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KIMMERIDGIAN–VALANGINIAN REEF CORALS FROM THE MOESIAN PLATFORM FROM BULGARIA

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Abstract: The coral fauna of the Late Kimmeridgian–Valanginian interval from the Slivnitsa Formation, Lyubash monocline, western part of the Moesian Platform, is presented. Coralliferous interbeds from a continuous, over 350 m thick sequence of well-bedded platform limestones, cropping out near the village of Lyalintsi, yielded 72 species (29 determined in open nomenclature) classified into 50 genera and 23 families belonging to the orders Scleractinia and Hexantiniaria. The following genera and/or species are described as new: *Epistreptum communeformae* gen. et sp.n., *Lyubasha gracilis* gen. et sp.n., *Oedalmiopsis cretacea* gen. et sp.n., *Siderastreites lyalintsensis* gen. et sp.n., *Latomeandra obliqua* sp.n., and *Microphyllia elevata* sp.n.; a new family Solenocoeniidae is erected. The fauna shows a mixed Late Jurassic/Early Cretaceous character, with Jurassic taxa prevailing over Cretaceous taxa. Epithecate phaceloid (pseudocolonial), lamellar, and ramose (colonial) growth forms dominate over massive (hemispherical) and solitary corals. Rich microencrusting organisms are associated. The predominantly pelmicritic sediment of thrombolite macrofabric, and the character of the fauna show that the palaeoenvironment was situated below wave base. The stratigraphical distribution of the Cretaceous coral taxa is conformable with the micropalaeontological (foraminifera, calcareous dinocysts, diploporids) stratigraphical zonation established in the Slivnitsa Formation.

Key words: Scleractinia, Hexantiniaria, Kimmeridgian–Valanginian, Moesian platform, western Bulgaria.

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INTRODUCTION

A recent review of investigations of Phanerozoic reefal environments demonstrates that, parallel to the worldwide restriction of carbonate platform development in the Late Jurassic–Early Cretaceous interval, there was a common reduction in shallow water coral occurrences (Leinfelder *et al.*, 2002). The exception to this was the northern Tethys region with its Carpathian carbonate platforms developed on elevated intrabasinal ridges (e.g. the Baška cordillera with Štramberk reef complex and the Pavlov cordillera with the Ernstbrunn Limestones: Eliaš & Eliášová, 1984; Eliášová, 1990) and on the south-western part of the Moesian Platform, in the Bulgarian West Sredogorie region (Fig. 1), considered herein (Ivanova *et al.*, 2008 with references). The External Carpathian Štramberk reef complex, Czech Republic (Eliášová, 1981b; Eliáš and Eliášová, 1984) with its famous coral fauna known from the 19th century (Ogilvie, 1897) and intensively investigated in the 20th century (Geyer, 1955; Eliášová,1973, 1975, 1976a–c, 1981a, b, 1990, and others) is the best example of the vitality of the coral environment in the Tithonian–Early Cretaceous interval. In the Carpathian Tethys, beside coral accumulations connected with platform complexes, dispersed patch reefs developed. Due to their location in the zone of intensive Alpine tectonics, Carpathian coral accumulations are accessible in large olistoliths (especially in the huge Štramberk quarry complex) or in isolated exotic coral limestone boulders of the so called "Štramberk type" in the Carpathian flysch nappes (Morycowa, 1964, 1968, 1974; Kołodziej, 1997, 2003).

The platform coral limestones from the Late Jurassic–Early Cretaceous interval considered here are situated in the West Srednogorie tectonic unit (Fig. 1) in the West Bulgarian Alpine thrust belt (Dabovski *et al.*, 2002). In contrast to those in the Carpathians, they form a well-bedded, undisturbed and easily accessible succession. The limestones form a part of the tectonically isolated Lyubash unit (Zagorchev, 2001) which, although situated among complex tectonic structures, is itself a relatively simple monoclinal structure (Zagorchev, 1995). This tectonic unit, significant because of a thick sequence of coral-bearing limestones, seems to be a relict structure of a spatially larger coral zone, which was consumed during Alpine compressive deformation.

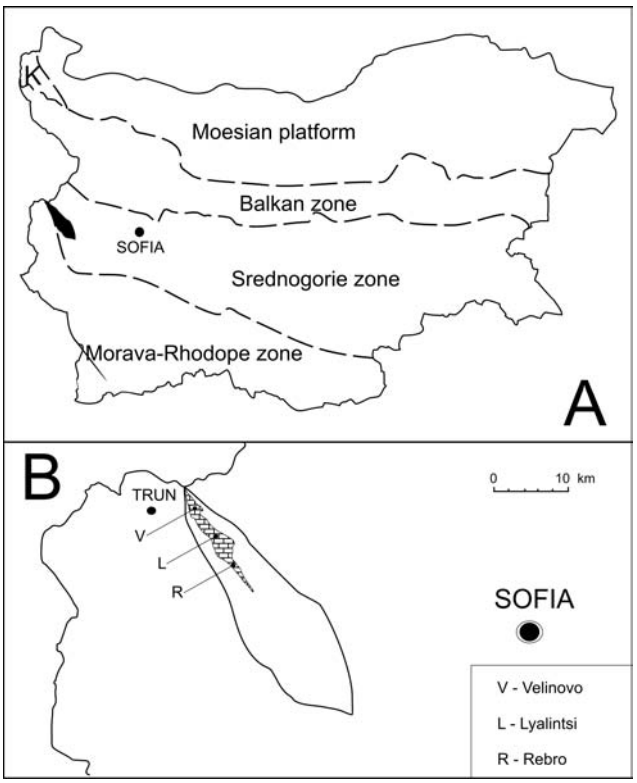

Fig. 1. **A.** Tectonic scheme of Bulgaria showing five main tectonic units (K Kraina unit) and localization of the Lyubash unit (in dark) at the westernmost part of the Srednogorie zone (after Dabovski *et al.*, 2002 and Zagorchev, 2000, simplified). **B.** Lyubash unit with its shallow-marine Upper Jurassic–Lower Cretaceous limestones (hatched), and localization of the Velinovo (V), Lyalintsi (L) and Rebro (R) sections

MATERIAL

The results presented here were based on examination of limestones of the Slivnitsa Formation sampled in the surface section on the N slopes of the Lyubasha Mountain, ca. 1 km from the village of Lyalintsi. The sampling followed the Lyalintsi section traverse, put in place during geological fieldwork undertaken in the early 1980s by L. Dodekova, P. Tchoumatchenco and I. Sapunov (Sapunov *et al.*, 1985), and marked in metre intervals. The corals considered were collected in 1982 by Dr. Vassil Zlatarski and the author.

The collection contains over 240 rock samples that yielded ca. 400 thin sections of coral skeletons for the purpose of taxonomic study. Because the rock is hard and the coral skeletons are highly recrystallized and poorly preserved, a large part of the coral determinations has been left in open nomenclature. The collection and thin sections are housed at the National Museum of Natural History, Sofia (fossil invertebrates collection NMNH F-30057 - 30300; thin sections have the sample number and a letter).

Institutional acronyms: NMNH – National Museum of Natural History, Sofia, Bulgaria; ZPAL – Institute of Palaeobiology, Warsaw, Poland.

GEOLOGICAL SETTING

Among the sedimentary zones of the tectonically very complex SW part of Bulgaria, the narrow Lyubash monocline is significant for its Jurassic calcareous platform sedimentation (Fig. 1A, B). It contrasts with the flysch zone to the south and passes into a zone of open basin calcareous sediments to the north (Sapunov *et al.*, 1985; Zagorchev, 2001). In the literature, it is also known as a sedimentary area on the Dragoman positive block (e.g. Lefeld *et al.*, 1986).

The Lyubash monocline includes Middle Jurassic–Lower Cretaceous limestones that are overlain by Upper Cretaceous sediments (Sapunov *et al.*, 1985; Ivanova *et al.*, 2006; 2008). Foraminifera and calcareous dinocysts document the Oxfordian–Valanginian age of the whole succession observed in the monocline (Ivanova *et al.*, 2008). The most complete information on facies distribution and microfossil stratigraphy of the above interval has been obtained from investigations of three sections: Rebro, Lyalintsi and Velinovo, situated along a nearly straight line, 13 km long (Fig. 1B). In these sections, the deposits are differentiated into Bajocian–Lower Bathonian limestones of the Polaten Formation, which are overlain unconformably by limestones representing the Slivnitsa Formation and comprising the whole Oxfordian–Valanginian part of the Lyalintsi and Velinovo sections, and at least the upper part of the Rebro section (Ivanova *et al.*, 2008). The Slivnitsa Formation, dominated by organogenic sedimentation, shows a thick succession of coral limestone facies in Lyalintsi (Fig. 2).

The above three sections, although situated not far from one another, represent different lateral facies zones discriminated using microfacies and microfossils**.** Sedimentological analysis enabled the recognition of microfacies groups assigned to three facies zones, identified as: (i) platform slope facies; (ii) reef and peri-reef facies; and (iii) lagoon-tidal facies (Ivanova, Koleva-Rekalova, 2004; Ivanova *et al.*, 2006; 2008). Open shelf microfacies are recognized in the lower parts of the sections studied; higher upsection, platform slope facies predominate in the Rebro section; the Lyalintsi section is dominated by reef and peri-reef facies, and the Velinovo section is dominated mainly by lagoon facies. In these sections, a sharp lithological boundary with a condensed section dividing the Middle Jurassic Polaten Formation from younger deposits, represents a local level of correlation. The Slivnitsa Formation terminates in a non-deposition surface with infaunal burrows that is overlain by transgressive, red and grey shelly Upper Cretaceous sandy limestones and marls (Sapunov *et al.*, 1985; Ivanova *et al.*, 2006).

Foraminifera and calcareous dinocysts examined by Ivanova (Ivanova *et al.*, 2006; 2008), document the Oxfordian–Valanginian age of the whole succession observed in the Lyubash monocline. In the Lyalintsi sequence, the microfossil zonation proves Kimmeridgian/Tithonian between the 102 m and 197 m levels, Berriasian between the 197 m and 300 m levels, and Valanginian up to the end of the continuous limestone sequence at the ca. 450 m level (Ivanova *et al.*, 2006; 2008). Above this sequence, there are isolated outcrops of rocks, the age of which has not been established

micropalaeontologically, albeit this part is also considered to be Valanginian in that the corals are similar to those from the lower part. The coral data are stratigraphically compatible with the microfossil indications, as the first typical Early Cretaceous coral *Felixigyra* cf. *duncani* Prever appears at the 182 m level, near the Jurassic–Cretaceous boundary indicated by microfossils. The Berriasian interval of ca. 200 m shows no age-diagnostic corals; above the 300 m level, throughout the whole Valanginian succession, rare Cretaceous coral taxa appear in an assemblage of taxonomically diverse corals of a Late Jurassic character.

CONSIDERATIONS ON THE CORAL FAUNA FROM THE LYALINTSI SECTION AND ITS ENVIRONMENT

General characteristics of the Lyalintsi section

The greater part of the Lyalintsi section consists of limestones of the Slivnitsa Formation divided into three different parts. The first part (from the base at the boundary of the Polaten and Slivnitsa Formations up to about the 70 m level) is composed of grey to light grey micrite limestones with rare fine-grained biodetritus, predominantly medium- to thick-bedded (bed thicknesses range from 0.20 to 1.50 m). On some bed surfaces there occur nodules of white flint with maximum dimensions of 10 × 12 cm. The second part (from the 70 to 190 m level) consists of pale-grey, beige and greyish-pink organogenic and biodetrital limestones with bed thicknesses ranging from 0.10 to 1 m. In this part, beginning at the 102 m level, there are coral limestone intercalations in limestones lacking corals and containing elements of the pelagic plankton crinoid *Saccocoma*. The third part of the continuous section is from the 190 m level to above the 450 m level; discrete coral occurrences observed above this level are composed of medium- to thick-bedded organogenic and fine-grained biodetrital limestones, mainly light grey in colour, with a diverse coral fauna. Colonies and phaceloid corals are generally either in life position, or disturbed. In the biodetrital limestones, fragments of phaceloid corallites, thin-lamellar colonies and solitary coralla are observed. The associated macrofauna is represented by rare diceratid rudists (on the rock surface at the 157 m level), oysters, nerineacean gastropods (on rock surfaces especially at the 181 m and 207 m levels), small gastropods and rare echinoid spines; dissociated echinoderm plates are common. Rare subglobular *Parachaetetes* ("*Solenopora*") are also to be found.

In the coral beds, micrite, pelmicrite or pelspar are the essential components of the sediment. The texture observed in thin sections is most commonly thrombolitic in character, layered in places. The clasts are composed of pellets of various sizes, calcispheres, foraminifera, coated grains, including *"Tubiphytes" morronensis*, rare accumulations of poriferan spicules, rather small, but common echinoid plates (2–3 mm), small fragments of thin-lamellar colonies, rare solitary corals and rare fragments of phaceloid corallites of different corallite diameters, fragments of thin, small bivalves, rare fragments of thin, porous brachiopod shells, rare small gastropods, and lime intraclasts. Diverse microencrusters covering coral skeletons are common, as well as microbial crusts. Sparitization of fine-detritic sediment is the most common diagenetic change observed. Voids are observed between branches of phaceloid and ramose corals. Hard limestones with naturally weathered surfaces commonly show a gradation from packstone/ wackestone sediment at the base (in the field observed as a rough rock surface) towards wackestone sediment at the top of the bed (smooth surface).

Taxonomic diversity of the coral fauna

Among the corals examined, 72 species belonging to 50 genera have been differentiated (Fig. 2), but, taking into consideration that this fauna occurring in hard rocks could be examined only in thin sections, the result suggests that the actual diversity is much higher.

In the whole succession, the commonest and taxonomically most diverse corals belong to the pennular group, suborder Microsolenina: (1) the latomeandrids represented by common phaceloid taxa (genus *Latomeandra*; four species), common colonial ramose and frondose corals (genera *Microphyllia*, "*Thamnarea*", *Protoseris*: more than four species in total), lamellar corals (genera *Dimorphastrea*, *Comophyllia*, *Ovalastrea*: four species in total); (2) the microsolenids differentiated into phaceloid corals (genus *Dermoseris*: three species) and colonial lamellar corals (genera *Microsolena*, *Comoseris*, *Synastrea*: five species in total), some of them observed also in ramose (*Microsolena*) or massive (*Comoseris*) morphotypes.

The ripidogyrinan spectrum is also diverse: solitary (genus *Rhipidogyra* sp. sp.), phaceloid (genus *Placophyllia*: two species), colonial uniserial dendroid (genus *Tiaradendron*: one species) and colonial taxa of lamellar form developing into submassive ones (genera *Ogilvinella*, *Placogyra*, *Pruvostastraea*: three species in total) are common, especially in the upper part of the succession.

Among the Stylinina, the commonest are phaceloid corals (genera *Stylosmilia*, *Cladophyllia*: five species in total), while ramose (genera *Pseudocoenia*, *Heliocoenia*: three species in total) and massive corals (genera *Pseudocoenia*, *Cyathophora*: four species in total) are less common. Very characteristic is a ramose *Solenocoenia* (one species) occurring throughout the succession; it is a homoeomorph of the hexameral *Pseudocoenia*, but classified separately.

The amphiastreinan corals that are common in the Carpathian basin (Štramberk), are uncommon in the Lyalintsi section and are taxonomically of rather moderate diversity (phaceloid *Mitrodendron*, *Pleurophyllia*: three phaceloid species in total, and lamellar-submassive *Amphiaulastrea*: one species).

The phaceloid montlivaltiid *Thecosmilia* (one species) and *Montlivaltia* (specific diversity not known) are common. Other montlivaltiid genera (phaceloid, lamellar) are represented by few finds. Among rare genera of other groups are corals with a regularly porous skeleton: haplareids (solitary genus *Haplaraea*: one species, lamellar and/ or ramous *Actinaraea*: two species), that are similar in their

regularly porous skeleton to microsolenids but lack pennules.

The structural characteristics of this fauna are as follows: (i) domination of phaceloid (pseudocolonial), lamellate (including thick-lamellate, submassive forms) and ramose (colonial of diverse types) over massive (convex colony surface) corals (40 genera in the first group in comparison with six genera in the second group); (ii) common epithecal wall in solitary (five species belonging to five genera) and especially in phaceloid corals (19 species belonging to 10 genera), that is, in over one-third of all species and genera; (iii) development of septal face micromorphology in the form of pennules and menianes that characterizes 21 species belonging to 12 genera (29% of all species, and 24% of genera, respectively); (iv) structurally conditioned, regular porosity of septa is specific to common corals of 13 species belonging to seven genera (18% of species and 14% of all genera) of microsoleninan and haplaraeid corals.

Coral growth form distribution

Kimmeridgian–Berriasian. In the interval from the 102 m up to the 300 m level of the Lyalintsi section coral beds are rather sporadic. In this part, ca. 15 coral beds can be observed, some beds are isolated, others form groups marked herein with linking dashes (metres levels: 102, 115, 137–142, 157, 177–179–181–192, 207, 247, 252, 257–260, 267, 287) interbedded with limestones that either lack corals or contain only rare traces of a coral fauna. Coral beds are from about 30 cm to ca. 100–150 cm thick, and are situated at varying distances from each other (2 m, 5 m, 10–20 m, 20–35 m).

The succession starts with a bed containing taxonomically diverse lamellar corals (102 m level: 1–3 cm thick: *Actinaraea*, *Synastrea*, *Comophyllia*), together with rare phaceloid and solitary forms. The assemblages of the succeeding beds are of diverse mixed types, with predominantly phaceloid corals (from two to seven genera, most commonly *Stylosmilia*, *Latomeandra*, *Thecosmilia*, *Dermoseris*, *Calamophylliopsis*) associated with ramose corals (most commonly *Solenocoenia*, "*Thamnarea*", *Microphyllia*, but also ramose morphotypes of *Actinaraea* and *Microsolena*) and subordinate, if present, lamellar corals (commonly limited to a single genus) that can attain a considerable thickness (submassive: flat upper side), and rare massive forms (convex upper side: *Pseudocoenia*, *Cyathophora*, *Bilaterocoenia*, *Ovalastrea*, *Comoseris*). Submassive *Microsolena* sp. from the 115 m, 137 m (colony ca. 20 cm thick and showing surface with thick but not laterally extending tiers) and 307 m levels, and *Placogyra hykel*i from the 181–192 m interval, participate in mixed assemblages, while a submassive colony of *Complexastraea* cf. *thevenini* from the 257 m level was the only coral observed in that bed.

Valanginian. In the upper part of the succession, beginning with the bed at the 307 m level, the frequency of coral beds over a distance of 150 m is double that of the lower part. However, since the beds are partly covered with soil and are commonly fragmented into blocks, their exact horizons can be identified only with difficulty. Because of this, the coral horizons are indicated arbitrarily within larger bed packets. The presence of nearly 30 coral horizons (including isolated beds) manifests a considerable increase in the significance of corals in the environment (isolated beds and beds grouped per two or more; metre levels: 314–317, 325, 332–335–337, 352, 359–367–372–375–377–382, 387–392–395–397, 412–415–417–420–427, 437, 442, 453, 457).

Multispecific assemblages are composed of predominantly phaceloid and ramose or only ramose corals, lamellar and other forms being accessory. Among phaceloid genera, the most common are *Thecosmilia*, *Stylosmilia*, *Latomeandra*, and *Cladophyllia*, among ramose are *Solenocoenia*, *Microphyllia*, and "*Thamnarea*". Lamellar forms are represented by *Dimorphastrea*, diverse species of *Microsolena* and *Protoseris*, and submassive, thick *Ogilvinella*, *Placogyra*, *Pruvostastraea*. The only thin-lamellar assemblage, observed at the 359 m level is composed of *Actinaraea* and *Dimorphastrea*.

The taxonomically most diverse assemblages comprise: sporadic solitary *Montlivaltia*, *Rhipidogyra*, *Haplaraea* and *Pleurosmilia* (overturned and some heavily damaged), debris of fine uniserial colonies of *Enallhelia*, fragments of thick branches of *Tiaradendron*, e.g., beds from the 377, 382, 417 and 421 metre levels (Fig. 2).

A question of ecological zonation

Because of observations being restricted to the coral beds, remarks on the faunal zonation of the succession are necessarily limited. However, it has been assumed that the corals and diverse epibionts of faunal, algal and microbial origin form associations that are only slightly differentiated throughout the succession, from poorer in the Kimmeridgian/Tithonian part to rich in the Cretaceous. Generally, both the ecological character and taxonomy of the corals identified from recrystallized skeletons, and the composition of the associated fairly well preserved microencrusters, are surprisingly uniform throughout the succession, with only rare variations. In fact, nearly all the coral beds (or horizons observed in the soil) show associations of a mixed, phaceloid-ramose-lamellar type. Only a few beds contain predominantly lamellar colonies: the first, at the 102m level, contains mainly lamellar corals (*Actinaraea*, *Synastrea*, *Comophyllia*) associated with phaceloid *Placophyllia* and solitary *Montlivaltia*; the bed at the 257 m level contains only thick-lamellar submassive *Complexastrea*; and the bed at the 359 m level contains thin lamellar *Actinaraea* and *Dimorphastrea*. It is worthy of note that sub-massive rhipidogyrinan corals (*Placogyra*, *Pruvostastraea* and *Ogilvinella*) occur in the mixed associations in the Valanginian part of the succession.

The only taxonomic change in coral composition observed between the Kimmeridgian/Tithonian and Berriasian parts of the succession is a slight shift towards Cretaceous families. This is parallelled by an increasing frequency of microencrusting organisms, with their acme in the Valanginian part. The most complete list of the encrusters contains the following taxa: the enigmatic *Lithocodium aggregatum* Elliot with the symbiotic foraminifer *Troglotella incrustans* Wernli, the foraminifer *"Tubiphytes" morronensis* Cres-

centi, bryozoans resembling *Kolophos* and *Berenicea*, sclerosponges belonging to the genus *Murania* Kaźmierczak, *Parachaetetes* sp.; calcisponges indet.; the green alga *Thaumatoporella parvovesiculifera* Pia; the enigmatic *Koskinobullina socialis* Cherchi & Schroeder; common specimens of the problematic microorganism *Radiomura* Senowbari-Daryan & Schaefer, rare *Cayeuxia*-like forms and microbial crusts. Thin coatings of *Murania* have hitherto been observed only in Valanginian associations.

Considerations on the coral environment

Micropalaeontological and lithological investigations (Ivanova *et al.*, 2008) of the Lyalintsi succession enable some general interpretations of the evolution of the sedimentary environment. The lower part of the Slivnitsa Formation cropping out here, composed of light grey bedded micritic limestones with flints, is considered to have been deposited on an open shelf or ramp. In the overlying succession containing coral beds (from the 102 m up to the 190 m level) the interbeds of limestones without corals yielded the pelagic planktonic microcrinoid *Saccocoma*. This part is considered to have been deposited in the environment of a homoclinal ramp. The remaining part of the succession (up to the 450 m level of the continuous section and outcrops above that level) contains limestones with a taxonomically diverse coral fauna; the microfacies are considered to represent reef/peri-reef facies deposited in the reef zone of the platform.

The abundance of corals growing *in situ* allows the concept of a reef environment to be adopted. However, Mesozoic reefs were not comparable in their composition and location to Recent reefs and hence a restricted application of the term "reef" is needed when discussing them.

The coral accumulations considered herein show coral growth forms and specific skeletal structures that are different from those of Recent ones. Massive corals (convex surface up to hemispherical shape) are rare and poorly represented. The taxonomically most diverse are epithecate phaceloid, i.e., pseudocolonial forms (25 species, 14 genera), lamellar colonies (24 species, 19 genera), corals with pennular septal micromorphology and corals with regularly, structurally porous septa. The epithecate corals had the surface of the corallites completely unprotected against mechanical injuries, implying that they lived either in sheltered parts of a shallow water environment behind the zone of high energy water, or at depths below this zone (Roniewicz & Stolarski; 1999, with discussion). Lamellar corals, some of them attaining submassive form (i.e., thick, with a flat upper surface), are indicative of a quiet-water environment (compare Geister & Lathuilière, 1991; Morycowa & Roniewicz, 1995; Insalaco, 1996; Insalaco *et al.*, 1997; Roniewicz & Stolarski, 1999; Rosen *et al.*, 2002). The high proportion of pennular corals resembling those from Recent deep reef slopes (Chevalier *in* Chevalier & Beauvais, 1987) and from sea floors at depths below 100 m (Schlichter, 1992) supports the inference that they developed below storm wave base. Fossil corals with pennular septa are interpreted as indicative of light-deficient conditions caused by depth or turbidity (Morycowa & Roniewicz, 1995; Geister & Lathuilière, 1991; "euphotic floor model": Rosen *et al.*, 2002; Sanders & Baron-Szabo, 2005). The regular, structural porosity of pennular microsoleninan corals is supposed by Insalaco (1996) to be linked with reduced $CaCO_3$ deposition related to light deficiency or to some degree of eutrophication. Haplareid regularly porous corals lacking pennulae are to be added to this group.

In the light of the above environmental prerequisites, the taxonomically and structurally significantly diverse ramose colonial corals (eight genera, 10 species; some of them pennular and regularly porous) occurring commonly in mixed associations with the coral types described above, cannot be paralleled with externally similar modern acroporid and pocilloporid asociations, nor can their environments be compared.

The Lyalintsi coral fauna, although shallow-water (in a general sense) and taxonomically diverse, lived below the depths occupied by Recent reefs. All the above-mentioned specific features of skeleton structure point to a deeper zone of a shallow sea as a possible environment of the coral meadows. An environment in which such a taxonomically diverse biotope could develop allows the supposition that there was sufficient light for autotrophy and no significant oxygen deficit, albeit fluctuations in the oxygen content of the water could have temporarily hampered coral growth, enhanced microbialite activity (compare Dupraz & Strasser, 1999), and led, possibly, to a tendency to develop taxa with a regularly porous skeleton (compare Insalaco, 1996)

Interbeds of limestones devoid of corals and containing *Saccocoma* observed in the Kimmeridgian–Tithonian interval (Ivanova *et al.*, 2008) in the intercalations between coral-bearing beds (at the ca. 100, ca. 180 and ca. 190 m levels), indicate the influence of open-sea sedimentation and a temporary deepening of water inhibiting the development of corals.

The coral growth forms, skeletal structural porosity, abundant microencrusters, and type of sediment indicate a low to moderate hydrodynamic environment (only incidentally affected by the higher water agitation inferred from the grainstone facies recorded in places in the upper part of the succession), illuminated but situated at depths below storm wave base. Damaged solitary corals and fragments of phaceloid corallites or thin-lamellar colonies dispersed within fine-grained sediment are considered to be either autochthonous or transported from the immediate vicinity and produced by the activity of organisms feeding on the coral polyps, e.g. echinoderms. The succession shows repeated renewals of coral associations starting with coral recruitment, at least partly autochthonous production of fine biodetritic sediment, followed by intensification of formation of microbial authigenic pelmicrite, development of microepibionts and microbial crusts, and ended with smothering of the living corals; the microencrusters are commonly observed nestling in the calices. This cycle shows considerable analogy to the development of phaceloid coral-microbialite associations in Bajocian thin-bedded reef units in eastern France; the cyclicity of development of such reefal structures is referable to trophic fluctuation in the environment (Olivier *et al.*, 2006). Although microbial crusts are present in the Lyalintsi succession, they are not so inten-

sively developed as those reported from the Bajocian. The associations of microencrusters and microbialites with corals in Lyalintsi generally correspond to cases reported from the Middle and Upper Jurassic of Western Europe (especially Schmid, 1996; Helm & Schülke, 2006; Olivier *et al.*, 2006); the main difference lies in their continual recurrence throughout the ca. 350 m thick sequence, especially in the last 150 m.

Beside the supposed trophic fluctuations that could influence coral/microbial growth, their environment was subjected to exogenic factors. Among other factors, there was a continual supply of fine-grained sediment from the vicinity to the plain, sedimentary floor populated with baffling corals.

