (Meropella) plejanae Renz and Renz, 1947

- 1947 *Arianites (Meropella) plejanae* Renz and Renz, p. 67, p. 79.
 1948 *Arianites (Meropella) plejanae* – Renz and Renz, p. 95, pl. 3, figs. 3-3b, 11-11b.
 1969 *Meropella plejanae* – Kummel, p. 447, pl. 20, figs. 14, 15, text fig. 26.
 1980 *Meropella plejanae* – Assereto et al., p. 725.

Material. 1 specimen; MB-C 5128 (not measurable).

Description. Evolute with a rounded whorl section. The early volution shows slight umbilical nodes. The suture line is incomplete; it consists of two lateral bifid lobes.

Discussion. The specimen resembles the figures by Renz & Renz (1948).

Occurrence. The genus is known only from the *Subcolumbites* fauna of Chios. A fragmentary specimen has been described as *Meropella* cf. *plejanae* from Afghanistan (Kummel 1968a).

Genus *Palaeophyllites* Welter, 1922

Type species: *Palaeophyllites steinmanni* Welter, 1922

Palaeophyllites cf. *steinmanni* Welter, 1922

Pl. 3, fig. 10; Fig. 29

- 1922 *Palaeophyllites steinmanni* Welter, p. 119, pl. 162, figs. 5-7, pl. 163, figs. 3-6.
 1934 *Palaeophyllites steinmanni* – Spath, p. 297, fig. 103.
 1947 *Monophyllites (Palaeophyllites) thalmanni* – Renz and Renz, p. 61, p. 78.
 ?1947 *Monophyllites (Palaeophyllites) praekiepertii* – Renz and Renz, p. 61, p. 78.
 1948 *Monophyllites (Palaeophyllites) thalmanni* – Renz and Renz, p. 79, pl. 3, figs. 10-10b.
 ?1948 *Monophyllites (Palaeophyllites) praekiepertii* – Renz and Renz, p. 80, pl. 4, figs. 5-5b.

- 1969 *Palaeophyllites steinmanni* – Kummel, p. 527.
- 1980 *Palaeophyllites* cf. *steinmanni* – Assereto et al., p. 725.
- 1980 *Palaeophyllites* cf. *steinmanni* – Gaetani et al., p. 187 (text fig. 4).
- 1997 *Paleophyllites steinmanni* – Germani, p. 285, pl. 2, figs. 2a-b, 9b.

Material. 1 specimen; MB-C 5038.

Description. The conch is compressed and evolute. The whorl section is rectangular with rounded ventral shoulders and parallel flanks. The venter is relatively wide and rounded. Umbilicus is deep with nearly vertical walls. Ornamentation consists of badly preserved, closely spaced, concave ribs. A suture line is not preserved.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5038	1.61	0.68	0.4	0.44	0.34	0.53	1.54	0.32

Discussion. The species attribution is tentative due to the rather small conch.

Occurrence. *Palaeophyllites steinmanni* is known from the *Subcolumbites* faunas of Albania and Chios, and from the *Prohungarites* zone of Timor (Kummel 1968b, Kummel 1969).



(natural size)

Fig. 29 - Whorl section of *Palaeophyllites* cf. *steinmanni* (MB-C 5038).

Genus *Leiophyllites* Diener, 1915

Type species: *Monophyllites suessi* Mojsisovics, 1882

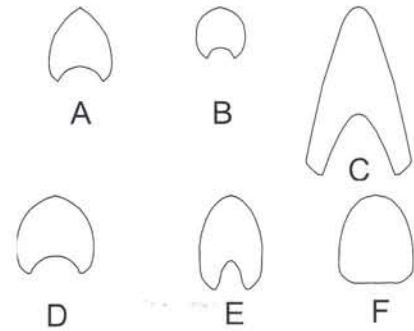
***Leiophyllites variabilis* (Spath, 1934)**

Pl. 4, figs. 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 14, 14, 15, 16;
Figs. 30, 31, 32

- 1911 *Monophyllites pitamaha* - Arthaber (non Diener), p. 234, pl. 20, figs. 9-11.
- 1915 *Monophyllites (Leiophyllites) pitamaha* - Diener, p. 205.
- 1928 *Monophyllites pitamaha* - C. Renz, p. 155.
- 1934 *Eophyllites variabilis* Spath, p. 296, pl. 2, fig. 3, pl. 6, fig. 1, pl. 7, fig. 1.
- 1934 *Eophyllites variabilis* var. *evoluta* Spath, p. 296.
- 1934 *Eophyllites variabilis* var. *involuta* Spath, p. 296, pl. 4, fig. 1.
- 1947 *Monophyllites (Leiophyllites) georgalasi* Renz and Renz, p. 61, p. 77.
- 1947 *Monophyllites (Leiophyllites) palaeotriadicus* Renz and Renz, p. 61, p. 78.
- 1947 *Monophyllites (Leiophyllites) aff. pitamaha* - Renz and Renz, p. 61.
- 1947 *Monophyllites (Leiophyllites) praeconfucii* Renz and Renz, p. 61, p. 77.
- 1948 *Monophyllites (Leiophyllites) georgalasi* - Renz and Renz, p. 74, pl. 4, figs. 3-3a.
- 1948 *Monophyllites (Leiophyllites) palaeotriadicus* - Renz and Renz, p. 75, pl. 4, figs. 4-4a.
- 1948 *Monophyllites (Leiophyllites) aff. pitamaha* - Renz and Renz, p. 76, pl. 3, figs 9-9a, pl. 4, figs 7-7b.
- 1948 *Monophyllites (Leiophyllites) praeconfucii* - Renz and Renz, p. 73, pl. 4, figs. 1-1b, 2-2a.

- 1958 *Leiophyllites praematurus* - Kiparisova, pl. 7, fig. 13, text fig. 17.
- 1961 *Leiophyllites praematurus* - Kiparisova, p. 134, pl. 28, figs. 5, 6.
- 1969 *Leiophyllites variabilis* - Kummel, p. 531, pl. 22, figs. 5-10, text figs. 49, 50.
- 1980 *Leiophyllites variabilis* - Assereto et al., p. 724, p. 725..
- 1992 *Leiophyllites variabilis* - Gaetani et al., p. 187, text fig. 4.

