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Jurassic algae of the Perachora-Peninsula: Biostratigraphical and paleoecological implications

Jurassische Algen der Perachora Halbinsel: Biostratigraphische und paläoökologische Folgerungen

by

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Contents

Abstract

Calcareous algae from carbonate sequences of the Perachora-Peninsula (Greece) represent different neritic environments of Jurassic age. The sequences are parts of isolated "megaparticles" of a tectonical breccia. In this area of Greece blocks of three isopic zones of the Hellenides (Parnassus Zone, Beotian Zone and western Pelagonian Zone) are mixed up in a melange belt.

Neritic carbonates of platform-facies (subtidal to supratidal) dominate the sedimentation until Oxfordian (?) – lowermost Kimmeridgian. During Kimmeridgian time, the western Pelagonian Zone and the Beotian Zone settle down and only on the Parnassus Zone neritic carbonates are being formed later than the Kimmeridgian. In order to correlate the isolated carbonate sequences with the different isopic zones, differentiation of facies and stratigraphical position is of highest importance.

Stratigraphical classification of these sequences is based on microfossil evidence. Genera described are: *Palaeodasycladus, Teutloporella, Cylindroporella* (Dasycladaceae), *Rivularia* (Rivulariaceae), *Alpinella graeca* n.sp. (Scytonemataceae), *Girvanella, Hedstroemia* (Porostromata) and Microproblematicae.

Biostratigraphically, a succession of algae and foraminifera assemblages is acertained as following: Upper Sinemurian: *Palaeodasycladus mediterraneus* ACME Zone (*P. gracilis*, *Eodasycladus ogilviae, Rivularia lissaviensis, Thaumatoporella parvovesiculifera, Siphovalvulina* sp.); Carixian: *Teutloporella elongatula* ACME Zone (*Orbitopsella primaeva* assemblages with rare *Palaeodasycladus gracilis* and oncoid levels); Carixian/Domerian boundary: *Orbitopsella praecursor* assemblages. Characteristic for this level is the disappearance of the *Palaeodasycladus–Teutloporella* species. The frequent presence of "Thaumatoporellids" organisms (Microproblematicae) is recorded in Upper Sinemurian-Carixian. Bajocian – Bathonian: *Praekurnubia* cf. *crusei* assemblage with *Girvanella* oncoids and rare *Cylindroporella arabica*; Upper Jurassic: abundant species of Rivulariaceae (*R. piae, R. lissaviensis, R. pumili*), Scytonemataceae (*Alpinella graeca* n.sp.), *Tubiphytes morronensis, Baccanella parvissima* and rare Codiaceae (*Hansiella* and *Carpathocodium* sp.). In addition levels of reworked deposits with *Palaeodasycladus-Uragiella* in the Middle Jurassic and with *Saccocoma* in the Oxfordian – Kimmeridgian – Lower Tithonian (?) exist.

Zusammenfassung

Kalkalgen verschiedener Karbonat-Sequenzen der Perachora-Halbinsel (Griechenland) dokumentieren ausschließlich flachmarine Environments des Juras. Die Sequenzen sind Teile von isolierten „Megapartikeln" einer tektonischen Brekzie. In diesem Bereich Griechenlands wurden Teile dreier isopischer Zonen der Helleniden (Parnass Zone, Bötische Zone und westl. Pelagonische Zone) in einem Melangegürtel gemischt.

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Subtidale bis supratidale Karbonate dominieren die Sedimentation der drei zuvor genannten Zonen (= pelagonische Karbonatplattform) vom Oxfordium (?) bis zum untersten Kimmeridgium. Während des Kimmeridgiums sanken die Böotische Zone und das westliche Pelagonikum ab. Nach dem Kimmeridgium entstanden neritische Kalke nur noch in der Parnass Zone. Somit erlauben Faziesanalysen in Verbindung mit biostratigraphischen Bearbeitungen der isolierten Karbonat-Megapartikeln Interpretationen für regionalgeologische Interpretationen.
Die stratigraphische Klassifikation der Sequenzen beruht auf einer Analyse der Mikroflora/-fauna. Es treten folgende Gattungen auf: *Palaeodasycladus, Teutloporella, Cylindroporella* (Dasycladaceae), *Rivularia* (Rivulariaceae), *Alpinella graeca* n.sp. (Scytonemataceae), *Girvanella, Hedstroemia* (Porostromata) und Mikroproblematicae.
Biostratigraphische Ergebnisse anhand von Algen- und Foraminiferen-Vergesellschaftungen: Oberstes Sinemurium: *Palaeodasycladus mediterraneus* ACME Zone, (*P. gracilis, Eodasycladus ogilviae, Rivularia lissaviensis, Thaumatoporella parvovesiculifera, Siphovalvulina* sp.); Carixium: *Teutloporella elongatula* –ACME Zone (*Orbitopsella primaeva*-Vergesellschaftung mit wenigen Exemplaren von *Palaeodasycladus gracilis* und Onkoidlagen); Carixium/Domerium-Grenze (*Orbitopsella praecursor*-Vergesellschaftung) – Charakteristisch für dieses Niveau ist die Abwesenheit von *Palaeodasycladus – Teutloporella.* "Thaumatoporelliden-Organismen" treten im Obersten Sinemurium-Carixium auf. Bajocium-Bathonium: *Praekurnubia* cf. *crusei*-Vergesellschaftung mit *Girvanella*-Onkoiden und selten auftretend *Cylindroporella arabica;* Oberer Jura: Verschiedene Arten von Rivulariacae (*R. piae, R. lissaviensis, R. pumili*), Scytonemataceae (*Alpinella graeca* n.sp.), *Tubiphytes morronensis, Baccanella parvissima* und seltener Codiaceae (*Hansiella* und *Carpathocodium* sp.). Aufgearbeitete Horizonte mit *Palaeodasycladus/Uragiella*-Floren können in den mitteljurassischen Abschnitten vorkommen und aufgearbeitete Kalke mit *Saccocoma* im Oxfordium–Kimmeridgium–Unter Tithonium (?).

1. Introduction

During our investigation of the biostratigraphy of Mesozoic neritic limestones from the Perachora-Peninsula northwest of Corinth, calcareous algae have been used to clarify the regional geological context.
The southern termination of the Parnassus Zone is a point of discussion. Suggestions are include that the end of this zone is at the gulf of Corinth (JACOBSHAGEN, 1986; comp. Fig. 1) or its continuation to the NE Peloponnesus (CELET, 1962; DERCOURT, 1964). In the latter opinion, the Perachora-Peninsula often seems to be a problem and the maps of some authors show a white area with question marks (AUBOUIN et al., 1960). For the first time, HERFORTH & RICHTER (1979:3) compared the "chaotic" bedding of the units in this region with a melange sequence.
The Parnassus Zone is part of the western Pelagonian carbonate platform until Middle Jurassic time. In the Upper Jurassic, the area of the Beotian Zone settles down (first flysch sedimentation). There after the Parnassus Zone is an indipendent carbonate platform between Beotian Zone and Pindos Zone until the Upper Cretaceous (cf. HOFGEBAUER, 1985). Equivalents of the Parnassus Zone, south of continental Greece, can be identified by sequences of Tithonian or Cretaceous age built up by a neritic facies (RICHTER et al., 1992). They can be distinguished from adjacent areas of Beotian Zone and Pindos Zone showing pelagic facies at the same time (i.e. radiolarites, pelagic limestones, some kinds of flysch sediments) and the eastern Pelagonian zone with stratigraphic gaps (phases of erosion) (JACOBSHAGEN, 1986).
BORGER (1976) described a widespread occurrence of Mesozoic neritic limestones at the Perachora-Peninsula, but clear biostratigraphical results to classify and date these units have not been published until now. This was made possible through our enhanced knowledge of Mesozoic calcareous algae, mainly through the work of DRAGASTAN (1985–90). Parallel to the investigation of biostratigraphical aspects of algae and microproblematika, new systematical aspects of the specimens and groups of algae and microproblematica could be developed.

2. Geological settting

The Mesozoic massive limestones of the Perachora-Peninsula (Fig. 1) are bounded tectonically by deep water sediments of Jurassic and Cretaceous age (i.e. radiolarites, some kinds of flysch sediments) apart from postorogene sequences of the Neogene and the Quarternary.
Samples of red, sometimes clayish, radiolarites from the southcoast of the Perachora-Peninsula (leg. B. SEDAT) yielded an association of Upper Jurassic age: *Mirifusus mediolatatus, Sethocapsa cethia, Triactoma tithonianum* (det. Dr.T.Steiger/Univ. Munich). In other localities we found a radiolarian facies with frequent Sphaerollaria and sparse Nassellaria – probably proximal – basinal facies of Callovian. These Upper Jurassic radiolarites are attributed to the Beotian Zone by BORNOVAS et al.(1984), which on the Perachora-Peninsula is composed of Jurassic to Lower Cretaceous sediments (chiefly radiolarites, pyroclasts, mudstones, different gravity flow sediments; identical to the eohellenic flysch of Tithonian to Lower Cretaceous age (BACHMANN & RISCH, 1976)). Locally, an Upper Cretaceous to Lower Tertiary flysch covers the Mesozoic units (Fig. 1), which southeast of the Vouliagmeni-Lake (southcoast of the Perachora-Peninsula) shows all transitions from normal flysch to a broken formation until a melange formation (Wildflysch sensu BORGER, 1976). Samples of this flysch formation contain nannoplankton of late Paleocene to early Eocene

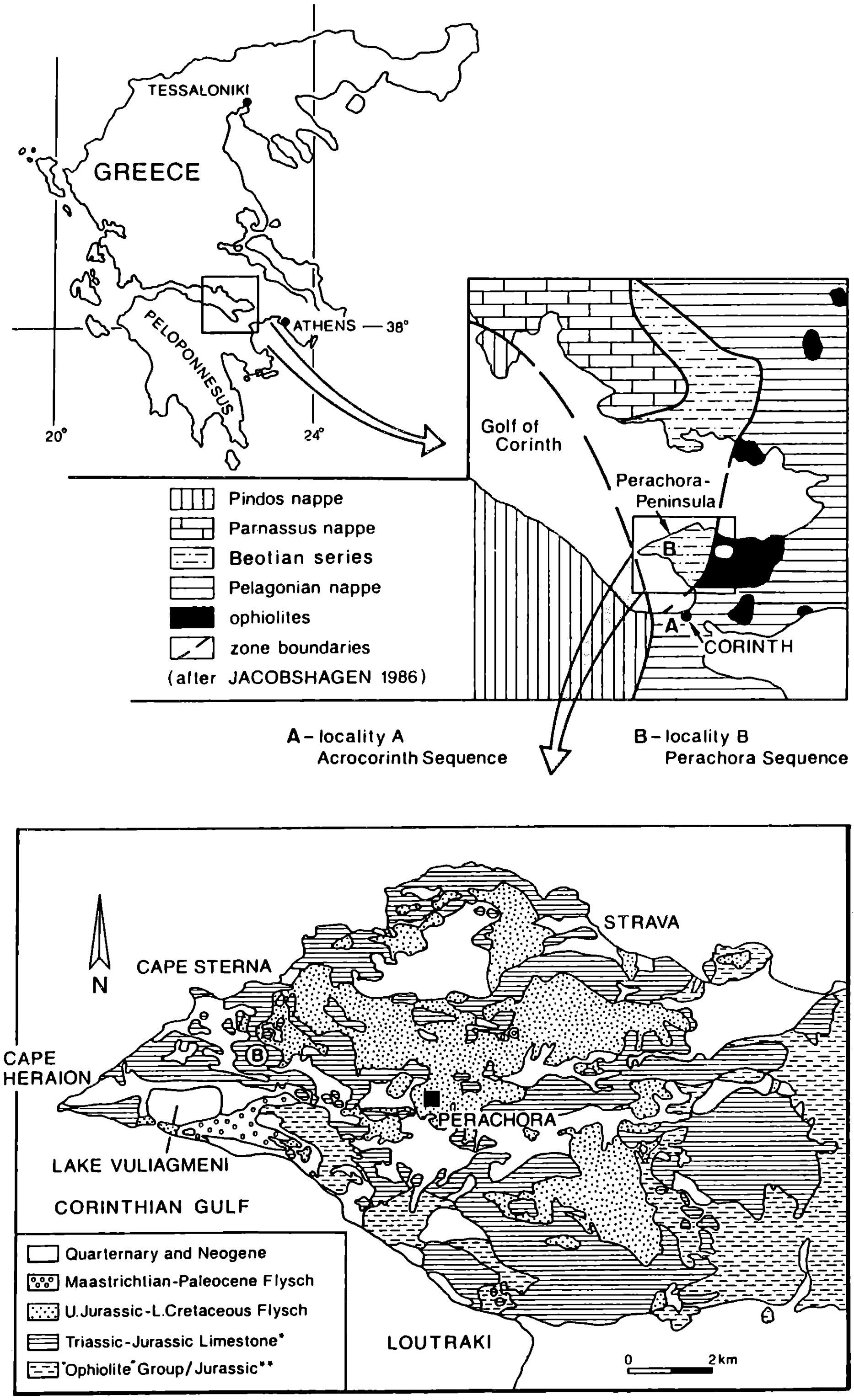


Figure 1: Sketch–map of the study area showing the position of Perachora-Peninsula (Greece). Geological units compiled after BORNOVAS et al. (1984) and new mappings produced by the Bochum working group.

age (M. FILEWICZ pers. comm. to B. SEDAT).
The Mesozoic limestones of the Perachora-Peninsula could be classified as neritic limestones showing shallow water to tidal characteristics with Triassic up to Upper Jurassic age, in addition with "Hornsteinplatten-Kalk" which is built up by pelagic limestones with cherty intercalations, mass flow-units with mainly carbonatic components including volcano-clastic materials and pelagic limestones of Triassic and Jurassic age.
The carbonate sequences studied in this investigation are

Jurassic limestones of tidal character. These limestones occur in one section in the central peninsula (loc. B, Fig. 1). While all other locations are isolated blocks without any sedimentary transitions to the surrounding units (Fig. 1). The facies and biostratigraphical inventory of these isolated limestone-blocks is correlative to identical parts of the main stratigraphical profile west of the village "Perachora" Therefore it is possible to present a generalized lithological column of the Jurassic sequences of the Perachora-Peninsula (Fig. 2), representative for all neritic limestones of the peninsula of Jurassic age.