Of the different styles of sedimentation discussed in Sanders and Baron Szabo (2005), the example of an assemblage subject to moderate, but persistent sediment stress, seems to correspond to the coral thickets of the Lyalintsi succession. The main argument for this is the composition of coral growth forms on the one hand, i.e. baffling forms of phaceloid and ramose corals, and lamellar corals sensitive to sediment cover; and, on the other hand, the fine-grained sediment in which the coral thickets are embedded, not all of microbial origin.

TRANSITIONAL JURASSIC–CRETACEOUS CHARACTER OF THE CORAL FAUNA FROM LYALINTSI

Within the 102 m to 460 m interval there is a taxonomic shift from Jurassic coral faunas into Early Cretaceous faunas. The fauna, as a whole, is dominated by Jurassic genera, but with a significant lack of *Isastrea*, *Stylina* and *Thamnasteri*. Typical Jurassic families are observed throughout the succession and this spectrum is completed with the Aulastraeoporidae, the only Cretaceous family which appears in the upper part of the succession.

The majority of taxa represent either common species and forms with an affinity (aff.) or resemblance (cf.) to those species, or specifically undeterminable taxa, belonging to common Oxfordian–Tithonian genera, such as: *Actinaraea*, *Calamophylliopsis*, *Dermoseris*, *Dimorphastrea*, *Epistreptum*, *Latomeandra*, *Microphyllia*, *Microsolena*, *Mitrodendron*, *Placophyllia*, *Pleurophyllia*, *Pseudocoenia*, *Rhipidogyra*, *Solenocoenia*, Stylosmilia and *Thecosmilia*. The rhipidogyrinans *Tiaradendron*, *Pruvostastraea*, *Placogyra* and *Ogilvinella*, together with the amphiastraeid *Amphiaulastrea* and the axosmiliid *Columnaphyllia*, are typical of the Late Kimmeridgian–Tithonian.

Occurrences of genera that are either limited to the Cretaceous or represent Cretaceous families, and of genera described as new herein, begin with *Felixigyra* cf. *duncani* Prever at the 182 m level, followed by *Lyubasha gracilis* gen. et sp.n. at the 267 m level, *Latusastrea* sp. (different from the Jurassic *L. alveolaris*) at the 330 m level, and *Oedalmiopsis cretacea* gen. et sp.n. together with *Siderastreites lyalintsensis* gen. et sp.n. at the 339 m level. Of these, the faviid *Felixigyra* is a Barremian–Cenomanian element, and *Oedalmiopsis* represents the family Aulastraeoporidae, which is typical of the Berriasian–Cenomanian; an additional Neocomian element, *Cladophyllia clemencia* de Fromentel, appears in the Valanginian part of the section in the 359 m–377 m interval and persists to the 421 m level.

The longevity of some Jurassic species is surprising, e.g., *Solenocoenia sexradiata* (Goldfuss), common in the epicontinental Oxfordian–Kimmeridgian (Roniewicz, 1976), is noted in the section from the beginning of the Kimmeridgian–Tithonian sequence at the 115 m level, and observed up to the 457 m level, in the Valanginian.

This transition from a Jurassic into a Cretaceous character of the coral fauna gives a rare occasion to trace step-by step taxonomic changes in an ecologically stable environment that persisted on the platform from the Kimmeridgian throughout the Valanginian.

AFFINITIES OF CORALS FROM THE WESTERN PART OF THE MOESIAN PLATFORM

The coral fauna from the SW Moesian platform examined here, exemplified by the corals from the Lyubasha Mountain near Lyalintsi, resembles in its composition to different degrees the faunas from the Oxfordian–Kimmeridgian of Portugal, Jura Mts and Romania (compare Koby, 1881–1889, 1905; Geyer, 1955; Roniewicz, 1976; Errenst, 1990–1991), as well as from the Tithonian of the Carpathians (Morycowa, 1964, 1968, 1974; Eliášová, 1973, 1975, 1976a–c, 1981; Kołodziej, 2003) and Serbia (Turnšek & Michajlović, 1973). Beside its general resemblance to the Late Kimmeridgian fauna of Württemberg (Geyer, 1954; Lauxmann, 1991), the Bulgarian fauna seems to be ecologically closest to that of Sinabronn in the abundance of phaceloid and branching forms (compare Geyer, 1954), and, in the common occurrence of phaceloid forms and the environmental conditions, to the fauna composing the coral-microbial meadows of the Middle Oxfordian of northern Germany (Helm & Schülke, 2006).

The fauna from the SW margin of the Moesian platform, although not comparable in generic diversity to the amphiastreid and rhipidogyrid Tithonian corals of Štramberk in north Moravia, Outer Carpathians (compare Eliášová, 1973, 1974, 1976b), shares species in common with the Štramberk fauna, as well with the Upper Jurassic–Lower Cretaceous Ernstbrunn Limestone fauna of south Moravia (compare Eliášová, 1990). To the east, a similar fauna is known from the limestone considered to be Albian in the Caucasus (Sikharulidze, 1979).

This short review shows that the environment on the SW margins of the Moesian platform enabled the coral fauna to develop there later than the analogous coral faunas to the west in the Tethys and related epicontinental regions. Together with the coral environment-rich Late Jurassic–Early Cretaceous Carpathian platforms, these marginal parts of the Moesian platform took part in the formation of the coral belt rimming the northern margin of the Tethys.

SYSTEMATIC PALAEONTOLOGY

Remarks: The synonymies are limited to first descriptions and to well illustrated descriptions. The terminology concerning the structure of the corallite follows the glossary in Moore *et al.* (1956); typology of the growth forms follows Coates & Jackson (1985): *solitary*; pseudocolonial *phaceloid*; colonial *uniserial* of dendroid form; colonial *multiserial* erect, herein called *ramose* (some *columnar*); multiserial encrusting, herein called *lamellar* when flat/concave upper surface (some frondose, other thick and submassive), or *massive* when convex. Multiserial colonies show various types of corallite connections (degree of integration): cerioid, meandroid, thamnasterioid, plocoid, astraeoid (after the glossary in Moore *et al.*, 1956).

Abbreviations used in the descriptions: *c* number of costae; *c-c* distance between calicular axes; *cd/mm* costal density; *col-col* distance between axes of collines; *d* diameter (calicular diameter if not stated otherwise), in plocoid corals measured between midpoints of the walls, and in phaceloid corals measured on the external surface of the corallite; *ed/mm* density of endotheca (number of dissepiments, or tabulae per mm) measured in longitudinal section; *f* length of calicular fossa; *gf* growth form; *gr/mm* – density of granulations measured in transverse section; *l* lumen; *md/mm* density of menianes measured in longitudinal section; *pd/mm* density of perithecal dissepiments; *s* number of radial elements (septa, costosepta); *S1…Sn* septa of succeeding size orders (not cycles); *sd/mm* septal density measured directly on the calicular circumference (not calculated from *other* measurements); *trd/mm* density of trabeculae (in Microsolenina) counted in the transverse septal section.

Order HEXANTHINIARIA Montanaro-Gallitelli, 1975

Remarks: The corals of this group appeared in the Triassic (Zardinophyllidae Montanaro-Gallitelli, 1975, junior synonym Pachythecaliidae Cuif, 1975). Montanaro-Gallitelli (1975) discussed the coral ontogeny (with bilateral pattern of septal inception) and corallite structure (thick, fibrous wall independent of other structures), and considered this group to represent a separate order within the class Anthozoa. Within the order Hexanthiniaria, Eliášová (1976c) erected the suborder Pachythecaliina in which, apart from the Triassic corals mentioned above, the family Amphiastraeidae Ogilvie, 1897, previously placed in the suborder Amphiastraeida Alloiteau, 1952, was included (Roniewicz & Stolarski, 2001). A review of the morphological and microstructural characters of corals belonging to the suborder Pachythecaliina was given by Stolarski & Russo (2001), and a phylogenetic analysis was undertaken by Roniewicz & Stolarski (2001).

Suborder PACHYTHECALIINA Eliášová, 1976
Family AMPHIASTREIDAE Ogilvie, 1897
Genus *Pleurophyllia* de Fromentel, 1856

Pleurophyllia aff. *cara* Eliášová, 1975
Fig. 3B

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	Occurrence in Lyalintsi section
30299	542	phaceloid	4.0-5.5	14-16 (6+6+S3)	Valanginian
30290*	542				
30202 30196	412				
30134	359-377				

* bold – samples presented on photos

Remarks: Three septa are dominant: the columellar septum and two S1 septa in its vicinity; the other S1 septa are well developed. The number of septa is lower than in *P. cara* (20–24) due to the incomplete number of S3 septa.

Distribution: *Pleurophyllia cara* has been described from the Tithonian of the West Carpathians (Štramberk, Eliášová, 1975), and the Lower Kimmeridgian of Romania (Roniewicz, 1976). *P.* aff. *cara* is known from the Valanginian – Bulgaria; repository acronym and collection numbers as above.

Genus *Mitrodendron* Quenstedt, 1881

Mitrodendron sp. 1
Fig. 3C–E

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	Occurrence in the Lyalintsi section
30275	453	phaceloid	7-11	22-26 (24S1/ S3+S4)	Valanginian
30215	415				
30096 30090	182				Tithonian/ Berriasian boundary zone
30087 30086 30084	179				

Remarks: In the corallite no. NMNH F-30275 a ring of small "parricidal " buds is developed. The pattern of septal apparatus in those juvenile calices is typical of the *Pleurophyllia – Mitrodendron* group of genera.

Distribution: Known from the Tithonian/Beriasian boundary zone to Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Mitrodendron sp. 2
Fig. 3F, G

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	Occurrence in the Lyalintsi section
30300 30299 30292 **30290**	bed "a"above 460 m	phaceloid, corallites long	14-20	26	Valanginian
30096 30092	182				Tithonian-Berriasian boundary zone

Remarks: The species forms large coralla with thin and long septa. The maximum corallite diameters are larger than those of *M. tenuiseptum* Eliášová from the Tithonian (Eliášová, 1975) and *M. mitratum* Quenstedt from the Upper Kimmeridgian (compare Becker & Milaschewitsch, 1875–1876: pl. 51, fig. 9).

Distribution: Known from the Tithonian/Beriasian boundary zone to Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Genus *Amphiaulastrea* Geyer, 1955

Amphiaulastrea sp.
Fig. 3H, I

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	l	c-c	s	Occurrence in the Lyalintsi section
30204 **30199** 30197 30298	412	lamellar, cerioid	7, 8×10	4	7-9	14 (6+6+S3)	Valanginian

Remarks: This species is characterized by a very low number of septa.
Distribution: Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Family INTERSMILIIDAE Melnikova et Roniewicz, 1976
Genus *Intersmilia* Eliášová, 1974

Intersmilia sp.
Fig. 3J

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	Occurrence in the Lyalintsi section
30065	115	phaceloid	7	ca 25 S1-S3 at least	Tithonian

Remarks: A fragment of corallite found in transverse section shows a thick intersmiliid wall that passes smoothly into the septa. The coral resembles either *I. malevola* Eliášová, or *I. diaboli* Eliášová, both from the Tithonian of the West Carpathians (Eliášová, 1974: p. 416, pl. 1, figs. 1a, b, and pl. 2, figs. 1, 2, pl. 3, figs. 1, 2, pl. 4, figs. 1, 2, respectively). It represents a genus typical of the transition between the Jurassic and Cretaceous.
Distribution: Tithonian/Beriasian boundary zone – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

Order SCLERACTINIA Bourne, 1900
Suborder CARYOPHYLLIINA Vaughan et Wells, 1943
Family AXOSMILIIDAE Geyer, 1955
Genus *Columnaphyllia* Geyer, 1955

Columnaphyllia sp.
Fig. 4J, L–N

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	sd/10	f	Occurrence in the Lyalintsi section
30248	421-427	phaceloid	ca.60	ca.120	12	5	Valanginian
30186	392		ca.55	ca.100	10-12		
30157	377		40×50	ca.100	10	5-6	

Description: Corallites oval with a narrow and short axial fossa. Radial elements thin, differentiated into five size orders: S1 and S2 septa approaching the fossa, subequal, slightly fusiform and thicker than the others. Two S1 septa situated in the longer diameter of the corallite may penetrate the fossa with thin lobes of the internal border that form rudiments of a columella. The S3 septa are about 3/4 the length of the S1 septa; the S4 septa are thin, uneven, some of them longer than half the length of the S1 septa; the S5 septa are filiform, short and uneven, developed in the systems situated at two opposite sides of the longer calicular diameter. The adaxial and costal septal margins are thin, the septal faces are nearly smooth, showing faint and irregular granulations. The dissepiments are extended, convex at the periphery and sloping steeply axialwards. A tendency to form lonsdaleoid septa is very poorly marked. The wall must be very delicate, pellicular, as it is mostly abraded. In specimen no. NMNH F-30186, a thin, straight or wavy septal midline is fragmentarily preserved, corresponding to that of Recent deep-water caryophylliinan corals. No traces of budding are to be observed.
Remarks: *Columnaphyllia* sp. differs from *Columnaphyllia tithonica* Geyer (type species, Štramberk) in far larger diameters, higher numbers of septa, and in a poor axial structure. In septal structure and organization of the endotheca, the coral greatly resembles the Jurassic *Axosmilia marcou* figured by Turnšek (1973), but differs from it in a phaceloid, rather than solitary, growth form.
Distribution: Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Genus *Pleurosmilia* de Fromentel, 1856

Remarks: Alloiteau (1957) designated the Portlandian *Pleurosmilia graciosa* de Fromentel as the type of the genus, describing it as having "epithecal wall of endothecal origin", septa probably not ornamented distally, lenticular columella, and endotheca built of subtabular dissepiments at the axial region and abundant convex vesicules at the periphery. This briefly diagnosed genus was classified differently by different authors: into Eusmiliinae (Koby, 1884), Amphiastreidae (Koby, 1905; Vaughan et Wells, 1943), Stylophyllidae (Alloiteau, 1957), Placosmiliidae (Eliášová, 1976b); Vaughan et Wells (1943) considered it to be a synonym of *Axosmilia* Milne Edwards et Haime, 1845. Differences in septal micromorphology between the type species of *Pleurosmilia* and *Axosmilia*, expressing differences in the microstructure indicating that these represent different genera, are presented in Table 1 (after Alloiteau, 1957).

Table 1

Micromorphology of septa in *Pleurosmilia* de Fromenel and *Axosmilia* Milne Edwards & Haime (after Alloiteau, 1957)

Genus	Type species	Distal border	Internal border of the S1 septa	Septal faces	Stratigraphic position
Pleurosmilia Fromentel	*Pleurosmilia graciosa* de Fromentel	exsert, crenulated	free	thick granules	Portlandian
Axosmilia Milne Edwards et Haime	*Caryophyllia extinctorium* Michelin	non-exsert, smooth	anastomosing; join the columella	smooth [small granules in other species]	Bajocian

The only significant indication for a possible caryophylliinan affinity of this genus concerns the microstructure of the Hauterivian *P. neocomiensis*: Alloiteau (1957) noted small trabeculae at 20 μm intervals, aligned in the septal midline in this species. It should be noted that the early Aptian *Axosmilia bofilii*, *A.kobyi*, *A. villersensis* and *Peplosmilia fromenteli* described in Turnšek and Michajlović (1981) also show well expressed septal midlines corresponding to the caryophylliinan microstructure.

The genus is known from the Oxfordian to the Neocomian.

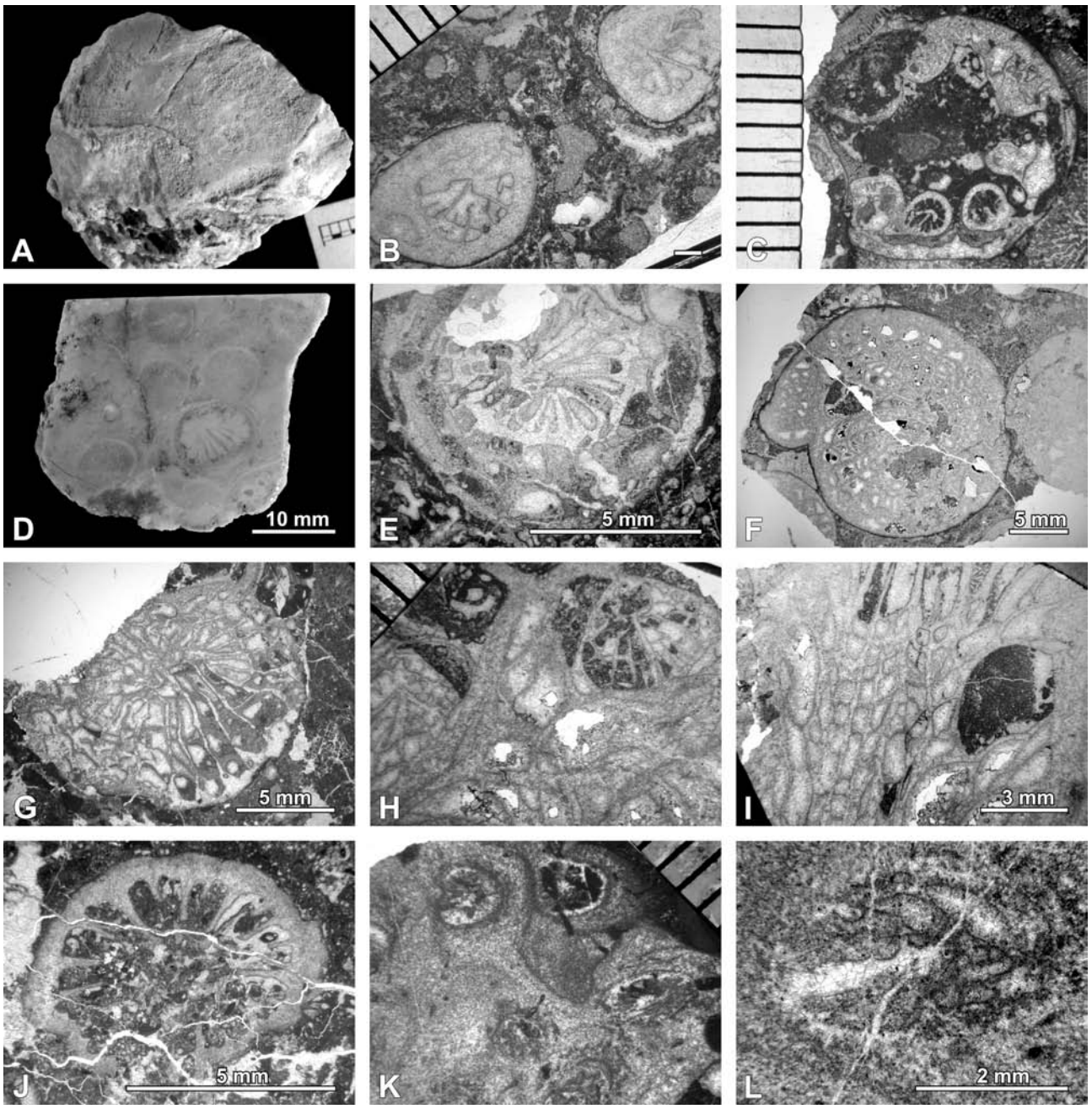

Fig. 3. The families Actinastraeidae, Amphiastraeidae, Intersmiliidae and Heterocoeniidae. **A** – Actinastreid indet. Calicular colony surface, no. NMNH F-30276. Valanginian. **B** – *Pleurophyllia* aff. *cara* Eliášová. Corallites with few peripheral dissepiments, thin section, no. NMNH F-30290b. Valanginian. **C–E** – *Mitrodendron* sp. 1. C – distal part of corallite with multiple parricidal buds, thin section, no. NMNH F-30275a; D – polished section showing intergrowing phaceloid corallites of *Dermoseris* sp. 2 (on left, see also Fig. 10E) and *Mitrodendron* sp.1 (on right: one complete corallite, and two incomplete corallites in upper and lower corners); complete calice of *Mitrodendron* sp. 1 represents distal calicular part filled with sediment, situated above peripheral dissepimental ring, no. NMNH F-30275. Valanginian. E – corallite with peripheral dissepimental ring encircling deep calicular part containing septal apparatus, thin section, no. NMNH F-30087d. Tithonian. **F, G** – *Mitrodendron* sp. 2. Thin sections: F – corallite with long, abundant septa; bud on left, no. NMNH F-30290a.Valanginian. G – septal apparatus composed of numerous thin septa, no. NMNH F-30096a. Tithonian/Berriasian border zone. **H, I** – *Amphiaulastrea* sp. Thin sections: H – septal apparatus composed of small number of septa, no. NMNH F-30199a; I – longitudinal section showing peripheral region built of large dissepiments, no. NMNH F-30199b. Valanginian. **J** – *Intersmilia?* sp. Distal part of calice, thin section, no. NMNH F-30065a. Tithonian. **K, L** – *Latusastrea* sp. Transverse/oblique thin section: colony fragment (K), and enlarged fragment (L) showing calice oval in shape with thick main septum and thin rudimentary septa, no. NMNH F-30221b. Valanginian

Pleurosmilia sp.
Fig. 4G–I, K

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	ed/5	Occurrence in the Lyalintsi section
30159	382	solitary	20×24	96 (12+12+24 +48)	9-10	Valangi-nian
30130	359-377			94 (12+12+24 +46)	8-10	

Description: Calice suboval, with calicular fossa 5 mm long and about 1 mm wide. Columella thin (5 mm long, ca. 1 mm wide), in contact with one or two opposing S1 septa. In section, the columella is composed of irregular, vertical, thick elements (probably septal projections) and thick-walled tabuloid dissepiments. Radial elements are slightly enlarged peripherally. S1 septa are T-shaped at the inner margin. Systems regular, the S1 and S2 septa approaching the fossa, differing in thickness, the S3 septa reaching about 7/8 the length of the S1 septa, and the S4 septa reaching up to half the length of the S1 septa. Lateral faces with large, truncated granulations circular in section. Endotheca built of very strong, widely extending peripheral dissepiments sloping steeply down and extended dissepiments producing a promontorium in the axial region. Traces of septal microstructure in the form of an opaque midseptal line can be discerned (specimen no. NMNH F-30159). The wall is abraded.
Remarks: The difference between this taxon and those described in the literature consists in its poorly developed columella, i.e., a spongy, poorly consolidated structure that does not resemble the lenticular columella in the species described so far. However, this difference may be attributable to the fact that the Bulgarian material was examined in thin section whereas the other taxa were observed from the exterior. In the literature, the septal apparatuses are characterized frequently by the number of septal cycles: the species of *Pleurosmilia* were described as having five septal cycles (or more, i.e., 6+6+12+24+48 septa, and so on) that correspond to four size orders in the descriptions herein (12+ 12+ 24+48).

The coral examined greatly resembles *P. geneviensis* Koby (1881: p. 40, pl. 4, fig. 2) from the Oxfordian of the Jura Mts. Two other possibly closely related species are the Oxfordian *P. truncata* Koby from the Jura Mts, and *P. carrapateirensis* Koby from the Oxfordian of Portugal (Koby, 1881 and 1905, respectively).
Distribution: Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Suborder ASTROCOENIINA Vaughan et Wells, 1943
Family ACTINASTREIDAE Alloiteau, 1952

Actinastreid indet.
Fig. 3A

Material (measurements in mm)

No. NMNH F-	metre levels	gf	d	c-c	Occurrence in the Lyalintsi section
30276	453	ramose, cerioid	2	2	Valanginian

Description: Wall slightly protruding, radial elements differentiated into two to three size orders; axial pit occupied by skeletal tissue that possibly represents the columella and paliform lobes.
Distribution: Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

Suborder STYLININA Alloiteau, 1952

Remarks: Microstructure of radial elements is characterized by thin monoaxial trabeculae with lateral offsets producing sharp granulations (*Stylina gaulardi* Michelin, 1843: Stolarski & Roniewicz, 2001: fig. 2.1).

Family STYLINIDAE d'Orbigny, 1851
Genus *Stylosmilia* Milne Edwards et Haime, 1848

Stylosmilia corallina Koby, 1881
Fig. 5F, K

1881. *Stylosmilia corallina*: Koby, p. 62, pl. 14, figs. 3-7.
1976. *Stylosmilia corallina* Koby: Roniewicz, p. 56, pl. 8, figs. 3, 4 (with synonymy).

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	Occurrence in the Lyalintsi section
30262	437	phaceloid, ca. 20 cm high	2.0-2.5	6+6+12	Valanginian
30247	421-427				
30223 30224	420				
30131	359-377				

Distribution: Common in the Oxfordian–Kimmeridgian of Europe (Roniewicz, 1976; Errenst, 1990; Turnšek, 1997). Known from the Valanginian of Bulgaria; repository acronym and collection numbers as above.

Stylosmilia octonaria Roniewicz, 1976
Fig. 5E, H

1976. *Stylosmilia octonaria:* Roniewicz, p. 6, pl. 8, fig. 5.

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	ed/5	Occurrence in the Lyalintsi section
30196	412	phaceloid	1.3-1.5	8+8		Valanginian
30167	382					
30140	377					
30073	137-142		(1.8) 3.0-2.5		6	Tithonian

Distribution: Known from the Lower Kimmeridgian of Romania. In Bulgaria known from the Valanginian; repository acronym and collection numbers as above.

Stylosmilia sp.
Fig. 5I, J

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	l	s	c	Occurrence in the Lyalintsi section
30194	397	phaceloid	2.5	1.5-1.8	10+10	20, thick	Valanginian

Remarks: Phaceloid corallites branching at nearly right angles. S1septa do not reach columella; columella composed of two to three parts. Endotheca tabuloid. A thick ring around the columella observed in the section results from the intersection of endothecal tabuloid elements.