Material. 74 specimens; MB-C 5006, MB-C 5013, MB-C 5016, MB-C 5019, MB-C 5026, MB-C 5030, MB-C 5033, MB-C 5034, MB-C 5035, MB-C 5036, MB-C 5037, MB-C 5039, MB-C 5040, MB-C 5041, MB-C 5042, MB-C 5043, MB-C 5044, MB-C 5045, MB-C 5048, MB-C 5049, MB-C 5050, MB-C 5052, MB-C 5053, MB-C 5054, MB-C 5055, MB-C 5058, MB-C 5061, MB-C 5063, MB-C 5064, MB-C 5065, MB-C 5066, MB-C 5067, MB-C 5071, MB-C 5073, MB-C 5077, MB-C 5080, MB-C 5082, MB-C 5083, MB-C 5084, MB-C 5085, MB-C 5086, MB-C 5089, MB-C 5090, MB-C 5091, MB-C 5092, MB-C 5093, MB-C 5094, MB-C 5095, MB-C 5097, MB-C 5099, MB-C 5100, MB-C 5101, MB-C 5102, MB-C 5103, MB-C 5105, MB-C 5106, MB-C 5107, MB-C 5111, MB-C 5114, MB-C 5115, MB-C 5116, MB-C 5118, MB-C 5119, MB-C 5120, MB-C 5121, MB-C 5122, MB-C 5123, MB-C 5126, MB-C 5129, MB-C 5131, MB-C 5132, MB-C 5136, MB-C 5137, MB-C 5152.



(all natural size)

Fig. 30 - Whorl sections of *Leiophyllites variabilis* (Spath) (A MB-C 5067, B MB-C 5030, C MB-C 5061, D MB-C 5077, E MB-C 5094, F MB-C 5080).

Description. A great number of specimens is attributed to *Leiophyllites variabilis*. They all have very evolute, serpenticone conchs without ornamentation. Whorl section shows a relatively high rectangular shape with rounded shoulders and a rounded venter. The flanks are parallel. The umbilical shoulder is rounded. Up to one half of the previous turn is covered. Some show compressed whorl sections, its width higher than height. The suture lines consist of three major lobes deeply serrated. Denticulation reaches high up on to the flanks. Outline of the saddles is rounded. Fig. 32 shows the wide range of dimensions between specimens.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5013		2.1						
MB-C 5016	2	0.65				1.4		0.68
MB-C 5030	2.23	0.98	0.7	1.05		1.89	0.93	0.52

MB-C 5034	3.82	1.25	0.94			1.63		0.42
MB-C 5037	1.04							
MB-C 5039	1.49	0.5	0.34			0.65		0.43
MB-C 5040	1.3	0.37	0.29	0.32	0.25	0.64	1.15	0.49
MB-C 5041	1.72	0.79	0.5			1.02		0.44
MB-C 5042	2.05	0.63	0.34			0.75		0.43
MB-C 5043	2.25	0.85	0.5			0.9		0.4
MB-C 5044	1.5	0.44	0.36			0.7		0.46
MB-C 5048	1.32	0.42	0.31	0.37	0.23	0.59	1.13	0.44
MB-C 5049	2.31	1.22	0.83	0.88	0.68	1.66	1.38	0.44
MB-C 5050		0.4	0.3			0.59		0.45
MB-C 5052		1.41	1.3	2	1.45		0.70	
MB-C 5053	2.84	0.96	0.72			1.16		0.40
MB-C 5054		1.8	1.44					
MB-C 5055	2.26							
MB-C 5058	3.51	0.94	0.65					
MB-C 5061	8	2.37	1.85	1.5	1.3	3.78	1.58	0.47
MB-C 5063	1.05	0.31	0.22	0.21	0.18	0.52	1.47	0.49
MB-C 5065	2.72	0.72	0.46		0.35	0.87		0.42
MB-C 5066	2.05	0.9	0.61	0.64	0.46	0.95	1.40	0.38
MB-C 5067	2.47	0.84	0.59	0.81	0.68	1.04	1.03	0.42
MB-C 5071	1.75	0.48	0.34			0.93		0.53
MB-C 5073	2.46	1.14	0.8	0.97	0.63	1.13	1.17	0.36
MB-C 5077	3.57			1.12		0.96		
MB-C 5080	3.07	0.77	0.49	0.5	0.36	0.59	1.54	0.31
MB-C 5082	1.74	0.55	0.41			0.78		0.44
MB-C 5083	1.56	0.49	0.35	0.36	0.31	0.72	1.36	0.46
MB-C 5084	1.05	0.29	0.23			0.53		0.50
MB-C 5085	2.71	0.86	0.52	0.92	0.63	1.33	0.93	0.49
MB-C 5086	0.96	0.7		0.96			0.72	
MB-C 5089	0.83	0.27	0.18		0.17	0.38		0.45

MB-C 5090	1.85	0.74	0.48	0.61	0.4	0.75	1.21	0.38
MB-C 5091	2.22	0.76	0.47	0.6	0.55	0.99	1.26	0.44
MB-C 5092	2.05	0.76	0.59	0.94	0.66	0.7	0.80	0.34
MB-C 5093	1.97	0.83	0.61	0.63	0.38	0.96	1.31	0.4
MB-C 5094	3.71	0.81	0.61	0.48	0.45	0.99	1.68	0.41
MB-C 5095	1.85					1.85		
MB-C 5100	2.4	0.85	0.52	0.63		0.88	1.34	0.39
MB-C 5101	3.56	1.15	1	1.06		1.41	1.08	0.39
MB-C 5103	2.25	0.65	0.43			0.92		0.46
MB-C 5106	2.22	0.57	0.46	0.47	0.41	1.19	1.21	0.53
MB-C 5107	5.55	1.48	1.07	1.32	0.86	3	1.12	0.54
MB-C 5114	1.88	0.58	0.45	0.57	0.44	0.85	1.01	0.45
MB-C 5115	1.95	0.87	0.48	0.69		0.6	1.26	0.30
MB-C 5118	1.48	1.25	0.84	0.98	0.67	1.42	1.27	0.40
MB-C 5123	4.61	1.62	1.08			1.91		0.41
MB-C 5131	2.41	0.81	0.61	0.48	0.45	0.99	1.68	0.41
MB-C 5132	3.26	1.53		2.32			1.40	
MB-C 5136	1.29	0.4	0.3			0.59		0.45
MB-C 5137	2.97	1.08	0.79			1.1		0.37