Macroscopically the 70m thick limestone unit west of the village "Perachora" (loc. B, Fig. 1) consists of mostly structureless, massive bedded to massive limestones. In the sequence, coated grains are the dominating components. Levels with gastropods and cm- to dm-thick radialcalcitic cemented cavities (sheet cracks or solution vugs) are found only occasionally.

The limestones are packstones and wackestones, rich of algae. The components are agglutinated mostly by meniscuous, micritic - pelsparitic links. All gradations to real grapestones can be observed. Similar micritic links of components are described by PURDY (1963), WINLAND & MATTHEWS (1974) and CROS (1979) from recent grapestone-sediments of the Great Bahama Bank. The authors trace back this micritic links to a participation of organic substance (Cyanophyceae). At the Perachora sequence, these links grow prior to a first phreatic/vadose cementation. Therefore, we interpret its genesis in the environment of the coated grain sediments. Following RICHTER et al. (1992) these pseudomenisci can originate in subaquatic areas, because a contacting of components by reason of organogene mucilage (bacteria, algae a.o.) in consequence of the surface tension leads also in aquatic environments to meniscuous character. Finally a syngenetic stabilization through carbonate cementation preserves the links. KALPAKIS & SIDERIS (1981) and STEUBER (1989) described such menisci from the Upper Jurassic/Lower Cretaceous neritic limestones of the Parnassus Zone at Delphi and from the Carnian, lagoonal pelsparites of the Helicon-Mountains, indeed as formations in vadose environments.

Bladed, radiaxial, radialfibrous and blocky cements can be identified, in which the first two types occur as gravitational cements (vadose environment) and as even style cements (phreatic environment). Originally the bladed, radiaxial and radialfibrous cements had a Mg-calcitic composition,as shown frequently by homoaxial mircodolomites, interlayered in the calcite crystals. This is related to a change from Mg-calcite to calcite and dolomite in a closed system, similar to syntaxial overgrowths on echinoderms and to radiaxial cements of the Mississippian of New Mexico (LOHMANN & MEYERS, 1977) or for rimcements of the Middle Triassic Trochitenkalk of northwest Germany (RICHTER, 1985).

Cathodoluminescence-studies clearly indicated that the spectrum of cementation brigdes the eo-, meso- and telogenesis at the Acrocorinth sequence (RICHTER et al., 1992). Thereby, during the eogenesis , meteoric-phreatic phases of cementation could be intercalated in the marine phases of cementation in the surrounding of plane emerged areas of the carbonate platform.

The neritic carbonate sequences of the Perachora-Peninsula must be attributed to the lagoonal facies areas of a carbonate platform, which existed at least from Upper Jurassic to Lower Cretaceous time. With such a neritic character during the Jurassic/Cretaceous transition zone it is probable to relate this carbonate sequences to the Parnassus Zone. Subsidence of this carbonate platform occurred not earlier than during Upper Cretaceous time, whereas the Pindos Zone in the west and the Beotian Zone in the east have been distributive provinces of pelagic environments at the same time (cf. columns of HOFGEBAUER, 1985).

Therefore it is possible to trace the Parnassus Zone from continental Greece over the Perachora-Peninsula to the NE Peloponnesus (Acrocorinth sequence RICHTER et al., 1992).

The Parnassus Zone doesn't occur everywhere, because from the Perachora-Peninsula, southward to the Argolis and at least until the island of Hydra, laying directly southeast in front of the Argolis, the unit is part of a melange belt, which take place west of the Pelagonian platform (RICHTER & FÜCHTBAUER, 1981).

Beginning in the uppermost Jurassic, oceanic crust - which was formed in the Beotian Zone – was obducted onto the Pelagonian platform during an eastward subduction of the Beotian ocean basin under the Pelagonian platform. During this collision, parts of the Pindos-, Parnassus-, Beotian- and Pelagonian- Zone were mixed up completely. The theory of a melange sequence will be corroborated by the fact, that the units, containing the investigated sequences, are "swimming" in a matrix of identical age, representing deep water sediments.

3. Biostratigraphy and distribution of algae

Distribution of calcareous algae is strongly controlled by facies. The use of algae for biostratigraphy is restricted to assemblages zones, mainly on the Dasycladaceae (Fig. 7).

Lower Jurassic – The Lias assemblages of Perachora are dominated by dasyclad calcareous algae and benthic foraminifera (Fig. 3). The inner platform biotope is defined by the occurrences of *Palaeodasycladus mediterraneus* (PIA) having a strong calcified thalli and a quantitative predominance of the specimens in the Upper Sinemurian (Fig. 3).

Taking into account the Sinemurian–Pliensbachian range of species and the dominance of specimens in the Upper Sinemurian, the *mediterraneus* has a character of ACME-Zone for this time interval. This algae is well known and widespread in carbonate platform environments of the

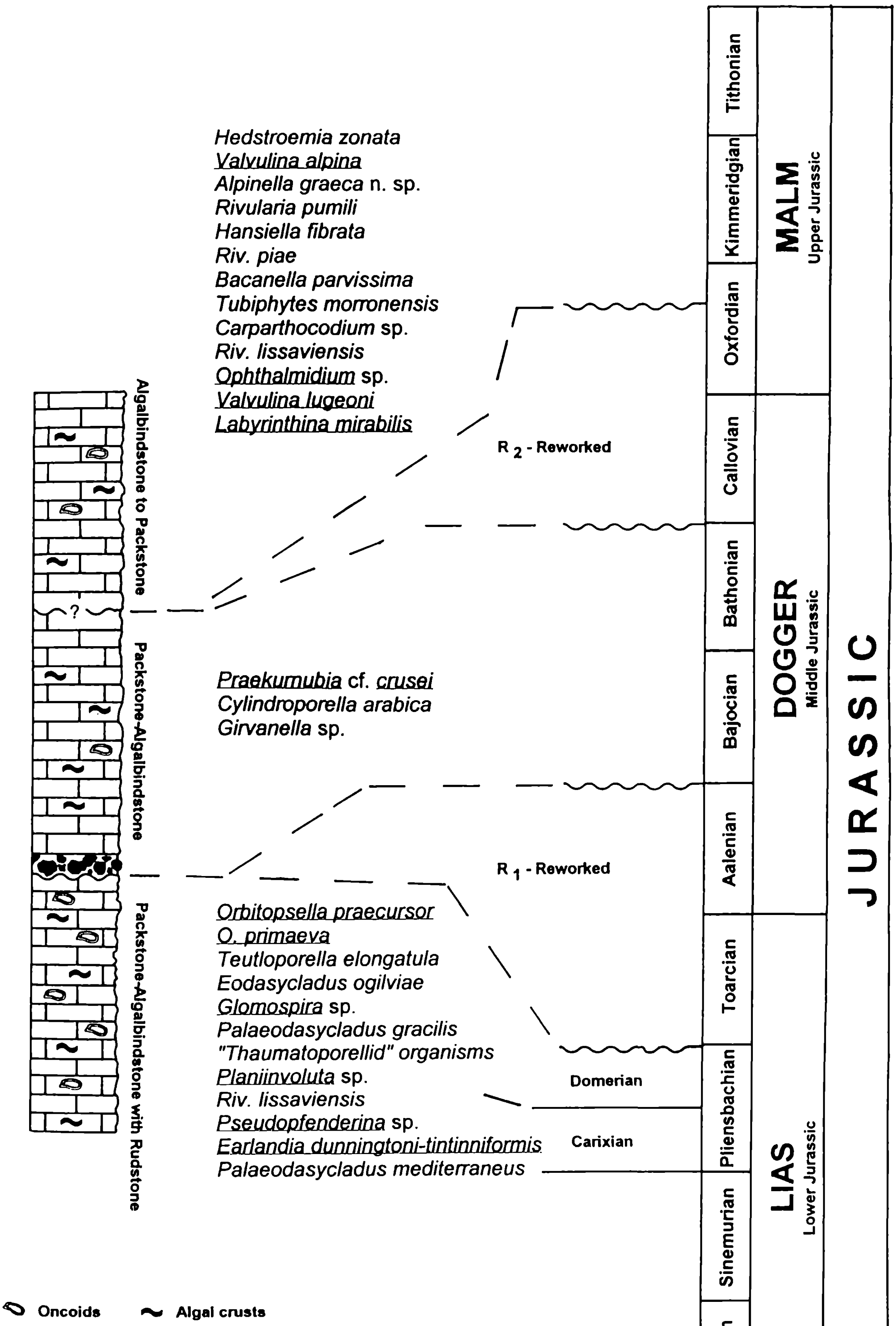


Figure 2: Generalized lithological column of Jurassic sequences in the Perachora-Peninsula (Greece); *Foraminifera*.

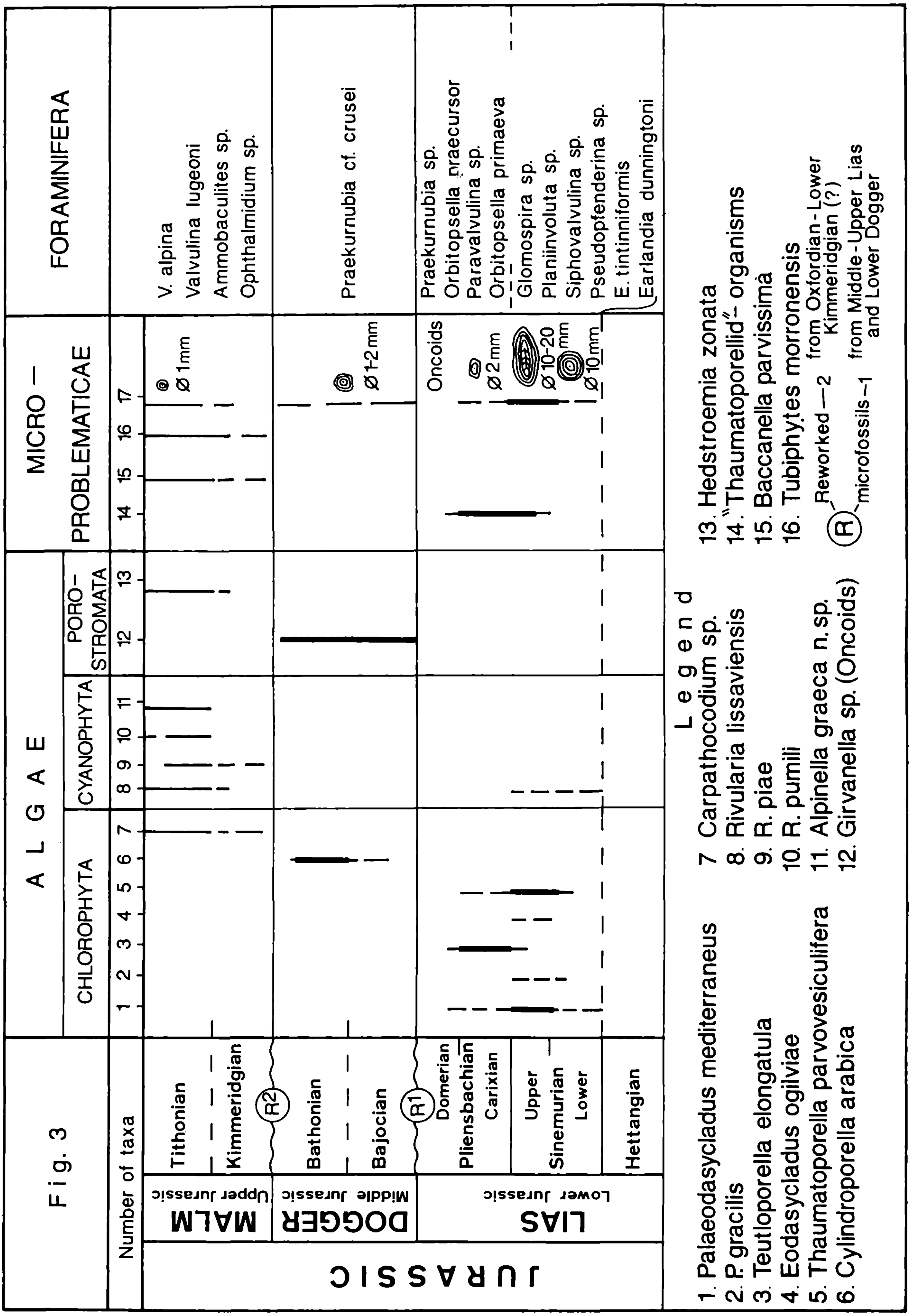


Figure 3: Stratigraphical range of algal-taxa from Perachora-Peninsula.

Mesogean realm, mainly on the southern margin of the Tethys from Southern France, Spain, Italy, Albania, Greece, Turkey, Southern Iran, up to Northern Africa (Tunesia, Algeria, Morocco).

The same large distribution and dominance of this species, in the carbonate platforms can well be distinguished on the Greek territory (Fig. 4).

Palaeodasycladus mediterraneus less frequently appears together with *P. gracilis*(CROS & LEMOINE), a controversial, but valid species, which has been regarded as synonym for *P. mediterraneus* var. *elongatulus* (PRATURLON) by CROS & LEMOINE (1967). The *gracilis* species has a delicate, long, slender thallus with fine polyfurcate branches (I, II, III orders) disposed under an acute angle to the axial cavity. According to CROS & LEMOINE (1967) this species was found in the Sinemurian s. str. (Lotharingian) of the Southern Alps, Spain and Greece.

More rarely, *Eodasycladus ogilviae* (CROS & LEMOINE) appears during this interval, also with strong thalli, a close morphological similarity with *Palaeodasycladus* and the presence of secondary, fertile branches (sporangia). The latter is a distinct feature, clearly observable in the axial – longitudinal section. Other taxa found in the Sinemurian were: *Rivularia lissaviensis* (BORNEMANN), *Thaumatoporella parvovesiculifera* (RAINERI), possibly Chlorophyta, with a cylindrical thalli, large, axial cavity and thick perforated walls.

The benthic foraminifera during Sinemurian are represented by a Triassic stock of genera and species as: *Earlandia tintinniformis* (MISIK), *E. dunningtoni* (ELLIOTT), *Planiinvolutina* sp., *Glomospira* sp. and small renewal stock of Jurassic genera as: *Pseudopfenderina* sp. and *Siphovalvulina* sp.

The Carixian represents a time of decrease of dasycladaceans, also in the Perachora peninsula. During this time, still remain, with rare presences of *P. mediterraneus* and *P. gracilis,* situation which is in contrast with dominance of *Teutloporella elongatula* (PATURLON), a species often found in the oncoid core, sometime conquered totally by the "Thaumatoporellid" organisms.