The coral resembles *S. pumila* (Quenstedt, 1852) in symmetry and dimensions but differs from it in far shorter S1 septa. In Europe, *Stylosmilia pumila* is common in the Oxfordian–Tithonian interval (compare Roniewicz, 1976, Errenst, 1990).
Distribution: Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

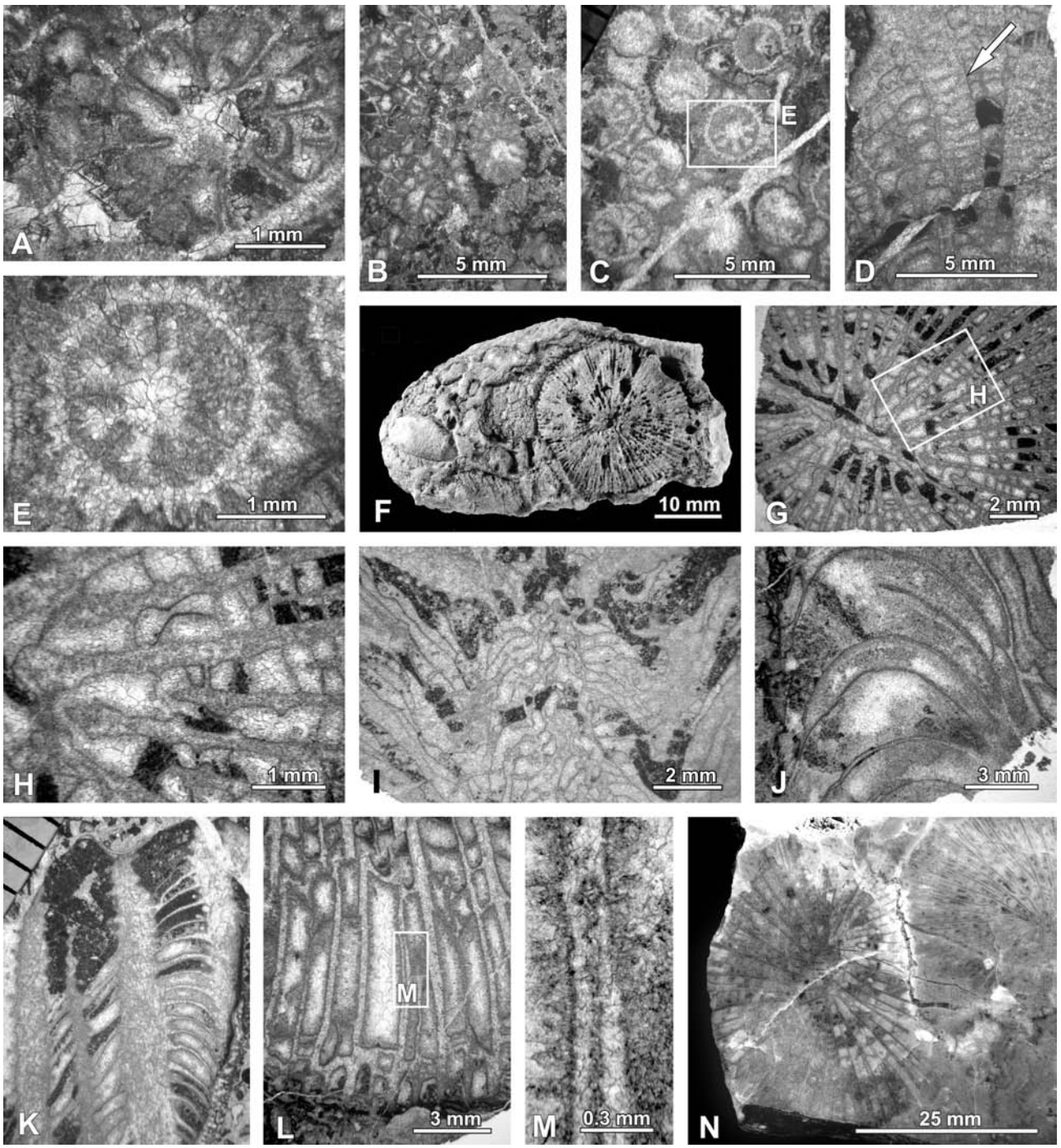

Fig. 4. The families Stylinidae and Axosmiliidae. **A, B** – *Pseudocoenia suboctonis* d'Orbigny. Thin section: A – corallite with septal apparatus typical of species, having underdeveloped costae of third size order, and B – colony in transverse section, no. NMNH F-30072a. Tithonian. **C–E** – *Pseudocoenia* aff. *limbata* (Goldfuss). Thin sections: C, E – transverse sections showing remarkably developed costae of third size order (compare with Fig. *2A*), no. NMNH F-30142a; D – longitudinal section with tabular endotheca (arrow), no. NMNH F-30142c. Valanginian. **F–I, K** – *Pleurosmilia* sp. F – corallum on weathered rock surface, no. NMNH F-30130. Valanginian. Thin sections: G – transverse section of corallum with lamellar columella, and H – enlarged fragment showing septa with lateral granulation, *n*o. NMNH F-30159a. Valanginian. I – longitudinal section cutting axial part of corallum displaying endotheca elevated in centre, no. NMNH F-30130b; K – longitudinal thin section showing large dissepiments in wall region and a rough surface of septa and lateral granules (on right), no. NMNH F-30159b. **J, L–N** – *Columnaphyllia* sp. Thin sections: J – rare, extended dissepiments of wall region in longitudinal section, no. NMNH F-30186c; L – septa and large dissepiments in wall region, and M – enlarged fragment showing septum with traces of midseptal line, transverse section, no. 3 NMNH F-0186b. Valanginian. N – two corallites on polished rock surface, no. NMNH F-30157. Valanginian

Genus *Pseudocoenia* d'Orbigny, 1850

Remarks: The status of *Pseudocoenia* d'Orbigny has been discussed by Baron-Szabo and Bertling (1995) and by Baron-Szabo (1996), who considered *Pseudocoenia* to be a valid genus, and by Löser (1998), who included it in the synonymy of *Adelocoenia* d'Orbigny, 1849. The colony structure, based on the holotype of *P. suboctonis*, was described by Roniewicz (1966).

Pseudocoenia suboctonis d'Orbigny, 1850
Fig. 4A, B

1850. *Pseudocoenia suboctonis*: d'Orbigny, t.2, p. 34.
1966. *Pseudocoenia suboctonis* d'Orbigny: Roniewicz, p. 182, text-figs. 6, 7, pl. 4, fig. 1 (with synonymy).

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	Occurrence in the Lyalintsi section
30071-2	115	columnar, plocoid	2.8	8+8	Tithonian

Distribution: *P. suboctonis* is frequent from the Upper Oxfordian to the Tithonian of Europe (Roniewicz, 1976; Errenst, 1990; Eliášová, 1994). Known from the Tithonian – Bulgaria; repository acronym and collection numbers as above.

Pseudocoenia aff. *limbata* (Goldfuss, 1826)
Fig. 4C–E

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	c-c	s	ed/5	pd/5	Occurrence in the Lyalintsi section
30145 **30141-2**	377	ramose, plocoid, d of branches 20-30 mm	2.0	2.5-3.5	8+8	12	9-10	Valanginian
30069	115				8+8			Tithonian

Remarks: Specimen no NMNH F-30069 shows a septal apparatus similar to those from the Lower Kimmeridgian of Poland (Roniewicz, 1966) with only 16 costae in prolongation of septa at the calicular margin; all 32 costae are only clearly discernible on the colony surface. In contrast, specimen NMNH F-30141 shows in transverse section 32 thin and equal costae at the calicular margin. This difference may be of minor significance, but it also may express speciation in this group of *Pseudocoenia*.
Distribution: *Pseudocoenia limbata* is common in the Upper Oxfordian and Lower Kimmeridgian of Europe (Roniewicz, 1976; Bendukidze, 1982; Errenst, 1990; Turnšek, 1997). *P.* aff. *limbata* is known from the Tithonian to Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Pseudocoenia aff. *baltovensis* Roniewicz, 1966
Fig. 5C

Material (measurements in mm):

No. NMNH F-.	metre levels	gf	d	c-c	s	ed/5	pd/5	Occurrence in the Lyalintsi section
30228-9	420	massive, plocoid	3.0-3.8	6.5-9.0	8+8	9-11	6-11	Valangnian
30212	ca.415							
30192	397							
30170	382							
30154, 30157	377							
30116-7	352							

Remarks: In having a large peritheca built of extended dissepiments, the species is closest to the Middle Oxfordian *P. baltovensis* from Poland (Roniewicz, 1966, p. 186, pl. 2: 3), but differs from it in the lower density of endothecal and perithecal elements (in the latter 14/5 mm and 10–14/5 mm respectively).
Distribution: *P. baltovensis* is known from the Middle Oxfordian of Poland (Roniewicz, 1966) and from the Upper Oxfordian/ Lower Kimmeridgian of Slovenia (Turnšek, 1973). *P.* aff. *baltovensis* is known from the the Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Genus *Bilaterocoenia* Morycowa, 1974

Remarks: The genus *Bilaterocoenia* is characterized by a septal apparatus composed of costoseptal radial elements of four size orders arranged in bilateral symmetry: two adjacent systems are complete while in the remaining four the S2 septa are lacking. This pattern differentiates the genus from *Pseudocoenia*, which has costosepta of only three size orders, arranged in radial symmetry.

Bilaterocoenia sp.
Fig. 5A, B

Material (measurements in mm):

No. NMNH F-.	metre levels	gf	d	c-c	s	Occurrence in the Lyalintsi section
30214	415	massivepl ocoid	5.0-5.5	9	6+6+S3	Valangi-nian

Remarks: In its tabuloid endotheca, well developed septal apparatus composed of septa of three size orders and costae of four size orders, and in the large corallite diameters, the Bulgarian form resembles the Tithonian genus *Bilaterocoenia* from the Carpathians (Morycowa, 1974; Eliášová, 1981a).
Distribution: Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

Family EUHELLIIDAE Vaughan et Wells, 1943
Genus *Enallhelia* Milne Edwards et Haime, 1849

Enallhelia sp.
Fig. 5D

Remarks: The genus is characterized by a branching uniserial colony (uniserial erect) enlarged by zigzag budding (sympodial terminal budding). The form from Lyalintsi determined as *Enallhelia* sp. occurs embedded in hard rocks in the interval from the 257 m level up to the 427 m level. The specimen No. NMNH F-30170 (from the level 382m) figured herein shows calicular lumen diameters of 2.0×2.5 mm.
Distribution: Known from the Beriasian and Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

Genus *Heliocoenia* Etallon, 1859

Heliocoenia sp.
Fig. 5G

Material (measurements in mm):

No. NMNH F-	metre levels	gf	c-c	ed/2	Occurrence in the Lyalintsi section
30298	bed "a" above 460 m	ramose, plocoid	1.8-3.5		Valanginian
30085	ca. 180				Tithonian/Berriasian boundary zone
30082	177			4	

Remarks: Because of recrystallization of the skeleton, precise

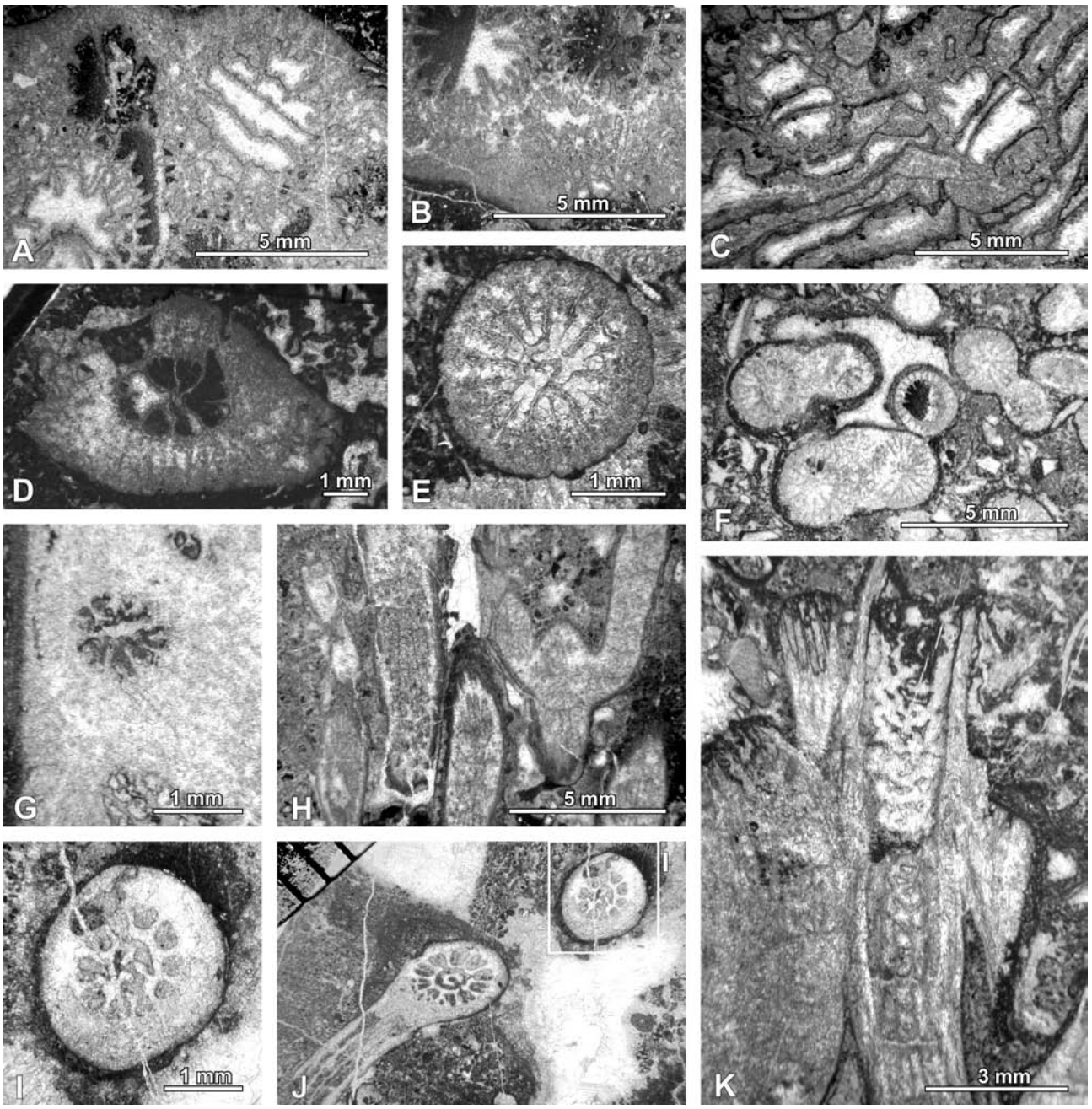

Fig. 5. The families Stylinidae and Euhellidae. **A, B** – *Bilaterocoenia* sp. Thin sections: well developed S1-S3 septa, costae of the fourth size order, and tabuloid dissepiments in transverse sections, no. NMNH F-30214c and d. Valanginian. **C** – *Pseudocoenia* aff. *baltovensis* Roniewicz. Transverse/oblique thin section showing large-dissepimental peritheca and corallites with poorly developed septal blades, no. NMNH F-30116a. Valanginian. **D** – *Enallhelia* sp. Transverse thin section of branch of uniserially budding coral with oval calices, no. NMNH F-30170f. Valanginian. **E, H** – *Stylosmilia octonaria* Roniewicz. Thin sections: E – transverse section displaying traces of septal microstructure preserved in the form of white line or row of points in middle of septal blades, no. NMNH F-30140a. Valanginian. H – longitudinal section showing tabular endotheca and twin corallites budding at nearly a right angle and then turning upwards, no. NMNH F-30073b. Tithonian. **F, K** – *Stylosmilia corallina* Koby. Thin sections: F – transverse section of phaceloid corallum showing corallites at various stages of budding, no. NMNH F-30131a; K – auricular internal septal margins and tabular endotheca in corallite longitudinal section, no. NMNH F-30131b. Valanginian. **G** – *Heliocoenia sp.* Transverse thin section of distal part of calice showing well marked auriculae, no. NMNH F-30085b. Tithonian. **I, J** – *Stylosmilia* sp. Thin section: corallites with remarkably thick tabuloid dissepiments encircling columella; *note*: budding at nearly a right angle, no. NMNH F-30194a. Valanginian

data on the type of septal apparatus (haxameral? or octomeral?) are unavailable. Another ramose taxon, with comparable corallite diameters, the octomeral *H. gracilis* Roniewicz, 1976 from the Upper Oxfordian of Romania, shows an endothecal density more than twice as dense (13/5 mm).

Distribution: Known from the Tithonian/Beriasian boundary zone to Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Family CLADOPHYLLIIDAE Morycowa et Roniewicz, 1990

Genus *Cladophyllia* Milne Edwards et Haime, 1851

Remarks: Morycowa and Roniewicz (1990) described the morphology and microstructure of the genus, and included the genera *Schizosmilia* Koby and *Schizosmiliopsis* Beauvais in its synonymy. Lathuilière (2000) recently clarified the misunderstandings concerning its type species, *C. babeana* (d'Orbigny). The most characteristic feature of the genus is a mode of budding producing equal calices by symmetrical septal division of the corallites.

Cladophyllia skuviensis (Turnšek, 1981)
Fig. 6A, D

1981. *Pleurophyllia skuviensis* Turnšek: Turnšek & Michajlović, 19, pl. 14, figs. 1-4; pl. 15, figs. 1, 2.

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	ed/2	Occurrence in the Lyalintsi section
30268-9 30264-5	437	phaceloid	3-4	(16)22-26 (10-12S1/ 2+S3+S4)	3-4	Valanginian
30202	412					
30181-2 30177 30179	387					
30172	382					
30123 -4	359-377					
30086 -7	180					Tithonian/ Berriasian boundary zone

Description: Coralla phaceloid, loose in structure. Corallites tortuous, oval in section. Symmetry radial-bilateral. Calicular centre occupied by flat columella that may connect with at least one S1 septum lying in the plane of bilateral symmetry. Septal apparatus differentiated into septa of three (four) size orders. S1 septa approach the axial cavity, two S2 septa lying in the plane of bilateral symmetry are subequal in length to the S1 septa, the others are shorter. Septa of higher orders rarely have fully developed blades and are indicated by ridges on the internal wall surface; the S4 septa are most frequently observable as rudiments incorporated into the wall structure. As a result, the corallite interior has a lot of free space. Wall variable in thickness: if thin, the septa of the last order may protrude into the calicular space in the form of low ridges. Endotheca built of rare tabular horizontal dissepiments. The budding typical of the genus is rare.

Remarks: In all aspects of corallite structure the corals from Lyalintsi correspond to *Pleurophyllia skuviensis* Turnšek, 1981 from the Lower Cretaceous of Serbia, differing from it in the slightly smaller corallite diameters. The coral described from Serbia shows all the features of *Cladophyllia*. The radial-bilateral corallite symmetry is similar to that in *Pleurophyllia*, but the genera differ essentially in the mode of budding: symmetrical septal division in *Cladophyllia* (Cladophylliidae) and *pocket budding* (Taschenknospung) in *Pleurophyllia* (Amphiastraeidae). The sharp, rare granulations that form the lateral septal micromorphology observable in the type specimen of *C. skuviensis* are also typical of *Cladophyllia* (Turnšek & Michajlovć, 1981: pl. 15, figs. 1, 2).

The corals from Lyalintsi described herein and those described by Turnšek from Serbia agree in dimensions and numbers of septa with those of the type species of *Cladophyllia*, the Upper Jurassic *Cladophyllia dichotoma* (Goldfuss, 1826) (compare Morycowa & Roniewicz, 1990: p. 175, text fig. 1.4, pl. 18, figs. 1-3.). However, the completely silicified Goldfuss types were described without internal details except those discernible in the calices, so no detailed comparisons can be made. The *C. dichotoma* form from Württemberg presented by Lauxmann (1991) shows the smallest diameters of the range observed in that species.

Distribution: Barremian–Lower Aptian in Serbia. Tithonian–Valanginian in Bulgaria; repository acronym and collection numbers as above.

Cladophyllia clemencia de Fromentel, 1857
Fig. 6B, C

1857. *Cladophyllia clemencia*: de Fromentel, p. 29, pl. 3, figs. 2, 3.

Material (measurements in mm):

No .NMNH F-	metre levels	gf	d	s	Occurrence in the Lyalintsi section
30232 30235	421 -427	phaceloid	1.5-1.8 (2.0)	6+6+S3	Valanginian
30214-5	415				
30167	382				
30120-21	359 -377				

Remarks: The corallites of *C. clemencia*, in their subradial calicular symmetry and small corallite diameters resemble those in the genus *Apocladophyllia* Morycowa and Roniewicz 1990 (Portlandian–Lower Berriasian), but differ in the corallum structure lacking any connections (apophyses) between the corallites. The coral shows S2 septa equal or subequal in length to the S1 septa, and rare S3 septa, hidden in the wall structure.

Kołodziej (1997) reported a similar form, *Cladophyllia* sp. (d (1.5) 2–2.5 (3) mm) from the exotics of the limestones of Štramberk type found at Woźniki (Poland), External Carpathians.

Distribution: The species is described from the Neocomian of Saint-Dizier, Dept. l'Yonne, France. Known from the Valanginian – Bulgaria; repository acronym and collection numbers as above.

Suborder RHIPIDOGYRINA Roniewicz, 1976
Family PLACOPHYLLIIDAE Eliášová, 1990

Remarks: The family was erected for the epithecate phaceloid genus *Placophyllia* d'Orbigny, 1849, which shows neorhipidacanth microstructure (Eliášová, 1990).

Genus *Placophyllia* d'Orbigny, 1849

Placophyllia rugosa Becker, 1875
Fig. 6E, F

1875. *Placophyllia? rugosa*: Becker: Becker & Milaschewitsch, p. 140, pl. 38, fig. 9.
1966. *Placophyllia rugosa* Becker: Roniewicz, p. 220, text-fig. 12, pl. 12, fig. 1a, b.
1990. *Placophyllia rugosa* Becker: Eliášová, p. 121, pl. 2, fig. 1 (with synonymy).

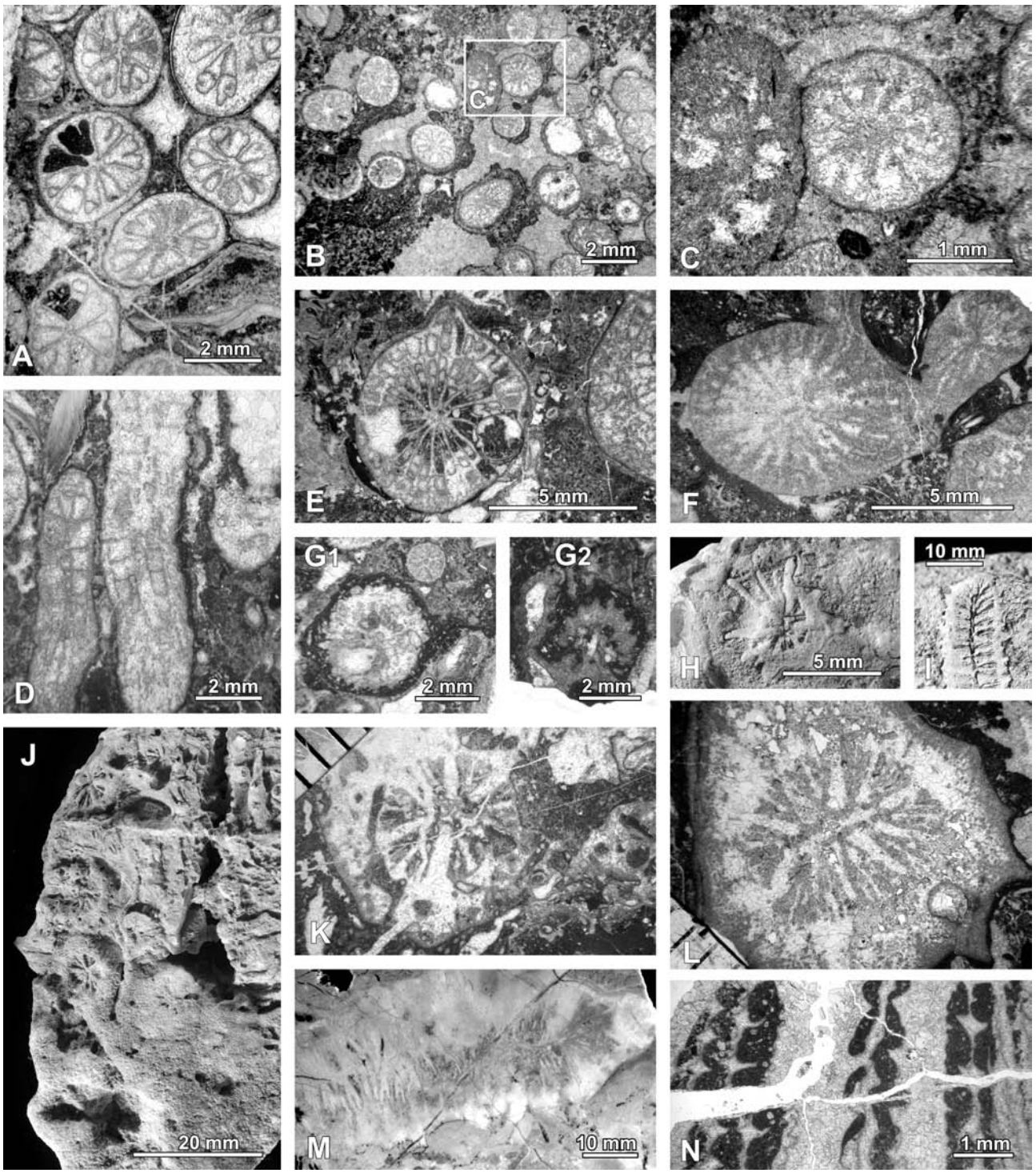

Fig. 6. The families Cladophylliidae, Placophylliidae and Rhipidogyridae. **A, D** – *Cladophyllia skuviensis* (Turnšek & Michajlović). Thin sections: A – septal apparatus showing radial-bilateral symmetry, no. NMNH F-30182a; D – tabular endotheca in longitudinal section, no. NMNH F-30182b. Valanginian. **B, C** – *Cladophyllia clemencia* de Fromentel. B – thin section showing poorly preserved corallites, and C – corallite with septa arranged in subradial symmetry, no. NMNH F-30167b. Valanginian. **E, F** – *Placophyllia rugosa* Becker. Thin sections: E – specimen lacking any traces of microstructure, no. NMNH F-30089a. Tithonian. F – specimen showing micritized skeleton with traces of rhipidogyrinan microstructure, no. NMNH F-30058a. Tithonian. **G** – *Placophyllia blastemon* Eliášová. G1, G2 – two corallites of same corallum showing thick costae, no. NMNH F-30196b. Valanginian. **H** – Juvenile rhipidogyrid on rock surface, no. NMNH F-30247. Valanginian. **I, L** – *Rhipidogyra* cf. *minima* Koby. I – fragment of flat distal part of corallum on weathered rock surface, no. NMNH F-30205; L – proximal part, circular in section, of same corallum in thin section, no. NMNH F-30205d. **J, K** – *Tiaradendron germinans* Quenstedt. J – fragment of branch on weathered rock surface, no. NMNH F-30255; K – corallite with thick wall bored by endolithic organisms, transverse section, no. NMNH F-30255b. Valanginian. **M, N** – *Rhipidogyra* sp. sp. M – large corallum on polished rock surface, no. NMNH F-30245.Valanginian. N – longitudinal section showing auricular septa, no. NMNH F-30215a. Valanginian

Material: (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	Occurrence in the Lyalintsi section
30089 30094-5	182	phaceloid	5-6.5 adult 3-4 juveniles	ca. 30	Tithonian/ Berriasian boundary zone
30058	102				Kimmeridgian/ Tithonian

Description: Columella flattened. Budding marginal, situated at the corallite circumference. Endotheca built of large dissepiments. Neorhipidacanth microstructure typical of Rhipidogyrina is preserved in traces. The specimens examined show features corresponding to those of *P. rugosa* from the Lower Kimmeridgian of Poland (Roniewicz, 1966).
Distribution: Common in the Upper Jurassic and Lower Cretaceous of the whole European epicontinental and Tethyan coral facies (Central Poland: Roniewicz, 1966; Germany, Württemberg: Becker & Milaschewitsch, 1875–1876; External Carpathians: Eliášová, 1976b, 1990; Caucasus: Bendukidze, 1982; Slovenia and Croatia: Turnšek, 1973 (1972), 1975; Portugal: Rosendahl, 1985). Known from the Kimmeridgian/ Tithonian to Berriasian – Bulgaria; repository acronym and collection numbers as above.

Placophyllia cf. *blastemon* Eliášová, 1976
Fig. 6G

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	Occurrence in the Lyalintsi section
30196	412	phaceloid	2.8-3.5 (4)	ca.20	Valanginian

Remarks: The material is very fragmentary, but the small corallite dimensions and very thick costae covered with epitheca indicate *P. blastemon* Eliášová (1976b: p. 340, pl. 3, fig. 3) as the most probable assignment. Traces of the neorhipidacanth microstructure are preserved.
Distribution: *P. blastemon* is known from the Tithonian, External Carpathians: Štramberk. *P.* cf. *blastemon* occurs in the Valanginian in Bulgaria; repository acronym and collection numbers as above.

Family RHIPIDOGYRIDAE Koby, 1905
Genus *Rhipidogyra* Milne Edwards et Haime, 1848

Remarks: Some solitary? or phaceloid? coralla of uncertain generic affinity (*Rhipidogyra* or *Aplosmilia*) are recorded herein as *Rhipidogyra* sp.sp. in Valanginian part of the Lyalintsi section.