Discussion. Renz & Renz (1948) distinguished four species: *Leiophyllites pitamaha*, *Leiophyllites praeconfucii*, *Leiophyllites palaeotriadicus*, *Leiophyllites georgalasi*. Differences are expressed in whorl dimensions and ornamentation. E.g. *Leiophyllites georgalasi* is more compressed in its whorl section than *Leiophyllites praeconfucii*. *Leiophyllites pitamaha* shows a fine striation, and *Leiophyllites palaeotriadicus* may have a sinuous striation on its external parts. Kummel (1969) regarded these differences as intraspecific variations and established *Leiophyllites variabilis*, which includes the mentioned forms as well as *Leiophyllites praematurus*, originally described by Kiparisova et al. (1958). He stated that even the suture lines have the same general pattern with minor differences only. Assereto et al. (1980) and Gaetani et al. (1992) mentioned *Leiophyllites variabilis* in the sense of Kummel.

Occurrence. *Leiophyllites variabilis* is described from Albania (Kummel 1969; Germani 1997), Chios (Renz & Renz 1948; Gaetani et al. 1992) and Primorye region (Kiparisova 1961).

Leiophyllites sp.

Pl. 4, fig. 7; Fig. 33

Material. 12 specimens; MB-C 5024, MB-C 5078, MB-C 5112, MB-C 5113, MB-C 5133, MB-C 5139, MB-C 5140, MB-C 5141, MB-C 5146, MB-C 5157, MB-C 5168, MB-C 5175.

Description. *Leiophyllites* is characterized by generally very evolute, serpenticone conchs. The venter is rounded, the ventral shoulders and the umbilical shoulders are rounded as well. The umbilical wall is low.

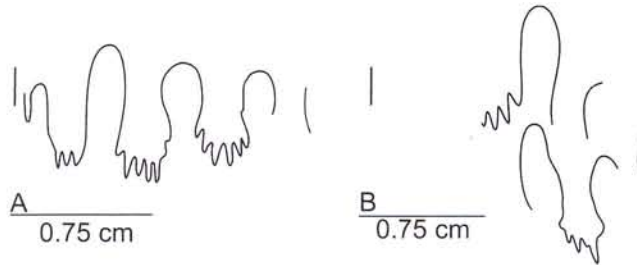


Fig. 33 - Suture lines of *Leiophyllites* sp. (A MB-C 5168, B MB-C 5175).

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
MB-C 5113	0.95							
MB-C 5139	3.41	1.06	0.86	0.82	0.66	1.49	1.29	0.43
MB-C 5140	1.71	0.79	0.37	0.51	0.33	0.55	1.54	0.32

MB-C 5141	2.25							
MB-C 5146	1.91	0.67	0.37	0.61	0.33	0.87	1.09	0.45
MB-C 5157	1.09	0.3	0.25			0.54		0.49

Enigmatic attributions

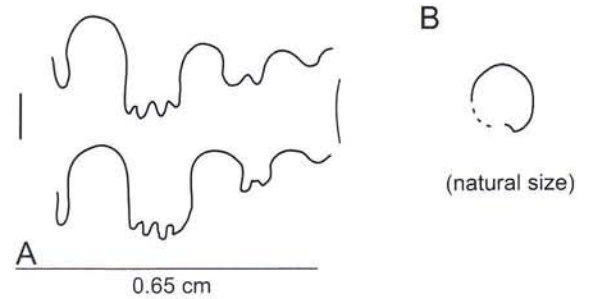


Fig. 34 - Suture line (A) and whorl section (B) of *Dieneroceras* sp. (MB-C 5207; partly restored - dashed line).

?*Dieneroceras* sp.

Pl. 3, fig. 13; Fig. 34

Material. 1 specimen; MB-C 5207 (not measurable).

Description. Preservation of the specimen is not fine. The conch is moderately evolute. The venter is