An index fossil for the Sinemurian/Carixian boundary is the lituolid foraminifer *Orbitopsella primaeva* (HENSON), which apart from the dominance of *Teutloporella elongatula*, corresponds to a Carixian ACME-Zone in the Perachora-Peninsula.

The Carixian/Domerian boundary is marked by the decline of dasycladaceans and the disappearance of *Palaeodasycladus -Eodasycladus* species and *Teutloporella elongatula.* Characteristic for this substage remain the presence of *Orbitopsella praecursor* (GÜMBEL), *Praekurnubia* sp., "Thaumatoporellid" organisms and small oncoids.

Although, generally speaking the Liassic Palaeodasycladus limestone "may be richer in the dasycladaceans remains, up to 60%" (FLÜGEL, 1991).

During the Carixian begins the tendency of decreasing of number of specimens and species continuing up to the Domerian extinction. It is relevant here, that our biostratigaphical scheme bring new data concerning the time-range interval of some dasycladaceans species during the Lias, in comparison with previous one (SARTONI & CRESCENTI, 1962; BASSOULLET & POISSON, 1975; ALTINER & SEPTFONTAINE, 1979; DELOFFRE & LAADILA, 1990).

Middle Jurassic - At the Perachora-Peninsula, the Dogger (Bajocian-Bathonian) assemblage is poor in genera and species, due to the different sources of limestone-blocks and facies zones.

The scarcity in the dascladaceans genera and species and other group of algae is so evident, not only for Perachora, but also for Greek territory (Fig. 5).

Selliporella donezellii (SARTONI & CRESCENTI) described and figured as *Actinoporella* sp. by CELET (1962) in the Parnassos and *Neoteutloporella gallaeformis* (RADOICIC) from Euböa (BASSOULLET & GUERNET, 1970) are the main index species for Dogger.

The Dogger assemblage from Perachora-Peninsula contains *Cylindroporella arabica* ELLIOTT, *Praekurnubia* cf. *crusei* REDMOND and *Girvanella* sp. The predominance of *Girvanella* and scarcity of dasyclad *Cylindroporella arabica* give this assemblage an antithectical character (Fig. 7).

Cylindroporella arabica was cited from Bathonian by ELLIOTT (1975). The *Girvanella* oncoids were frequently cited in the english Dogger and *Praekurnubia* cf. *crusei,* a foraminifer has a stratigraphical range of Upper Bajocian–Bathonian–Callovian (SEPTFONTAINE, 1980).

The base of the Dogger sequence is build up by a breccia, which included reworked limestone-clasts, containing *Palaeodasycladus–Uragiella* species and foraminifera of Middle–Upper Lias and Lower Dogger in age (R 1, Fig. 3).

Upper Jurassic – The most commonly found algae during Malm are dasycladaceans, some codiaceans and cyanophyceans. The dasyclads species *Clypeina jurassica* FAVRE, *C. ? delphica* CARRAS, *Pseudoclypeina distomensis* BARATTOLO & CARRAS, *Salpingoporella pygmaea* (GÜMBEL) and *Teutloporella obsoleta* CAROZZI (Fig. 6) – only described or figured species are cited – can be recognized in a vast carbonate platform area (Parnassos) on the Greek territory.

In contrast with this general distribution of dasyclads, only cyanophyceans (*Rivularia, Alpinella*) and codiaceans (*Hansiella, Carpathocodium* sp.) prevail at the Perachora-Peninsula. The occurrences of foraminifera (*Labyrinthina, Valvulina*) and microproblematicae (*Tubiphytes, Baccanella*) are subordinate compared to that of algae.

The stratigraphical range of the *Rivularia* species shows a greater variance, for: *R. lissaviensis* (BORNEMANN) from Ladinian to Lower Aptian and for *R. piae* (FROLLO) from Lower Jurassic to the Upper Cretaceous.

Rivularia pumili DRAGASTAN has a short, stratigraphical range of Tithonian age. This species was found in the Transylvanian carbonate platform from Eastern Carpathians (DRAGASTAN, 1988).

Calcareous Algae described from the Lias of Greece

P — *Palaeodasycladus mediterraneus*
AUBOUIN (1959) - Epyrus, Thessalia
CELET (1962) - Koukos Mts. (Tithoera)
OROMBELLI & POZZI (1967) - Rhodos Island
CHRISTODOULOU (1969) - Symi (Simi) Beotia
BASSOULLET & GUERNET (1970) - Beotia
DERCOURT(1964) - Argolis
BACHMANN & RISCH (1979) - Argolis
FLÜGEL (1983) - Korfu Island
This paper - Perachora

P_g — *P. gracilis*
This paper - Perachora

P_b — *P. barrabei*
HERAK (1967) - Chios Island

S — *Sestrosphaera liasina*
CHRISTODOULOU (1969) - Euböa

T — *Tersella alpina*
CHRISTODOULOU (1969) - Euböa

D — *Dissocladella cretica*
CREUTZBURG & PAPASTAMATIOU (1967) - Crete

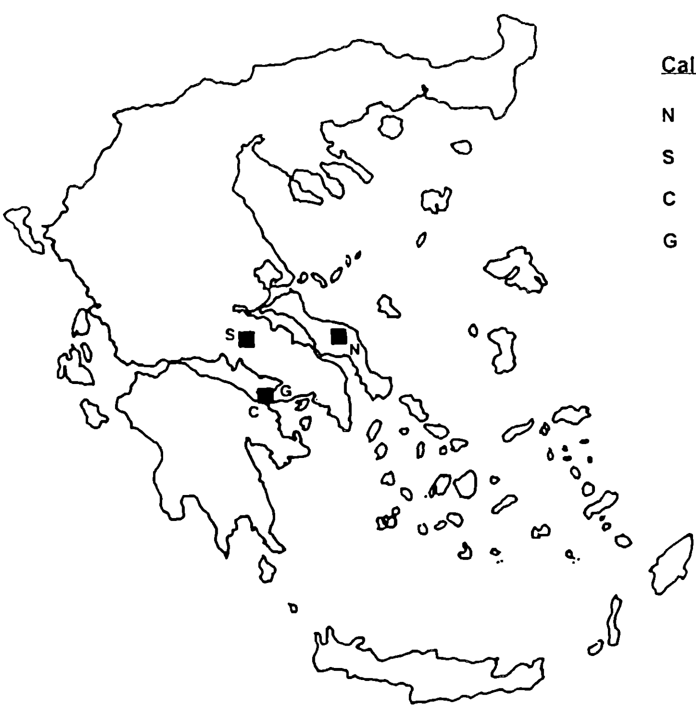
Te — *Teutloporella elongatula* former *P. elongatulus*
CROS & LEMOINE (1967) - Peloponnesus
FLÜGEL (1983) - Korfu Island
This paper - Perachora

U — *Uragiella liasica*
FLÜGEL (1983) - Korfu Island

E — *Eodasycladus ogilviae*
This paper - Perachora

R — Porostromata
FLÜGEL (1983) - Korfu Island
This paper - Perachora

Figure 4: Distribution of calcareous algae described in the Lias of Greece.



Calcareous Algae described from the Dogger of Greece

N — *Neoteutloporella gallaeformis*
BASSOULLET & GUERNET (1970) - Euböa

S — *Selliporella donezelli* (described as *Actinoporella*)
CELET (1962) - Pr. Ilias Vlachi

C — *Cylindroporella arabica*
This paper - Perachora

G — *Girvanella* sp.
This paper - Perachora

Figure 5: Distribution of calcareous algae described in the Dogger of Greece.

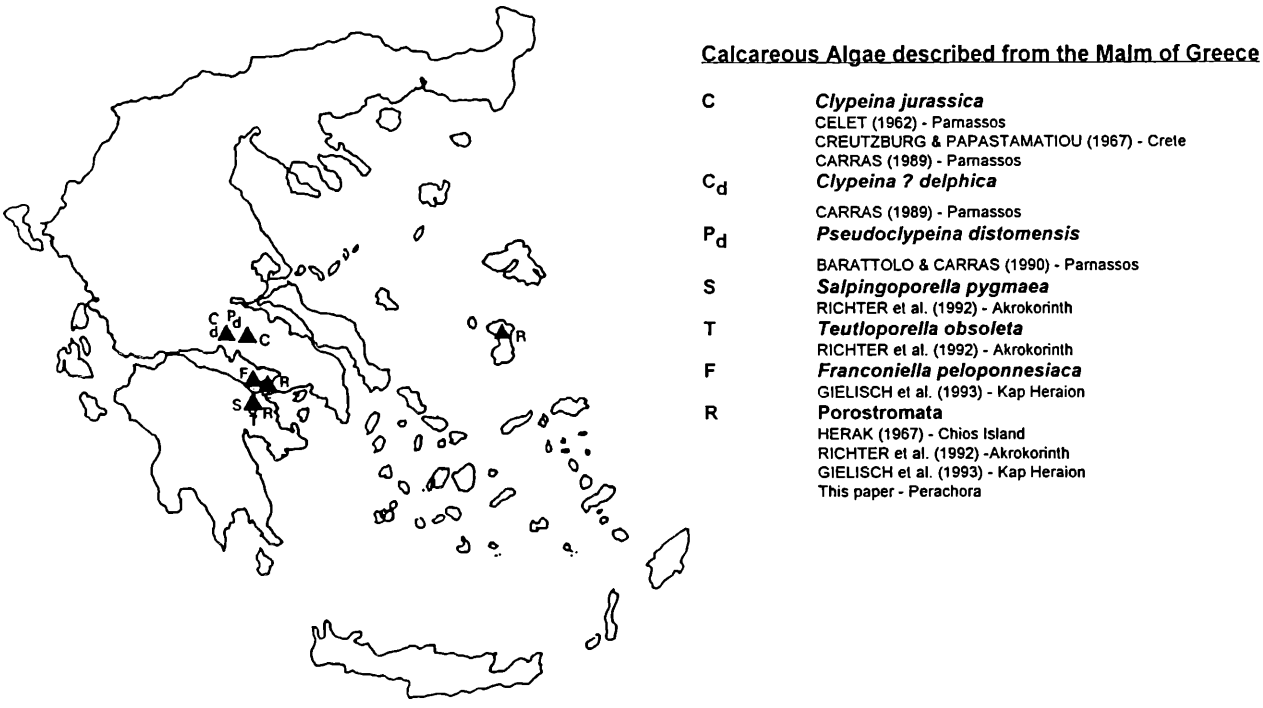


Figure 6: Distribution of calcareous algae described in the Malm of Greece.

The scytonematacean alga *Alpinella graeca* n. sp. was first described from the Tithonian of Bucegi Mts. (Saint Ana Boulders – 1100 m), Eastern Carpathians, having the same age at Perachora and cross over the Jurassic/Cretaceous boundary, in the Berriasian of Bicaz Gorges, Eastern Carpathians. In the Bicaz Gorges, the new species occurs in a micrite-pelmicrite facies together with *Trocholina alpina–elongata* (LEUPOLD), *Gaudriyna* cf. *ectypa* ARNAUD-VARNNEAU and "*Conicospirillina*" *basiliensis* MOHLER (DRAGASTAN, 1992).

Hansiella fibrata DRAGASTAN, a codiacean, has an Upper Oxfordian-Kimmeridgian stratigraphic range. This species often appears to be "in association" with *Labyrinthina mirabilis* WEYNSCHENK, *Parurgonina celinensis* CUVILLIER et al., *Heteroporella anici* (NIKLER & SOKAC) and debris of *Thecosmilia dichotoma* GOLDFUSS from Dimbovicioara Basin, Eastern Carpathians (DRAGASTAN, 1990).

A foraminifera assemblage with *Labyrinthina mirabilis* WEYNSCHENK, *Valvulina lugeoni* SEPTFONTAINE, *V. alpina* DRAGASTAN, *Ophthalmidium* sp. represents the same Malmian interval (SEPTFONTAINE, 1980; SOTAK, 1989; DRAGASTAN, 1990).

The occurrence of some reworked deposit with *Saccocoma*, a planctonic crinoid, which has an Upper Oxfordian–Kimmeridgian–Lower Tithonian stratigraphical range, could be an argument in favour of time – of emersion and erosion of the Parnassos platform during the Lower Malm (Oxfordian). This could maen that parts of the Perachora-Peninsula belong to the Parnassos Platform (b_2-bauxite-level).

The occurence of *Tubiphytes morronensis* CRESCENTI and *Baccanella parvissima* (DRAGASTAN), in organic reefs area could point at an Oxfordian – Lower Kimmeridgian age (TURNSEK et al., 1981) or a Kimmeridgian – Tithonian age (FLÜGEL, 1991).

4. Paleoecology

Areas built up by Jurassic carbonate platform are connected to very complex basins. Due to this, the ecological assemblages cannot be easily deduced, considering the framework and position of the "platforms" in the Hellenides. The assemblages could be considered indicative of the inner platform, lagoonal facies with the transitions to the outer carbonate platform at the end of Domerian and perhaps in the Upper Jurassic.

During a Liassic transgressive phase, concomitant with reduced subsidence, supra–inter– and subtidal zones (Fig. 9) can be distinguished on the shelf area.

The convolute stromatolite, planar algal-laminite and oncoids occurred in the Sinemurian supratidal zone under modest water energy, trapping sediments and binding shell-debris (Ostracods) (Fig.8). The depositional area was close to shorelines, having quiet waters sedimentation and possibly a brackish influence (Fig. 9).