Rhipidogyra cf. *minima* Koby, 1881
Fig. 6I, L

Material (measurements in mm):

No. NMNH F-	metre levels	gf	h	d	s	sd/10	Occurrence in the Lyalintsi section
30273	442-447	solitary					Valanginian
30205	415		ca.40	11 proximal 12×35 distal	S1-S5	11	

Remarks: In its measurements, this distally flat coral, proximally circular in section, is most similar to *R. minima* Koby (Koby, 1881: p. 46, pl. 10, figs. 5, 5a), but differ from it in having costae.
Distribution: *R. minima* is known from the Oxfordian, Salève, Switzerland (Koby, 1881). *R.* cf. *minima* occurs in the Valanginian – Bulgaria; repository acronym and collection numbers as above.

Rhipidogyra sp. sp.
Fig. 6H, M, N

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	sd/10	remarks	Occurrence in the Lyalintsi section
30247	457	solitary		6+6+12		juvenile on rock surface	Valanginian
30245	421-427		30×90				
30215 30219 30208	415						
30152	377						
30132	359-377		20×40		4S1		

Remarks: Of the corals commonly encountered in section, at least two resemble known species: specimen no. NMNH F-30132 is similar to *R. crispa* Koby from the Upper Jurassic of Portugal (Koby 1905); specimen no. NMNH F-30245, which is wide and elongated, and shows buds at the ends of its longer axis, resembles the Upper Oxfordian *R. percrassa* Koby from the Jura Mts (Koby 1881) in shape and dimensions.

Two corallites at an early ontogenetic stage (preserved on weathered rock surface) represent an unidentifiable species. Both have a large basal attachment to the substrate, radial calices, with a styliform columella and thick costae (Fig. 6H).
Distribution: Frequent in Valanginian part of the Lyalintsi section; repository acronym and collection numbers as above.

Genus *Tiaradendron* Quenstedt, 1858

Remark: *Tiaradendron* belongs to the rare Mesozoic genera with dendroid colonies of the uniserial erect growth form.

Tiaradendron germinans (Quenstedt, 1852)
Fig. 6J, K

1852. *Lobophyllia germinans*: Quenstedt, p. 654, pl. 58, fig. 18.
1991. *Tiaradendron germinans* (Quenstedt): Lauxmann, p. 135, fig. 5, pl. 3, fig. 4-8 (with synonymy).

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	lumen	s	c	Occurrence in the Lyalintsi section
30272	437	uniserial	9-10	6.0	ca. 48(6+6+12 +ca.24)	12	Valanginian
30255	421-427						
30121	359-377						

Remarks: This is closest to the form from the Kimmeridgian of Nattheim that was separated by Quenstedt from *Lobophyllia germinans* and figured under the name of *Tiaradendron germinans rotundum* Quenstedt (1881: p. 741, pl. 172, fig. 7). Branches clustered; thick-walled calices circular in section, lacking columella; septal apparatus hexameral, composed of regularly developed S1-S3 septa and a variable number of S4 septa developed in the form of apophysal elements (term of Eliášová, 1973). Auriculae present on internal margins of the S1-S3septa.
Distribution: Kimmeridgian, south Germany. Valanginian – Bulgaria; repository acronym and collection numbers as above.

Genus *Ogilvinella* Eliášová, 1976

Ogilvinella elegans (Eliášová, 1973)
Fig. 7A–C

1973. *Ogilviella elegans*: Eliášová, p. 276, fig. 3, 4, pl. 5, fig.1a, b.

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	c-c	s	Occurrence in the Lyalintsi section
30227 30230 **30225**	420	lamellar - submassive, plocoid	3-4	4-6	12-16S1/ S2+nS3	Valanginian
30201	412					
30179	387					
30143	377					

Distribution: Tithonian, External Carpathians: Štramberk. Albian: Caucasus (Sicharulidze, 1979). Valanginian – Bulgaria; repository acronym and collection numbers as above.

Genus *Placogyra* Koby, 1905

Placogyra hykeli Eliášová, 1973
Fig. 7D–F

1973. *Placogyra hykeli*: Eliášová, p. 278, fig. 5, pl. 6, fig. 1a, b.

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	col-col	s	sd S1-S3/5	Occurrence in the Lyalintsi section
30231	421-427	lamellar - submassive, plocoid-meandroid	6-10 6×12	8-15 mm	S1-S4	12	Valangi-nian
30169	382						
30091	182						Tithonian-Berriasian boundary zone
30088	181						

Remarks: Large submassive colonies show flat upper surface with flexuous series separated by poorly defined ambulacra, and isolated calices; costae nonconfluent. In the series, the septa are differentiated into three size orders; in isolated calices there are four size orders. The S1and S2 septa have thick costae and internal margins with thick auriculae; the septal faces bear abundant granules. Columella lamellar, continuous. Endothecal and perithecal dissepiments vesicular and abundant. Colony increase by equal division of corallites.
Distribution: Tithonian, External Carpathians: Štramberk. Valanginian – Bulgaria; repository acronym and collection numbers as above.

Genus *Pruvostastraea* Alloiteau, 1957

Remarks: Alloiteau (1957) considered the genus to represent the amphiastraeids, Beauvais (1970) separated it into the family Pruvostastraeidae and, finally, Eliášová (1973) removed it to the Rhipidogyridae, pointing out the structural resemblance to *Acanthogyra* Ogilvie, 1897. From fossiliferous limestones considered to be Albian, Sikharulidze (1979) described the genus *Tskhanarella* (type species: *T. crassisepta* Sikcharulidze), which appears to be a junior subjective synonym of *Pruvostastraea* (type species: *P. labyrinthica* Alloiteau).

Pruvostastraea crassisepta (Sikharulidze, 1979)
Fig. 7G–I

1979. *Tskhanarella crassisepta*: Sikharulidze, p. 24, pl. 3, fig. 3, 3a; pl. 14, fig. 1a, b.

Material (measurements in mm):

No. NMNH F-	metre levels	gf	col-col	sd/5	Occurrence in the Lyalintsi section
30271	437	lamellar - submassive, meandroid	6-8	5-6	Valanginian
30233-4 30240 30256	421-427				
30209	415				

Description: Colonies submassive. Series perfectly meandroid. Columella lamellar, well marked. Radial elements confluent or joining those of the adjacent series to form an incomplete wall. Septal apparatus differentiated into S1 and S2 septa with additional S3 septa, which may develop as lonsdaleoid septa. Endotheca composed of large dissepiments sloping down from the periphery toward the centre and subhorizontal ones at the centre.
Remarks: In measurements, the coral closely corresponds to the form from the Caucasus, and differs in the smaller width of the series from the Late Jurassic *P. labyrinthica* (Alloiteau, 1957: width of series of ca. 10 mm; Eliášová, 1973: 11–13 mm; Rosendahl, 1985: 8–12 mm; Turnšek, 1997: ca. 10 mm).
Distribution: Albian – the Caucasus. Valanginian – Bulgaria; repository acronym and collection numbers as above.

Family AULASTRAEOPORIDAE Alloiteau, 1957

Remarks: The most striking microstructural features of the genera included here are: (1) septa with midseptal zone built of individualized small trabeculae flanked by (2) lateral septal stereome organized into centred fascicles of fibres subperpendicular to the midseptal zone, and (3) trabecular wall termed rhipidotheca (Morycowa & Marcopoulou-Diacantoni, 2002) in continuity with the midseptal zone (line). The microstructure was documented by Morycowa & Kołodziej (2001).

Two Late Jurassic rhipidogyrids, *Pruvostastraea* Alloiteau and *Acanthogyra* Ogilvie, show the same type of wall and septal microstructure as the Aulastraeoporidae. However, these genera differs from the aulastraeoporids in having a T-shaped, auricular internal septal border and lamellar columella typical of the Rhipidogyridae. The differences are presented in Table 2.

Table 2

Morphological features of corals belonging to the families Aulastraeporidae and Rhipidogyridae

Taxon	growth form and type of colony	columella	lonsda-leoid septa	apo-physeal septa	T-shaped axial septal border
Aulastraeoporidae					
Aulastraeopora	solitary	0	+	+ rare	?
Apoplacophyllia	phaceloid	0	+		?
Preverastraea	massive cerioid/meandroid	0	+	+	?
Oedalmiopsis	lamellar, thamnasterioid	0	0	0	0
Rhipidogyridae					
Acanthogyra	submassive, cerioid	lamellar	+	?	+
Pruvostastraea	submassive, meandroid	lamellar	?	+	+

Genus *Oedalmiopsis* gen. n.
Type species: *Oedalmiopsis cretacea* sp.n.

Derivation of the name: The name derives from the Rhaetian genus *Oedalmia* Cuif, 1976 of the family Reimaniphylliidae, superfamily Volzeioidea; gender feminine.
Diagnosis: Thamnasterioid, lacking columella; septa with internal border smooth; endotheca dissepimental; midseptal zone composed of small trabeculae, lateral septal stereome organized into centred fascicles of fibres. Monotypic.
Remarks: The genus *Oedalmiopsis* is assigned to the Aulastraeoporidae because this is the only family among post-Triassic scleractinian groups with which the genus shares such features as the septal microstructure and the shape of the internal septal border.

In the essential features of the microstructure of the radial elements, such as the presence of a midseptal zone, septal lateral

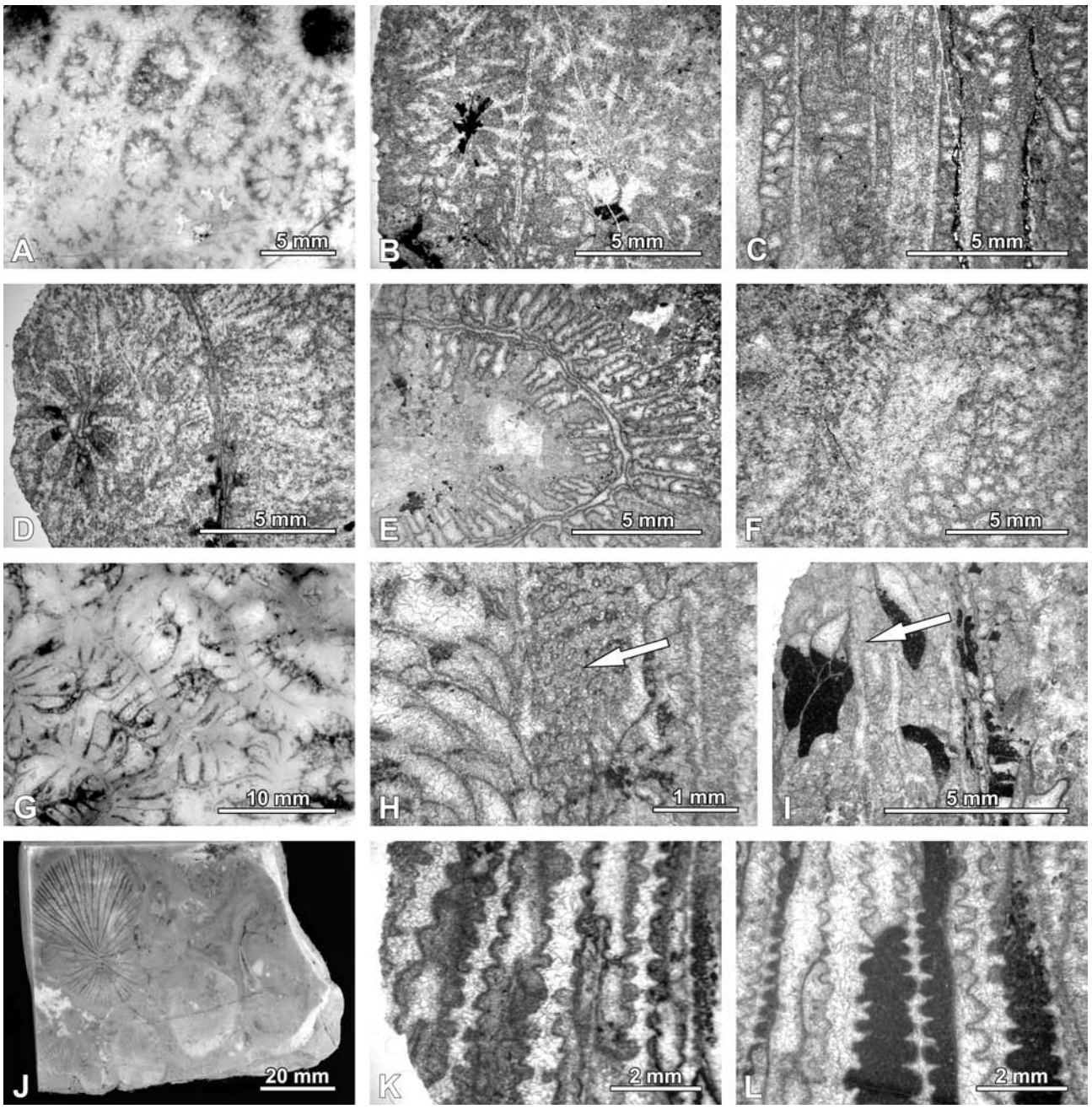

Fig. 7. The families Rhipidogyridae and Montlivaltiidae. **A–C** – *Ogilvinella elegans* (Eliášová). A – colony fragment in transverse section, polished surface, no. NMNH F-30225; B – the same in thin section, no. NMNH F-30225b; C – longitudinal thin section showing perithecal dissepiments hardly distinguishable from endothecal ones, no. NMNH F-30225c. Valanginian. **D–F** –*Placogyra hykeli* Eliášová. Thin sections: D – transverse section with valley (on right) and isolated corallite (on left), divided by narrow perithecal zone, no. NMNH F-30091b. Tithonian–Berriasian border zone. E – well marked lamellar columella and septa with prominent lateral granulation, no. NMNH F-30088c. Tithonian–Berriasian border zone. F – longitudinal section showing small endothecal dissepiments (compare with those in *Pruvostastraea crassisepta,* below), no. NMNH F-30231b. Valanginian. **G–I** – *Pruvostastraea crassisepta* (Sikharulidze). G – polished colony surface with meandering valleys and dividing septothecal walls, no. NMNH F-30209; H – longitudinal section showing large endothecal dissepiments, and septal lateral micromorphology in the form of ranges of granules (arrow), no. NMNH F-30209b. Valanginian. I – longitudinal section traversing wall between valleys (arrow), and showing large dissepiments based on the wall, no. NMNH F-30271a. Valanginian. **J–L** – *Montlivaltia* sp. J – corallum in rock, polished section, no. NMNH F-30135; K and L – enlarged fragments in transverse thin section showing septal micromorphology in the form of sharp granules, no. NMNH F-30135d. Valanginian

stereome arranged into well centred fascicles of fibres, and thamnasterioid colony type, the Valanginian coral strikingly resembles the Rhaetian reimaniphylliid genus *Oedalmia* (compare Cuif, 1976; Roniewicz, 1989). Morphologically, *Oedalmiopsis* differs from *Oedalmia* in the higher number of radial elements and in the uniform arrangement of the calices, instead of a serial one in the latter, with valleys parallel to the colony circumference and divided from one another by broad collines. Microstructurally, *Oedalmiopsis cretacea* differs from the Triassic *Oedalmia norica* (Frech, 1890) in well individualized small trabeculae in the midseptal line, and in smaller diameters of the lateral fascicles forming the lateral septal stereome (lateral fascicles in Triassic *Oedalmia norica* are from 180 to 300 μm in diameter). In the regular arrangement of lateral septal granulations, *Oedalmiopsis* resembles the Triassic reimaniphylliids on the one hand, and Recent Caryophylliina and Dendrophyllina on the other.

Oedalmiopsis cretacea sp.n.
Fig. 8D–G, J, K

Syntypes: Specimens NMNH F-30251, 30252 (may be fragments of one colony).
Type-level: Slivnitsa Formation, interval between 421 m and 427 m of the Lyalintsi section.
Type-locality: Lyalintsi, Lyubasha Mountain, Bulgaria.
Diagnosis: Thamnasterioid colony with calices in a uniform arrangement; distance between calicular centres 5–10 mm; number of radial elements approximately 30–40 per calice; trabeculae in the midseptal zone approximately 33 μm in diameter.
Material (measurements in mm):

No. NMNH F-	metre levels	gf	c-c	s	sd/5	Occurrence in the Lyalintsi section
30251 **30252**	421-427	lamellar, thamnasterioid	5-7(10)	30-36	8	Valanginian

Description: Colony lamellar, more than 15cm in diameter and more than five cm thick, thamnasterioid, apparently increasing by corallite division, with corallites arranged without any special order. Corallites with well marked, empty axial pit. Radial elements of biseptal type, thick, and differentiated into three size orders: the S1 and S2 septa, slightly differentiated in thickness, approach the axial pit, the S3 septa are very short and thin. Internal septal border slightly rounded, not enlarged. Lateral septal faces covered with rounded granulations arranged into subvertical rows and in striae paralleling distal septal margin. Dissepiments vesicular.

Microstructure. Septal midline wavy or zigzag, composed of trabeculae approximately 30 μm in diameter. Lateral septal stereome organized into short fascicles 150–180 μm in diameter, subperpendicular to the midseptal zone and emerging on the septal surface in the form of rounded, densely packed granulations.
Distribution: Valanginian – Lyubasha Mountain, Lyalintsi: NMNH F-30251, 30252.

Suborder HETEROCOENIINA M. Beauvais, 1977

Remarks: The Heterocoeniina, with a single family Heterocoeniidae Oppenheim, is characterized by a bilateral corallite symmetry passing through the columellar septum, dense coenenchymal deposits of trabecular nature nearly completely replacing the extrathecal dissepiments, and a subtabular endotheca.

Kołodziej (1995) proposed to lower the rank of the suborder to the superfamilial level, and to include it in the suborder Amphiastreina. However, heterocoeniids, although similar to amphiastraeids in corallite symmetry, show not only a plocoid type of colony that represents a high integration level alien to the suborder Pachythecaliina Eliášová, but also thick-trabecular walls and septa (compare Morycowa, 1974: text-figs. 19, 21, 23; pl. 12, fig. 1d, e; Kołodziej, 1995: fig. 3) different from the modular wall structure and thin-trabecular septa in pachythecaliinan corals (Roniewicz & Stolarski, 1999: figs. 8, 9; Roniewicz & Stolarski, 2001: fig. 2).

Family HETEROCOENIIDAE Oppenheim, 1930
Genus *Latusastrea* d'Orbigny, 1849

Latusastrea sp.
Fig. 3K, L

Material (measurements in mm):

No. NMNH F-	metr levels	gf	lumen	c-c	s	Occurrence in the Lyalintsi section
30221	415	lamellar, plocoid	2	4-5	12	Valanginian

Description: Irregular platy colony. Corallites subcircular in section. Septal apparatus consisting of approximately 12 septa in total, differentiated into a very robust columellar septum, two rather long and thin septa on each side of the columellar septum and the remaining very short septa developed as continuous blades. Columellar septum club-like, either smooth or with strong lateral processes. Endotheca formed of large subtabuloid dissepiments. Peritheca formed of large dissepiments and a thick stereomal deposit of trabecular origin. An intensive development of the stereome limited the share of vesicular tissue in formation of the peritheca, resulting in a highly dense skeleton.
Remarks: The coral differs from other species of *Latusastrea* in the subcircular shape of the corallites and a septal apparatus composed of well developed septal blades. The colony structure and corallites with an overgrown, robust columellar septum justify the generic assignment of this taxon.
Distribution: Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

Suborder FAVIINA Gregory, 1900
Family FAVIIDAE Gregory, 1900, emend. Alloiteau, 1952
Genus *Felixigyra* Prever, 1909

Remarks: The genus *Felixigyra* is known in the Early Cretaceous, beginning in the Hauterivian, and is especially typical of the Urgonian facies (Barremian–Upper Aptian, ?Lower Albian).

Felixigyra cf. *duncani* Prever, 1909
Fig. 8A–C, H, I

Material (measurements in mm):

No. NMNH F-	metre levels	gf	c-c	sd/5	Occurrence in the Lyalintsi section
30093	182	lamellar, meandroid-hydnophoroid	3.5	6-7/3mm	Tithonian/Berriasian boundary zone

Description: Colony lamellar, about 20–25 mm thick with short collines and rare monticules. Septa thick, their faces covered with sharp granulations. An excessive, rhythmic development of secondary sclerenchyme resulted in development of rhythmic accretionary layers of the skeleton observable in longitudinal section, and in supression of development of dissepiments. Vestiges of original colony surface with microarchitectural details of distal septal borders and of septal sides are to be observed in microstructural traces of succeeding sclerenchymal layers.

This coral resembles *Felixigyra* sp. from the Neocomian of the External Carpathians (Morycowa, 1964), as well as *F. duncani* from the Serbian deposits (Turnšek & Michajlović, 1973: originally considered to be Tithonian, but subsequently not confirmed

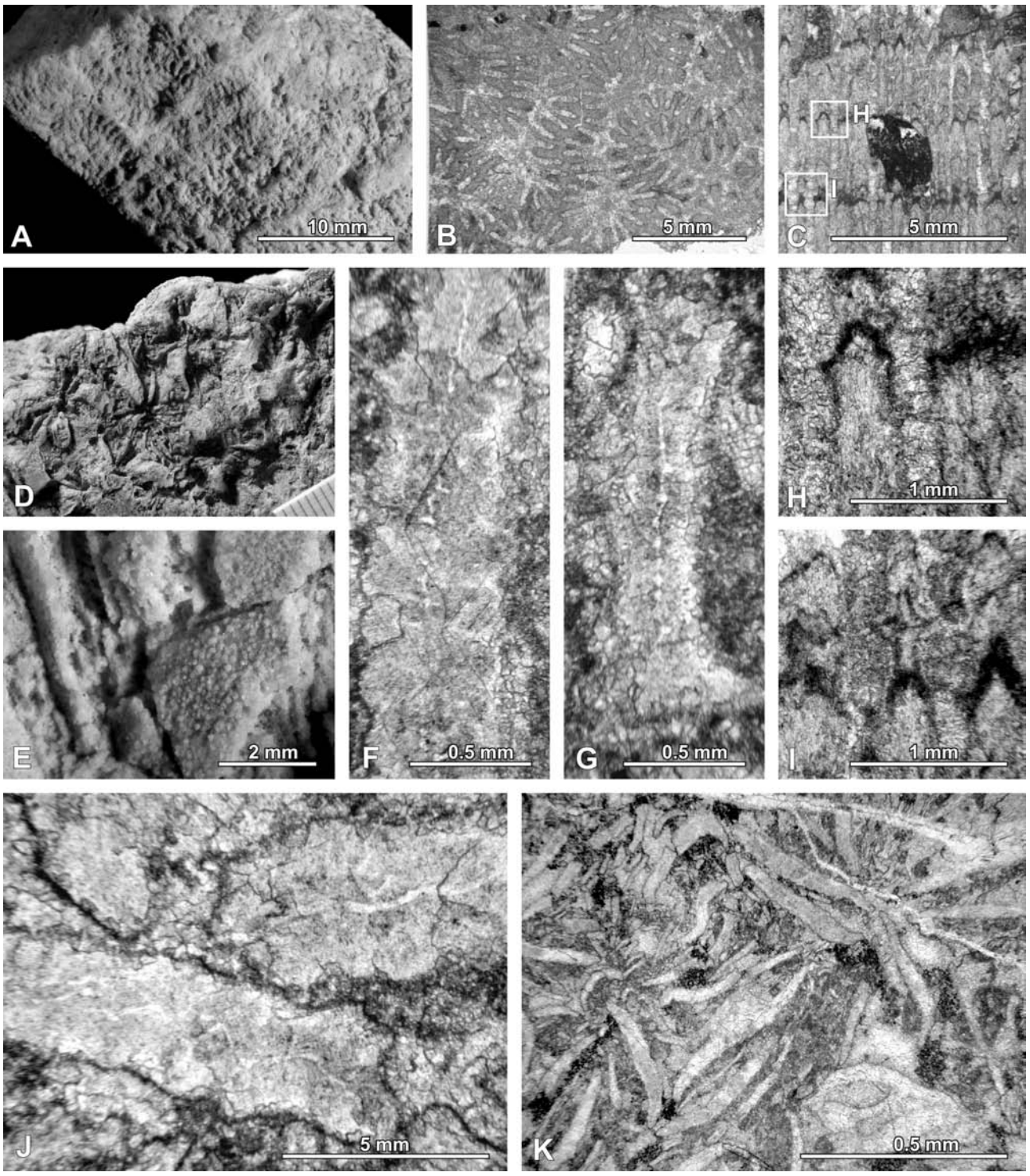

Fig. 8. The families Faviidae and Aulastreoporidae. **A–C, H, I** – *Felixigyra* cf. *duncani* Prever. A – colony upper surface, no. NMNH F-30093; B – transverse thin section showing continuous and disrupted collines, no. NMNH F-30093b; C – longitudinal thin section displaying three micritized levels marked in the skeleton corresponding to succeeding growth stages of the colony, H – and I enlarged fragments showing details of surface morphology at successive growth stages, no. NMNH F-30093c. Tithonian–Berriasian border zone. **D–G, J, K** – *Oedalmiopsis cretacea* gen. et sp.n. D – the holotype colony in upper view, and E – septum in side view showing granular micromorphology, no. NMNH F-30251. F, G, J – septa in transverse section showing midseptal zone with individual centres preserved (F, G), or recrystallized into a homogeneous line (J), no. 30252c; K – fragment of colony in transverse section with discernible thamnasterioid corallite connections, no. NMNH F-30252a. Valanginian

by Turnšek, personal communication 1991), and *F. duncani* from the early Barremian of the French Alps and early Aptian of the Swiss Alps (Morycowa & Decrouez, 1996).
Distribution: Tithonian/Beriasian boundary zone – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

Family MONTLIVALTIIDAE Dietrich, 1826
Genus *Montlivaltia* Lamouroux, 1821

Montlivaltia sp.
Fig. 7J–L

Material (measurements in mm):

No. NMNH F-.	metre lavels	gf	d	f	s	cd/10	gr/5 (in section)	Occurrence in the Lyalintsi section
30232 30250	421-427	solitary	25×30	4	ca. 100(15+15+30+40+nS5)	15	S2: 13-14S3: 18	Valanginian
30135	359 -377							

Description: Corallites oval in cross-section, up to 25x30mm in diameter, with elongated axial pit. Radial elements approximately 100. Septa compact and thin, differentiated into four size orders and accessory S5; S1 and S2 septa slightly thicker than the others, S1 septa reaching the fossa, S2 septa slightly shorter, S3 septa up to three-quarters the length of the S1 septa, S4 septa up to one-quarter the length of the S1 septa; S5 septa very short and sporadic. Distal margin of the S3 and S4 septa regularly denticulated. Microarchitecture of lateral sides of the S1 and S2 septa in the form of pointed, single- or double-tip granulations. Endotheca of numerous, extended dissepiments.
Remarks: The description is based on an incomplete corallum. Granules observed in cross section show one to two tips, differing in this feature from the type species, which is characterized by single-tip granules (compare Gill & Lafuste, 1971). Similar granulations can be observed in *Montlivaltia multiformis* Toula described from the Aptian of southeast Spain (Morycowa *et al.*, 2001).
Distribution: Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Genus *Thecosmilia* Milne Edwards et Haime, 1848

Thecosmilia pinguis Eliášová, 1976
Fig. 9B–D

1976. *Thecosmilia pinguis*: Eliášová, p. 171, pl. 3, fig. 2; pl. 4, fig. 1.

Material (measurements in mm):

No.NMNH F-.	metre levels	gf	d	s	cd/5	Occurrence in the Lyalintsi section
30280	453	phaceloid	9-14	40-70	9	Valanginian
30190 **30187**	395					
30161-4 30166 30170 30174-6	387					
30127	359-377					
30110 **30114**	332-335					

Remarks: The form differs from Tithonian specimens from Štramberk (Eliášová, 1976a) in thinner septa and more prominent septal granulations (frequently a variable intraspecific feature). Specimen No. NMNH F-30187, with faint granulation, resembles *Thecosmilia* sp. from the Late Jurassic—Early Cretaceous limestones of Ernstbrunn from Pavlovske Kopce, S Moravia (Eliášová, 1990), and also *T. magna*, described by Turnšek (1975) from the Upper Jurassic of Croatia.
Distribution: Tithonian, External Carpathians: Štramberk. Valanginian – Bulgaria; repository acronym and collection numbers as above.