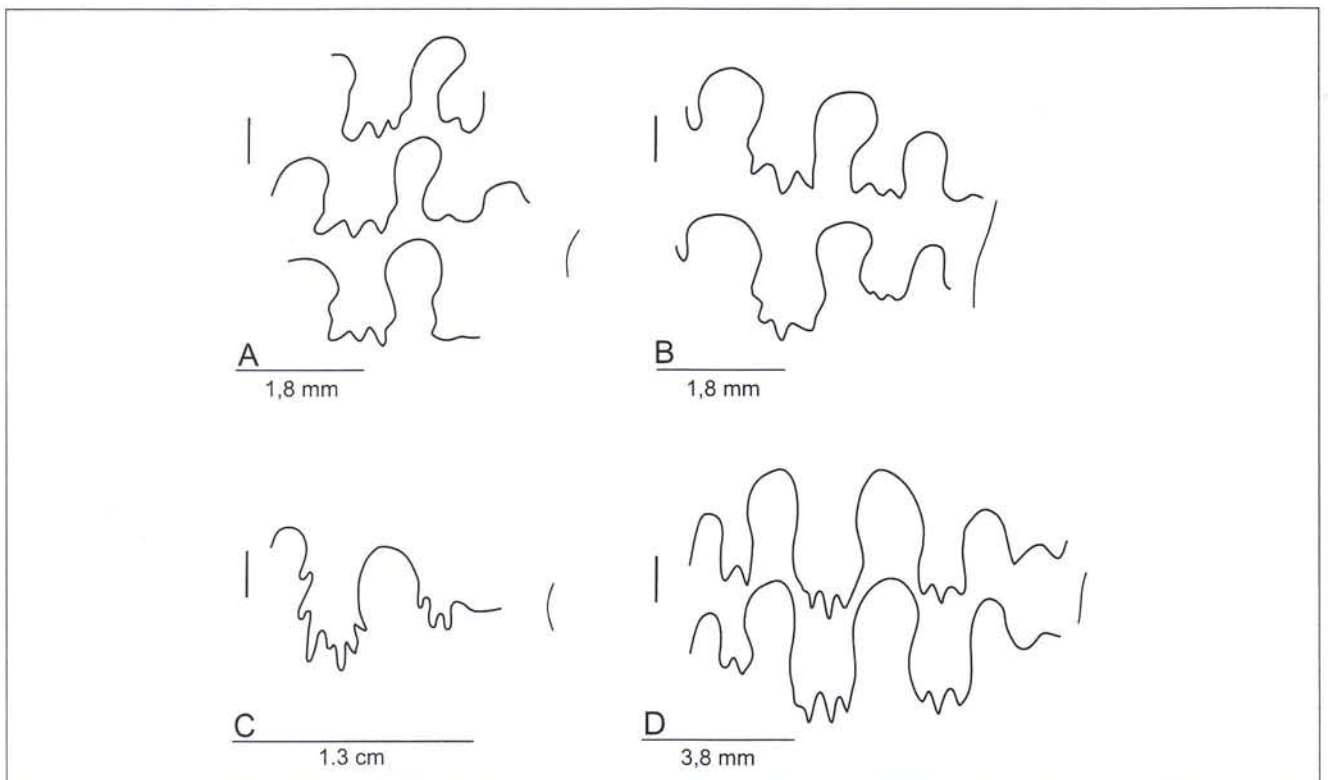


Fig. 31 - Suture lines of *Leiophyllites variabilis* (Spath) (A MB-C 5066, B MB-C 5071, C MB-C 5126, D MB-C 5152).

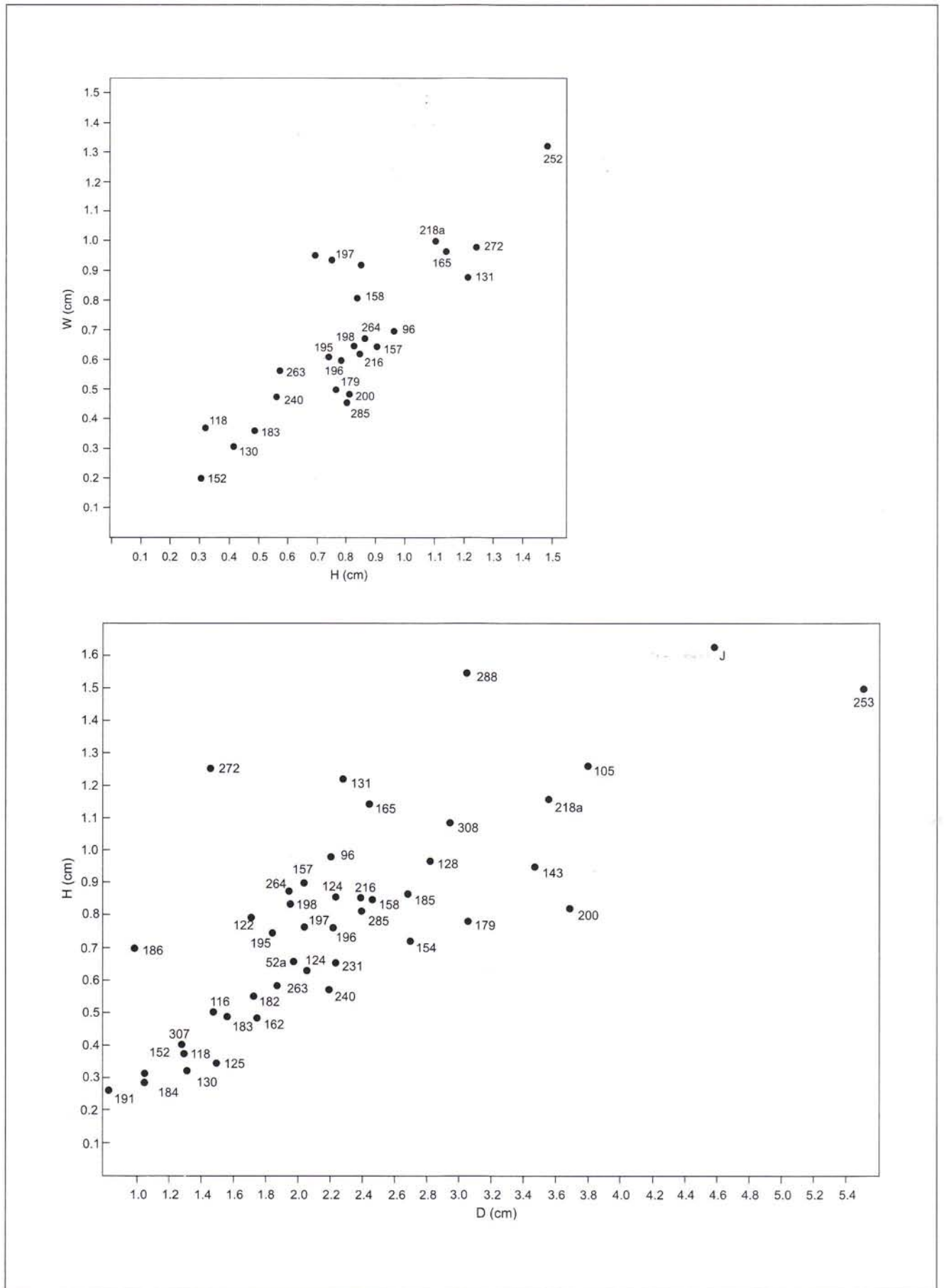


Fig. 32 - Graphs showing the variations in conch dimensions of *Leiophyllites variabilis* (Spath). Subdivision into previously described species of *Leiophyllites* seems to be impossible. Abbreviations compare to page xx.

rounded, the visible flank is convex. The umbilical shoulder seems to be rounded. Growth lines and ornamentation are not visible. The suture line is composed of two lateral lobes and a serrated lobe on the umbilical shoulder.