Starting in the Upper Sinemurian up to the Domerian, subsidence of the shelf increased. This, affected the distribution of algae in the lagoon and in the coastal subtidal environments (Fig. 9). In the intertidal zone, mainly dasyclads (*Palaeodasycladus, Eodasycladus*) are present, having their maximum development in the Upper Sine-

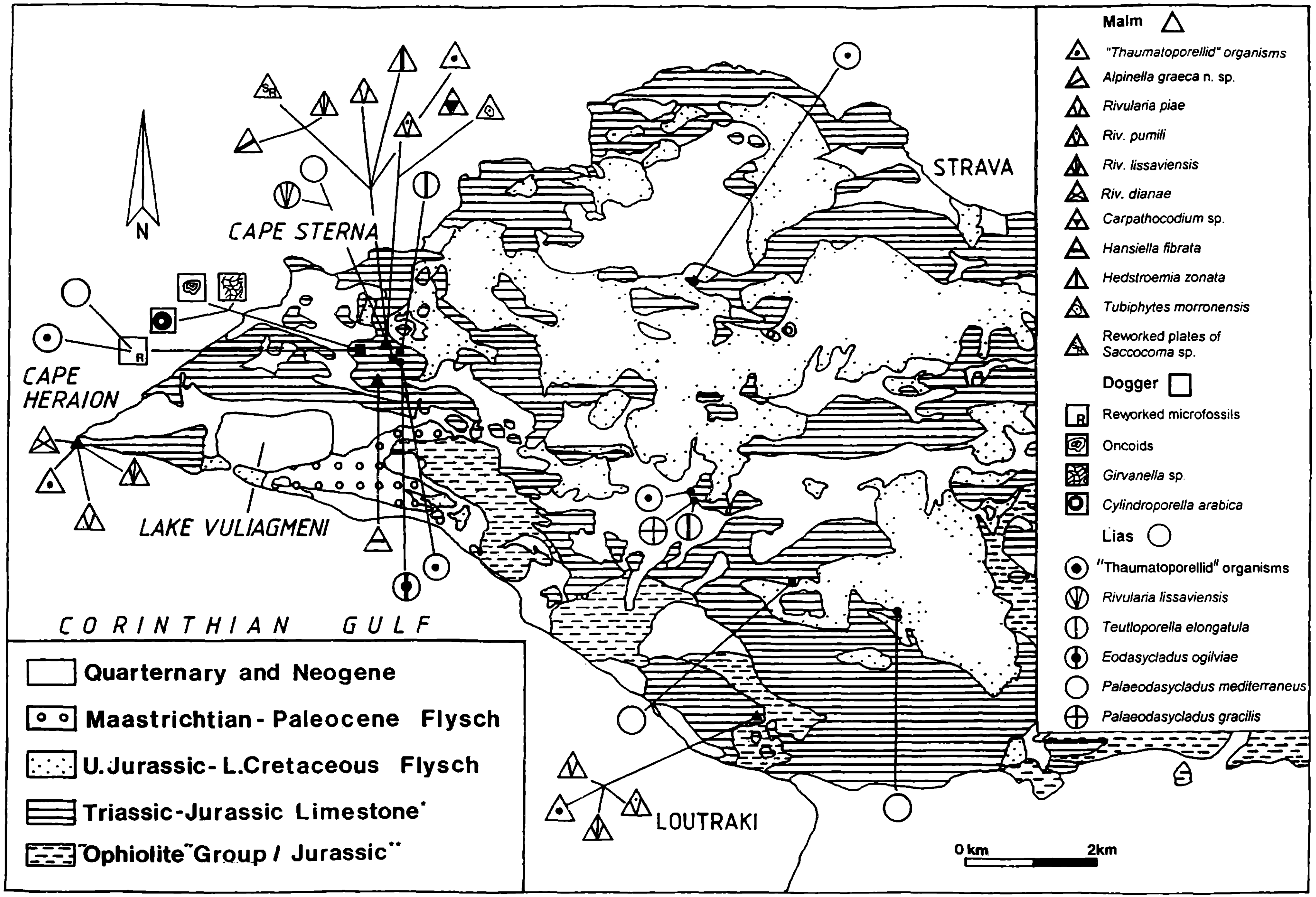


Figure 7: Distribution of calcareous algae described in the Jurassic of Perachora-Peninsula (Greece).

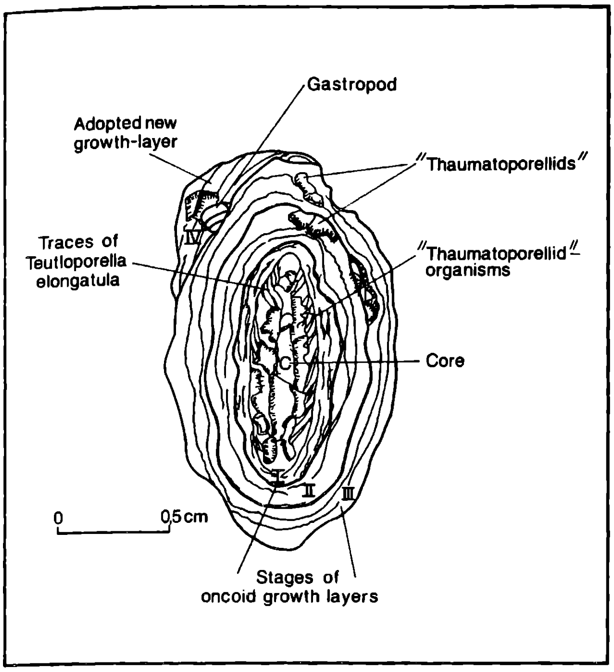


Figure 8: The inner structure of a Lias oncoid and stages of trapping of sediments and binding of organisms (gastropods).

murian. Apart from dasyclads, shell debris of gastropods, pelecypods and echinoderms can be observed. The fenestral fabrics are developed in the high intertidal zone. The "Thaumatoporellid" organisms are very common in the intertidal, lagoonal and also, in the coastal, subtidal environments. These organisms could indicate the transition from inter- to subtidal zones. Oncoids, with a diameter of up to 30 mm were concentrated in the lagoon of low intertidal zone, showing stages of trapping of sediments and binding organisms like "Thaumatoporellids" and gastropods shells (Fig. 9). According to BARATTOLO (1991) the *Palaeodasycladus* - assemblages can be found in high energy environments.These can be sometimes tolerant to brackish conditions, facts which explain the lower species diversity. The *Palaeodasycladus* is an indicator of the lagoonal and close to the shelf margin facies.

The Carixian/Domerian orbitopsellids, together with *Siphovalvulina, Paravalvulina, Praekurnubia* are considered indicative of the subtidal environment (Fig. 9). The presence of "Thaumatoporellid" organisms point to the subtidal, shallow-water conditions, near the coastal line. The same inner platform distribution on small "ridges-substratum" was considered by DARGA & SCHLAGINTWEIT (1991).

The Dogger interval corresponds to a regressive phase with breccia deposits, oncoids and full of "ball"-forming *Girvanella* of the supratidal environment. The *Girvanella* occurs throughout the whole range of the photic zones in settings including restricted lagoons, carbonate shelfs and ramps (MAMET, 1991). The scarcity of dasyclads thalli (*Cylindroporella arabica*) and foraminifera, together with small oncoids and fenestral fabric commonly occur in of the intertidal-lagoon environment (Fig. 9).

A regressive tendency is clearly indicated during the Upper Jurassic. The dominance of *Rivularia* species, scytonemataceans and oncoids are indicative of intertidal conditions (Fig. 9). The presence of *Rivularia* and *Alpinella* species indicate a zone situated between low tide level and highest tide level. This very shallow environment could be the reason for the absence of the dasyclads in the assemblage of the basin. *Tubiphytes* formed an organic framework within the subtidal environment on a presumed ridge of the inner platform. The peri-reefal biota consists of *Rivularia pumili,* small thalli fixed on *Tubiphytes morronensis* oncoids and codiaceans represented by *Hansiella fibrata* and debris of *Carpathocodium* sp. The presence of reworked plates of *Saccocoma* are indicative for on open marine influence within a shallow subtidal environment.

5. Systematic description

Division CHLOROPHYTA
Family Dasycladaceae KÜTZING 1843
Tribe Triploporelleae (PIA 1920)
BASSOULLET et al. 1979

Palaeodasycladus (PIA 1920) PIA 1927

Palaeodasycladus mediterraneus (PIA 1920) PIA 1927 emend.DELOFFRE & LAADILA 1990

(Pl. 1, Figs. 1–2; Pl. 2, Fig. 1)

Palaeodasycladus mediterraneus: n. gen. n.sp. 1920 PIA, Pl. VI, Fig. 1–5, Calabria, Italy; 1927 PIA in HIRMER, Fig./texte 62; 1959 AUBOUIN, Pl. 22, Fig. 1–2, Epyrus, Thessalia; 1967 OROMBELLI & POZZI, Pl.41, Fig.1, Rhodos Island; 1969 CRISTODOULOU, Pl.1, Fig. 1–2, Simi (Dodecanese); Pl. 9, Fig. 1–2; Pl. 10 g, Fig. 1, Beotia; 1970 BASSOULLET & GUERNET, Pl. 1, Fig. 8, Beotia; 1965 DERCOURT in CROS & LEMOINE 1966, Peloponnese, NF; 1979 BACHMANN & RISCH in SCHÄFER & SENOWBARI–DARYAN (1983) Argolis and Hydra, NF.; 1983 FLÜGEL, Taf. 46/5–9, Taf. 47/1–6, Northeastern Korfu.

H y p o t y p e s : Pl. 1, Fig. 1–2; Pl. 2, Fig. 1, Upper Sinemurian–Carixian, Ruhr University Bochum, Institute of Geology, Coll. No. 11400 (Pl.1, Fig. 1), 11402 (Pl.1, Fig. 2), 11401 (Pl.2, Fig.1), Perachora–Peninsula, Greece.

D e s c r i p t i o n Thallus composed by a claviform-shaped head and more cylindrical elongated stem crossed by narrow axial cavity. The three orders branches are strinkingly inclined to the vertical axis. The primary were large, phloiophorous having a diameter increasing distally, secondary small branches arranged in tufts and to the exterior a third division of short, tubular-filamentous branches, also disposed in tufts. At some stratigraphical levels, the specimens present the walls strongly calcified like a palisadic zone sensu DELOFFRE & LAADILA (1990) function of energy of environment. Sporangia are not observed.

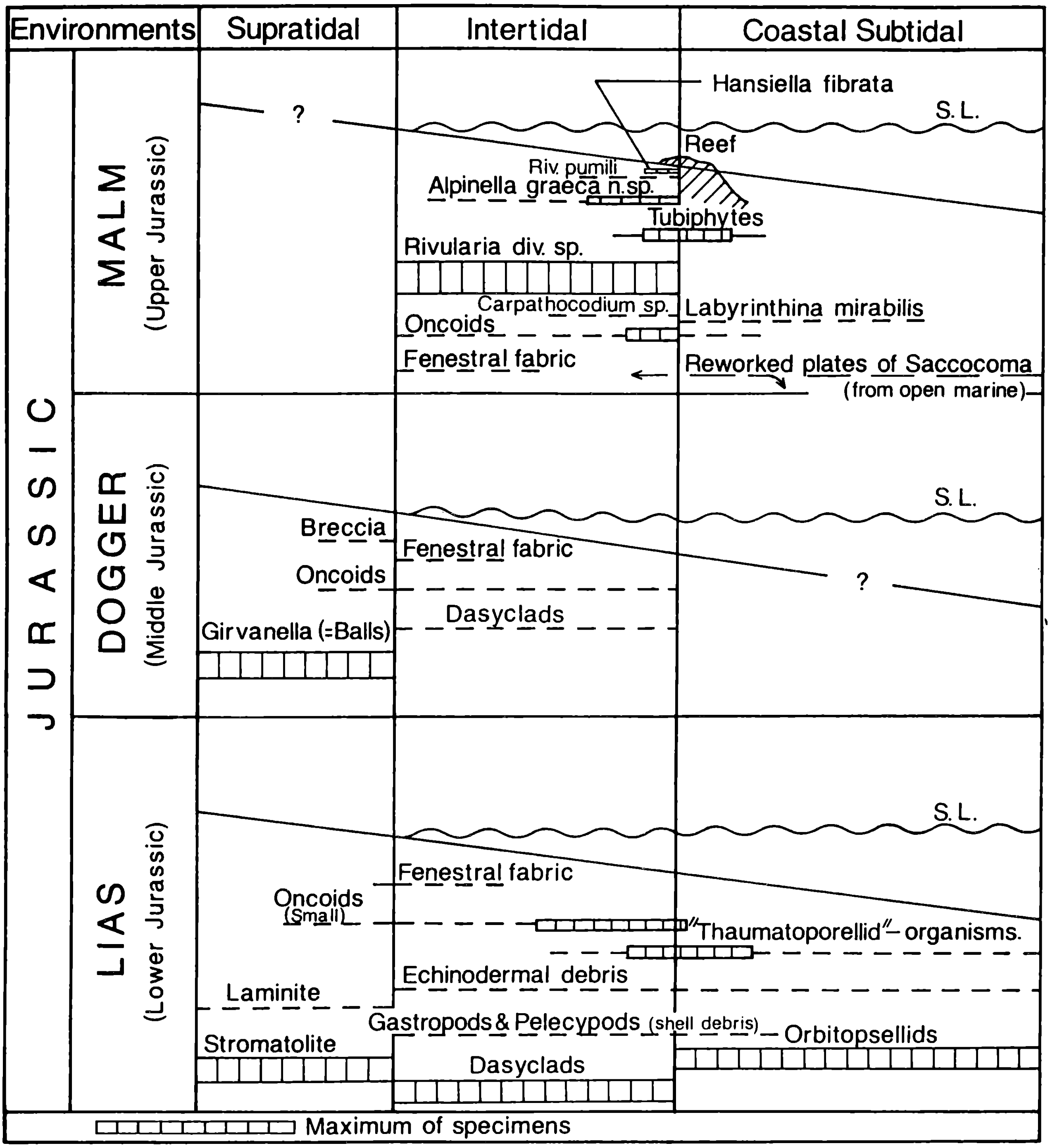


Figure 9: Relationships of algae with depositional environments and idealized evolution of the Jurassic Parnassos carbonate platform.

Dimensions in mm:	1	2		3
		Head	Stem	
Outer diameter (D)	1.0 -2.20	4.81–9.10	2.30–2.60	0.80 – 2.20
Inner diameter (d)	0.38–0.60	2.73–7.54	0.91–1.56	0.45 – 0.65
Length of primary branches (lp_1)				0.40 – 0.45
Diameter of primary branches (dp_1)				0.090–0.12
Length of secondary branches (lp_2)			–	0.25 – 0.27
Diameter of secondary branches (dp_2)	–			0.030–0.045

Dimensions in mm:	1	2		3
		Head	Stem	
Length of tertiary branches (lp_3)		0.52	0.65	0.45 – 0.50
Diameter of tertiary branches (dp_3)		0.26		0.18 – 0.20
Number of branches per whorl (w)				24 (30)

(1 = PIA, 1920; 2 = DELOFFRE & LAADILA, 1990; 3 = Perachora)

Stratigraphical range: ACME Zone in the Upper Sinemurian, Perachora, Greece.

Palaeodasycladus gracilis (CROS & LEMOINE 1967) DRAGASTAN, GIELISCH, RICHTER, GREWER, KAZIUR, KUBE & RADUSCH (Pl. 1, Fig. 7)

Palaeodasycladus gracilis n.sp. 1967 CROS & LEMOINE, p. 251, Pl. 1, Fig. 2–4, 7, Upper Sinemurian, Alps (Dolomites).