Genus *Latiphyllia* de Fromentel, 1861

Remarks: An Early Cretaceous form attributed by Turnšek and Michajlović (1981) to *Gyrodendron* Quenstedt reveals similar features to *Latiphyllia*, including the microarchitectural characters.

Latiphyllia cf. *suevica* (Quenstedt, 1858)
Fig. 9A, E

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	cd/10	gr/1	Occurrence in the Lyalintsi section
30236 **30111** **30110**	421-427	phaceloid	25	13-18	5	Valanginian

Remarks: The corals attributed so far to *Latiphyllia suevica* (Quenstedt) represent a particular mode of branching that developed independently in a number of species differing in corallite diameters. The Portuguese form represents the thinnest corallites (Koby, 1905), the Kimmeridgian coral from Württemberg the thickest (Geyer, 1954, pl. 15:1, the original from Quenstedt collection). The Bulgarian coral is close to the form described from Württemberg by Becker (Becker & Milaschewitsch, 1875–1876: 153, pl. 38, fig. 6-8).
Distribution: *Latiphyllia suevica* (Quenstedt) has been described from the Upper Oxfordian (compare Beauvais, 1964) up to the Tithonian, Štramberk (compare Geyer, 1954). In Bulgaria, *L.* cf. *suevica* is known from the Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Genus *Complexastrea* d'Orbigny, 1849

Complexastrea cf. *thevenini* (Etallon, 1858)
Fig. 9F, G

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	sd/5	ed/5	Occurrence in the Lyalintsi section
30098-9	257-260	lamellar, astraeoid	ca.15	5-6	6	Berriasian

Distribution: *C. thevenini* is known from the Upper Jurassic of Switzerland (Etallon 1858), south Germany (Lauxmann 1991), central Poland (Roniewicz, 1960) and Serbia (Turnšek and Michajlović, 1973). In Bulgaria, *C.* cf. *thevenini* is known from the Berriasian; repository acronym and collection numbers as above.

Dimorphocoenia de Fromentel, 1849

Remarks: This genus, rarely described and therefore poorly known, is a Cretaceous representative of the montlivaltiids. The Bulgarian form fits the generic diagnosis externally but, in thin section, it shows synapticulae and a papillar columella that have not been reported in this genus so far, and it is therefore assigned to *Dimorphocoenia* with reservation.

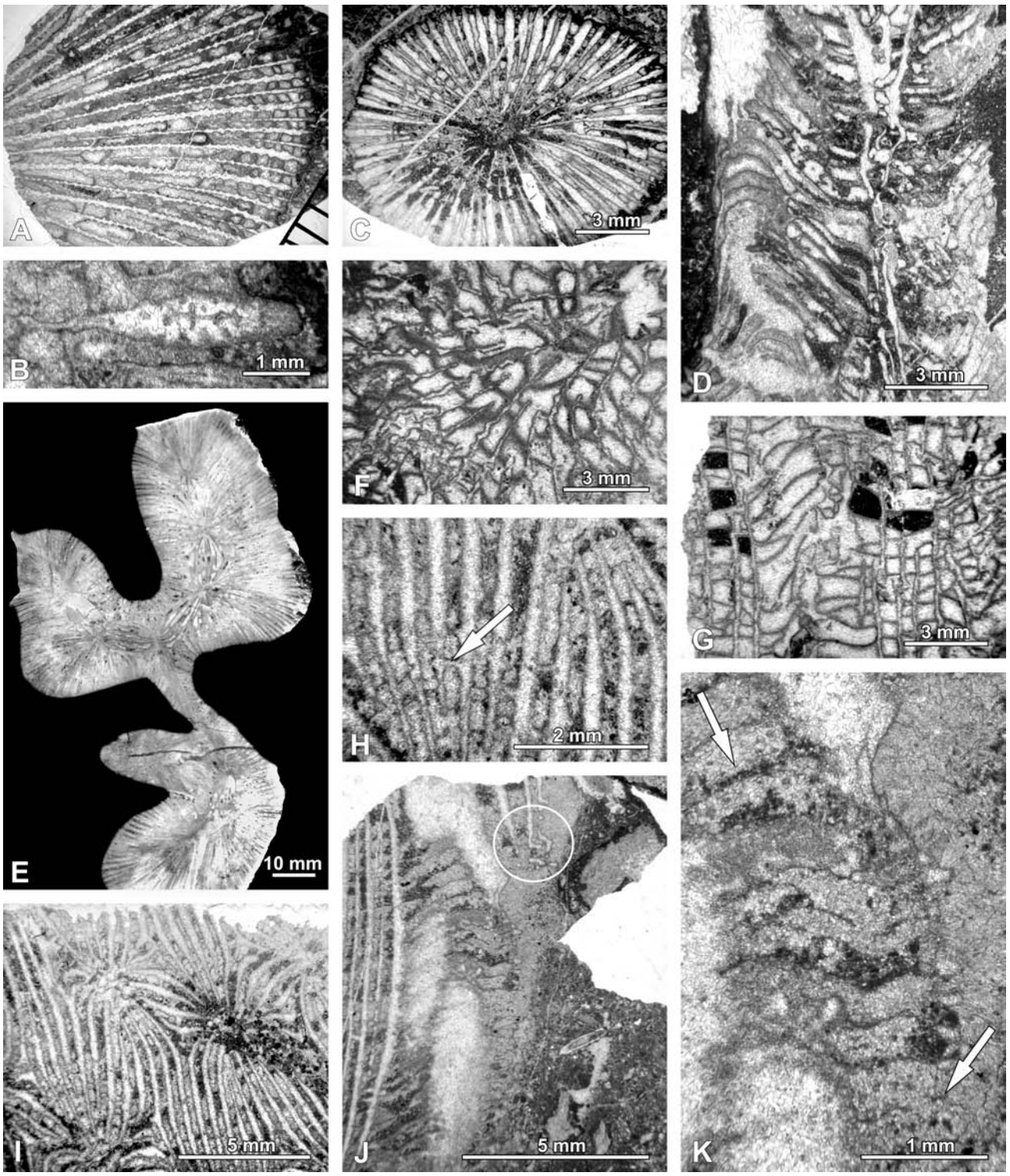

Fig. 9. The family Montlivaltiidae. **A, E** – *Latiphyllia* cf. *suevica (*Quenstedt). A – fragment of corallite in transverse thin section showing montlivaltiid septal structure, no. NMNH F-30111a; E – polished rock surface, transverse section of flabelloid-phaceloid corallum displaying lamellar connections between corallite centres, no. NMNH F-30110. Valanginian. **B–D** – *Thecosmilia pinguis* Eliášová. Transverse sections: B – traces of montlivaltiid microstructure of septum, no. NMNH F-30114a. Valanginian. C – corallite with numerous septa, no. NMNH F-30187a. Valanginian. D – longitudinal section showing endotheca built of extended dissepiments, no. NMNH F-30127b. Valanginian. **F, G** – *Complexastrea* cf. *thevenini* Etallon. Thin sections: F – fragment of colony in transverse section, no. NMNH F-30098c; G – longitudinal section showing characteristic elevation of dissepiments in the intercorallite colony part (centre of photo) sloping down to corallite axes to the left and right, no. NMNH F-30099a. Berriasian. **H–K** – *Dimorphocoenia?* sp. Thin sections: H, I – transverse section showing intercorallite parts of septa (H) with synapticulae (arrow), and I colony fragment, no. NMNH F-30218a; J, K – longitudinal section tangential to the septal surface showing extended dissepiments, extensions of internal septal borders (circled: J), sections of rows of septal lateral granules (K: arrows) and synapticulae (large white dots), no. NMNH F-30218b. Valanginian

Dimorphocoenia? sp.
Fig. 9H–K

Material (measurements in mm):

No. NMNH F-	metre levels	gf	c-c		sd/5	Occurrence in the Lyalintsi section
30218	415	lamellar, thamnasterioid	4-6	24-30	12	Valanginian

Description: Colony surface flat, with shallow calices. Radial elements differentiated into three size orders: S1and S2 septa approaching the axial pit, S3 septa irregularly distributed. Septal faces with small, abundant granulations. Synapticulae abundant, thin, circular in section. Internal borders of S1-S2 septa provided with long trabecular projections that form a poor papillar columella. Endotheca with widely extended, thin-walled and densely ordered dissepiments. Budding not observed.
Remarks: In general, this form agrees with the diagnosis of the montlivaltiid genus *Dimorphocoenia*. However, the presence of synapticulae is not acceptable in this family. A parietal columella has been recorded in this family in some species of *Isastrea* Milne Edwards et Haime (Roniewicz, 1982).
Distribution: Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Family MISISTELLIDAE Eliášová, 1976

Remarks: To this family, originally containing only the genus *Misistella* Eliášová, 1976 b, two genera may be added: *Puschastraea* Roniewicz, 1966 and, provisionally, *Lyubasha* gen. n. (see below).

Genus *Misistella* Eliášová, 1976

Remarks: In morphological features, the Tithonian *Misistella* Eliášová resembles thick-septal Jurassic species of *Calamophylliopsis* Alloiteau. In the latter genus, to judge from well preserved microstructural details in the Upper Jurassic *C. compacta* (Koby, 1884), the microstructure is thin-trabecular (Roniewicz, 1976), while in *Misistella* it remains unknown, although thick costae and thin septa may indicate a mixed type composed of thin and thick trabeculae similar to the faviid microstructural type.

Misistella cf. *carpathica* Eliášová, 1976
Fig. 10D, E

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	cd/5	Occurrence in the Lyalintsi section
30279	453	phaceloid	up to 11	ca. 50	ca. 8	Valanginian
30270	437					
30248	421-427					
30205	415					

Remarks: The taxon is characterized by straight, non-porous radial elements with rare, large granulations, thick and prominent costae, a papillar columella, and budding by symmetrical division (fissiparous budding). When recrystallized, this coral is hardly distinguishable from *Calamophylliopsis crassitorquata* (de Fromentel); externally they differ from each other in their costae, much fewer and thicker in *Misistella* than in *Calamophylliopsis*.
Distribution: *Misistella carpathica* is known from the Tithonian of Štramberk (Eliášová, 1976b: p. 396, pl. 9, fig. 3; pl. 10, fig. 2). In Bulgaria, *M.* cf. *carpathica* is known from the Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Genus *Lyubasha* gen. n.
Type species: *Lyubasha gracilis* gen. et sp.n.

Derivation of the name: *Lyubasha* – from the name of the Lyubasha Mountain in the neighbourhood of the village of Lyalintsi (west Bulgaria), which provides a long sequence of Tithonian–Lower Cretaceous coral-bearing deposits.
Diagnosis: Astraeoid colony with costulated intercalicular surface; radial elements exsert, nonconfluent or subconfluent. First three orders of radial elements fusiform, costoseptal in type, those of the highest order are of lonsdaleoid septal type. Lateral septal granulations prominent, asymmetrical. Calicular fossa empty. Endotheca and exotheca built of homogeneous, vesicular dissepiments. Budding extracalicular.
Remarks: The corallites of *Lyubasha* especially resemble those of *Puschastraea* Roniewicz, 1966 (Middle Oxfordian) in the zigzag course of the septal part of the fusiform costosepta and the large asymmetrical granulations of the septal faces. However, the lonsdaleoid septa of the highest size order differentiate it from the misistellid coral group. For this reason, the genus is assigned to this family with reservation.

Lyubasha gracilis sp.n.
Fig. 10A–C

Holotype: NMNH F-30107.
Type locality: Lyubasha Mountain, Lyalintsi, Bulgaria.
Type level: Valanginian, Slivnitsa Formation, 325 m level of the section Lyalintsi.
Derivation of the name: Latin *gracilis* – gracile, for its clear and thin skeletal structure.
Diagnosis: *Lyubasha* with 40–46 septa at calicular diameters of approximately 8 mm.
Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	c-c	s	sd/2	Occurrence in the Lyalintsi section
30107	325	lamellar, astraeoid	ca.8	7-8	46(23S1/S3+23S4) 40(20S1/S3+20S4)	3	Valanginian

Description: Colony submassive, astraeoid. Calices slightly elevated, suboval. Calicular fossa slightly elongated, empty. Radial elements nonconfluent or subconfluent, those of the first three orders 20–23 in number, costoseptal in type, fusiform, and those of the fourth order, developed in the form of lonsdaleoid, filiform septa (lacking costal prolongation) situated rather regularly in the interseptal spaces. S1 and S2 septa subequal, approaching the axial fossa, S3 septa shorter and thin, but with well developed costal part. Septal face granulations protruding, asymmetrically distributed; S4 septa with rare granulations. Internal septal margin thin, frequently zigzag. Endotheca vesiculous, built of abundant dissepiments, concave in corallite centres and convex peripherally. Exotheca built of dissepiments similar to endothecal ones. The wall is septo-parathecal, marked by widened septa and endothecal dissepiments elevated at the calicular margin. Increase by perithecal budding: septal apparatus of new individual is formed from costal ends of surrounding corallites. Division of calices is not excluded, as in one calice two opposing S1 septa are more thickened than others.

Distribution: Valanginian – Lyalintsi, Lyubasha Mountain: NMNH F-30107.

Family DERMOSMILIIDAE Koby, 1889

Remarks: *Calamophylliopsis compacta* (Koby) from the Upper Jurassic of Poland is the only taxon that has been characterized microstructurally: its septa are thin, zigzag, the trabeculae are approximately 80 μm in diameter; the wall is composed of septa and

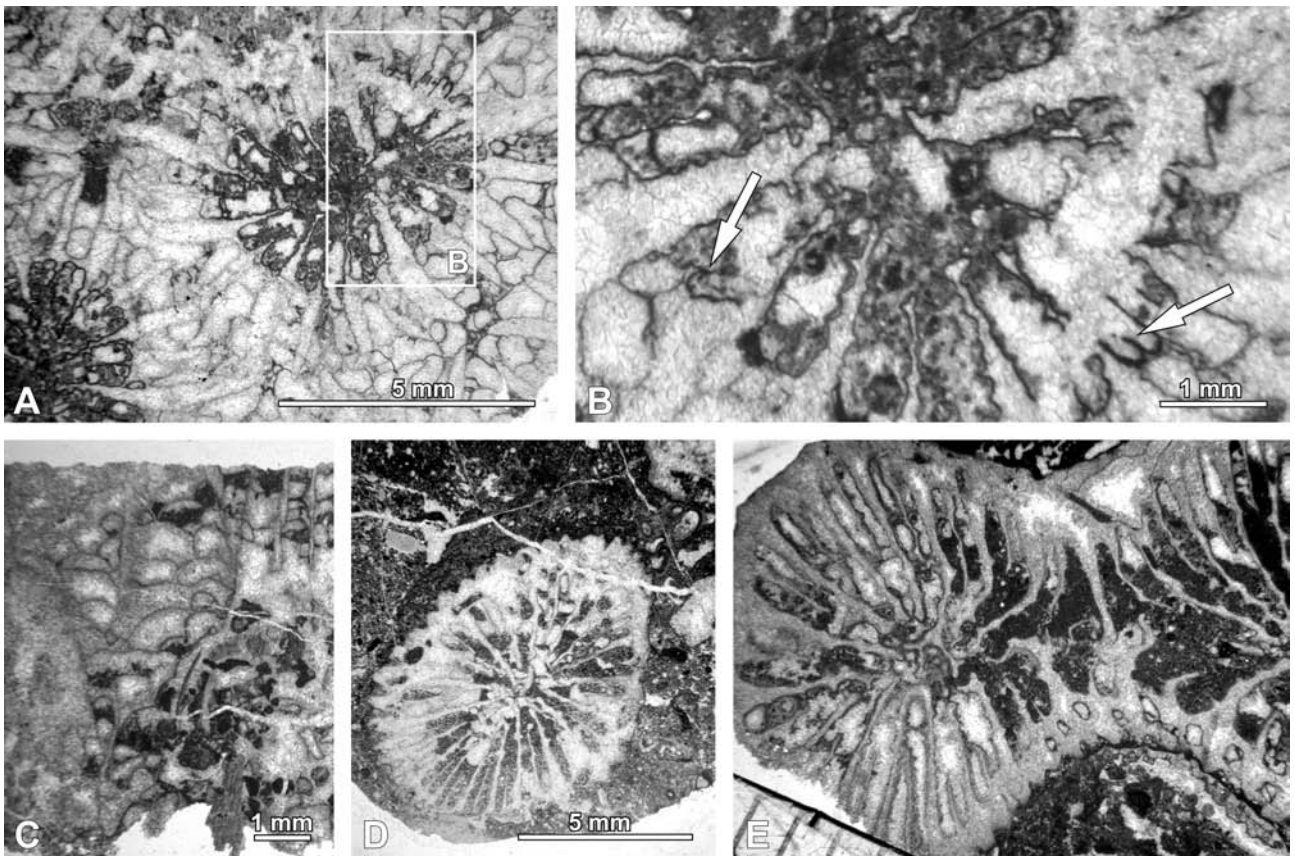

Fig. 10. The family Misistellidae. **A–C** – *Lyubasha gracilis* sp.n. Thin sections: A – the holotype colony, astreoid type with fusiform costosepta, and enlarged fragment (B) showing prominent septal granulation distributed asymmetrically on septal sides, and thin, lonsdaleoid septa of the highest order (arrows), no. NMNH F-30107a; C – vesicular peritheca in longitudinal section, no. NMNH F-30107c.Valanginian. **D, E** – *Misistella* cf. *carpathica* Eliášová. Thin sections: D – corallite with typical, compact septa and thick costae, no. NMNH F-30248a. Valanginian. E – corallites showing symmetrical division (fissiparous budding), parietal columella, and prominent, asymmetrical septal granules, no. NMNH F-30205c. Valanginian

"euthecal" segments built of trabeculae of the same diameter as those in the septa; a pellicular epitheca is present (Roniewicz, 1976: pl. 18, figs. 1, 2).

The above septal microstructural characters are also typical of the genus *Epistreptum* gen. n.

Genus *Epistreptum* gen. n.

Type species: *Epistreptophyllum giganteum* Roniewicz, 1976

Diagnosis: Solitary coral with abundant, very thin radial elements of four to five size orders with lacerated internal margins and adaxial septal portions pierced by large pores; lateral septal faces with pointed granules rounded in section; columella spongy; endotheca dissepimental, abundant.

Derivation of the name: *Epistreptum* – shortened form of *Epistreptophyllum*; gender neuter.

Species included: *Epistreptum giganteum* (Roniewicz, 1976), *E. densum* (Roniewicz, 1976), *E. communeformae* sp.n.

Remarks: In *Epistreptum* gen. n., the septa are very thin, the S4 septa zigzag; the columella is spongy, made of internal septal borders, septal faces covered with pointed granulations. These corals thus have features in common with *Calamophylliopsis* and may be assigned to the family Dermosmiliidae.

Late Jurassic corals of the genus have hitherto been attributed (Roniewicz, 1966, 1976) to the morphologically similar genus *Epistreptophyllum* Milaschewitsch. The genus *Epistreptophyllum* was revised by Pandey and Lathuilière (1997) and synonymised with *Protethmos* Gregory; the authors discussed the systematic position of the revised genus based on the septal pennular micro-architecture but without having resolved this question. Morycowa and Roniewicz (1995) included the genus *Protethmos* (junior synonym of *Epistreptophyllum)* in the family Latomeandridae (see below), suborder Microsolenina.

The difference between *Epistreptum* gen. n. and the homoeomorphic *Epistreptophyllum* Milaschewitsch, 1876 lies in septal microstructure manifested in different micromorphology: the septa are covered with small, pointed granules in *Epistreptum* but with irregular, thick pennulae in *Epistreptophyllum* Milaschewitsch (Pandey & Lathuilière, 1997).

Epistreptum communeformae sp.n.

Fig. 11A–C

1966. *Epistreptophyllum commune* Milaschewitsch: Roniewicz, p. 238, pl. 21, figs. 3a, b, 4 (specimen ZPAL XVI/46).

Type series: ZPAL H.III/797, 798, 799, 1272.

Type-level: Lower Kimmeridgian

Type-locality: Minostowice, Góry Świętokrzyskie (Holy Cross Mountains), Poland

Derivation of the name: The specific name is derived from *E. commune* Milaschewitsch under which name the form was originally described from Poland.

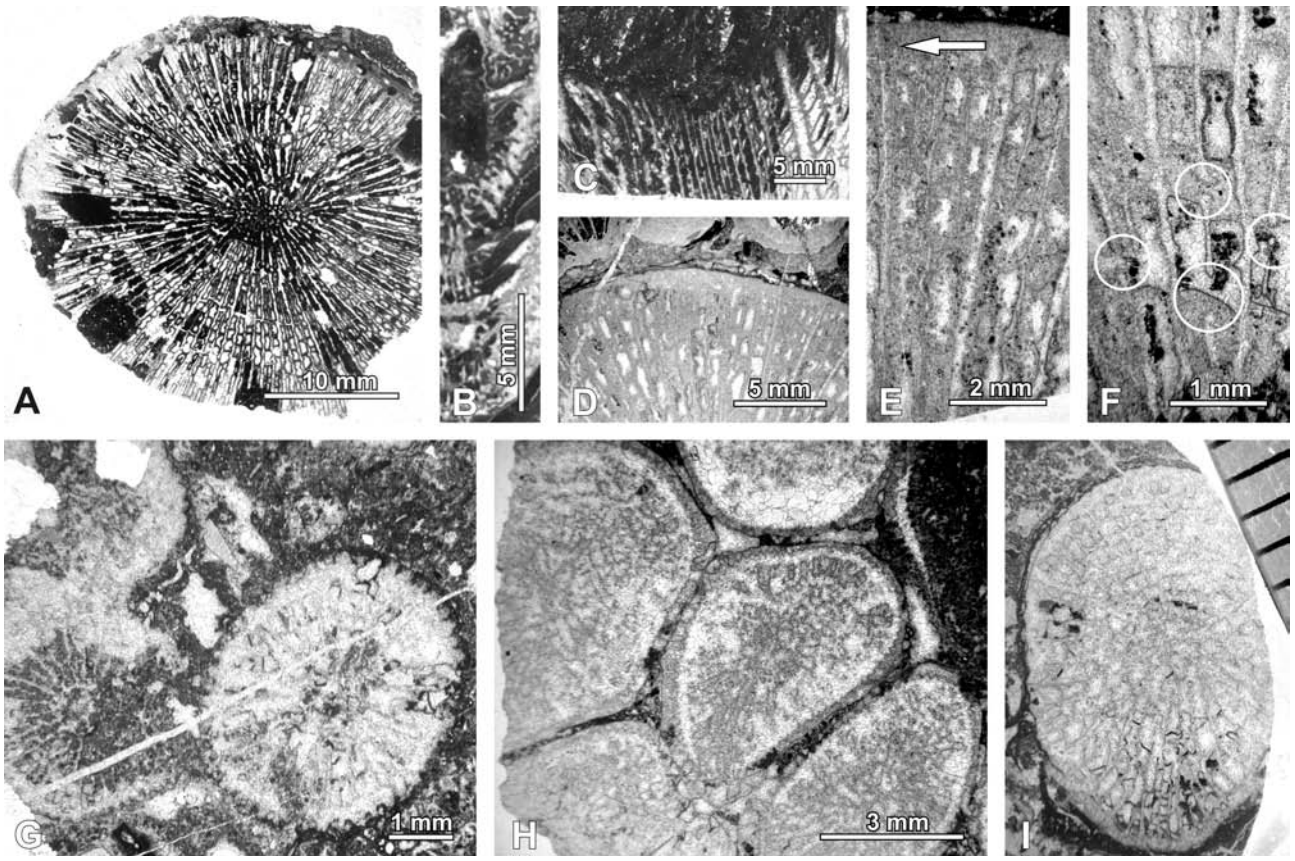

Fig. 11. The family Dermosmiliidae. **A–C** – *Epistreptum communeformae* gen. et sp.n. Specimens from the type series, Holy Cross Mountains, Poland. Thin sections: A – the holotype specimen in transverse section showing irregularly perforated septa, asymmetrical granulation of septal sides and papillar columella filling the axial cavity, no. ZPAL H.III/1272. B – extended dissepiments and lateral spiniform septal granulation in longitudinal radial section, tangential to the septal blade, no. ZPAL H.III/799. C – distal part of calice in longitudinal section showing extended dissepiments, no. ZPAL H.III/798. All Lower Kimmeridgian. **D–F** – *Epistreptum* cf. *communeformae.* Specimens from Lyalintsi section, slope of Lyubasha Mt. Transverse thin sections: D – peripheral part of corallum, and E – enlarged fragment showing septothecal wall (E: arrow), no. NMNH F-30279f; F – periaxial region of septa with irregular porosity (circled) and asymmetrical granulation, no. NMNH F-30279a. Valanginian. **G** – *Calamophylliopsis moreauana* (Michelin). Corallites with fine skeletal structure, thin section, no. NMNH F-30068b, Tithonian. **H** – *Calamophylliopsis compacta* (Koby). A fragment of corallum with densely arranged corallites showing fine septal structure and rings of epicostal dissepiments, thin section, no. NMNH F-30242b. Valanginian. **I** – *Calamophylliopsis* cf. *stockesi* (Milne Edwards et Haime). Corallite in transverse section, no. NMNH F-30146a. Valanginian

Diagnosis: Elliptical calices of mean diameters from 35 mm to 50 mm, and radial elements approximately 200 in number; septal density up to (7) 10 (11)/5mm. Smaller diameters and higher number of septa differentiate it from the type species (*E. giganteum*: 240, 280 and 290 septa at diameters of 50, 60 and 70mm respectively).

Material (measurements in mm):

No.	d	f	s	sd/5	Occurrence in Poland
ZPAL H. III/1272	32×38	7×	190×	10	Minostowice, Holy Cross Mts.
ZPAL H. III/799	35×45	7	ca.200	10	Minostowice, Holy Cross Mts.
ZPAL H. III/798	40×45x	10	ca. 210	10	Minostowice, Holy Cross Mts.
ZPAL H. III/806	44×57	7	ca.200	7	Niziny, Holy Cross Mts.
ZPAL H. XVI/46	35×40	8	190	10-11	Polish Lowland, boreholes

Remarks: The species was described in detail in Roniewicz 1966. The specimens presented here are figured for the first time (Fig. 11A–C).

Distribution: Lower Kimmeridgian – Poland (Holy Cross Mountains and Central Poland) (repository acronym and collection numbers as above), and Romania (Dobrogea).

Epistreptum cf. *communeformae* sp.n.
Fig. 11D–F

Material (measurements in mm):

No. NMNH F-	metre levels	d	sd/5	Occurrence in the Lyalintsi section
30279	453	above 40	10	Valanginian
30080bis	157	above 30	11	Tithonian

Decription: The material from the Tithonian and Valanginian of Lyalintsi comprises fragmentarily preserved coralla. *E.* cf. *communeformae* corresponds in diameter and density of septa to specimens of *E. communeformae* from the Lower Kimmeridgian of Poland. The radial elements are thin, covered with pointed granules and differentiated into five size orders; at the internal border, the S1-S4 septa show rare and irregular pores; the S4 septa are zigzag.

Distribution: Occurs from the Tithonian to Valanginian – Lyuba-

sha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Genus *Calamophylliopsis* Alloiteau, 1952

Remarks: In corallum form and corallite exterior, the genus *Calamophylliopsis* Alloiteau resembles *Latomeandra* Milne Edwards et Haime. The main difference lies in the micromorphology of the septa, indicating a different septal microstructure. In *Calamophylliopsis*, thin monoaxial trabeculae are provided with alternating lateral offsets that form pointed granulations on the septal sides, while in *Latomeandra* the offsets form semilunar pennulae and therefore the main trabecular axes are of the type characterizing the Microsolenina (Morycowa & Roniewicz, 1995). In both genera, budding is intracalicular; in *Calamophylliopsis* division is subequal (fissiparous budding), without any linkage between the calicular centres (indirect linkage), while during division in *Latomeandra* the centres are initially linked by septa (direct linkage).