Discussion. The attribution is enigmatic. The specimen resembles the original figures of Renz & Renz (1948) of *Celtites kcirensis* (Arthaber, 1908). This was included in *Dieneroceras mediterranea* (Arthaber) by Kummel (1969). Later Dagys & Ermakova (1988) established *Boreoceras*. Its synonymy includes *Dieneroceras* of Kummel (1969). However Dagys & Weitschat (1993) and Dagys (1997) mentioned that, together with *Nordophiceras* and *Bajarunia*, also *Boreoceras* seems to be a restricted element of the boreal or eastern boreal basin.

Occurrence. Specimens of *Dieneroceras* were described from Albania and Chios (Renz & Renz 1948). *Boreoceras* is known from the Spathian of Sibiria and the *Columbites* beds of the western U.S.A. (Dagys & Weitschat 1993).

?*Metahedenstroemia* sp.

(Plate 3, fig. 12; Fig. 35)

Material: 1 specimen; MB-C 5221.

Description. The small specimen is highly involute. The venter is flat, the shoulders are angular. The suture line is composed of several lobes and saddles. Basis of the lobes are slightly undulated. Height of the suture line is diminishing towards the umbilicus. However, due to grinding, the suture line is conspicuous.

Dimensions.

No.	D	H	h	W	w	U	H/W	U/D
FUG 667	1.83	1.03	0.7	0.55	0.4	0.1	1.87	0.05

Discussion. The specimen is tentatively assigned to *Metahedenstroemia* sp. due to its characteristic flat venter and angular shoulders. The suture line differs from examples figured by Renz & Renz (1948) in having less serrated lobes. Based on the appearance of the suture line alone, a comparison with *Beatites berthae* seems to be possible, the latter depicted by Kummel (1969). But its conch exhibits an arched venter.

Occurrence. The genus is known only from the *Subcolumbites* faunas of Albania and Chios (Kummel 1969).

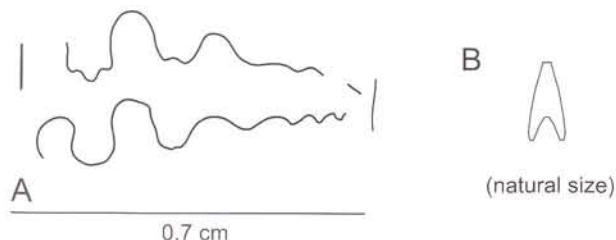


Fig. 35 - Suture line (A) and whorl section (B) of ?*Metahedenstroemia* sp. (MB-C 5221).

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Plate 1

Fig. 1 - *Chioceras mitzopouloi* Renz and Renz, 1947, MB-C 5230, 1.5:1. Fig. 2 - *Paranannites* sp., MB-C 5098, 2:1. Fig. 3 - *Sulioticeras* sp., MB-C 5109, 1:1. Fig. 4 - *Paranannites* sp., MB-C 5007/5008, 1:1. Fig. 5 - *Isculitoides originis* (Arthaber, 1911), MB-C 5025, 2:1. Fig. 6 - *Chiotites globularis* Renz and Renz, 1947, MB-C 5022, 2:1. Fig. 7 - *Isculitoides originis* (Arthaber, 1911), MB-C 5021, 2:1. Fig. 8 - *Chiotites globularis* Renz and Renz, 1947, MB-C 5023, 2:1. Fig. 9 - *Chiotites globularis* Renz and Renz, 1947, MB-C 5028, 2:1. Fig. 10 - *Isculitoides originis* (Arthaber, 1911), MB-C 5031, 1.5:1. Fig. 11 - *Albanites triadicus* (Arthaber, 1908), MB-C 5005, 1:1. Fig. 12 - *Albanites triadicus* (Arthaber, 1908), MB-C 5228, 1:1

Plate 2

Fig. 1 - *Albanites triadicus* (Arthaber, 1908), MB-C 5096, 1:1. Fig. 2 - *Pseudosageceras albanicum* (Arthaber, 1908), MB-C 5060, 1:1. Fig. 3 - *Pseudosageceras albanicum* (Arthaber, 1908), MB-C 5130, 1:1. Fig. 4 - *Pseudosageceras* sp., MB-C 5135, 1:1. Fig. 5 - *Dinarites* cf. *liatsikasi* Renz and Renz, 1947, MB-C 5178, 1:1. Fig. 6 - *Columbites* sp., MB-C 5203, 1:1. Fig. 7 - *Hellenites praematurus* (Arthaber, 1911), MB-C 5215, 1:1. Fig. 8 - *Hellenites praematurus* (Arthaber, 1911), MB-C 5195, 1:1. Fig. 9 - *Hellenites praematurus* (Arthaber, 1911), MB-C 5190, 1:1. Fig. 10 - *Hellenites praematurus* (Arthaber, 1911), MB-C 5212, 1:1. Fig. 11 - *Hellenites* sp., MB-C 5216, 1:1. Fig. 12 - *Hellenites radiatus* Renz and Renz, 1947, MB-C 5177, 1.5:1. Fig. 13 - *Hellenites radiatus* Renz and Renz, 1947, MB-C 5229, 1:1. Fig. 14 - *Epiceltites gentii* Renz and Renz, 1947, MB-C 5222, 1:1