H y p o t y p e s : Pl. 1, Fig. 7, Upper Sinemurian, Ruhr University Bochum, Institute of Geology, Coll. No. 11403, Perachora-Peninsula, Greece.

D e s c r i p t i o n : Thallus cylindrical, delicate, moderately long crossed by narrow axial cavity with clear, but not so deep interannulations. The branches arranged in the euspondyle manner are strikingly inclined to the longitudinal axis after a constant angle of 80°

According to CROS & LEMOINE (1967) the branches of three orders of divisions are fine, show a characteristic linear, directional disposition. This was also present by authors in the essay of reconstruction of branches at pages 251, Fig. 4.

The primary branches are long, phloiophorous and secondary acrophorous having in the proximal and distal extremities the same diameter. The secondary are disposed in tufts.

The tertiary branches are tubular, short, filiform, also arranged in tufts.

The main features of this species are: cylindrical shape of thallus, delicate, fine aspect of branches, linear, directional disposition, not constricted branches.

The *gracilis* species was not found in the same level with *Palaeodasycladus mediterraneus* (PIA). The last one is a species showing a great variability of thalli shape in the Greek material. The small cylindrical thalli of "*mediterraneus*" could be regarded like a subspecies, segregation influenced by different ecological niches.

Dimensions in mm:

Length of thallus	2.0–3.1
Outer diameter (D)	0.60–0.90 (1.0)
Inner diameter (d)	0.16–0.30
Length of primar branches (lp_1)	0.16–0.27
Diameter of primary branches (dp_1)	0.024–0.050
Length of secondar branches (lp_2)	0.16–0.18
Diameter of secondar branches (dp_2)	0.020–0.025
Length of tertiar branches (lp_3)	0.090–0.10
Diameter of tertiar branches (dp_3)	0.010–0.015
Distance between whorls (H)	0.090–0.10

R e m a r k s : Taking into account the original material of CROS & LEMOINE (1967) the specimen figured at plate 1, Fig. 2 is characteristic and can be designated as holotype. *Palaeodasycladus mediterraneus* (PIA) is different by shape of thallus separated in two parts head and stem, by presence of the palisade zone, by presence of constricted branches divided in small articles disposed after a variable angle of 50°–70°. This species has a great variability of shape and dimensions. The small specimens could be represent a subspecies, segregated from the *mediterraneus* population.

S t r a t i g r a p h i c a l r a n g e : Upper Sinemurian, Perachora-Peninsula, Greece.

Eodasycladus CROS & LEMOINE 1967 *Eodasycladus ogilviae* CROS & LEMOINE 1967 (Pl. 1, Fig. 5)

Eodasycladus ogilviae: n.sp. 1967 CROS & LEMOINE, p.162, Pl. 1, Fig. 3–7, Upper Sinermurian, Alps (Dolomites).

H y p o t y p e s : Pl. 1, Fig. 5, Upper Sinemurian, Ruhr University Bochum, Institute of Geology, Coll. No. 11402, Perachora-Peninsula, Greece.

Description: Tangential vertical section in the thallus which show clear annulation, a large axial cavity and three orders of branches disposed in tufts. The secondaries were disposed 5 in a tuft. No fertile parts were observed.

Dimensions in mm:

Length of thallus:	4.10
D	1.15
Distance between whorls:	0.12 – 0.14

S t r a t i g r a p h i c a l r a n g e Upper Sinemurian, Perachora-Peninsula, Greece.

Family Seletonellaceae (KORDE 1950) BASSOULLET et al. 1975 Tribe Dasyporelleae (PIA 1920) BASSOULLET et al. 1979

Teutloporella PIA 1912 *Teutloporella elongatula* (PRATURLON 1966) SOKAC & NIKLER 1967 (Pl. 1, Figs. 3–4, 6)

Palaeodasycladus mediterraneus (PIA) *elongatulus*: n. var. 1966 PRATURLON, p. 169, Fig. 1, Lias, Latium, Italy; *P. elongatulus*, in CROS & LEMOINE, p. 252, Dercourt's samples, not figured, Peloponnes, Greece; *Teutloporella elongatula* (PRATURLON 1966) 1967, SOKAC & NIKLER, Pl. I–IV, Middle Lias, Velebit Mts., Croatia.

H y p o t y p e s : Pl. 1, Fig. 3–4, 6, Carixian, Ruhr University Bochum, Institute of Geology, Coll. No. 11404 (Pl. 1, Fig. 3–4), 11400 (Pl. 1, Fig. 6), Perachora-Peninsula, Greece.

D e s c r i p t i o n : Thallus cylindro-conic, more or less elongated, crossed by an axial cavity and deeply annulations which cut the walls into segments. The branches, only primary are trichophorous and disposed near vertical, parallel to the axis of thallus. They are fine, slender, long having in the proximal part a large diameter.

Dimensions in mm:

D:	1.0–1.2	
d:	0.30–0.45	
lp_1:	0.20–0.60	
dp_1:	0.060–0.10	(proximal)
	0.020–0.030	(distal)

Remarks: The specimens of Perachora have cylindrical thalli with segments (deep annulation) crossed by a narrow, axial cavity, which in many cases growed together with "Thaumatoporellid" organisms (Types B or C). The branches are long, slender disposed vertical up to parallel, to the axis and doesn't present polytomic division. The branches, only primary, are trichophorous, typical for the genus *Teutloporella* PIA.

We consider that, the PRATURLON's original (Figure 1) and sure, some specimens figured by SOKAC & NIKLER (1967) at Pl. I, Fig.1–3, Pl. II, Fig.1–4, Pl. III, Fig.1–4, from Lias of Latium and Velebit have the same morphological features and "Thaumatoporellids" organisms in the or on the thalli, belong to *Teutloporella elongatula* (PRATURLON) SOKAC & NIKLER 1967.

There is an interrelationship between alga and microproblematicum, like a commensalism (vital processes) or like a "parasitism" in time of life or post mortem.

Palaeodasycladus gracilis described by CROS & LEMOINE (1967) remain a valid species characterized by the presence of whorls with primary phloiophorous, secondary acrophorous and tertiary fine, short, filiform, tubular branches. The branches are not disposed vertically, but under an acute angles to the axis of thallus. The axial cavity is empty without "Thaumatoporellid" organisms. The thalli presents also an intusannulation, not so deep to segregate into segments. It is a phenomenon of homologies morphology between thalli with different characters and which belong to distinct genera.

Stratigraphical range: ACME in the Carixian, Perachora-Peninsula, Greece.

Family Dasycladaceae KÜTZING, 1843
Tribe Cylindroporelleae PAL 1976

Cylindroporella JOHNSON 1954
Cylindroporella arabica ELLIOTT 1957
(Pl. 2, Fig. 2)

Cylindroporella arabica: n.sp. 1957 ELLIOTT, Pl. I, Fig. 13–16, Upper Jurassic, Qatar; 1975 ELLIOTT, Pl. 50, Fig. 2–4, Bathonian, England.

Hypotypes: Pl. 2, Fig. 2 , Middle Jurassic, Ruhr University Bochum, Institute of Geology, Coll. No. 11405, Perachora-Peninsula, Greece.

Description: Cross-section in a cylindrical thallus with small, axial cavity and 6 to 8 alternanting fertile/sterile branches in a whorl. The fertiles are round and have a large diameter.

Dimensions in mm:

D:	0.46	
d:	0.18	
	0.070–0.090	(diameter of fertile branches)
w:	6–8	

Stratigraphical range: Bajocian-Bathonian, Perachora-Peninsula, Greece.

Division CYANOPHYTHA
Family Rivulariaceae RABENHORST 1865

Rivularia (ROTH 1802) AGARDH 1824
Rivularia lissaviensis (BORNEMANN 1887) DRAGASTAN 1985
(Pl. 2 , Fig. 5)

Zonotrichites lissaviensis n.gen. n.sp., 1887 BORNEMANN, Taf.V, Fig. 1–2, Taf. VI, Fig. 1–2, Upper Triassic, Poland; *Rivularia lissaviensis* (BORNEMANN 1985, Pl. I, Fig. 1–3, Pl. III, Fig. 1–6, Pl.V, Fig. 1–5, Pl. VI, Fig. 1–2, Pl. VII, Fig. 1–4, Pl. VIII, Fig. 1–5; 1991 DARGA & SCHLAGINWEIT, Taf. 3, Fig. 10.

Hypotypes: Pl. 2, Fig. 5, Upper Jurassic; Ruhr University Bochum, Institute of Geology, Coll. No. 11406, Perachora-Peninsula, Greece.

Description: Thallus hemisphaerical or fan like with flaring borders crossed by tubes-"filaments" of dichotomic axial-close-isotomic type. The growth zones occur often at some specimens in the Upper Jurassic.

Dimensions in mm:

Width of thallus :	10
Height of thallus:	9.0
Diameter of "filaments":	0.030–0.045
Thickness of walls:	0.010
Angle of divergence:	5° (10°)

Stratigraphical range: Jurassic, Perachora-Peninsula, Greece.

Rivularia piae (FROLLO 1938) DRAGASTAN 1985
(Pl. 2, Fig. 6)

Cayeuxia piae n. gen. n.sp. 1938, FROLLO, p.264, Pl. 18, Tithonian, Bicaz Gorges, Eastern Carpathians, Romania; *Rivularia piae* (FROLLO 1938) 1985 DRAGASTAN, Pl. III, Fig. 5–6, Pl. IX, Fig. 1–5, Pl. X, Fig. 1–2.

Hypotypes: Pl. 2, Fig. 6, Upper Jurassic, Ruhr University Bochum, Institute of Geology, Coll. No. 11407, Perachora-Peninsula, Greece.

Description: Thallus subsphaerical or ellipsoidal, sometime with erect growing crossed by V-shaped pseudobifurcate tubes-"filaments", dichotomic close-isotomic generating a compact inner structure.

Dimensions in mm:

Width of thallus :	4.0
Height of thallus:	2.5
Diameter of "filaments":	0.075 (0.090)
Angle of divergence:	under 10°

Stratigraphical range: Upper Jurassic, Perachora-Peninsula, Greece.

Rivularia pumili DRAGASTAN 1988
(Pl. 2, Fig. 7)

Rivularia pumili n.sp. 1988 DRAGASTAN, Pl. I, Fig. 3–4, Tithonian, Giuvala Massif, Dimbovicioara Basin, Eastern Carpathians, Romania.

Hypotypes: Pl. 2, Fig. 7, Upper Jurassic, Ruhr University Bochum, Institute of Geology, Coll. No. 11406, Perachora-Peninsula, Greece.

Description: Small hemisphaerical thallus fixed on the surface of oncoids. The dichotomic, fine tubes-"filaments" of one or maximum two series have a sinous contur and are filled with coarsely crystalline calcite.

Dimensions in mm:

Width of thallus :	0.63
Height of thallus:	0.54
Diameter of "filaments":	0.040–0.045
Angle of divergence:	3°–5°

Stratigraphical range: Tithonian, Perachora-Peninsula, Greece.

Family Scytonemataceae KÜTZING 1843

Alpinella DRAGASTAN 1988

Alpinella graeca n.sp.

(Pl. 3, Figs. 1–5)

Alpinella n.sp. 1992 DRAGASTAN, Pl. IV, Fig. 1–3, Berriasian, Fagetul Ciucului, Bicaz Gorges, Eastern Carpathians, Romania.

Holotypes: Pl. 3, Fig. 1, Upper Jurassic (Tithonian), Ruhr University Bochum, Institute of Geology, Coll. No. 11406, Perachora-Peninsula, Greece.

Syntypes Pl. 3, Fig. 2–3 , Berriasian, Fagetul Ciucului, Bicaz Gorges, Eastern Carpathians, Romania; Pl. 3, Fig. 4–5, Tithonian, Saint Ana Boulder (1100m), Bucegi Mts., Southern Carpathians, Romania, University of Bucharest, Laboratory of Paleontology, Coll. L.P.B. V No. 0713 and No. 0714.

Derivatio nominis: "graeca" from the Greek territory.

Diagnosis: Hemisphaerical thallus crossed by dichotomic "filaments" of large diameter with a basal part like a fork and two long, tubular branches. The main features of the species are the presence of the sphaeroidal "hormogonia" at the distal part of the "filaments" and sometimes horizontal "partitions" preserved in micrite as traces of cells-trichome.

Description: Thallus hemisphaerical crossed by dichotomic long "filaments" radially disposed. The dichotomic "filaments" have in the basal part a forklike shape. The dichotomic branches are long, sometimes with large sinuosities and horizontal "partitions" The main feature of the species is the precence of "hormogonia" "Hormogonia" are disposed at the tips of some specialized branches, mainly in the central or in the outer margin of the thallus.

They are sphaeroidal or almost sphaeroidal preserved in coarsely crystalline calcite, supported by two special filaments-branches, one with a function of sustainer and other of cover-sheath. The sustainer has a central position, is fine, short, tubular and near the base of "hormogonia" became large, like a funnel. The filament transformed in cover-sheath is thin, and flat when covering uniformly "hormogonia", like a continous sheath.

Dimensions in mm:

Width of thallus :	2.0–3.78
Height of thallus:	2.40–5.0
Diameter of the main tubular filam.:	0.045–0.080
Diameter of dichotomic branches:	0.030–0.054
Diameter of the sustainer, distal part:	0.050–0.060
Thickness of the cover sheath:	0.010
Diameter of "hormogonia":	0.12–0.20
Angle between "filaments":	30°–50°

Remarks *Alpinella graeca* n. sp.has some appropriate morphologies with *A. distincta* DRAGASTAN 1988 from Tithonian of the Eastern Carpathians, as thallus morphology, fork-like filaments, dichotomic branched and presence of horizontal "partitions" Compared with *A. distincta*, the new species is different due to its size, diameter and angle between dichotomic filaments. The main distinctive character remain the presence of "hormogonia" at the tips of specialized filaments, disposed mainly in the central area or to the outer margin of the thallus.

It ressembles with *Hansiella fibrata* DRAGASTAN 1990 from Upper Oxfordian-Kimmeridgian of Ghimbav Massif, Eastern Carpathians due to the thallus shape and presence of the calcitic bodies in all regions of thallus. Differs from the new species by the presence of polymorphic filaments or many kind of filaments (DRAGASTAN 1990).

Stratigraphical range: Tithonian/Berriasian, Perachora-Peninsula, Greece; Saint Ana Boulder (1100m), Bucegi Mts., Southern Carpathians and Fagetul Ciucului, Bicaz Gorges, Eastern Carpathians, Romania.