In the Lyalintsi section, both genera are well represented but distinction between them is frequently impossible due to recrystallization of the skeletons. They occur together at the 155 m level.

Calamophylliopsis cf. *moreauana* (Michelin, 1843)
Fig. 11G

Material (measurements in mm):

No.NMNH F-	metre levels	gf	d	s	cd/2	Occurrence in the Lyalintsi section
30070 **30068**	115	phaceloid	4	60	10	Tithonian

Remarks: The form resembles *C. moreauana* in the numbers of radial elements and corallite diameters. The scanty and poorly preserved material represents the smallest *Calamophylliopsis* in the Lyalintsi section.

Distribution: *C. moreauana* is known from the Oxfordian and Kimmeridgian of France, Poland and Romania (compare Roniewicz, 1976). *C.* cf. *moreauana* is known from the Tithonian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Calamophylliopsis compacta (Koby, 1884)
Fig. 11H

1884. *Calamophyllia flabellum* Blainville var. *compacta*: Koby, p. 182, pl. 54, figs. 1, 4.
1976. *Calamophylliopsis compacta* (Koby): Roniewicz, p. 76, pl. 18, figs. 1, 2; pl. 19, fig. 3 (with synonymy).

Material (measurements in mm):

NoNMNH F-	metre levels	gf	d	cd/2	Occurrence in the Lyalintsi section
30242	421-427	phaceloid	6-7	11-12	Valanginian
30180	387		5-7		
30125	359 -377		from 3.5 young to 5.0 (7.0) adult		

Remarks: The corallum is composed of densely packed corallites covered with pellicular epitheca. Internal corallite parts are recrystallized. Costae are thin and equal.

Distribution: *C. compacta* is known from the Middle Oxfordian to Lower Kimmeridgian of Europe: France, Switzerland, Romania and Poland. In Bulgaria occurs in the Valanginian; repository acronym and collection numbers as above.

Calamophylliopsis cf. *stockes*i (Milne Edwards et Haime, 1851)
Fig. 11I

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	cd/5	Occurrence in the Lyalintsi section
30289	457	phaceloid	8-9	ca. 65	10-13	Valanginian
30146	377		9-10	ca. 60	ca.12	

Remarks: The Bulgarian corals differ from *C. stockesi* described from Poland and Romania (Roniewicz, 1966 and 1976 respectively) in the lower density of the costae and slightly larger corallite diameters.

Distribution: *C. stockesi* is common in the European Oxfordian–Kimmeridgian (compare Turnšek, 1997). In Bulgaria, *C.* cf. *stockesi* is known from the Valanginian; repository acronym and collection numbers as above.

Suborder MICROSOLENINA Morycowa et Roniewicz, 1995

Remark: The suborder contains the corals excluded from the Fungiina Verrill, 1865 because of the structural porosity of the septa and the pennular microarchitecture of the septal faces (discussed in Morycowa et Roniewicz, 1995).

Family MICROSOLENIDAE Koby, 1889
Genus *Trocharea* Etallon, 1864

Remarks: The genus (type species: *Trocharea actiniformis* Etallon, 1864, Oxfordian) is poorly known. It has been characterized by the regular, microsolenid porosity of the septa and the solitary growth form, and therefore has features in common with *Chomatoseris* Thomas, 1935. However, in contrast to the latter genus, with its cupoloid, free corallum, *Trocharea* shows a flattened coralla attached to the substrate. Possible relationships of *Trocharea* and *Epistreptophyllum* Milaschewitsch, 1876 are discussed below based on direct comparison of corallum structure.

Trocharea sp.
Fig. 12F

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	tr (µm)	Occurrence in the Lyalintsi section
30222	415	solitary	25	ca. 200	200×240	Valanginian

Description: Corallum solitary, flat, with deep and circular axial pit. Radial elements differentiated into five to six size orders; slightly wavy, thin, and regularly perforated; anastomosis present. The trabeculae are rectangular in transverse section and elongated in a radial direction.

This form macroscopically resembles solitary Jurassic corals belonging to the pennulae-bearing genus *Epistreptophyllum* Milaschewitsch (Pandey & Lathuilière, 1997). However, the radial elements of these genera show a different structure. In *Trocharea*, the septa are of microsolenid type, regularly porous, while in *Epistreptophyllum* the septal blades are compact, with irregular porosity occurring in the vicinity of the axial border. In this feature, *Epistreptophyllum* is closer to the Latomeandridae than to the Microsolenidae.

Distribution: Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

Genus *Dermoseris* Koby, 1886

Remarks: In the Lyalintsi section, the genus is represented by three forms differing in corallite diameters and septal density, *D. delgadoi* being the best represented.

Dermoseris delgadoi Koby, 1905
Fig. 12A–C

1905. *Dermoseris delgadoi:* Koby, p. 127, pl. 25, figs. 1-6.
1976. *Dermoseris delgadoi* Koby: Roniewicz, p. 103, pl. 32, figs. 1a, b.

Material (measurements in mm):

No. NMNH F-	metre lavels	gf	d	s	sd/5	Occurrence in the Lyalintsi section
30120	359-377	phaceloid	10-15	ca. 120 at at d=15		Valanginian
30064	115				17	Tithionian

Distribution: Common in Europe in the Oxfordian–Kimmeridgian (compare Koby, 1905; Roniewicz, 1966, 1976). Known from the Tithonian to Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Dermoseris sp.1
Fig. 12D

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	sd/5	Occurrence in the Lyalintsi section
30077	137-142	phaceloid	15	170	27-28	Tithonian

Remarks: *Dermoseri*s resembling *D. delgadoi* in diameter, but having far thinner and more numerous septa.
Distribution: Tithonian – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

Dermoseris sp 2.
Fig. 12E

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	sd/5	Occurrence in the Lyalintsi section
30275	453	phaceloid	7-9	60-80	15	Valangi-nian

Remarks: *Dermoseris* sp. 2 resembles *D. delgadoi* in septal density, but differs from it in smaller corallite diameters and numbers of septa. In those features it approaches the form from the Tithonian of Serbia (Turnšek & Michajlović, 1973) described as *Dermoseris irregularis* (Etallon, 1864), but has even more slender branches than that species and a lower number of septa.
Distribution: Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

Genus *Microsolena* Lamouroux, 1821

Remarks: In the Lyalintsi section, the genus is represented by three species: *M. agariciformis* Etallon, *M. tuberosa* (Michelin) and *M.* aff. *exigua* Koby. This taxonomic differentiation, based on fragmentary and diagenetically highly altered specimens, provides information that is useful in characterizing the faunal diversity, albeit of limited value in completing knowledge of the species concerned.

Trabecular diameters in *Microsolena* may serve as a valuable taxonomic feature. Because of the diagenesis that obliterates the trabecular outline, instead of direct measuring of diameters, an indirect way of presenting dimensions of trabeculae is used, namely the trabecular density, which is the number of trabeculae per mm (trd) measured in sections.

Microsolena agariciformis Etallon, 1858
Fig. 12G

1858. *Microsolena agariciformis*: Etallon, p. 252.
1966. *Microsolena agariciformis* Etallon: Roniewicz, p. 227, pl. 17, fig. 1-2.
1997. *Microsolena agariciformis* Etallon: Turnšek, p. 127, pl. 127, fig. A-E (with synonymy).

Material (measurements in mm):

No. NMNH F-	metre levels	gf	c-c	sd/5	trd/2 *mean*	md/5 *mean*	Occurrence in the Lyalintsi section
30277	453	lamellar	6-12	21	11	18	Valanginian
30210 30211	415						
30159	382						
30080	157						Tithonian
30080bis		ramose, d of branch 20					
30075	137-142	lamellar, up to submassive					

Remarks: In the lamellar form common in Lyalintsi, the calicular centres are arranged in no particular order; their features are presented in the table above. In the Valanginian part of the sequence (421 m level), another, foliaceous form is present (No. NMNH F-30235) differing from the above in the more densely structured skeleton (sd 26/5; md 25/5) and thiner trabeculae (trd 12/2); this form may represent a new species.
Distribution: Common in Europe from the Oxfordian to Aptian–Albian (compare distribution in Turnšek, 1997). Known from the Tithonian to Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Microsolena aff. *exigua* Koby, 1887
Fig. 12H, I

Material (measurements in mm):

No. NMNH F-	metre levels	gf	c-c	d	s at corallite peri-phery	sd/2 at corallite peri-phery	trd/2	md/5	Occu-rrence in the Lyalintsi section
30285	457	lame-llar, 2-13 mm thick	3-5 (7)	1.5-2.02.0	ca. 20	7	9-11	21-26	Valan-ginian
30279	453								
30259	437								
3024 30235	421-427								
30221	415								
30170	382								

Remarks: Colonies lamellar or composed of many foliaceous plates. Calices are well delimited, distributed in series or not. In trabecular dimensions, the species resembles *M. agariciformis*, differing from it in the small, well marked calices. Because of the fine structure of the trabeculae and the small calices, this form is closest to *M. exigua* Koby. However, the specimens from Lyalintsi differ in the smaller density of the skeleton (measured with septal density) from the forms of *M. exigua* described from the Jura Mts (Koby, 1887; Beauvais, 1964), External Carpathians (Eliášová, 1990), and Dobrogea, Romania (Roniewicz, 1976); the lower number of septa, lower septal density and slightly thinner trabeculae differentiate this form from *M. exigua* (Table 3). It is too poorly preserved to be diagnosed, but its affinity to *M. exigua* can be postulated.

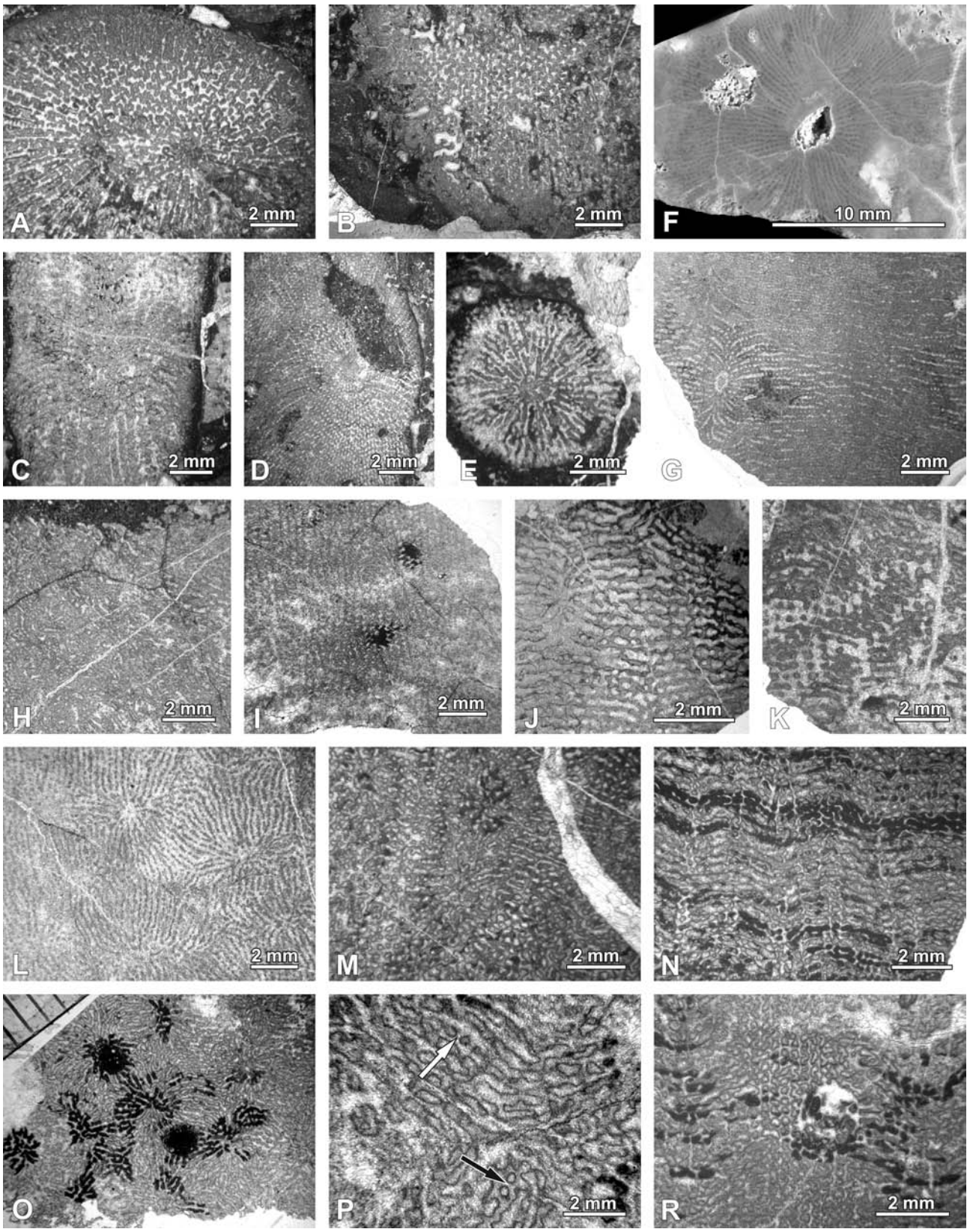

Fig. 12. The family Microsolenidae. **A–C** – *Dermoseris delgadoi* Koby. Thin sections: A – corallite at an early stage of budding showing synapticulae and well marked septal porosity, no. NMNH F-30064a; B – fragment of longitudinal section perpendicular to septal blades: pennules are regularly distributed, no. NMNH F-30064b. Tithonian. C – corallite in longitudinal radial section: menianes paralleling distal septal border define the shape of convexe calice, no. NMNH F-30120b. Valanginian. **D** – *Dermoseris* sp. 1. Corallite in transverse/oblique section showing fine structure of the skeleton, no. NMNH F-30077b. Tithonian. **E** – *Dermoseris* sp. 2. Corallite of typical diameter; the skeleton resembles the thick-trabecular skeleton of *D. delgadoi*, transverse thin section, no. NMNH F-30275c. Valanginian. Compare also Fig. 1D. **F** – *Trocharea* sp. Corallum in transverse section, polished rock surface, no. NMNH F-30222. Valanginian

Table 3

Comparison of skeletal features of small-corallite taxa classified to *M. exigua* Koby

Microsolena exigua Koby described from:	d	s	sd/2	sd/5 estimated	tr/2
Jura Mts Beauvais, 1964:p. 229, pl. 23, fig. 6	2-3	28-42	8-9	18.5-21	8-11
Romania Roniewicz, 1976 : p. 104, pl. 32, fig. 4 a-c	1-2	24	10	23.5	9-10
Carpathians (Ernstbrunn) Eliášová, 1990: p. 127, pl. 1, fig. 3		24-30	8-9	18.5-21	

Distribution: *Microsolena exigua* Koby is known from the European Upper Oxfordian, Kimmeridgian, Tithonian, and Lower Cretaceous (compare distribution in Eliášová, 1990). *M.* aff. *exigua* occurs in the Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Microsolena tuberosa (Michelin, 1843)
Fig. 12J, K

1843. *Alveopora tuberosa* Michelin, p. 110, pl. 25, fig.7.
1976. *Microsolena tuberosa* (Michelin): Roniewicz, p. 106, pl. 33, figs. 4a, b.
1990. *Microsolena tuberosa* (Michelin): Eliášová, p.127, pl. 3, fig. 4.

Material (measurements in mm):

No. NMNH F-	metre levels	gf	c-c	d	s at the calicular border	sd/5 *mean*	trd/2 *mean*	md/5	Occurrence in the Lyalintsi section
30284	457	lamellar, 15 mm thick	6-15	3-4	20-32	12.5	6	16	Valanginian
30279	453								
30220 **30213**	415								
30191	395								
30179	387								
30171	382								

Remarks: In Lyalintsi, the colonies range from lamellar to foliaceous, calices are delimited, deep and distributed in series. The species was described hitherto as having calices arranged in no particular order, although in Romanian material there is a form with serial arrangement. In the serial calices and rather thick trabeculae, this form resembles *M. foliosa* Roniewicz, 1976; the two species differ in the dimensions of the trabeculae, which are thicker in *M. tuberosa* (6/2 mm) than in *M. foliosa* (7/2 mm); and in the septal density, which is lower in *M. tuberosa* (12.5/5 mm) than in *M. foliosa* (mean 14/5 mm).
Distribution: The species is known from the Upper Oxfordian–Kimmeridgian of France, Portugal, Romania and Uzbekistan, and the Upper Jurassic–Lower Cretaceous of the External Carpathians. Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Genus *Comoseris* d'Orbigny, 1849

Comoseris cf. *bargyensis* Morycowa et Decrouez, 1993
Fig. 12M, N

Material (measurements in mm):

No. NMNH F-	metre levels	gf	c-c	col-col	s calices at the end of series	sd/2	md/2	trd/1	Occurrence in the Lyalintsi section
30170	382	lamellar, up to 40 mm thick	2-4.5	5-7	26-28	6-7	6-7	4	Valanginian
30105	314								

Description: The material consists of small fragments of lamellar colonies. In density of septa, trabeculae and menianes this coral resembles *C. minima* Beauvais, 1964 (Beauvais, 1964: p. 237, pl. 30, fig. 5; pl. 31, fig.1; Roniewicz, 1976: p. 107: pl. 34, figs. 4, 5) but in the high number of septa in corallites situated at the end of series it more resembles *Comoseris bargyensis* (Morycowa et Decrouez, 1993: p. 208, pl. 2, fig. 3; 2006: p. 822, pl. 12, fig. 4, 5). Because of the similar density of their skeletal elements, all these taxa seem to form a group of related species.
Remarks: In the Lyalintsi section two forms differing in colony shape were observed: massive observed in the field at the 115m level in the Upper Jurassic part of the section (resembling in shape the early Kim- meridgian *C. minima* described from Poland in Roniewicz, 1966), and the lamellar colonies described herein, which are found in the Lower Cretaceous part of the section.
Distribution: *Comoseris minima* Beauvais is known from the European Kimmeridgian (compare Errenst, 1991), while *Comoseris bargyensis* Morycowa et Decrouez is known from the early Barremian of the French Alps and early Aptian of the Swiss Alps (Morycowa & Decrouez, 1993, 2006). *C.* cf. *bargyensis* is known from the Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Family SYNASTREIDAE Alloiteau, 1952
Genus *Synastrea* Milne Edwards et Haime, 1848

Synastrea microsolenoides sp. n.
Fig. 12L, O–R

Holotype: NMNH F-30061.
Type-level: Kimmeridgian/Tithonian, Slivnitsa Formation, 102m level of the Lyalintsi section.
Type-locality: Lyubasha Mountain, Lyalintsi, Bulgaria.
Derivation of the name: the name reflects the resemblance to microsolenid structure.
Diagnosis: Calices with radial septal arrangement; septa uniformly thin with irregularly distributed pores; pennules short; synapticulae abundant; columella built of trabeculae from the internal septal border.
Remarks: In its fine septa, this coral greatly resembles *Microsolena agariciformis* but its irregularly arranged pores and the

Fig. 12. continued G – *Microsolena agariciformis* Etallon. Colony fragment in transverse thin section, no. NMNH F-30277a. Valanginian. **H, I** – *Microsolena* aff. *exigua* Koby. H – transverse section showing small, fine-skeletal corallites, no. NMNH F-30285a; I – longitudinal section, no. NMNH F-30285b. Valanginian. **J, K** – *Microsolena tuberosa* (Michelin). J – transverse section showing thick-structural skeleton, no. NMNH F-30213b. Valanginian. K – longitudinal section tangential to the septal blade, no. NMNH F-30191a. Valanginian. **L–R** – *Synastrea microsolenoides* sp.n. L – transverse section showing skeleton with traceable trabeculae, no. NMNH F-30060a. Tithonian. O, R – the holotype colony in transverse (O) and longitudinal (R) sections showing skeleton lacking traces of trabeculae, no. NMNH F-30061a, b. Tithonian. P – transverse section, skeleton lacking traces of trabecular structure: synapticulae (white arrow) and pores (black arrow), no. NMNH F-30188b. Valanginian. M, N – *Comoseris* cf. *bargyensis* Morycowa et Decrouez. Thin sections (skeleton in white): M – regularly porous skeleton in transverse section, no. 30170b; N – longitudinal section showing extended dissepiments and well marked pennules coalescing into menianes, no. NMNH F-30170c. Valanginian

structure of columella indicate a skeletal pattern differing from the microsoleninan type. In its fine skeleton with poorly developed pennules, it differs from typical synastreids which are characterized by robust trabeculae. It may represent a new genus belonging to the Microsolenina but it is too poorly preserved to be properly diagnosed. The generic assignment proposed here is provisional.

Material (measurements in mm):

No.NMNH F-	metre levels	gf	c-c	s	sd/3	trd/1	md/1	Occurrence in the Lyalintsi section
30258	437	lamellar, thamnasterioid	4-7	40-50	10-11	4-6	4	Valanginian
30188	395							
30061 **30060**	102							Kimmeridgian/Tithonian

Description: Colonies lamellar, thamnasterioid, increasing by symmetrical division of the calice. Calices partly ordered in series encircling the central part of the colony where the order is not clear. Axial pit small, with a poor columella made of trabecular projections of septal internal borders. Septa slightly wavy, in places geniculate, anastomosing, differentiated into three to four size orders distributed in irregular systems. Septal faces covered with short, subhorizontal pennules. Synapticulae abundant. Septal porosity is rarely observed. Dissepiments thin-walled, extended.

Microstructure. Two preservational styles of skeleton structure are presented in the species: the first, with traces of trabeculae clearly discernible in transverse section (Fig. 12L), and the second, without any traces of trabeculae, but with well defined shape of septa.

Distribution: In Bulgaria, known from the Kimmeridgian/Tithonian to Valanginian – Lyubasha Mountain, Lyalintsi: repository acronym and collection numbers as above.

Family LATOMEANDRIDAE Alloiteau, 1952, emend. Roniewicz, 1976

Genus *Latomeandra* Milne Edwards et Haime, 1848

Remarks: In *Latomeandra*, intratentacular budding gives rise to various types of branching of phaceloid coralla. These are: corallites bifurcating asymmetrically, corallites in triplets, series of corallites that remain connected for a long time after budding, or corallites arising from only one side of the branch. The centres of dividing corallites remain temporarily connected by lamellar linkages.

Latomeandra ramosa (Koby, 1884)
Fig. 13D

1884. *Calamophyllia flabellum* Blainville var. *ramosa*: Koby, p. 184, pl. 53, fig. 3.

1976. *Latomeandra ramosa* (Koby): Roniewicz, p. 96, pl. 27, fig. 4, 5 (with additional synonymy).

?1991. *Latomeandra fromenteli* (Koby): Errenst, p. 16, pl. 16, fig. 5.

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	cd/2	Occurrence in the Lyalintsi section
30232 30250 30257	421-427	phaceloid	6-11	55-100	9	Valanginian
30194	397					
30151 30155 30156	377					
30128	359-377					
30112	332-335					
30108	325					

Remarks: The species is characterized by its thin, but densely packed skeletal elements, large spongy columella and corallite surface covered with thin, even costae. The measurements of the form from Lyalintsi correspond to those of the form described as *L. fromenteli* (Koby) by Errenst.

Distribution: Oxfordian of Switzerland and France. Kimmeridgian of Romania and Spain. Valanginian – Bulgaria; repository acronym and collection numbers as above.

Latomeandra juettneri Eliášová, 1990
Fig. 12B, C

1990. *Latomeandra juettneri*: Eliášová, p. 123, pl. 2, fig. 3.

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	sd/5mm	Occurrence in the Lyalintsi section
30243 30241	421-427	phaceloid	8 to 12	80 to ca. 120	10(13)	Valanginian
30227 30223-4	420					
30216	415					

Description: Corallum increasing through asymmetrical, twofold or multiple lateral budding (up to five corallites). After budding, corallites can be temporarily connected. Branches smooth or costulated with even and sharp costae.

Distribution: *Latomeandra juettneri* is known as a species confined to the uppermost Jurassic and lowermost Cretaceous of the External Carpathians: in Moravia it is known from the exotic blocks of Tithonian?–Berriasian? age; and from the Tithonian of Štramberk (compare Eliášová 1990). Valanginian – Bulgaria; repository acronym and collection numbers as above.

Latomeandra obliqua sp. n.
Fig. 13F, I, M

Type series: NMNH F-30135 and 30137.

Type-level: Valanginian, Slivnitsa Formation, interval from 359m to 377m of the Lyalintsi section.

Type locality: Lyubasha Mountain, Lyalintsi, Bulgaria.

Derivation of the name: Latin *obliqua* – from the oblique course of corallites.

Diagnosis: *Latomeandra* of corallite diameters approaching 15x20 mm and numbers of septa higher than 120. Budding mainly on one side of the corallite.

Comparison: In the number and distribution of septa this form resembles *L. jeuttneri* Eliašova, but its corallite diameters are larger and the septa are thicker. The prevalent unilateral budding in the corallum differentiates the species from its congeners.

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	cd/5	md/5	Occurrence in the Lyalintsi section
30137 **30135**	368-377	phaceloid	11-14 adult monocentric; 14×18 multicentric	85 - above 120	13-14	10-12	Valanginian

Description: Corallum large. Budding observed in longitudinal section is a process repeating on one side of the corallites. In consequence, the phaceloid corallum shows a centrifugal increase. New individuals initiate at the periphery of adult calices as single or multiple centres. S1-S3 septa thick, S4 septa thin and short, radial elements of the fifth order marked as costae on the wall surface. S3 and S4 septa frequently anastomose with adjacent larger septa. Septal systems very irregular. Prominent pennules form menianes. Spongy columella is built of septal projections. Endotheca built of low, extended dissepiments.

Distribution: Valanginian – Lyubasha Mountain, Lyalintsi: NMNH F-30135, 30137.

Latomeandra sp. 1
Fig. 13A

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	cd/2	Occurrence in the Lyalintsi section
30263	437	phaceloid	2.0-5.0	50-70	12	Valanginian
30067 30065	115					Tithonian

Remarks: Septa anastomosing, very thin and abundant. Budding with lamellar linkages, frequent, producing unequal corallites. In the Jurassic part of the section, the species is known from the 115 m level where it is associated with another coral with small corallite diameters, *Calamophylliopsis moreauana*.
Distribution: Known from the Tithonian to Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Genus Protoseris Milne Edwards et Haime, 1851

Remarks: The genus is rather poorly known. Its most striking features are frondose colony forms with thamnasterioid corallites distributed into unifacial, narrow or multiserial widely extending fronds. Two morphotypes were differentiated in the Lyalintsi sequence: multiserial resembling in shape *P. robusta* Becker and a uniserial one that may represent another species. The corals were observed accidentally, mainly in the form of longitudinal sections of fronds.

Protoseris sp. sp.
Fig. 13G, H, J, K

Material (measurements in mm):

No.NMNH F-	metre levels	gf	Occurrence in the Lyalintsi section
Multiserial morphotype: *Protoseris* cf. *robustus* Becker			
30247	421-427	multiserial fronds, up to 5-6 mm thick	Valanginian
30214	415		
30193	397		
30132	359 -377		
Uniserial morphotype: *Protoseris* sp.			
30295 30293	Bed "a"above 460m	narrow and long monoserial fronds	Valanginian
30260	437	monoserial fronds	

Description: Multiserial morphotype, *Protoseris* cf. *robusta* Becker: wide fronds with corallites in numerous series separated by collines correspond to the corals described and figured as *P. foliosa* Becker and *P. robusta* Becker (Becker & Milaschewitsch, 1875–1876, pl. 42, figs. 2, 3); the species were synonymized by Geyer (1954: p. 145, pl. 10, figs. 7, 8) as *P. robusta* Becker. On the lower side of the fronds, individual corallite series are divided by deep grooves (Fig. 13 J).