Plate 3

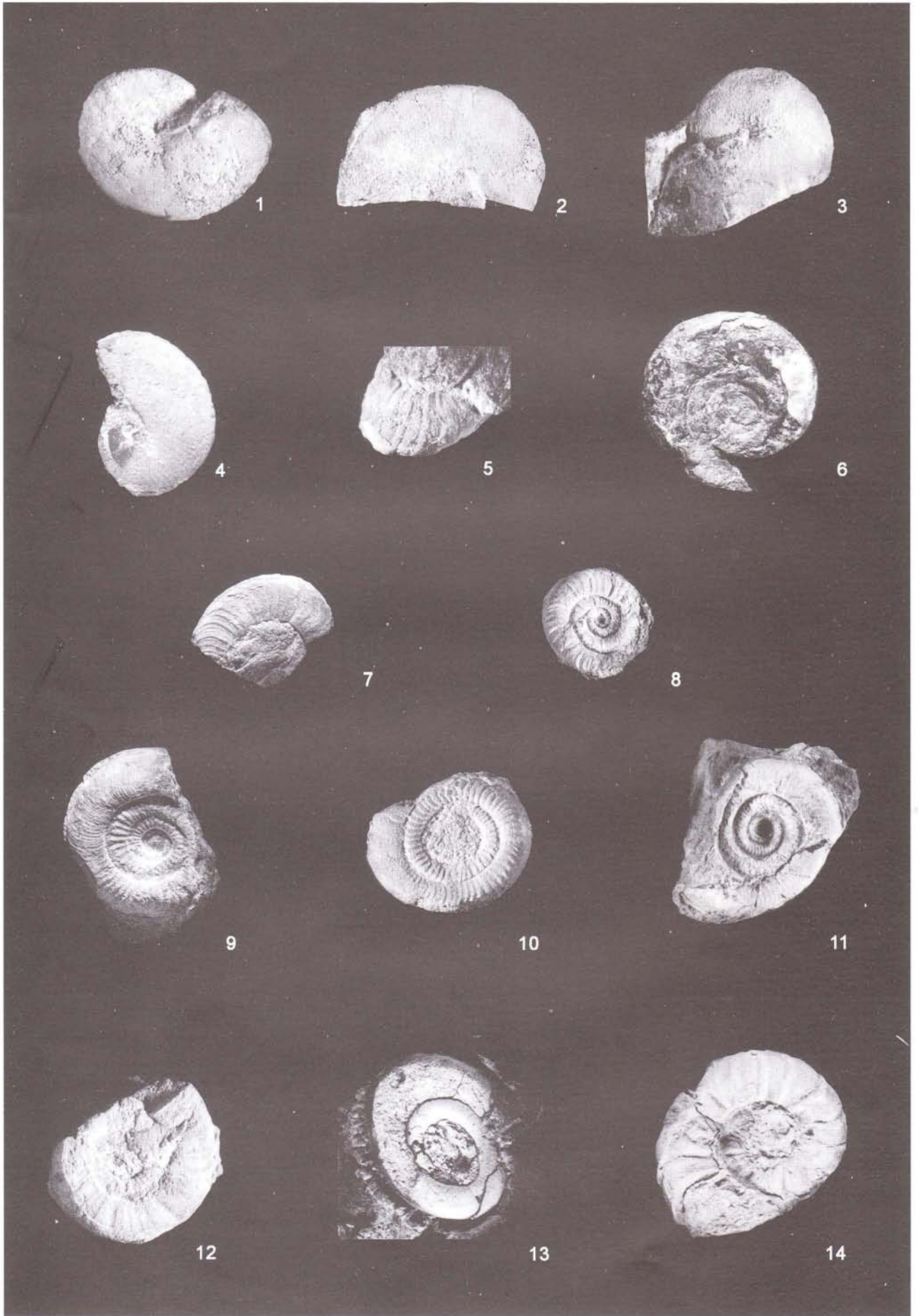
Fig. 1 - *Procarnites kokeni* (Arthaber, 1908), MB-C 5047, 1.5:1. Fig. 2 - *Procarnites kokeni* (Arthaber, 1908), MB-C 5068, 1.5:1. Fig. 3 - *Procarnites kokeni* (Arthaber, 1908), MB-C 5117, 1.5:1. Fig. 4 - *Procarnites kokeni* (Arthaber, 1908), MB-C 5072, 1:1. Fig. 5 - *Procarnites kokeni* (Arthaber, 1908), MB-C 5076, 1:1. Fig. 6 - *Eogymnites* cf. *arthaberi* (Diener, 1915), MB-C 5155, 1:1. Fig. 7 - *Eogymnites* cf. *arthaberi* (Diener, 1915), MB-C 5156, 1.5:1. Fig. 8 - *Eophyllites dieneri* (Arthaber, 1908); MB-C 5111, 1:1. Fig. 9 - *Eophyllites dieneri* (Arthaber, 1908); MB-C 5145, 2:1. Fig. 10 - *Palaeophyllites* cf. *steinmanni* Welter, 1922, MB-C 5038, 2:1. Fig. 11 - *Leiophyllites* sp., MB-C 5175, 1:1. Fig. 12 - ?*Metabedenstroemia* sp., MB-C 5221, 1.5:1. Fig. 13 - ?*Dieneroceras* sp., MB-C 5207, 1.5:1. Fig. 14 - *Procarnites kokeni* (Arthaber, 1908), MB-C 5165, 1:1

