

## *Salpingoporella robusta* n.sp. (Calcareous algae; Dasycladales) from the Upper Barremian - Lower Aptian of Mt. Biokovo, Croatia

Branko SOKAČ

**Key words:** Calcareous algae, Dasycladales, Lower Cretaceous, Dinaric Karst, Croatia

**Ključne riječi:** vapnenačka alga, Dasycladaceae, donja kreda, dinarski krš, Hrvatska

### Abstract

*Salpingoporella robusta* n.sp. (Dasycladaceae) is characterized by a narrow central cavity and comparatively thick calcareous sleeve with large ramifications. The new species was found in deposits which indicate a transitional subtidal-lagoonal to restricted shoal or back reef environment of Upper Barremian or, possibly, Lower Aptian age.

### Sažetak

Opisana je nova vrsta *Salpingoporella robusta* n.sp. (Dasycladaceae) koja se odlikuje uskom središnjom šupljinom i relativno debelim stijenkama skeleta. Potječe iz naslaga s odlikama prijelaza subtidal-lagunarne sredine u sredinu zatvorenog pličaka i back reefa taloženih u nivou gornjeg barema ili moguće donjeg apta.

### 1. SYSTEMATIC DESCRIPTION

Family Dasycladaceae KÜTZING, 1843  
Genus *Salpingoporella* PIA in TRAUTH, 1918  
*Salpingoporella robusta* n.sp.

Plate I

**Origin of the name:** The specific name derives from the massive and thick calcareous wall and equally large and massive ramifications.

**Type locality:** In the Mt. Biokovo massif. The outcrops are situated along the old road about 1 km from the crossroad at the Šošići settlement to the Staza vilage (Fig. 1). The Greenwich coordinates are 17°10'7''E and 43°14'50''N.

**Type stratum:** Brown, thin-bedded, foraminiferal-algal packstone to grainstone, intercalated with oncoidal-bioclastic floatstone. The interval in which the new species was found can be defined as belonging to a transitional-lagoonal environment passing to restricted shoal or back reef environment. The stratigraphic position of the type locality can be defined as transitional Barremian-Aptian levels.

**Holotype:** Oblique section figured in Pl. I, Fig. 7, thin-section No. B-126/5. All thin sections with the original topotype material are stored at the Institute of Geology, Zagreb.

**Diagnosis:** Cylindrical skeleton characterized by a thick calcareous wall and narrow central cavity (main stem). Undivided, comparatively large, phloiophorous ramifications, bowl-shaped at the base, either slowly

thickening towards the distal end or visibly thickening after a short, poorly pronounced, stalk. In consecutive whorls, the ramifications are arranged in an alternating way, and have a rounded to rhomboidal shape on the outer surface of the thallus.

**Description:** The massive, cylindrical skeleton is built up of turbid, recrystallized calcite. The outer surface of the thallus is clearly delineated and straight, and so is the narrow central cavity (main stem). The inner surface is perforated by small, alternating, pores which correspond to the alternating arrangement of the ramifications. The central cavity occupies from 25% to a maximum of 30% of the total diameter. Simple, large, phloiophorous ramifications reach the outer surface of the thallus but do not seem to extend outside the calcareous sleeve. From the main stem, the ramifications enter the skeleton wall through tiny pores, widen at their bases, and slightly thicken towards the distal end (Pl. I, Figs. 5, 13-14). Some specimens show a rather poorly pronounced short stalk, after which the ramifications thicken somewhat more abruptly (Pl. I, Fig. 7). Some sections suggest that both cases may be present in the same specimen. The arrangement of the ramifications in the consecutive whorls is clearly alternating (Pl. I, Figs. 1-3, 7, 10, 14). In tangential sections near the outer surface, the pores are rounded (Pl. I, Figs. 1, 9) and in cortical sections, passing just below the surface, they have a regular rhombic shape (Pl. I, Figs. 3, 7, 14). The position of the ramifications with regard to the direction of growth of the thallus is horizontal or sub-horizontal. Cysts are rarely visible, but sometimes they may be seen within the swollen parts of the ramifications.