Porostromata PIA 1927

Girvanella NICHOLSON & ETHERIDGE 1878

Girvanella sp.

(Pl. 2, Figs. 3–4)

Hypotypes: Pl. 2, Fig. 3–4, Middle Jurassic, Ruhr University Bochum, Institute of Geology, Coll. No. 11405, Perachora-Peninsula, Greece.

Description: Remarks: Thallus nodular crossed by flexuous, short contorted tubuli, circular in cross section. The tubes formed compact calcareous masses like and irregulary network. They are cylindrical, unbranched without internal partitions having mircocrystalline calcite walls. At the Perachora-Peninsula they often occur like nodules (= oncoids = or ball forming *Girvanella*).

Dimensions in mm:

Diameter of oncoids:	0.45–0.60
Diameter of tubes-"filaments":	0.009–0.010

Remarks: Taking into account the diameter of tubes, the specimens of Dogger from Perachora are close to *Girvanella staminea* GARWOOD having a diameter of tubes of 0.007–0.008.

Hedstroemia ROTHPLETZ 1913
Hedstroemia zonata DRAGASTAN 1989
(Pl. 2, Fig. 8)

Hedstroemia zonata n.sp. 1989 DRAGASTAN, Pl. 5, Fig. 1, Giuvala Massif, Dimbovicioara Basin, Eastern Carpathians, Romania.

H y p o t y p e s : Pl. 2, Fig. 8, Upper Jurassic, Ruhr University Bochum, Institute of Geology, Coll. No. 11408, Perachora-Peninsula, Greece.

D e s c r i p t i o n : Thallus hemisphaerical having the filaments radially disposed from the base. The dichotrichotomic (?) filaments become distal highly flaring.

Dimensions in mm:

Width of thallus :	0.90
Height of thallus:	0.60
Diameter of filaments:	
in the basal part=	0.030
in the distal part=	0.050–0.90

S t r a t i g r a p h i c a l r a n g e Upper Jurassic, Perachora-Peninsula, Greece.

Microproblematica
"Thaumatoporellid"–Type A
(Pl. 4, Figs. 1–8)

M a t e r i a l : Pl. 4, Fig. 1–8, Upper Sinemurian, Ruhr University Bochum, Institute of Geology, Coll. No. 11400–11409 (20 specimens), Perachora-Peninsula, Greece.

D e s c r i p t i o n : Test fixed on the substratum, variable in shape, from ovoidal, ellipsoidal, pyriform up to irregular-columnar, in the axial, vertical sections (Pl. 4,Fig. 8). The test has only one "chamber", in most cases filled with coarsely cyrstalline calcite.

In the cross sections the "chamber" present different shapes depending on the plane of cutting: circular (cross section), oval-elongate (oblique cross section), rectangular (basal cross section), oval-subangular (basal, oblique cross section) and ellipsoidal with alveoli of the walls, in vertical, oblique section. In the vertical section, the walls of the "chamber" have the tubular-cylindric alveoli filled with coarsely crystalline calcit and are unperforated. The alveoli are round in the cross section, sometime disposed so near one with another like a "riddle". Between alveoli there is microcrystalline calcite. A clear opening of the test have not observed.

Dimensions in mm:

Length of test at the base:	0.38– 0.56
Height of the test (axial):	0.28– 0.92
Thickness of walls:	0.010–0.046
Diameter of the alveoli:	0.010–0.023

R e m a r k s : The "Thaumatoporellid"–Type A is an organism fixed on the substratum, having a simple morphology with one "chamber" and walls having distinct, tubular alveoli. This organism can be compared with fixed Foraminifera of Group H sensu SEPTFONTAINE (1980). In the Subgroup H 1 is included genus *Placopsilina,* irregular in shape and with keriothecal walls, so close as structure to the "Thaumatoporellid"–Type A. A such "Thaumatoporellid" structure was figured by SEPTFONTAINE (1980) on Pl. 3, Fig. 5 from Lias of Algeria.

"Thaumatoporellid"–Type B
(Pl. 5, Figs. 1–8)

M a t e r i a l : Pl. 5, Fig. 1–8, Upper Sinemurian-Carixian, Ruhr University Bochum, Institute of Geology, Coll. No. 11400–11409 (20 specimens), Perachora-Peninsula, Greece.

D e s c r i p t i o n : Test fixed on the substratum, oval-ellipsoidal, angular, subangular or irregular in shape built of 2 up to 7 "chambers" The "chambers" have different shapes and dimensions. They are unequeally between them and have a tendency of growing from inner part to outer part. Specimens with 2 "chambers" have an axial growing, the initial "chamber" is like a "balloon" (Pl. 5, Fig. 1). The wall of the initial "chamber" is thin, microcrystalline and has small pores like an alveolar structure. The second "chamber" incorporated the initial one and has also, thin alveoli-network in the walls.

The specimens with more "chambers" start by a flat surface for attachement (Pl. 5, Figs. 2–3). In the basal region the "chamber" is narrow and long. After attachement follow the "chambers" (2–4) disposed in an irrelgulary-spiral - trochospiral coiling and finally they are covered by a last, large "chamber" (5).

Dimensions in mm:

Length of test at the base :	0.46–0.62	
Height of the test (axial):	0.26–0.32	
Length/Heigth of "chambers:		
1:	0.28 / 0.040–0.060	
2:	0.12 / 0.040–0.080	
3:	0.23 / 0.10–0.12	
4:	0.26 / 0.12–0.14	
5:	0.40 / 0.040–0.060	
Thickness of walls:	0.020	
Diameter of pores between chambers:		0.005–0.010
Diameter of alveoli:		0.010–0.020

R e m a r k s : The "Thaumatoporellid"–Type B is a fixed organism, having a tendency of growing in an irregularly-spiral-trochospiral manner, like recent genus *Ammotrochoides* JANIN 1984 of Subfamily *Placopsilininae* RHUMBLER (Foraminifera). FLÜGEL (1983) said that the organisms, generally called "*Thaumatoporella parvovesiculifera* (RAINERI)", are not algae, but should be interpreted as organisms with animal affinities. These fossils are represented by irregularly constricted tubes, which follow the relief of sediment..." In the figured materials of "Thaumatoporellid" from Lias of Korfu can distinguished the Type B on Pl. 49, Figs. 5, 7, 8;

– the *Mesopotamella angulata* DRAGASTAN, PAPANIKOS & PAPANIKOS on the Pl. 49, Fig. 2 (in the right) and a typical *Thaumatoporella parvovesiculifera* sensu RAINERI on the Pl. 49, Fig. 10.

The same organism, "Thaumatoporellid"-Type B was figured:

– at Pl. 1, Fig. 1 on the name of *Thaumatoporella parvovesiculifera* from the Lower Cretaceous of the Black Escarpment, Atlantic Ocean (JOHNSON, 1968);
– at Pl. 4, Fig. 4 from the Upper Triassic of Hydra (SCHÄFER & SENOWBARI-DARYAN, 1983);
– at Pl. 18, Figs. 1–2 from the Kimmeridgian of Western High Atlas (HÜSSNER, 1985) and from neritic limestone pebbles (Oxfordian-Tithonian) of Lostenstein Schists of Northern Calcareous Alps (SCHLAGINWEIT, 1991).

In the Lias of Perachora often the organisms of "Thaumatoporellid"–Types B and C are fixed on the big oncoids or "penetrated" in the dasyclad thalli of the *Teutloporella elongatula*, first on the walls of the axial cavity and after through the segmented regions (deep annulation) toward the outer side of the thalli.

The relationship could be interpreted as a phenomena of commensalism between an alga and another organism (Foraminifera or other group of algae) or of parasitism. In the last case the "Thaumatoporellid" enter in the cavity and in the "weakness" areas (annulation) covering the outer part of the thallus and perhaps conquering more part of the vital function of the alga. One of this phenomena is responsabile of covering the thalli of *Teutloporella elongatula* in the Lias of Perachora (Greece) and of Velebit Mts. (Croatia). In both places some specimens present "Thaumatoporellid" organisms in the axial cavity or over all areas of the thalli. Sometime these organisms are associated with *Palaeodasycladus,* being present in the axial cavity of thalli.

Refering to the RAINERI's original description of *Thaumatoporella parvovesiculifera* (1922) and to new interpretations of this organism as an alga included in the Order Thaumatoporellales (Chlorophyta) by DE CASTRO (1988), this assigning could be accepted only for cylindrical thalli having large pores in the walls, but without globose thalli inside. In our opinion, the globose thalli inside of the axial cavity correspond to another organism which have an irregularly-spiral tendency of growing. The growing of "globose thalli" start, first by the attaching of one "chamber" on the inner walls of the axial cavity and continued to grow in an irregularly-spiral-trochospiral manner by disposition of globose "chambers" toward the axis of the cavity. It is not excluded also activities of endo – or epilithic organism after post mortem transport and sedimentation.

The "Thaumatoporellid"–Type B could be compared with *Mesopotamella angulata* described from Upper Triassic of Ionian Zone (Epyrus) by DRAGASTAN, PAPANIKOS & PAPANIKOS (1985). The differences are due to the presence of one or more "chambers" without irregularly-spiral coiling and the homogenous, not alveolar walls. This species was compared with the genera *Uslonia* and *Tuberitina* (Foraminifera) and with algal genera *Cladophora* (Cladophorales) and *Phaeodermatium* (Chrysotrichales). WRIGHT & WRIGHT (1985) described in Carboniferous stromatolites an anastomosing threads often forming a reticulate pattern built by the extant cyanobacterium *Phormidium*, which could be compared with some structures of "Thaumatoporellids" – Types B and C.

"Thaumatoporellid"–Type C
(Pl. 6, Figs. 1–8)

M a t e r i a l : Pl. 6, Fig. 1–8, Carixian, Ruhr University Bochum, Institute of Geology, Coll. No. 11400–11409 (20 specimens), Perachora-Peninsula, Greece.

D e s c r i p t i o n : "Thallus" composed by a roof-chain of linar cells, variable in shape (ellipsoidal, ovoidal, rectangular), after which grow or not a new linear chain of cells, large and variable in shape.

The horizontal linear cells occur in special locations having a tendency to conquer and to penetrate in the carbonate sustratum, after which follow a directional growth of large cells, more or less vertical toward the "floor" (Pl. 6, Fig. 1–2). The walls of cells are thin, microcrystalline and unperforated. In some cases after one horizontal row of linear-cells follow one up to three vertical, large cells, different in shape ending with an apical cell. The walls of apical cells are perforated. This organism functioned like an endolithic algae and could be covered sometime by an epilithic organism.

Dimensions in mm:	
Length of "thallus"	1.50–1.70
Height of "thallus":	1.00–1.20
Length / width of the horizontal rows-cells:	1.20 / 0.25–0.30
Length of vertical row cells:	0.60–0.80
Length / width of apical cells:	0.40 / 0.20
Thickness of wall-cells:	0.010
Diameter of pores in the floor apical-cells:	0.020
Thickness of walls in apical cells:	0.040–0.060

R e m a r k s : "Thaumatoporellid"–Type C could be compared with some Cyanophyta algae of Order Pleurocapsales, Family Hyellaceae by close morphology with one or two horizontal rows of cells, vertical apical cells growing toward the "floor". These algae developed in an endolithic manner, penetrating carbonate substratum or calcareous algae. The presence of unperforated thin walls of the cells correspond to a such interpretation. The walls of cells showing perforations in the "roof" and in the "floor" remain a distinct character. The microboring algae represent protected environments in shallow-water basin (GOLUBIC & KNOLL, 1993).

Baccanella PANTIC 1975
Baccanella parvissima(DRAGASTAN 1966) BUSER 1978
(Pl. 3, Fig. 7)

Baccanella parvissima n.sp. – 1966 DRAGASTAN, Tithonian, Carpathians, p. 45, Pl. L, Fig. 2–7; Calcareous algae (?) 1969; RADOICIC, p. 73, Fig. 5 a–e.

H y p o t y p e s : Pl. 3, Fig. 7, Upper Jurassic, Ruhr University Bochum, Institute of Geology, Coll. No. 11407,

Perachora-Peninsula, Greece.
Description: Small disk, isolated like an ellipsoidal rosette or combined in a sort of "colonial" bodies. The disk is formed by a radiating cells with a fibrous calcareous structure.
Remarks In the Carpathians these disks occur frequently in the Tithonian *Tubiphytes* assemblage; the "colonial" bodies within sheltered growth cavities between corals and hydrozoans and isolated found in large cavities of coralalgal reefs. According to TURNSEK et al. (1981) *Baccanella parvissima* occur in an Upper Oxfordian – Kimmeridgian barrier reef complex from Slovenia at the upper part of the reef interval associated with *Tubiphytes morronensis* CRESCENTI, *Mercierella ? dacica* DRAGASTAN, *Nerinea* and *Diceras*.

6. Conclusion

1. Genera of *Palaeodasycladus, Teutloporella, Cylindroporella* (Dasycladaceae), *Rivularia* (Rivulariaceae), *Alpinella* (Scytonemataceae), *Girvanella, Hedstroemia* (Porostromata) and microproblematiceae represent different neritic environments of a carbonate platform of Jurassic age.
2. The *Palaeodasycladus mediterraneus* ACME-Zone (Upper Sinemurian) is accompanied by *Palaeodasycladus gracilis, Eodasycladus ogilviae, Rivularia lissaviensis, Thaumatoporella parvovesiculifera* and *Siphovalvulina* sp.
3. *Orbitopsella primaeva* assemblages with "Thaumatoporellid organisms" and rare *Palaeodasycladus gracilis* are typical within the *Teutloporella elongatula* ACME-Zone (Carixian).
4. The Carixian/Domerian boundary is indicated by *Orbitopsella praecursor* assembleges and by the disappearance of the *Palaeodasycladus –Teutloporella* species.
5. Carbonates of Bajocian/Bathonian age contain the *Praekurnubia* cf. *crusei* assemblages with *Girvanella* oncoids and rare *Cylindroporella arabica* .
6. Abundant species of Rivulariaceae and Scytonemataceae accompanied by *Tubiphytes morronensis, Baccanella parvissima* and rare Codiaceae (*Hedstroemia* and *Carpathocodium*) are common for the sequence of Upper Jurassic age.
7. *Alpinella graeca* n.sp. – a new Scytonematacean species – indicates a stratigraphical range of Tithonian/Berriasian age.
8. Many specimens of "Thaumatoporellids" out of Upper Sinemurian – Carixian sequences allow a classification of three types.
9. The Liassic algae assemblages correspond with a lagoonal facies of the inner carbonate platform with transitions to the outer carbonate platform towards the end of Domerian. The Upper Jurassic algae assemblages indicate a similar lagoonal facies of an inner platform placed behind a presumed ridge which generated the reworked deposits.
10. The sequence is rich in coated grains – especially cortoids and oncoids. Pseudomenisci between particles are due to cyanobacterial mucilage in lagoonal environments, comparable to the grapestone facies of the Bahamas. First generations of cements are of marine – phreatic and marine – vadose origin. All facts together are typical of lagoonal to tidal environments.
11. Microfacies and age of the sequences indicate that they are part of the Parnassus Zone. On the other hand, tectonically adjacent sequences of deep water facies (cherty limestones with gravity flows, radiolarites) are of the same stratigraphical range. Based on these facts and the chaotic arrangement of the geological units (radiolarites, flysch, ophiolites, cherty limestones, km^3 sized blocks of shallow water limestone) we interpret the Pre-Neogene units as a melange.