Plate 4

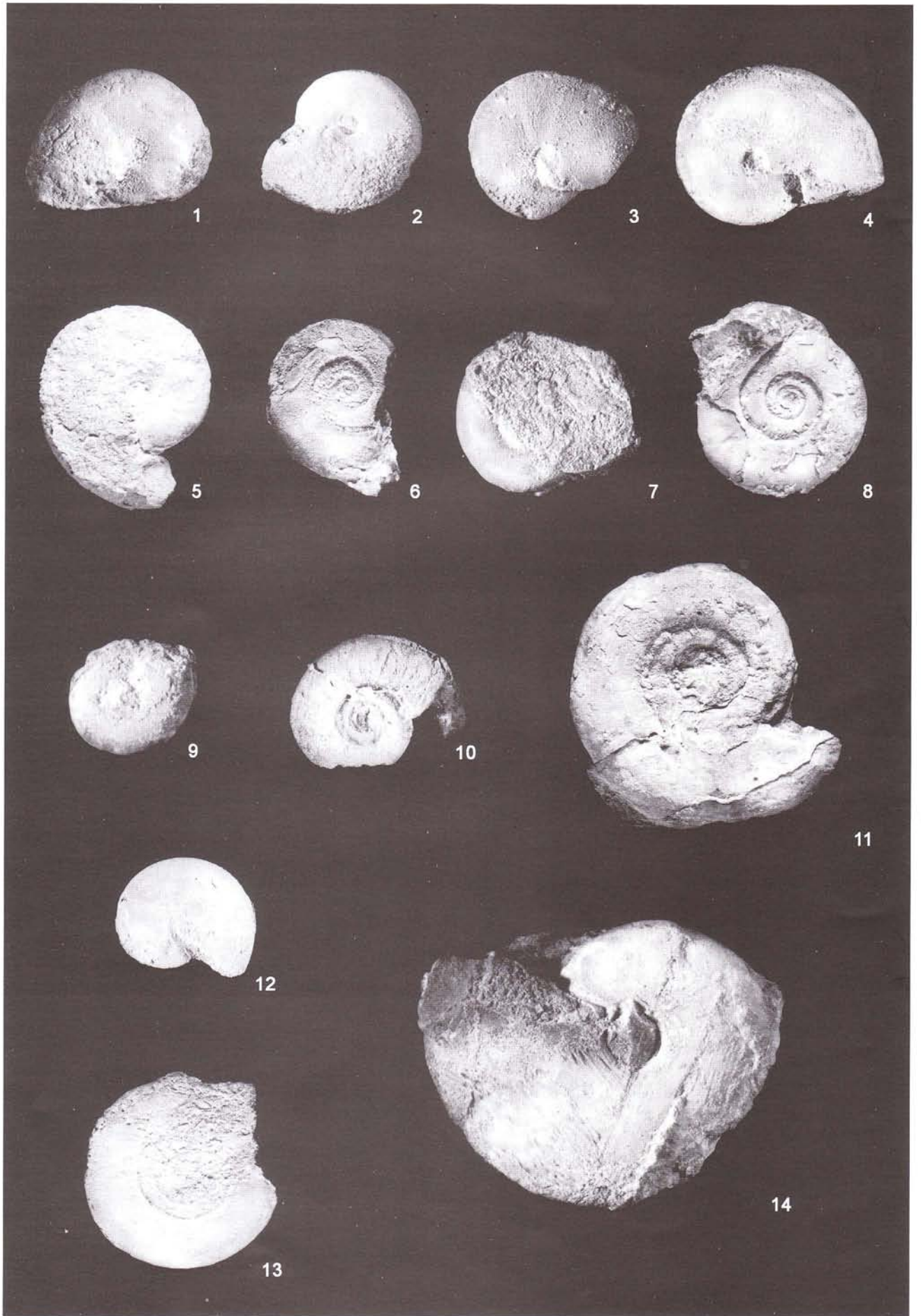
Fig. 1 - *Leiophyllites variabilis* (Spath, 1934), MB-C 5077, 1:1. Fig. 2 - *Leiophyllites variabilis* (Spath, 1934), MB-C 5030, 2:1. Fig. 3 - *Leiophyllites variabilis* (Spath, 1934), MB-C 5058, 1:1. Fig. 4 - *Leiophyllites variabilis* (Spath, 1934), MB-C 5053, 1:1. Fig. 5 - *Leiophyllites variabilis* (Spath, 1934), MB-C 5080, 1:1. Fig. 6 - *Leiophyllites variabilis* (Spath, 1934), MB-C 5085, 1.5:1. Fig. 7 - *Leiophyllites* sp., MB-C 5146, 1.5:1. Fig. 8 - *Leiophyllites variabilis* (Spath, 1934), MB-C 5136, 1.5:1. Fig. 9 - *Leiophyllites variabilis* (Spath, 1934), MB-C 5106, 1:1. Fig. 10 - *Leiophyllites variabilis* (Spath, 1934), MB-C 5103, 1:1. Fig. 11 - *Leiophyllites variabilis* (Spath, 1934), MB-C 5101, 1:1. Fig. 12 - *Leiophyllites variabilis* (Spath, 1934), MB-C 5131, 1.5:1. Fig. 13 - *Leiophyllites variabilis* (Spath, 1934), MB-C 5094, 1:1. Fig. 14 - *Leiophyllites variabilis* (Spath, 1934), MB-C 5107, 1:1. Fig. 15 - *Leiophyllites variabilis* (Spath, 1934), MB-C 5092, 1.5:1. Fig. 16 - *Leiophyllites variabilis* (Spath, 1934), MB-C 5141, 1.5:1