Monoserial morphotype, *Protoseris* sp. sp: elongated narrow fronds (13 G, H) resemble in section the latomeandrid coral described as ?*Latomeandra* sp. (Roniewicz, 1976, pl. 27, figs. 6a, b).
Distribution: *Protoseris robusta* Becker is known from the Upper Kimeridgian of Württemberg, Germany; ?*Latomeandra* sp. was described from the Lower Kimmeridgian of Romania. *Protoseris* sp. sp. are known from the Valanginian of Bulgaria – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Genus *Microphyllia* d'Orbigny, 1849

Microphyllia elevata sp.n.
Fig. 14G–I

Type series: NMNH F-30121-30124, 30138, 30150.
Type-level: Valanginian, Slivnitsa Formation, interval from the 359 m to377 m level of the Lyalintsi section.
Type-locality: Lyubasha Mountain, Lyalintsi, Bulgaria
Derivation of the name: from Latin *elevatus, elevata* – reflecting the erect colony shapes.
Diagnosis: *Microphyllia* of branched or columnar colony shape; series deep and 4–7 mm wide, calices distant from each other, septal density 18–20/5 mm.
Comparison: In series dimensions and septal density, the coral from Lyubasha resembles Oxfordian species from the Jura Mts such as *M. undans* Etallon, *M. rastelliniformis* Etallon and *M ducreti* Koby (Koby, 1885). However, it differs from all of these in its branched-columnar colony shape and in deep valleys.
Material (measurements in mm):

No. NMNH F-	metre levels	gf	col-col	s	sd/5	c-c	Occurence in Lyalintsi section
30275	453	ramose or columnar meandroid; branches 15-30 mm thick, columns 20 × 30 mm thick	3.5-4.0 to 5-7 m	50 at d=7.0	18-20	6-11 (15)	Valanginian
30244 30237	421-427						
30208	415						
30200	412						
30191	395						
30185-6	392						
30150 30149 30142 **30138** 30136	377						
30132 30121-4	359-377						
30113	332-335						
30107	325						Berriasian-Valanginian border zone
30101-2	314						Berriasian
30093	182						Tithonian-Berriasian border zone
30088	181						
30072 30069	115						Tithonian

Description: Colonies varying in shape from branched to columnar; both colony types may be associated with each other. In transverse section, branches crowded, irregular in shape, columns flattened or subcircular. In the rock, single vertical branches (solitary columnar colonies? parts of multicolumnar colonies?) are to be observed. Calices are arranged into series distributed subhorizontally on the sides of branches; valleys are deep; collines tectiform. In thin branches, the valleys are irregularly shaped and the series are short; in transverse section only oblique sections of corallites may be observed, which means that at the top there are no vertically growing corallites. In thick branches or flat columns, the valleys are long and wide, forking or straight. In the series, the calicular centres are connected with at least one septum-of-valley. Isolated calices (no. NMNH F-30200) show ca. 50 septa at a diameter of ca. 7 mm. Septa are thin, perforated near the margins, nonconfluent in the collins.
Remarks: In the rock specimen No. NMNH F-30134, two different ramose species of *Microphyllia* have been found: *M. elevata*

sp.n., with wide series; and *M. densecostata* Sicharulidze, with thinner branches and septa, and narrow calicular series.
Distribution: Tithonian–Valanginian, Lyubasha Mountain, Lyalintsi: repository acronym and catalogue numbers as above.

Microphyllia densecostata Sicharulidze, 1979
Fig. 14J–L

1979. *Microphyllia densecostata*: Sikharulidze, 35, pl. 22, fig. 2.

Material (measurements in mm):

No. NMNH F-	metre levels	gf	col-col	s in isolated calice	sd/1	Occurrence in the Lyalintsi section
30134	372-374	ramose, meandroid; d of branches 10-15	1.5-2.5	ca 30	5-7	Valanginian
30122	360-367				5	

Description: Colonies approximately 30 cm in height, branches parallel, anastomosing. Calices arrranged in flexuous series; valleys short and closed, collines tectiform, with well marked wall. In the collines, the septa are subconfluent. Septal blades with rare, irregular pores. Septal faces with rare pennules directed slightly upwards. Synapticulae present, thick. Columella rudimentary, composed of coalescing septa. Dissepiments rather scarce, thin-walled. Budding terminal with septal connections between the centres; septa-of-valley not permanent.
Remarks: In its specific features, the coral fits to *M. densecostata* (col-col: 1.8 – 2 (2.5) mm; sd 26/5 mm) from the Albian of Caucasus, but its ramose colony growth form is different from that of the Caucasian, massive form. In colony shape and valley width, the coral resembles the Late Oxfordian *Microphyllia dumosa* Koby; the description of the latter species was based on natural casts of branches (Koby, 1886: 255, pl. 71, figs. 1-4).

In transverse sections, the coral is surprisingly similar to *Meandrophyllia amedei* (Etallon, 1864). However, the difference between both corals is observable in the micromorphology of the septal sides: pennular in *Microphyllia densecostata* and granular in *Meandrophyllia*. Additionally, the endotheca in *M. densecostata* is composed of dissepiments, in contrast to the tabuloid, sparse endothecal elements of *Meandrophyllia amedei* (compare Roniewicz, 1966). The sections tangential to the branches (no. NMNH F-30134) show calicular series with tectiform walls between calicular series, typical of the genus *Microphyllia*. Specimen. no. NMNH F-30134 was associated with the dendroid morphotype of *M. elevata*.
Distribution: Valanginian – Lyubasha Mountain, Lyalintsi: NMNH F-30122, 30134. Albian – Caucasus, site at the village Tskhanari.

Genus *Thamnarea* Etallon, 1864

Remarks: The genera *Dendraraea* d'Orbigny, 1849 and *Thamnarea* Etallon, 1864 are known as two Jurassic and Cretaceous thin-branching genera with small corallites. The Jurassic *Dendraraea* d'Orbigny, 1849 was discussed by Lathuilière & Gill (1998 with synonymy) and, thanks to well preserved specimens of the Bajocian *D. dendroidea* Ferry and *D. excelsa* Milne Edwards et Haime, the Callovian *Dendraraea* sp. 1, *Dendraraea* sp. 2 and *Dendraraea* sp. 3, and the Oxfordian *D. racemosa* (Michelin), its essential structural features were presented. The authors postulated that at least a part of *Thamnarea* Etallon, 1864, with its type species *T. arborescens* Etallon (as a synonym of *D. racemosa*), should be included in its synonymy. The latter decision was based on observation of material from the specimen in the Koby collection. Lathuilière & Gill (1998) did not give a formal diagnosis of the genus *Dendraraea*, but characterized its features in the descriptions and figures as follows: colonies ramous, with thin-skeletal axial part and thick-skeletal peripheral part; corallites of small size; axial pit circular and empty (Etallon, 1864 mentioned a trabecular columella); septa microsolenid in structure, perfectly porous, built of trabeculae thick and distant from each other, but connected into septal blades by their pennules/menianes; synapticulae present, dissepiments thin-walled.

In the Lyalintsi sequence, there is another common thin-branching coral which shows some features that are similar to those of *Dendraraea* but other features that are different. Because of these differences (summarized in the Table 4), the taxonomic value of which remains unclear, the taxon is described herein under the informal name "*Thamnarea*". This coral externally resembles Early Cretaceous corals described as *Thamnarea* from Crimea (Bugrova, 1997).

Structurally, "*Thamnarea*" differs from *Dendraraea*, as characterized by Lathuilière & Gill (1998), in the sparse, irregular porosity of the septa, pennulae that do not coalesce into menianes, the trabecular columella, and in the vertical growth of the corallites situated on the growing top of the branch, similar to the growth of branches in, e.g., *Pseudocoenia*. Although it would be easy to ascribe it to *Dendraraea*, its pennulae that do not coalesce into menianes, subcompact septa, and trabecular columella seem to be sufficiently discriminative features for keeping it apart from *Dendraraea*, and for assigning it to the Latomeandridae rather than to the Microsolenidae.

The state of preservation of the material is inadequate for diagnosis of this form. Its taxonomic status cannot be clarified without a detailed examination of far better preserved skeletons than those from Lyalintsi.

Table 4

Features of *Dendraraea* d'Orbigny (after Lathuiliere & Gill, 1998) and "*Thamnarea"* sp. from Lyalintsi

taxon	c-c (mm)	colony	porosity	micro-morphology	synapticulae	columella	endotheca	Direction of growth at the top of branch
Dendraraea d'Orbigny, (diverse species)	medium 1.9-3.7	thamnasterioid, thin skeletal at the axis, thick at the periphery	**regular**	**menianes**	present	**Not mentione**d (but reported in Etallon 1864)	dissepimental	**Lateral**; in cross-section calices not discernible at the axis
"*Thamnarea*" sp.	minimum 1.5 maximum 2.0	as above	**sporadic**	**pennules**	as above	**trabecula**	as above	**Vertical**; in cross-section calices discernible at the axis

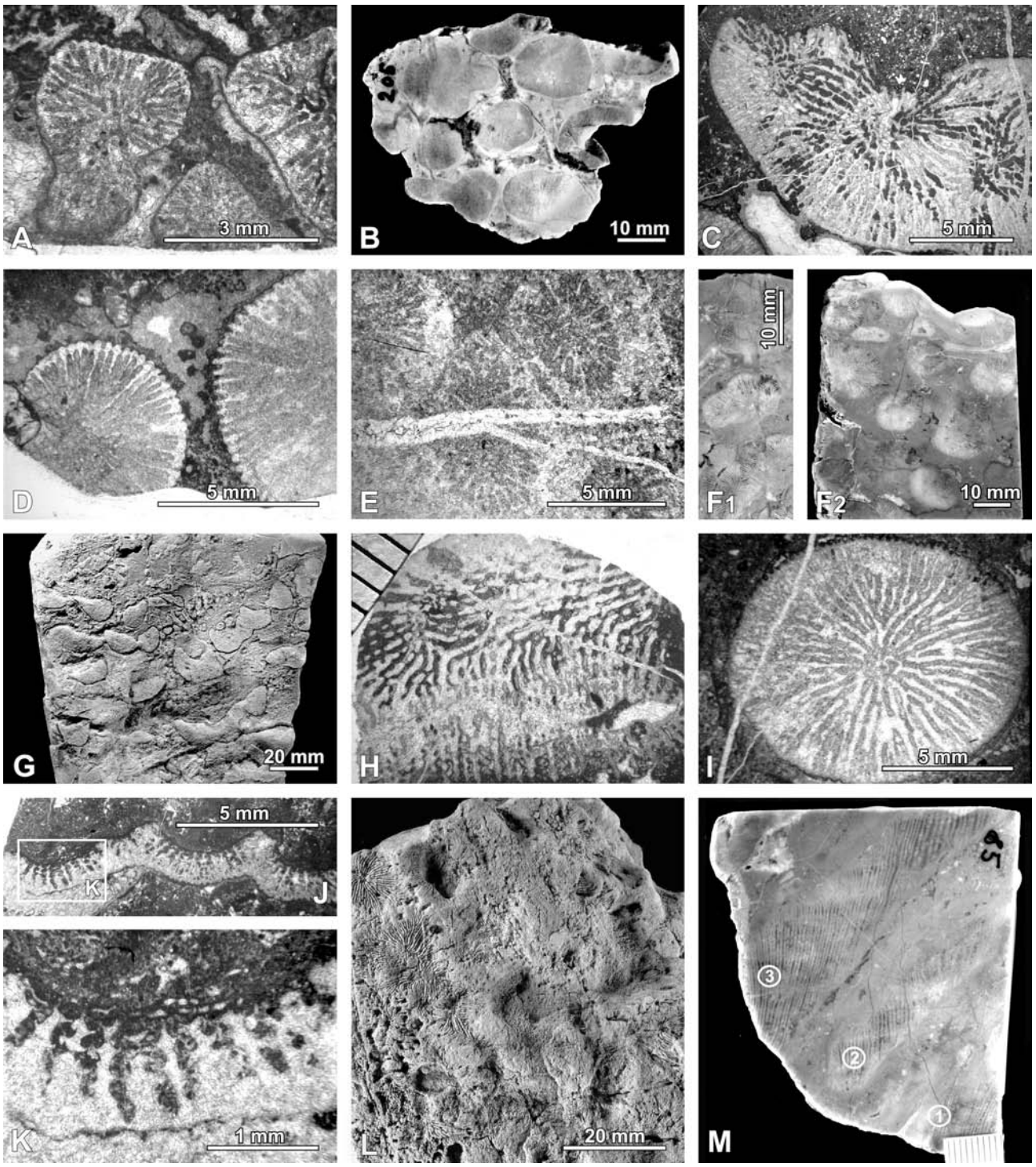

Fig. 13. The family Latomeandridae. **A** – *Latomeandra* sp. 1. Thin section: corallites showing latomeandriid anastomosis of septa, no. NMNH F-30065a. Tithonian. **B, C** – *Latomeandra juettneri* Eliášová. B – phaceloid corallum in transverse section, polished rock surface, no. NMNH F-30243. Valanginian. C – stage of budding with lamellar linkages between centres preceding division of corallites, thin section, no. NMNH F-30227a. Valanginian. **D** – *Latomeandra ramosa* (Koby). Regularly shaped corallites in thin section, no. NMNH F-30108a. Valanginian. **E** – *Ovalastrea* sp. Colony with narrow peritheca in thin section, no. NMNH F-30291b. Valanginian. **F, I, M** – *Latomeandra obliqua* sp.n. The holotype, no. NMNH F-30135. F1 and F2 – two fragments of phaceloid corallum in transverse sections, polished rock surfaces; I arrangement of septa in a young corallite, thin section, no. NMNH F-30135d; M – polished rock surface showing longitudinal sections of three obliquely growing corallites (1, 2, 3). Valanginian. **G, H** – *Protoseris* sp. sp. G – Weathered rock surface showing longitudinal section of a bunch of fronds monoserial in type and with calicular surfaces oriented upwards, no. NMNH F-30295. Valanginian. H – transverse thin section of a frond built of a single calicular series, no. NMNH F-30260a. Valanginian. **J, K** – *Protoseris* cf. *robusta* Becker. Thin section: J – multiserial frond in longitudinal section, and K – enlarged fragment showing strong pennules, no. NMNH F-30247b. Valanginian. **L** – *Comophyllia sp*. Colony in upper view on weathered rock surface, no. NMNH F-30062. Tithonian

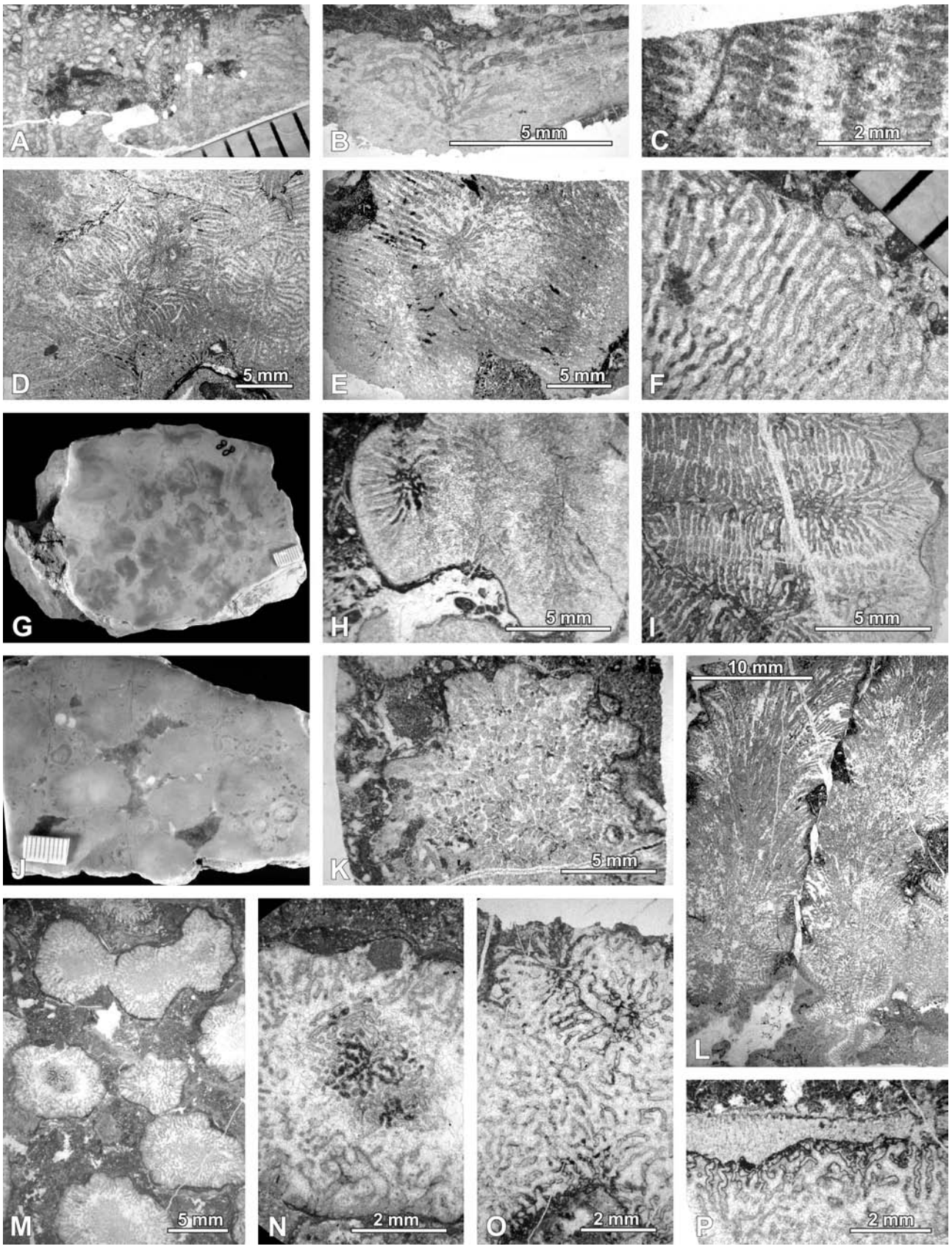

Fig. 14. The family Latomeandridae. **A, D** – *Dimorphastraea* cf. *dubia* de Fromentel. Thin sections: A – abundant endotheca in longitudinal section, no. NMNH F-30287b; D – colony in transverse section showing wavy septa, no. NMNH F-30287a. Valanginian. **B, E** – *Dimorphastraea* cf. *heteromorpha* (Quenstedt). Thin sections: B – thick crescent pennulae coalescing into menianes, longitudinal section crossing the calice, no. NMNH F-30119b. Valanginian. E – thick septa, transverse section, no. NMNH F-30207a. Valanginian. **C, F** – *Periseris* sp. A. Thin sections: C – menianes and synapticulae in longitudinal section tangential to the septal blade, no. NMNH F-30205a;

"*Thamnarea*" sp.
Fig. 14M–P

?1997. *Thamnaraea mamellonata* Turnšek: Bugrova, p. 35, pl. 12, figs. 1-3.

Material (measurements in mm):

No. NMNH F-	metre levels	gf	c-c	s	sd/1	Occurrence in the Lyalintsi section
30258	442	ramose, thamnasterioid, d of branches 6-8 mm, colonies at least 30 cm in height	1.5 -2.0	ca. 20	5-6	Valanginian
30203	412					
30189	392					
30158 30165 30168	382					
30106	325					
30097	182					Tithonian-Berriasian boundary zone
30079	157					Tithonian
30066	115					

Description: Thamnasterioid ramose colonies composed of thin, densely arranged sub-parallel branches that may coalesce with each other. As a rule, colonies with very thin branches show a thin-skeletal internal part, and a thick-skeletal peripheral part. In transverse section of well preserved branches, the corallites situated at the axis are recognizable and prove that at the top of branches the corallites grew vertically at least during the initial stage after budding. Septa thick, anastomosing; about 10 septa reach the columella. Pores rather rare. Pennules thick, directed slightly upwards; menianes never observed. Synapticulae thick. Columella monotrabecular. Corallites multiply by lateral budding with lamellar linkage: short series of two corallites are observed having centres connected by a single lamella; near the axis of the branch multidirectional budding can be observed.

A thin-skeletal colony (no. NMNH F-30066) from the 115 m level shows no differentiation into axial and peripheral parts, and corallites of low calicular diameters (generally 1.5 mm). In other parts of the sequence, the peripheral skeleton of branches is thick, and corallite diameters are larger.

Remarks: In the vertical growth of the top corallites, this coral seems to differ from *Dendraraea racemosa* and *D. dendroidea*. In transverse section, the branches of these taxa (Lathuilière & Gill, 1998, pl. 3, figs. 1-3; pl..4, figs. 2, 3; pl. 5, fig.6; pl. 6, figs. 1, 2) show only oblique sections, proving that the initial direction of corallite growth was lateral, rather than vertical. The thin-skeletal axial part and thick-skeletal peripheral parts of the branches are observed in both these *Dendraraea* species (compare Lathuilière & Gill, 1998) as well as in "*Thamnarea*".

In colony shape, dimensions of branches, and small corallite diameters, the Bulgarian coral resembles *T. mamellonata* Turnšek, described by Bugrova (1997) from the Barremian–Lower Aptian interval of the Crimea. However, their identy could be confirmed only by direct comparison of the material, as the illustrations of the coral from the Crimea (see synonymy) are not sufficiently informative. In comparison with *T. mamellonata* described by Turnšek & Michajlović (1981) from the Lower Cretaceous of Serbia, the Bulgarian form differs in the much smaller numbers of septa and smaller corallite diameters.

Distribution: In Bulgaria, known from the Tithonian to Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numberes as above.

Genus *Comophyllia* d'Orbigny, 1849

Comophyllia sp.
Fig. 13L

Material (measurements in mm):

No. NMNH F-	metre levels	gf	col-col	sd/5	Occurrence in the Lyalintsi section
30062	102	lamellar, meandroid; 65 mm thick	18-20	13-16	Kimmeridgian/ Tithonian

Description: Colony thick, submassive. Calices shallow, distributed in more or less individualized series, corallites of a very variable size. Budding with linkages. Collines low, tectiform. Calicular pit small, occupied by parietal columella. Septa thin, wavy, frequently anastomosing. Pennulae thin, directed upwards.

Distribution: Kimmeridgian/Tithonian – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

Genus *Ovalastrea* d'Orbigny, 1849

Ovalastrea sp.
Fig. 13E

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	c-c	sd/3	Occurrence in the Lyalintsi section
30291	bed "a"above 460 m	massive, plocoid, small colonies	5.0-6.0	5.0-7.0	10	Valanginian
30249 30254	421-427					
30148	377					
30120	359-377					

Remarks: The coral is a representative of *Ovalastrea* with a rather narrow peritheca and thin septa. In corallite dimensions and numbers of septa it resembles *Ovalastrea*? *tenuistriata* Koby, 1905 described by Errenst (1991) from the Kimmeridgian of Portugal. *Ovalastrea tenuistriata* Koby is known from the Kimmeridgian of the Iberian Penninsula. The highly recrystallized state of the skeleton does not allow determination of the coral at specific level.

Distribution: Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Fig. 14 continued. F – colony fragment showing small calices and robust septa, no. NMNH F-30205b. Valanginian. **G–I** – *Microphyllia elevata* sp.n. The syntype specimens: G – colony built of thin branches, transverse section, polished rock surface, no. NMNH F-30138; H – summit of a branch, transverse thin section, no. NMNH F-30138a. Valanginian. I – subhorizontal arrangement of calicular series on side of a columnar colony, tangential section of colony, no. NMNH F-30150a. Valanginian. **J–L** –*Microphyllia densecosata* Sikharulidze, 1979. The holotype colony, no. NMNH F-30134: J – transverse section, polished rock surface; K – a branch with deep valleys, transverse thin section, no. NMNH F-30134a; L – branches in longitudinal, partly tangential section showing deep valleys and sharp dividing walls on lower left-hand side, no. NMNH F-30134b. Valanginian. **M–P** – "*Thamnarea*" sp. Thin sections: M, N – colony built of thin branches, with clearly discernible thin-skeletal corallites at axial zone (N), skeleton thickened at peripheral part and irregular porosity, no. 30203a. Valanginian; O – tangential section of branch showing thick-skeletal corallites on colony surface, P – longitudinal section showing septa with thick pennulae, no. NMNH F-30258a. Valanginian

Genus *Dimorphastrea* d'Orbigny, 1849

Dimorphastrea cf. *dubia* (Fromentel, 1858)
Fig. 14A, D

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	c-c	s	sd/5	Occurrence in the Lyalintsi section
30287 30282 30286	457	lamellar, thamnaste-rioid	ca.6	4.5-7.0	ca. 50	15	Valanginian
30279	453						
30222	415						
30188	395						
30085	179-181						Tithonian/ Berriasian

Remarks: Axial cavity wide, filled with papillar columella. The form resembles *D. dubia* from Romania (Roniewicz, 1976) in its measurable parameters but has less porous septa.
Distribution: *D. dubia* is known from the Kimmeridgian of Germany, and from the Upper Oxfordian of Romania and Portugal (compare Roniewicz, 1976). *D.* cf. *dubia* is known from the Tithonian/Berriasian to Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Dimorphastrea cf. *heteromorpha* (Quenstedt, 1858)
Fig. 14B, E

Material (measurements in mm):

No. NMNH F-	metre levels	gf	c-c	s	sd/5	trd/1	Occurrence in the Lyalintsi section
30207	415	lamellar, thamnaste-rioid	8-12	30-40	10-12	2-3	Valanginian
30129	359-377						
30119 30118	359						

Remarks: The coral is represented by colonies ranging from thin to submassive, with large corallites, thick septa and strong pennules. Endotheca built of small dissepiments. The form resembles *D. heteromorpha* (Quenstedt) described from Romania (Roniewicz, 1976).
Distribution: *D. heteromorpha* is known from the Upper Oxfordian of Portugal (Koby, 1905) and Romania (Roniewicz, 1976), and from the Upper Kimmeridgian of Württemberg, Germany (Geyer, 1954). *D.* cf. *heteromorpha* is known from the Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Genus *Periseri*s Ferry, 1870

Remarks: The genus, originally described from the Bajocian (Lathulière, 2000, with synonymy), has been recently discovered in the Hauterivian (Löser, 2001). The form described herein is the second Cretaceous find of the genus presenting features similar to the Bajocian form: thick septa with robust menianes, rod-like synapticulae, styliform columella, scanty septal porosity. In its robust skeleton it differs from the third coral, described from the Aptian of the Swiss Alps (Morycowa & Decrouez, 2006) as *Periseris frondescens* (d'Orbigny, 1850), which shows thin septa covered with ornamented pennules, and lacks synapticulae. However, Neocomian *Thamnastraea frondescens*, Sainte-Croix, Jura Mts, coll. Koby, Géneve, having robust trabeculae and thick menianes (Morycowa peronal communication, 2008), may represent genus *Periseris*.

Periseris sp. A
Fig. 14C, F

Material (measurements inmm):

No. NMNH F-	metre levels	gf	d	c-c	s	sd/3	md/1	Occurrence in the Lyalintsi section
30205	415	lamellar, thamnasteri oid	2	2-4	10-12	11	4	Valanginian

Remarks: The coral is represented by a small fragment (three calices) of a lamellar colony with the following clearly observable features: thick septa with rare menianes, numerous synapticulae, scanty porosity and a thin columella.

The Valanginian form seems to have a more stable number of menianes per 1mm than the type species (in which the distance between two menianes ranges from 200 to 700 μm), and smaller calices (in the specimen of *P. elegantula* kindly offered for comparison by Dr. B. Lathuilière, *d* has been estimated at 3–4 mm). The Valanginian form differs in smaller calicular diameters and higher septal density from that described from the early Hauterivian of France (Löser, 2001: *Periseris* sp.: *d* 4.5–5.5 mm, *s* 16–20, sd 5/2).
Distribution: Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

Suborder FUNGIINA Verrill, 1865
Family SIDERASTRAEIDAE Vaughan et Wells, 1943
(*faut de mieux*)
Genus *Siderastreites* gen. n.
Type species**:** *S. lyalintsensis* sp.n.