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PLATE 1

Fig. 1. *Palaeodasycladus mediterraneus* (PIA), oblique axial section, claviform and strongly calcified thallus, typical for the species, Upper Sinemurian.

Fig. 2. *Palaeodasycladus mediterraneus* (PIA), oblique-longitudinal section, thallus with narrow axial cavity and interannulation tendency, could be a subspecies, Upper Sinemurian.

Figs. 3–4. *Teutloporella elongatula* (PRATURLON), axial section, as a core of an oncoid, thallus "conquered" by "Thaumatoporellid" orgamisms –Type C (t); Fig. 4 , the same thallus, which show in the upper part of the thallus the traces of trichophorous branches (tbr), Carixian.

Fig. 5. *Eodasycladus ogilviae* CROS & LEMOINE, tangential, vertical section in the 5 (6) secondary branches disposed in tufts, Upper Sinemurian.

Fig. 6. *Teutloporella elongatula* (PRATURLON), axial vertical section, having in the central cavity of the thallus and in segmented regions (annulation) "Thaumatoporellid" orgamisms – Type C (t); in the upper, left side, the trichophorous branches (tbr), Upper Sinemurian..

Fig. 7. *Palaeodasycladus gracilis* (CROS & LEMOINE), axial vertical section, fine cylindrical thallus with clear intusannulation, phloiophorous primary branches, acrophorous secondary and tertiary branches disposed, linear, directional after a constant angle, Upper Sinemurian.

PLATE 1

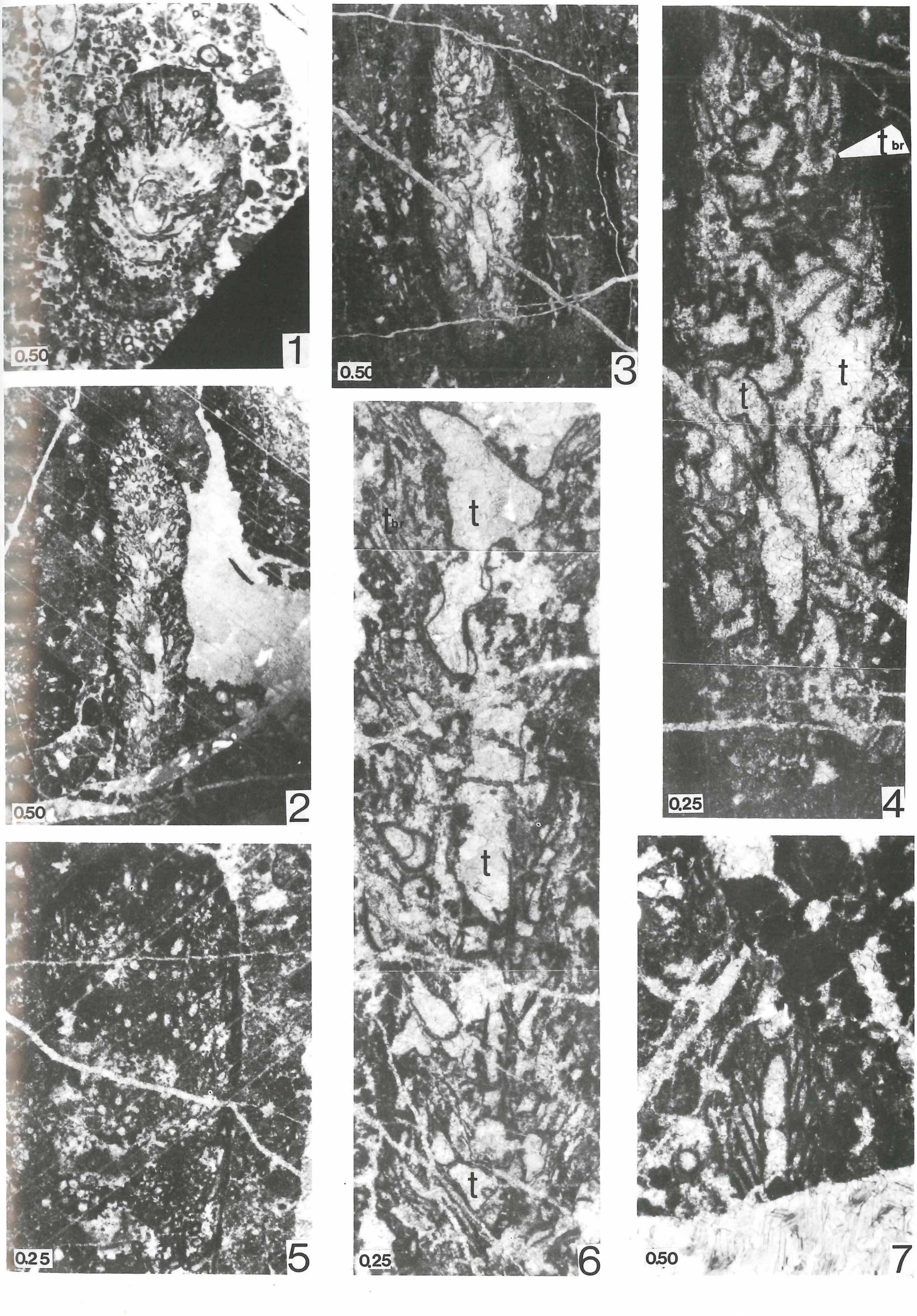


PLATE 2

Fig. 1. *Palaeodasycladus mediterraneus* (PIA), cross section, thallus in a core of an oncoid.
Fig. 2. *Cylindroporella arabica* ELLIOTT, cross section, Dogger.
Figs. 3–4. *Girvanella* sp., frequently forming oncoid, Dogger.
Fig. 5. *Rivularia lissaviensis* (BORNEMANN), axial – vertical section, typical V-shaped, close, dichotomic "filaments", Malm.
Fig. 6. *R. piae* (FROLLO), axial – oblique section, V–shaped close, dichotomic, "filaments", Malm.
Fig. 7. *R. pumili* DRAGASTAN, axial, vertical section, thallus fixed on the oncoid (rp), Malm.
Fig. 8. *Hedstroemia zonata* DRAGASTAN, vertical axial section, thallus with dichotrichotomic (?) filaments dilated in the distal part, Malm.

PLATE 2

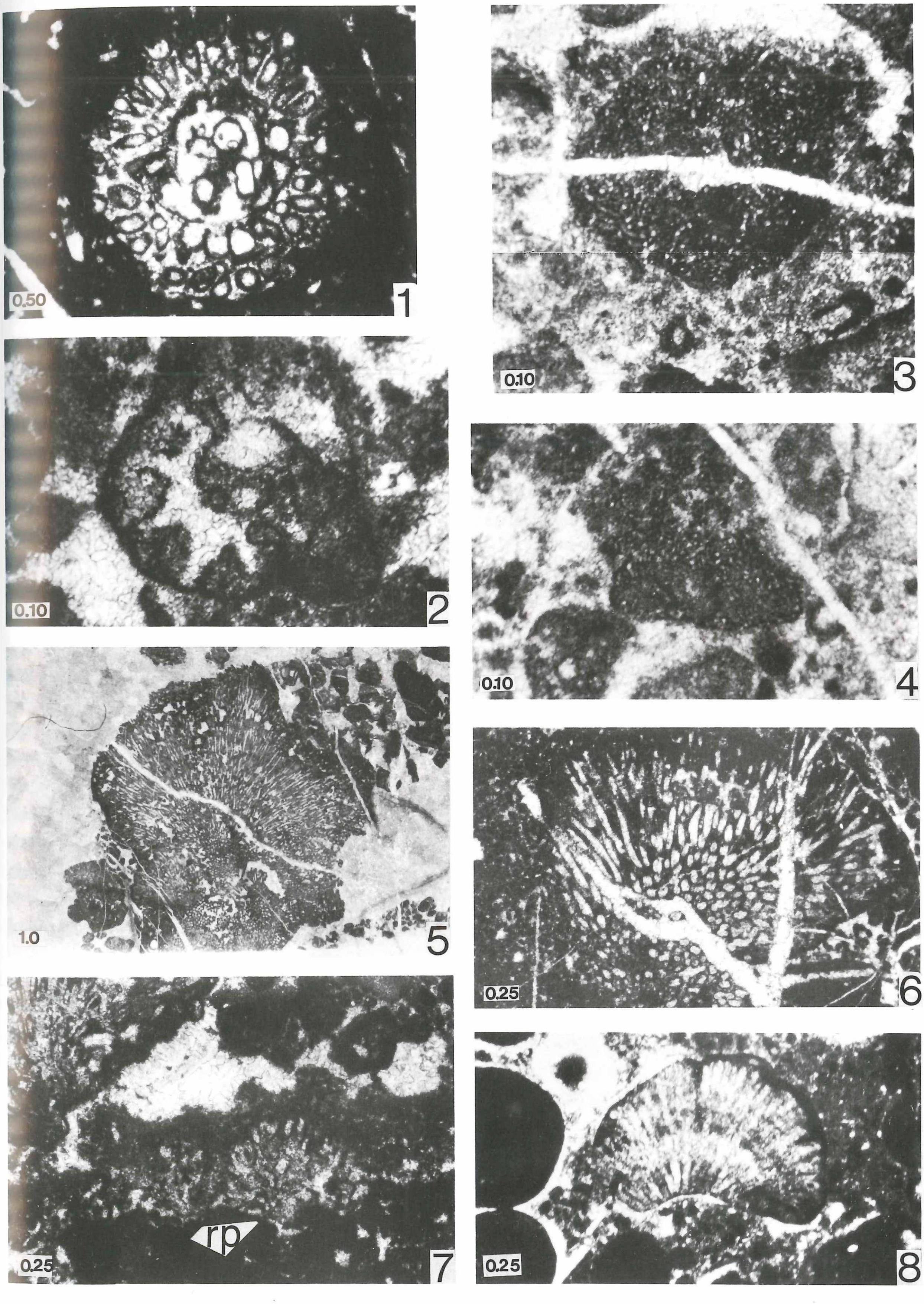


PLATE 3

Figs. 1–5. *Alpinella graeca* n.sp., thalli with calcitic bodies (c) as "hormogonia";

1. Holotype Ruhr-University Bochum, Institute of Geology, Coll. No. 11406, Malm, Perachora-Peninsula, Greece;

2. Syntype: vertical axial section, University of Bucharest, Lab. of Paleontology, L.P.B.V No. 0713, erriasian, Fagetul Ciucului, Bicaz Gorges, Eastern Carpathians, Romania;

3. Detail concerning the sustainer region of "hormogonia";

4. Syntype vertical axial section, University of Bucharest, Lab. of Paleontology, L.P.B.V No. 0714, Tithonian, Bucegi Mts. Saint Ana Boulders, 1100m), Southern Carpatrhians, Romania;

5. Type of branching and detail of the calcitic bodies area.

Fig. 6. *Tubiphytes morronensis* CRESCENTI, oblique longitudinal section, Malm, Perachora-Peninsula, Greece.

Fig. 7. *Baccanella parvissima* (DRAGASTAN), Malm, Perachora-Peninsula, Greece.

PLATE 3

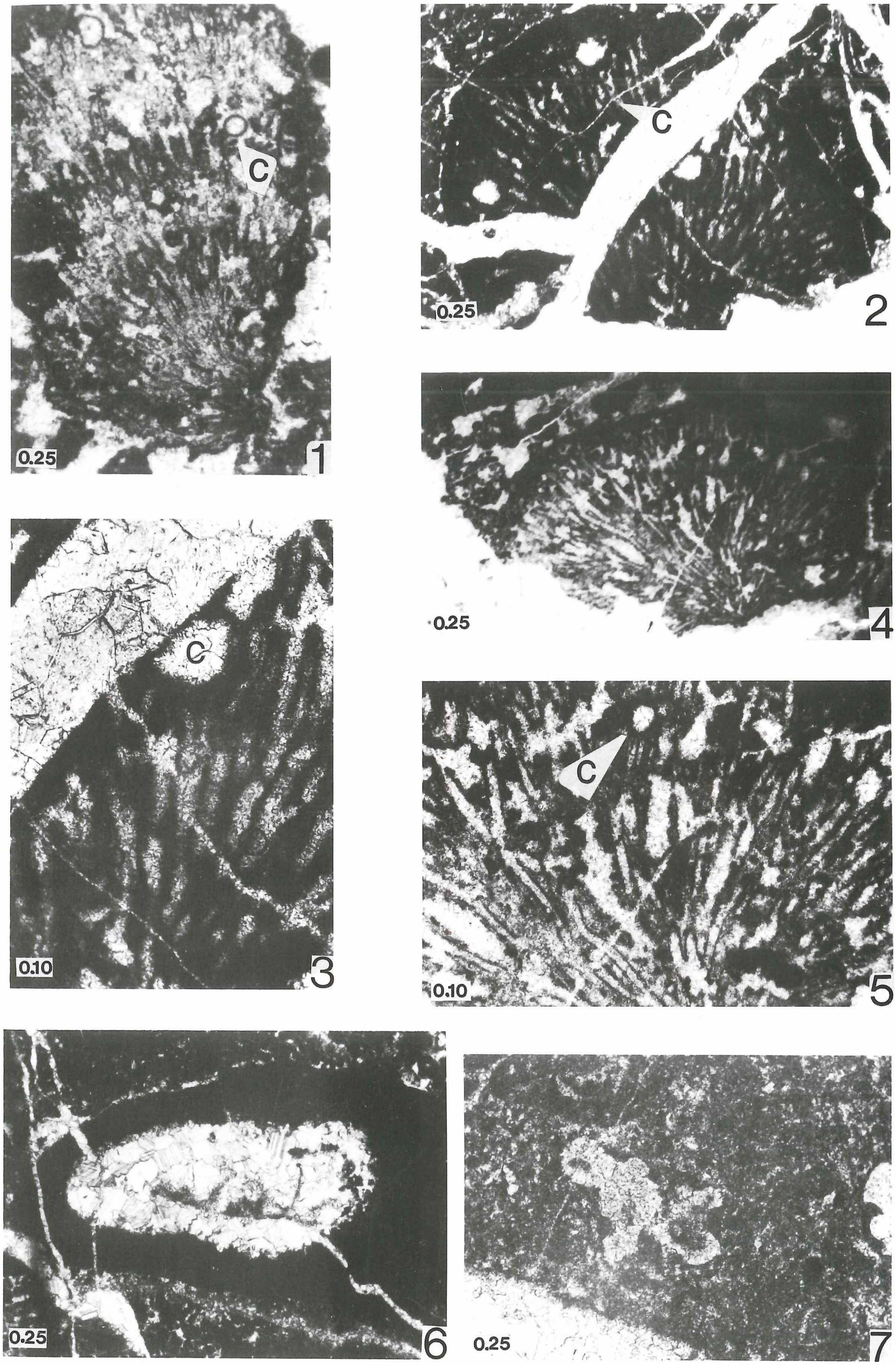


PLATE 4

Figs. 1–8. "Thaumatoporellid" – Type A, test fixed on the substratum (s) with one chamber and alveoli(a) in the unperforated wall, like a keriothekal structure of foraminifera, Upper Sinemurian:

1. vertical axial section;
2. oblique cross section in the middle level of chamber;
3. left – axial-perpendicular section on the short chamber axis; right – vertical axial section;
4. axial – vertical axial section on the long chamber axis;
5. oblique cross section, a false perforated structure, due to the " deep" level of cuting in the alveoli of walls;

6.– 8. different vertical axial sections.