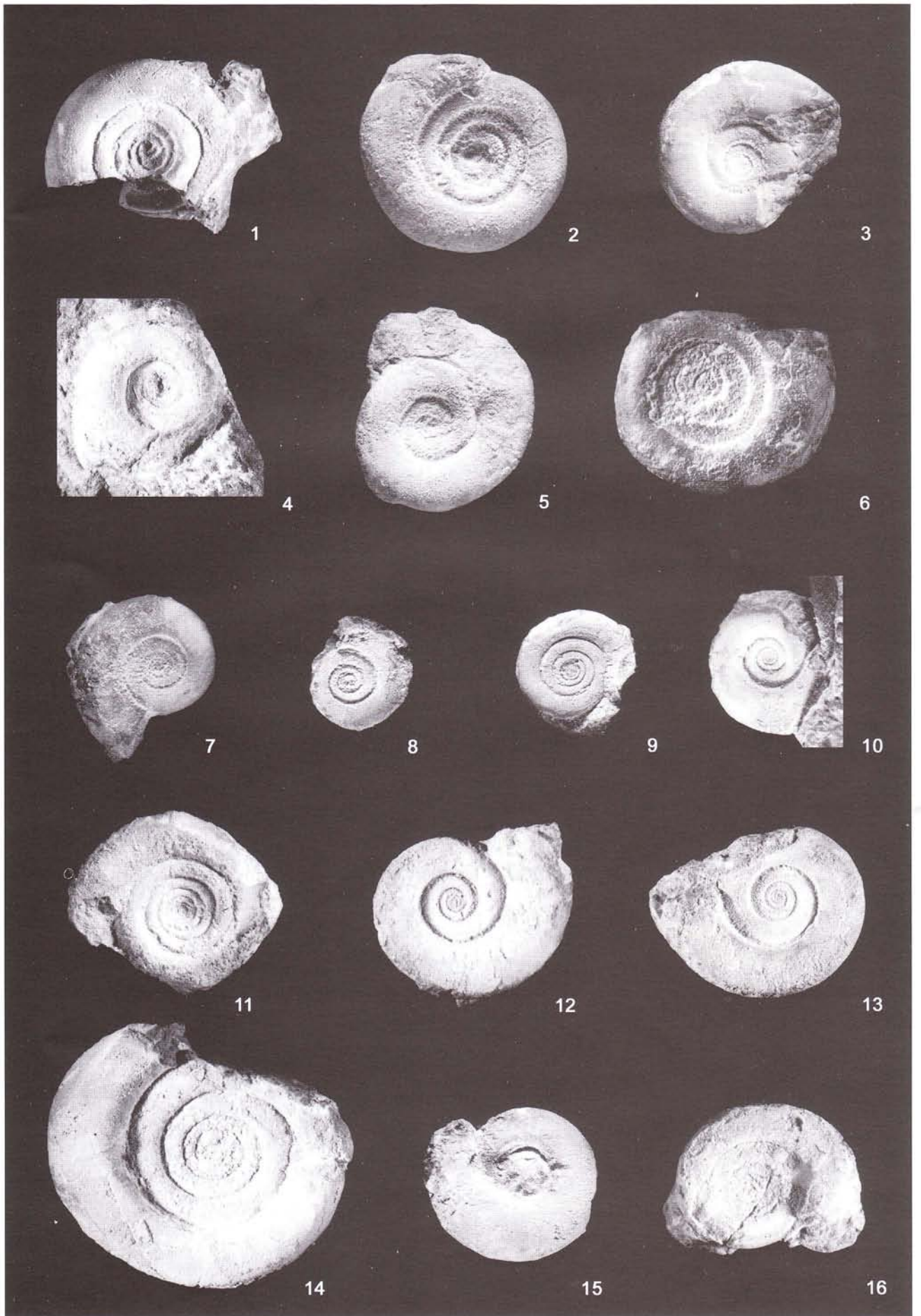
Pl. 1



Pl. 2



Pl. 3



Pl. 4

Appendix 1

Section	Sample	Numbering of ammonoids	MB-C numbers
A	CH 6	5-40	MB-C 5001-MB-C 5012
A	CH 8	47, 49, 53	MB-C 5003-MB-C 5016
A	CH 9	55-120	MB-C 5017-MB-C 5040
A	CH11	121-147	MB-C 5041-MB-C 5060
A	CH 11a	403- 408	-
A	CH 11b	409-428	MB-C 5139-MB-C 5147
A	CH 12	148-190	MB-C 5061-MB-C 5088
A	CH 13	191-219	MB-C 5089-MB-C 5101
A	CH 14	220	MB-C 5102
A	CH 23 a	429	MB-C 5148
G	CH 258	229-230, 237-272 a, B, E, F, G, H, J, K, M	MB-C 5103-MB-C 55123
G	CH 265	271, 273-307	MB-C 5124-MB-C 5136
G	CH 266	308-312	MB-C 5137-MB-C 5138
G	CH 258 neu	430-463	MB-C 5149-MB-C 5159
Parthenis Creek	182	511-520	MB-C 5160-MB-C 5164
Parthenis Creek	182 a	521-547	MB-C 5165-MB-C 5171
Parthenis Creek	183	548-582	MB-C 5172-MB-C 5186
Parthenis Creek	183 a	583-597	MB-C 5187-MB-C 5193
Parthenis Creek	184 a	598-641	MB-C 5194-MB-C 5217
Parthenis Creek	185	642-666	MB-C 5218-MB-C 5220
Parthenis (further samples)	182-185	667-703	MB-C 5221-MB-C 5227
Parthenis (further samples not orientated)	XC 20	800-808	MB-C 5228-MB-C 5229

Appendix 2

Ammonoids quoted in Assereto et al. (1980, signed *), and/or Gaetani et al. (1992)

Section A:	* <i>Pseudosageceras pasquayi</i> * <i>Procarnites kokeni</i> * <i>Prenkites</i> sp. * <i>Iscolitoides originis</i> * <i>Chioceras mitzopouloi</i> * <i>Chiotites globularis</i> * <i>Paranannites aspenensis</i> * <i>Albanites</i> cf. <i>triadicus</i> * <i>Hellenites</i> sp. * <i>Palaeophyllites</i> cf. <i>steinmanni</i> * <i>Leiophyllites variabilis</i> * <i>Hellenites praematurus</i> <i>Tunglanites alexi</i> <i>Eophyllites</i> sp.	Section G:	* <i>Pseudosageceras multilobatum</i> * <i>Pseudosageceras albanicum</i> * <i>Paranannitidae</i> gen. et sp. indet. * <i>Meropella plejanae</i> * <i>Procarnites kokeni</i> <i>Procarnites</i> sp. * <i>Eophyllites dieneri</i> * <i>Preflorianites</i> sp. * <i>Leiophyllites variabilis</i> <i>Leiophyllites</i> sp. <i>Eogymnites arthaberi</i>
Section F:	without ammonoids	Section Parthenis :	<i>Pseudosageceras</i> sp. <i>Procarnites kokeni</i> <i>Procarnites</i> sp. <i>Prosphingites ali</i> <i>Columbites parisianus</i> <i>Columbites</i> sp. <i>Subcolumbites</i> sp. <i>Chioceras</i> sp. <i>Epiceltites gentii</i> <i>Metadagnoceras terbunicum</i> <i>Nordophiceras</i> sp. <i>Albanites</i> sp. <i>Albanites triadicus</i> <i>Hellenites</i> sp. <i>Hellenites praematurus</i> <i>Hellenites radiatus</i> <i>Dinarites</i> cf. <i>liatsikasi</i> <i>Leiophyllites</i> sp. <i>Leiophyllites</i> cf. <i>variabilis</i>

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