Derivation of the name: *Siderastreites* – the name derives from *Siderastrea* Blainville, because of the resemblance of both genera in the appearance of their wall and synapticulae; gender *feminine*.
Diagnosis: Cerioid; increase by corallite division. Septa compact, thin, nonconfluent, anastomosing. Synapticulae rod-like. Columella parietal. Endotheca dissepimental. Wall zigzag, septo-synapticular.
Discussion: Because of the poor preservation of the skeleton, microstructural criteria cannot be used for comparisons of this coral with other genera and to enable its correct classification. Its compact septa, granulation on the septal sides and abundant synapticulae allow it to be placed in the Siderastraeidae, and this placement has been adopted here. However, in the numerous and thin septa, the genus resembles *Astraraea* Felix (assigned to the Haplaraeidae), from which it differs in nonconfluent septa and a cerioid type of colony. In its general morphological characters of thin septa and a cerioid colony, it also fits the Aptian *Plesiothamnasteria* Alloiteau, 1957, a genus characterized by a septal structure resembling that of *Isastrea*. The difficulties in classification arise not only from its poor state of preservation but also from a lack of clear diagnoses of the families.

Siderastreites lyalintsensis sp.n.
Fig. 15A–D

Holotype: NMNH F-30246.
Type-level: Valanginian, Slivnitsa Formation, 420m level of the Lyalintsi section.
Type-locality: Lyubasha Mountain, Lyalintsi, Bulgaria.
Derivation of the name: *lyalintsensis* – named after the village of Lyalintsi.
Diagnosis: *Siderastreites* cerioid with short series of calices ca. 8 mm wide; ca. 60 septa at a corallite diameter of 8 mm.

Material and measurements (in mm):

No. NMNH F-	metre levels	gf	d of isolated corallites	s	sd/5	Occurrence in the Lyalintsi section
30246	420	lamellar, cerioid-meandroid	8-9	ca. 60-70	16	Valanginian

Description: Colony cerioid to serial; calices shallow, series closed. Septa compact, nonconfluent, rarely subconfluent. Increase by division resulting in formation of more or less permanent series composed of two to four centres. In the series, corallite centres lacking septal connections. Septa straight, subequal in thickness. Septal apparatus differentiated into four size orders: the S1-S2 septa reaching axial pit; septa of higher orders anastomosing irregularly with septa of various orders to form a pattern resembling 'descending series' (term after Cuif, 1976). Synapticulae rod-like, distributed in rather regular, distant intervals. Wall thin, zigzag, formed by peripheral ends of septa and one circle of synapticulae (isastreid type, compare Roniewicz, 1982). Columella parietal, poorly developed. Endotheca dissepimental.

Microstructure. The skeleton is recrystallized. Septal thicknesses reaching 100–150 μm, and well developed rod-like synapticulae characterize the microstructure of the genus to some extent but are not sufficient for its correct classification.

Distribution: Valanginian – Lyubasha Mountain, Lyalintsi: NMNH F-30246.

Family HAPLARAEIDAE Vaughan et Wells, 1943

Remarks on the family content: The family Haplaraeidae originally contained seven genera (Vaughan & Wells, 1943: *Haplaraea* Upper Jurassic–Lower Cretaceous (Upper Cretaceous), *Diplarea* Upper Jurassic–Lower Cretaceous, *Pseudofavia* Upper Cretaceous, *Trechmannaria* Upper Cretaceous, *Astraraea* Upper Cretaceous, *Physoseri*s (Eocene), *Confusastraraea* ?Eocene, Miocene.

To the original content three genera were added, *Meandrophyllia* d'Orbigny, *Actinaraeopsis* Roniewicz and *Actinaraea* d'Orbigny, originally attributed to other families: Alloiteau (1952) added *Meandrophyllia*, originally classified to the Microsolenidae (Vaughan & Wells, 1943); Roniewicz (1976) added genus *Actinaraeopsis* originally (Roniewicz 1968) classified to the Actinacididae; herein, genus *Actinarae* has been transferred from the Actinacididae. From the above list only *Haplaraea*, *Meandrophyllia*, *Actinaraeopsis* and *Actinaraea* have been satisfactorily examined and their features illustrated in the literature (Roniewicz 1966, 1976; Morycowa & Masse 2007). This group is known from the Jurassic and Early Cretaceous. There exists a taxonomic problem, in that Geyer (1954: p. 127) questioned the status of *Haplaraea*, considering this genus, without analysis of the skeleton structure, to be a synonym of *Diplaraea*. To prove or disprove this synonymy a formal revision of the type material is needed.

Other genera in the original list known from the Late Cretaceous and Paleocene (as well as the Turonian *Haplaraea pratzi* Felix, devoid of epitheca) have been provisionally retained in the Haplaraeidae pending their revision.

Structural features. The above-mentioned restricted list comprising only Late Jurassic–Early Cretaceous genera represents corals of solitary, phaceloid and colonial growth forms of meandroid and thamnasterioid types. Their corallite structural features are as follows: parietal columella made of projections of the internal septal borders, endotheca made of rare, thin-walled, tabuloid elements, epitheca (holotheca), and a particular pattern of septal microstructure arising from structural porosity. The septa, similarly as in the microsolenids, are regularly perforated, as a result of rhythmical thickening of growing trabeculae. Thickenings formed nodes, while the internode part of the trabecular bodies remained thin. Lateral trabecular projections (*secondary trabeculae*: Jell, 1969) arose from the nodes. In the septum, the adjacent trabeculae contacted and coalesced by the nodes resulting in the formation of a regular, structural porosity of the septal blades. In contrast to the microsolenid corals producing synapticulae and lateral balconies (pennules and menianes) on the nodes, in the Haplaraeidae, the above-mentioned trabecular projections produced lateral granules frequently coalescing into synapticulae.

Genus *Haplaraea* Milaschewitsch, 1876

Remarks: Geyer (1954) considered solitary *Haplaraea* a synonym of phaceloid *Diplaraea* Milaschewitsch and placed the genus in the Microsolenidae based on a general similarity of structure. However, as described herein and in Roniewicz (1976), the skeleton structure of *Haplaraea* differs from that of the Microsolenidae. Various corals differing in structure from that of *Haplaraea* have been described under the name *Diplaraea*, (e.g. Errenst, 1991; Turnšek, 1997). Pending taxonomic revision of both taxa, I am using the genus name *Haplaraea* as it is relatively well diagnosed both macro- and microstructurally (compare also Roniewicz, 1976).

Haplaraea aff. *elegans* Milaschewitsch, 1876
Fig. 15E, F

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	sd/10	Occurrence in the Lyalintsi section
30173 **30160**	382	solitary	14×18	70	18	Valanginian
30128	359-377		17×23	78		

Description: The diameters of the corallites are smaller and the numbers of septa significantly lower than in the form described from Romania (Roniewicz 1976: d 20–25 mm; s 105; sd 16/10 mm). Septa are differentiated into three size orders: the S1 septa reach the centre and their trabecular projections produce a parietal columella; the S2 septa are slightly shorter; the S3 septa attain at least one-third of the radius in length. Anastomosis of the S3 septa with the adjacent septa is frequent. Septa are thickened peripherally and attenuated adaxially. Regular porosity can be observed in all the non-thickened septa of the third order, or in all the non-thickened septal parts, especially in the periaxial region. Lateral septal granulations are rather asymmetric and tend to join the granulations of the adjacent septum to form rod-like synapticulae. Synapticulae are equidistant.

Distribution: *Haplaraea elegans* is a rarely described coral, known from the Kimmeridgian of south Germany (Becker & Milaschewitsch, 1875–1876: p. 229, pl. 51, fig. 2; Geyer, 1954: pp.127, 171, pl. 14, fig. 3), and Romania (Roniewicz, 1976: p. 86, pl. 22, fig. 1a-e). *H.* aff. *elegans* is known from the Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Genus *Actinaraea* d'Orbigny, 1849

Actinaraea granulata (Münster, 1829)
Fig. 15G, H

1829. *Agaricia granulata* Münster: *in* Goldfuss, p. 109, pl. 38, fig. 4.
1876. *Actinaraea granulata* Münster: Becker & Milaschewitsch, p. 231, pl. 51, fig. 4.
1997. *Actinaraea granulata* (Münster): Turnšek, p. 6, pl. 6, figs. A-E (with synonymy).

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	trd/1	ed/1	Occurrence in the Lyalintsi section
Morphotype B							
30118 30119	287-290	lamellar, thamnasterioid	ca. 1	14-16	4	4	Berriasian
Morphotype A							
30081 **30083**	177	ramose, thamnasterioid; d of branches 15-20	ca. 1	14-16	4-5		Tithonian/ Berriasian

Description: Morphotypes A and B differ in colony shape but have similar skeletal structure. Septa are built of a few trabeculae separated by large pores. Rod-like synapticulae connect adjacent septa. Endotheca is composed of subtabular elements traversing large parts of the colony. In its measurable parameters the form may be placed between *A. minuta* and *A. granulata*. Morphotype A differs from other known *Actinaraea* in its ramose colony form. Morphotype B is thin-lamellar, with a well marked colony rim.
Distribution: *Actinaraea granulata* is common in Europe, from the Oxfordian up to the Tithonian (Turnšek, 1997). In Bulgaria, from the Tithonian to Berriasian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Actinaraea cf. *minuta* Roniewicz, 1966
Fig. 15I, J

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	s	trd/1	ed/1	Occurrence in the Lyalintsi section
30057	102	lamellar thamnasterioid	ca.1	ca. 14	6-8	7	Kimmeridgian/ Tithonian

Remarks: With the exception of the numbers of septa, which exceed those of *A. minuta* (ca. 10 per calice), the other features (lamellar shape, diameter, density of trabeculae and endotheca) agree with those of this species. In the numbers of septa the coral resembles *A. granulata*.
Distribution: *Actinaraea minuta* was described from the Middle Oxfordian of Poland (Roniewicz, 1966). *A.* cf. *minuta* is known from the Kimmeridgian/Tithonian – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

FAMILIES OF UNCERTAIN POSITION
Family CURTOSERIIDAE Melnikova, 1996
Genus *Mesomorpha* Pratz, 1883

Mesomorpha aff. *simionescui* Roniewicz, 1976
Fig. 15K, L

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	c-c	s	sd/1	Occurrence in the Lyalintsi section
30193	397	lamellar, thamnasterioid	ca. 1.5	3-4	ca. 20	5	Valanginian

Remarks: The coral resembles *M. simionescui* in its small, columellate calices, numbers of septa per calice and their arrangement, but it has evidently much thicker septa. The small piece of colony available does not allow for more detailed comparisons.

From *M. ornata* Morycowa, known from the Barremian, Aptian and Cenomanian (Morycowa, 1971; Morycowa & Masse, 1998; Morycowa & Decrouez, 2006), it differs in widely spaced calices and in the resulting pattern of septal arrangement.

Distribution: *Mesomorpha simionescui* is known from the Lower Kimmeridgian of Romania (Roniewicz, 1976). *M.* aff. *simionescui* occurs in the Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

Family CYATHOPHORIDAE Vaughan et Wells, 1943, emend. Alloiteau, 1957
Genus *Cyathophora* Michelin, 1843

Remarks: The genus is represented by single colonies of three undeterminable taxa. Measurements were taken from colonies and thin sections. The taxa differ from each other primarily in the development of the septal apparatus and/or in corallite diameters.

Cyathophora sp. 1
Fig. 16A–D

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	c-c	s	ed/10	Occurrence in the Lyalintsi section
30288	457	massive, plocoid	5-6	5-7	6+6+nS3	10-12	Valanginian
30147	377						
30078	137						Tithonian

Description: Colony plocoid; peritheca narrow. Septa short, developed as ridges on the wall, triangular in cross section, S1 septa more prominent than the others, S3 septa poorly discernible. Costae developed as ridges lying on the perithecal dissepiments. Wall parathecal, either incomplete, allowing dissepiments extending from the endotheca to the peritheca to be observed, or thickened by stereome; endotheca tabuloid.
Distribution: From the Tithonian to Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

Cyathophora sp. 2
Fig. 16E, F

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d adults	c-c	S	ed/10	Occurrence in the Lyalintsi section
30195	397	massive, plocoid	6-7	7-10	6+6+nS3	14	Valanginian

Description: Colony plocoid with rudimentary peritheca, septal apparatus hexameral with long S1septa, underdeveloped S2 septa, and rarely observable rudiments of S3 septa; costae of the third and fourth size orders marked on the surface of exothecal dissepiments; wall incomplete, parathecal with stereomal thickenings.
Remarks: This form differs from the other two in the well developed S1 septa and dense endotheca.
Distribution: Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

Cyathophora sp. 3
Fig. 16G–I

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d adults	c-c	s	ed/10	Occurrence in the Lyalintsi section
30294	bed "a"above 460m	massive plocoid	8-9	9-11	S1+S2+S3	12	Valanginian

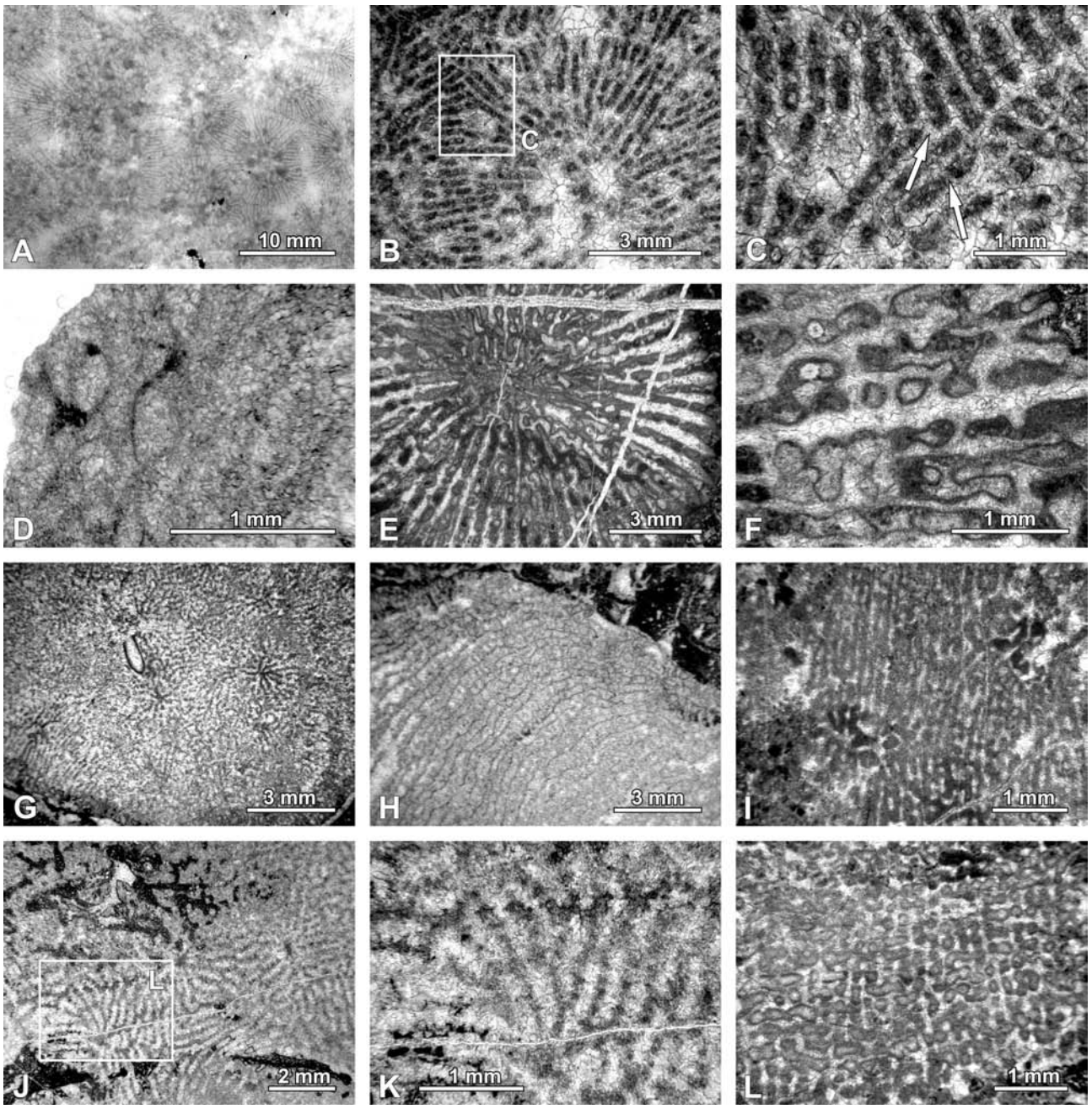

Fig. 15. The families Siderastraeidae, Haplaraeidae and Curtoseriidae. **A–D** – *Siderastreites lyalintsensis* gen. et sp.n. A – the holotype colony in transverse section, polished surface, no. NMNH F-30246; B – thin section showing cerioid corallites with thin, zigzag wall, and C – enlarged fragment of zigzag wall and synapticulae (arrows), no. NMNH F-30246a; D – thin-walled dissepiments in longitudinal thin section, no. NMNH F-30246c. Valanginian. **E, F** – *Haplaraea elegans* Milaschewitsch. Transverse thin sections: E – corallite with fusiform septa, regular porosity of the internal septal borders and papillar columella, no. NMNH F-30160a. Valanginian. F – fragment with regularly distributed synapticulae (skeleton in white), no. NMNH F-30128b. Valanginian. **G, H** – *Actinaraea granulata* (Münster). Thin sections: G – transverse section of branch of ramose colony, no. NMNH F-30081a. Tithonian–Berriasian border zone. H – branch in longitudinal section with tabuloid endothecal elements traversing colony, no. NMNH F-30083a, Tithonian–Beriasian border zone. **I, L** – *Actinaraea* cf. *minuta* Roniewicz. Thin sections: I – rapidly expanding part of lamellar colony showing parallel septa and dispersed calices, no. NMNH F-30057a; L – tabuloid endothecal elements and porous septa in longitudinal section, no. NMNH F-30057b. Kimmeridgian/Tithonian. **J, K** – *Mesomorpha* cf. *simionescui* Roniewicz. Thin section: J – corallites with thick columella and typical course of radial elements in peritheca, and K – enlarged fragment with septal anastomosis, large columella, sharp granulation on septal sides, and trabeculae traceable in septa, no. NMNH F-30193a. Valanginian

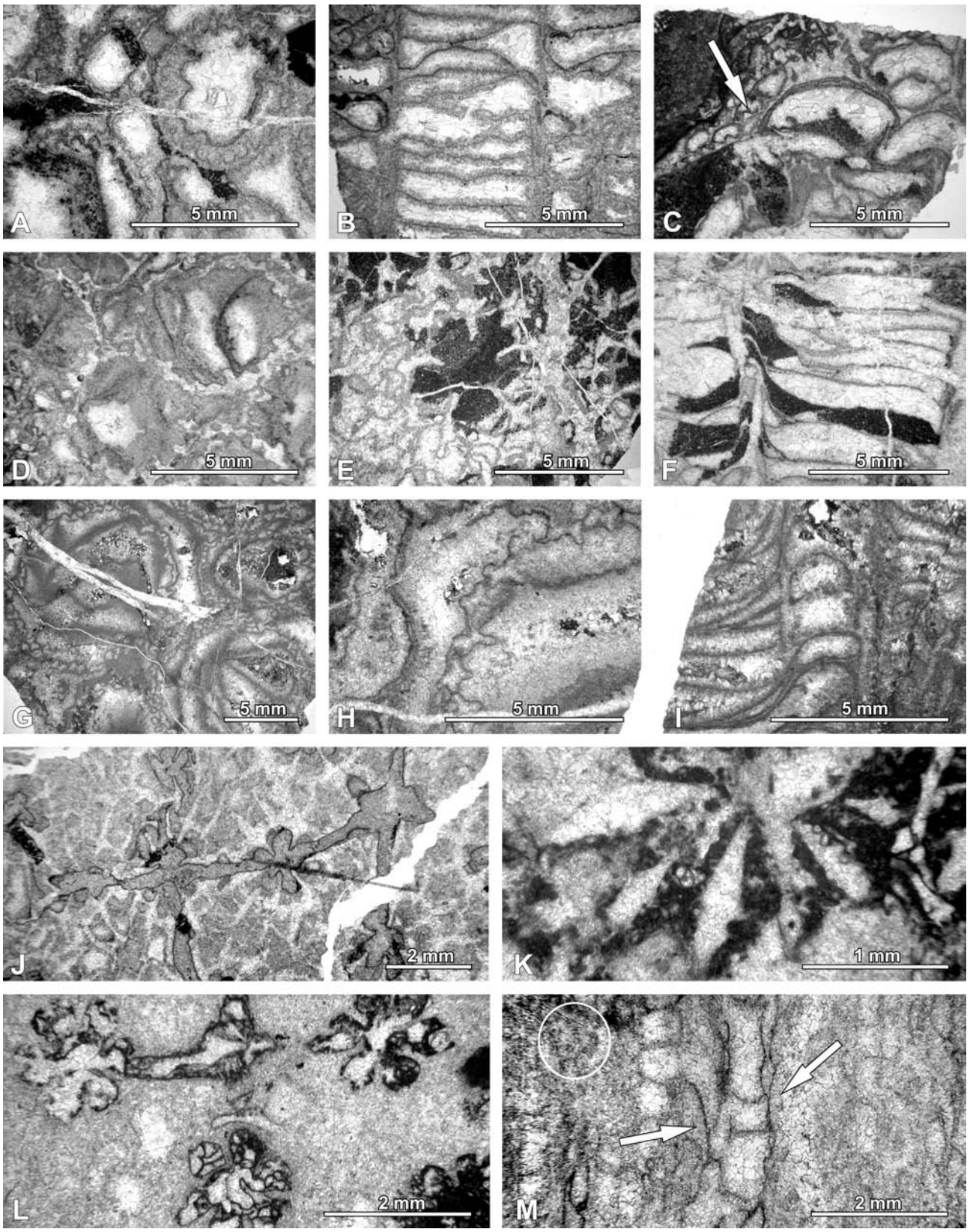

Fig. 16. The families Cyathophoridae and Solenocoeniidae. **A–D** – *Cyathophora* sp. 1, the species with short septa. Thin sections: A – plocoid colony with relatively wide peritheca, no. NMNH F-30288a; B – tabuloid endotheca and dissepimental peritheca in longitudinal section, no. NMNH F-30288c. Valanginian; C – perithecal dissepiments with upper surface covered with costae (arrow), longitudinal section, no. NMNH F-30147b. Valanginian. D – plocoid colony with very narrow peritheca, no. NMNH F-30078a. Tithonian. **E, F** – *Cyathophora* sp. 2, the species with long septa S1. Thin sections: E – S1 septa well developed, other septa rudimentary, peritheca narrow. no. NMNH F-30195a; F – longitudinal section showing endothecal, tabuloid dissepiments and exothecal dissepiments that form narrow, elevated zone, *note* structural continuity between endotheca and peritheca, no. NMNH F-30195b. Valanginian.

Description: Plocoid colony with rudimentary peritheca. Septa in the form of small ridges on the wall, slightly differentiated in length and thickness into three size orders. Endotheca tabuloid. The form is a representative of the *Cyathophora* with the largest corallite diameters, and is close to the type species, *C. richardi* Michelin.

Distribution: Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection number as above.

Family SOLENOCOENIIDAE fam. n.

Diagnosis: Radial elements of costoseptal type. Internal septal border with regular denticulation. Endotheca vesicular, peritheca subtabuloid. Corallites connected by perithecal horizontal channels. Channels contain dissepiments that continue from the endotheca.

Generic content and stratigraphical range: The family has been erected to include the only genus, *Solenocoenia* Roniewicz et Gill, 1976 (*in* Roniewicz, 1976), which occurs mainly in the Upper Jurassic of Europe and the Middle East. In Bulgaria its ranges from the Tithonian to the Valanginian; in Georgia it is reported from the Albian (Sikharulidze, 1979).

Genus *Solenocoenia* Roniewicz et Gill, 1976

Remarks: Because of homoeomorphy this genus has been misidentified as *Convexastrea*, *Cryptocoenia* and other genera (compare Roniewicz, 1976). It resembles the stylinids in the plocoid colony type, but, in contrast to the stylinids, its quasi-tabular peritheca is provided with a system of horizontal channels linking the corallites, and its endotheca is dissepimental, not tabular. The channels contain rare dissepiments in their lumina. Micromorphological features, such as the internal septal border with regularly distributed denticulation, resemble the regularity with which auriculae are distributed in the stylinids; the surfaces of the radial elements show abundant, minute granulations not observed in the stylinids. The microstructure of the septa has not been observed so far.

Solenocoenia sexradiata (Goldfuss, 1826)
Fig. 16J–M

1826. *Astrea sexradiata*: Goldfuss, p. 71, pl. 24, fig. 5.
1976. *Solenocoenia sexradiata* (Goldfuss): Roniewicz, p. 113, pl. 14, fig. 5; pl. 15, figs. 3a, b; text-fig. 9.
1979. *Solenocoenia sexradiata* (Goldfuss): Sikharulidze, p. 40, pl. 26, figs. 1a, b.
1990. *Solenocoenia sexradiata* (Goldfuss): Errenst, p. 174, pl. 5, figs. 2a, b.
1991. *Convexastraea sexradiata* (Goldfuss): Lauxmann, p. 116, pl. 1, fig. 7 (with synonymy).

Material (measurements in mm):

No. NMNH F-	metre levels	gf	d	c-c	s	c	Occurrence in the Lyalintsi section
30281 30287	457	ramose, plocoid; d of branches 15-20; d of pillars 40	(1.8) 2.0-2.5 (2.8)	2.0-3.5	12(6+6)	12	Valanginian
30278	453						
30183	392						
30173	382						
30149 30150 30144 30139 30142	377						
30103 30101-2	314						Berriasian/ Valanginian
30063	115						Tithonian

Remarks: Of the two known morphotypes of this species, i.e., massive (in Lyalintsi developed as pillars) and ramose, the ramose type predominates in Lyalintsi, with branches that anastomose frequently. Corallite diameters are variable: Colony fragment No. NMNH F-30278 shows minimum values of corallite diameter and intercorallite distance (d 1.8–2.0 mm and c-c 2.0–2.5 mm), while No. NMNH F-30173 shows maximum values (d 2.5 mm and c-c 3.0–3.5 mm); most specimens shows intermediate values. The peritheca is traversed by horizontal canals linking the calices; the endotheca is dissepimental, the number of of costae equals the number of septa.

Distribution: The species is widely distributed in the European Upper Jurassic (Roniewicz, 1976; Lauxmann, 1991) and ranges up to the Albian (Sikharulidze, 1979). In Bulgaria, it occurs from the Tithonian to Valanginian – Lyubasha Mountain, Lyalintsi; repository acronym and collection numbers as above.

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Fig. 16 continued. **G–I** – *Cyathophora* sp. 3, the species with short septa. Thin sections: G – plocoid colony with relatively narrow peritheca, large corallites and rudimentary septa, no. NMNH F-30294a; H – details of wall structure, no. NMNH F-30294b; I –longitudinal section showing endothecal (on left and right-hand sides) and perithecal elements (centre) in structural continuity, no. NMNH F-30294c. Valanginian. **J–M** – *Solenocoenia sexradiata* (Goldfuss). Thin sections: J, L – colonies showing perithecal canals: J – no. NMNH F-30173a from the Valanginian and L – no. NMNH F-30103b from the Berriasian/Valanginian boundary zone. K – micromorphology of septa in the form of granulation observed on septal sides and distal border, no. NMNH F-30149a; M – longitudinal section showing corallite (centre) with oblique peripheral dissepiments (arrows) and subhorizontal dissepiments traversing lumen; tangential section of septum (upper left) shows a field with lateral granules (circled), no. NMNH F-300278b. Valanginian

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