PLATE 4

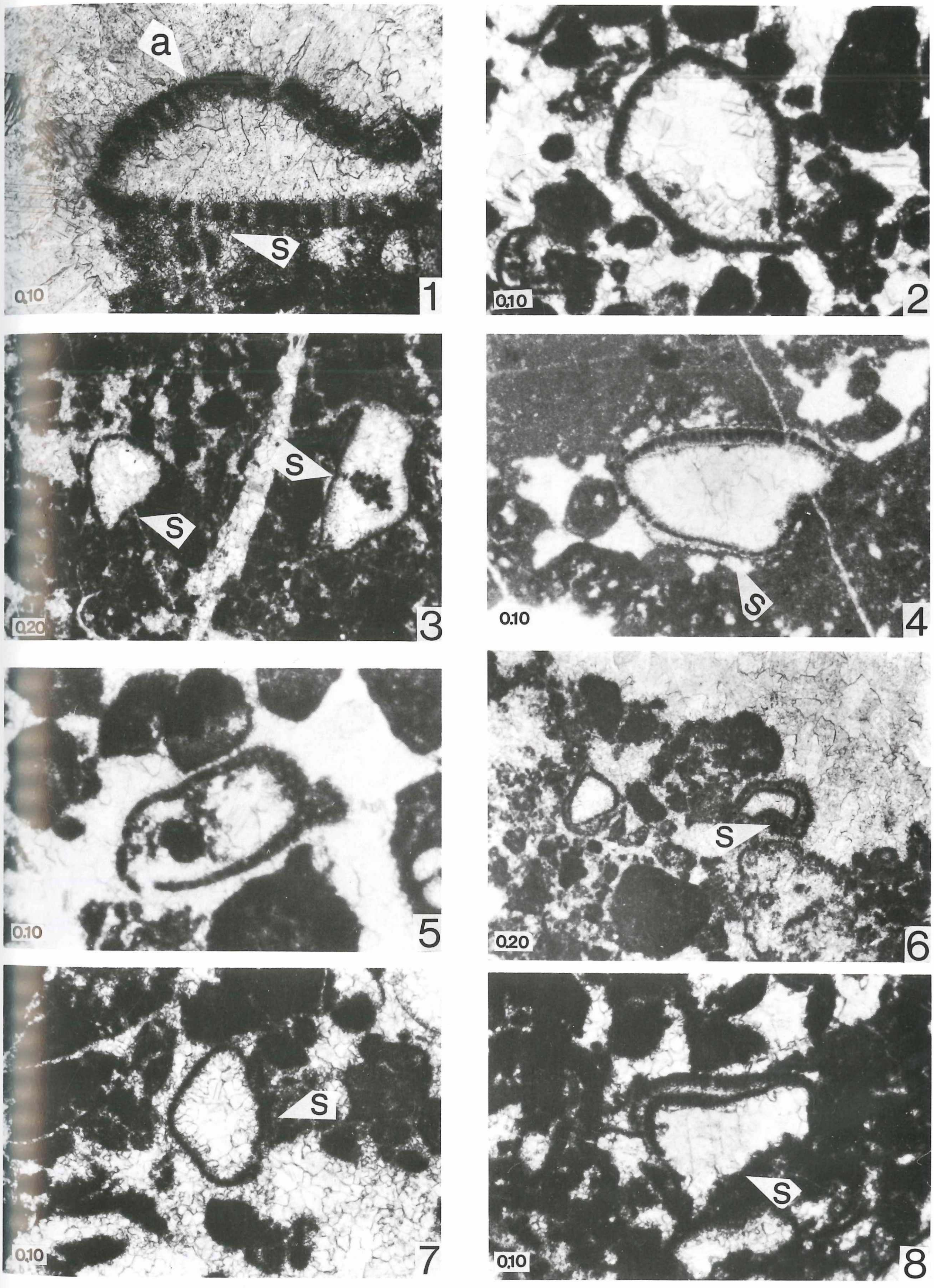


PLATE 5

Figs. 1–8. "Thaumatoporellid" – Type B, test fixed on the substratum (s) with 2 up to 7 chambers disposed in an irregulary, spiral-trochospiral coiling; the walls between chambers are perforated (p), the last, large chamber has the walls with alveoli, Upper Sinemurian-Carixian:

1–3, 5. vertical axial sections;

4. oblique – tangential section cuting 3 chambers;

6. cross section, in the middle level of the test;

7. oblique-perpendicular axial section in the margin of the test;

8. vertical - axial section, test fixed on the oncoid which has a *Palaeodasycladus* in the core.

PLATE 5

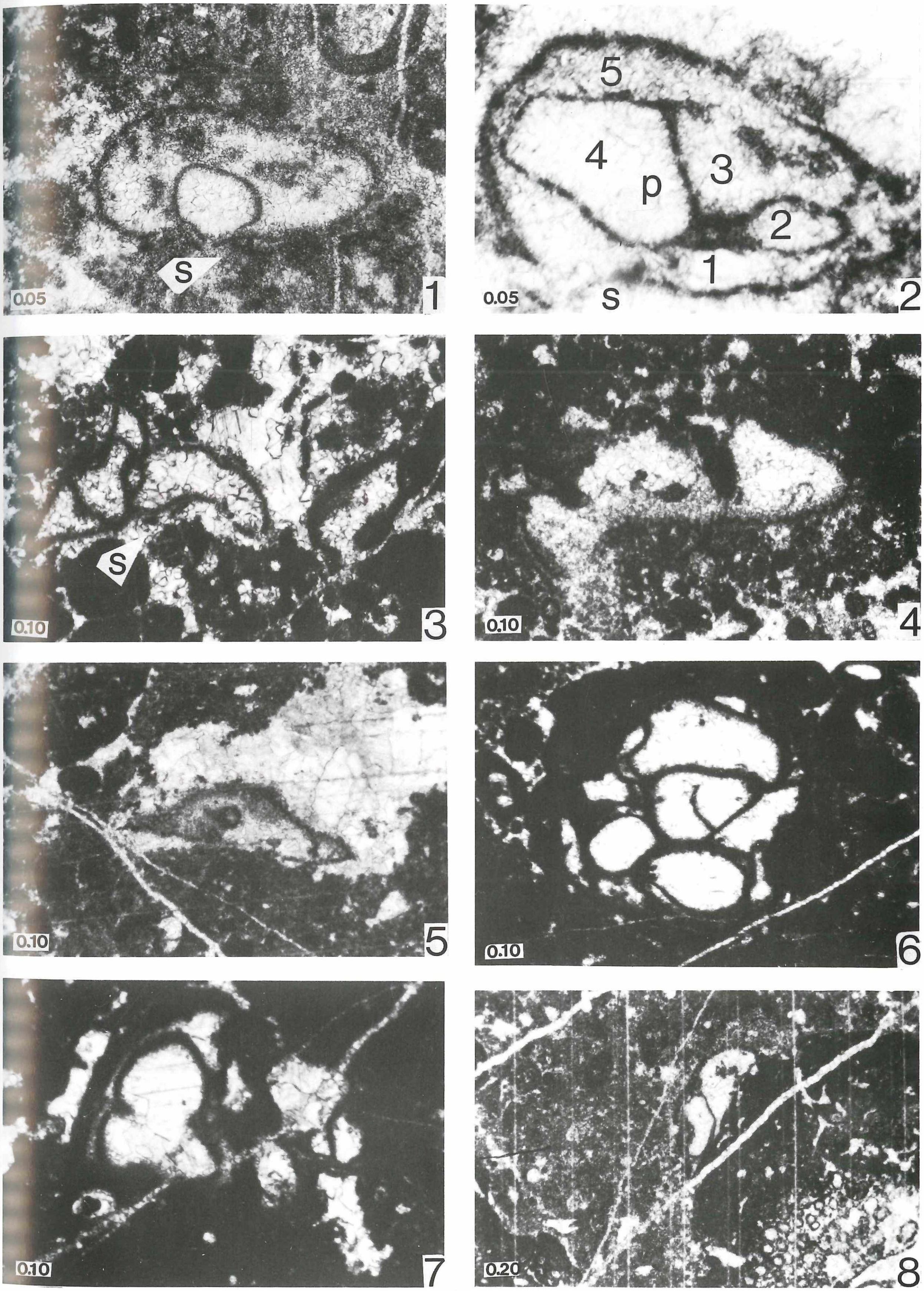


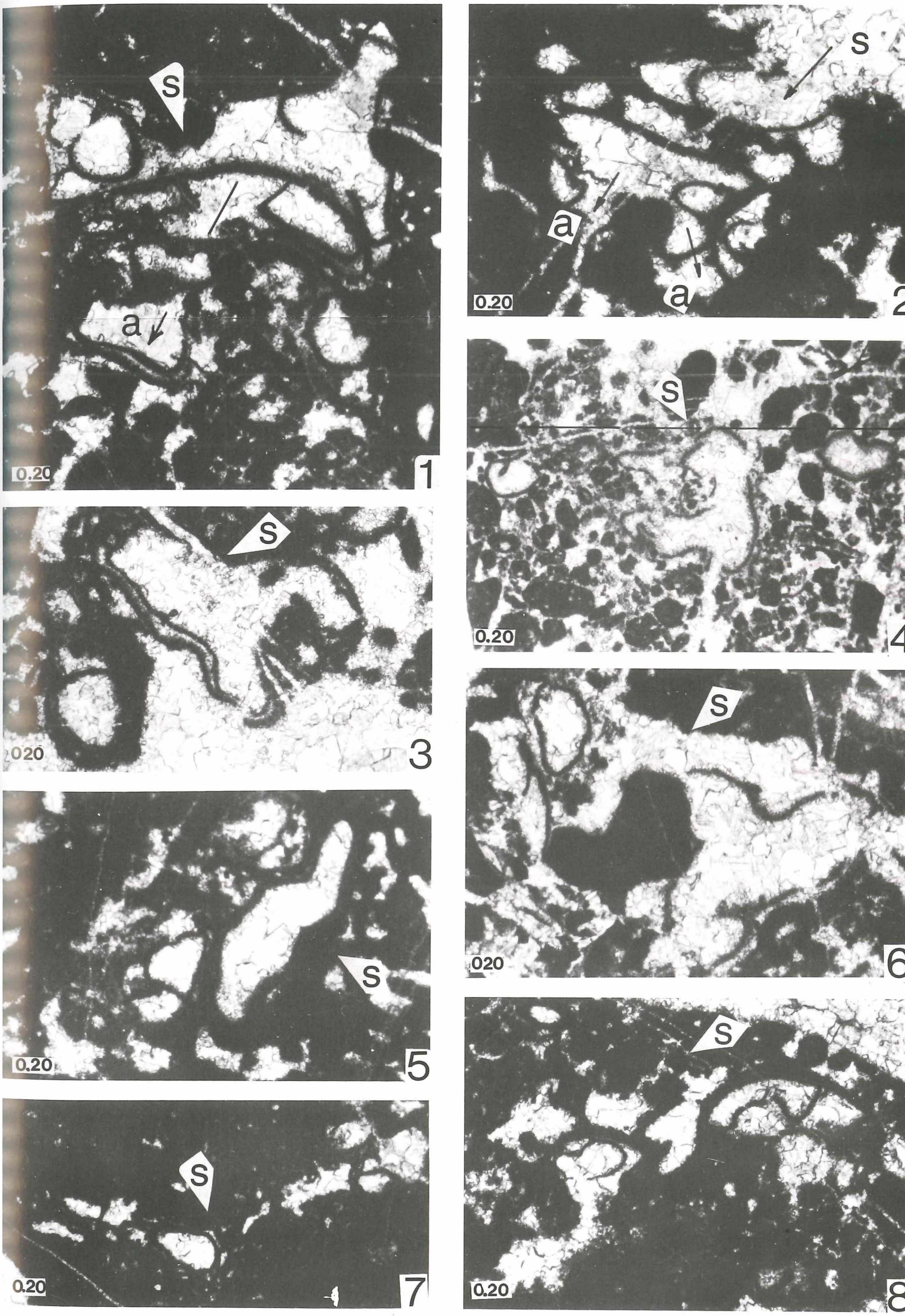
PLATE 6

Figs. 1–8. "Thaumatoporellid" – Type C, thallus endolithic, built of one or two rows of horizontal cells and one or more vertical row-cells in the substratum (s). The vertical row-cells has an apical cell (a) with perforated walls, Carixian with Orbitopsellids:

1.– 2. vertical axial section (arrows show direction of penetration in the substratum);

3.– 8. various sections in the thalli.

PLATE 6



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