**Similarities and differences:** The generic assignment of this species is based on the presence of undivid-

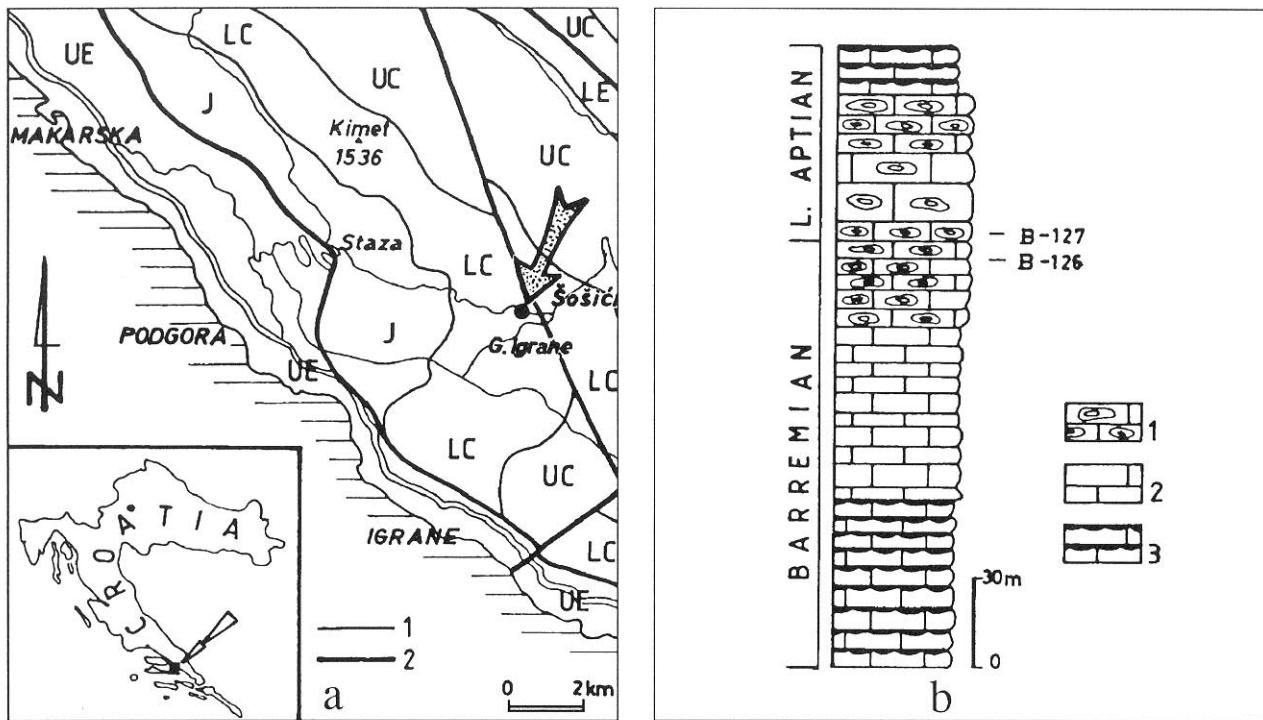


Fig. 1. a) Type-locality of *Salpingoporella robusta* n.sp. Geographical location and geological setting: J - Jurassic; LC - Lower Cretaceous; UC - Upper Cretaceous; LE - Lower Eocene; UE - Upper Eocene; 1 - normal boundary between geological units; 2 - tectonic boundary between geological units.

b) Schematic lithofacies column of the type-locality (after TIŠLJAR & VELIĆ, 1991): 1 - Lagoon to restricted shoals or back-reef facies; 2 - White recrystallized limestones lithofacies; 3 - Intertidal to supratidal limestone facies. Sample B-126: *Salpingoporella robusta*, n.sp., *S. muehlbergii*, *S. pygmaea*, *Bacinella irregularis*. Sample B-127: *Palorbitolina lenticularis*, *Triploporella marsicana*, *Suppiluliumaella polyreme*.

Sl. 1. a) Tipiski lokalitet *Salpingoporella robusta* n.sp. Geografski položaj i geološki odnosi: J - jura; LC - donja kreda; UC - gornja kreda; LE - donji eocen; UE - gornji eocen; 1 - normalna granica između geoloških jedinica; 2 - tektonska granica između geoloških jedinica.

b) Shematizirani litofacijsni stup tipskoga lokaliteta (djelomice prema TIŠLJAR & VELIĆ, 1991): 1 - facijes laguna do zaštićenih plićaka ili zagrebena; 2 - litofacijs svjetlih rekristaliziranih vapnenaca; 3 - facijes intertidala do supratidala. Uzorak B-126: *Salpingoporella robusta* n.sp., *S. muehlbergii*, *S. pygmaea*, *Bacinella irregularis*. Uzorak B-127: *Palorbitolina lenticularis*, *Triploporella marsicana*, *Suppiluliumaella polyreme*.

ed ramifications, their phloioporous shape, and clearly alternating arrangement. Less significant but nonetheless characteristic, is the shape of the ramifications at their distal end, which is also very close to other *Salpingoporella*. The comparison with other species of the genus (of which there are over 30 described up to now), ranging from to Dogger up to the Upper Cretaceous, highlights its species-specific characters, which make it easily distinguishable.

The new species is clearly distinguished from species such as *Salpingoporella annulata* CAROZZI, *S.*

*grudii* (RADOIČIĆ), etc., in which the ramifications at their distal ends are clearly compressed laterally (and therefore elongated in the direction of the longer axis of the thallus), or, on the other hand, from species such as *S. melitae* RADOIČIĆ, *S. dinarica* RADOIČIĆ, *S. hasi* CONRAD et al. (CONRAD et al., 1976), *S. genevensis* (CONRAD), and *S. urladanasi* CONRAD et al. (CONRAD et al., 1976), in which the ramifications are distally compressed vertically (and therefore elongated horizontally). Moreover, the new species differs from all the above mentioned species in its narrower central

Dimensions in mm:		Range	Most frequently observed values
Maximum observed length	L	4.7	
Outer diameter	D	0.77 - 1.44	0.86 - 1.10
Inner diameter	d	0.20 - 0.48	0.24 - 0.30
d/D		27-30%	
Maximum diameter of the ramifications	p	0.15 - 0.28	0.20 - 0.24
Length of the ramifications	l	0.28 - 0.48	0.30 - 0.40
Distance between consecutive whorls	h	0.12 - 0.24	0.15 - 0.20
Number of ramifications in a whorl	w	8 - 11	8-9

cavity. In some instances, cortical sections (i.e., tangential sections cutting near the surface) of *S. robusta* n.sp. may be slightly similar to deeper tangential sections (i.e., those passing approximately through the middle part of the wall) of *S. katzeri* CONRAD & RADOIČIĆ (CONRAD & RADOIČIĆ, 1978), in which case the pores of the ramifications appear, in both instances, to have the same, rhomboidal, shape. This similarity, however, disappears in more cortical sections of *S. katzeri*, when the pores of the ramifications become polygonal and vertically compressed (i.e., elongated horizontally). The inner diameter of the new species approaches that observed in *S. adriatica* (GUŠIĆ), but this is the only similarity between these two species, while they clearly differ from each other in outer thallus diameter, number of ramifications per whorl, and the distance between the consecutive whorls. Of particular importance are the differences with regard to the stratigraphically closely related species: in *S. muehlbergii* (LORENZ) the ramifications widen more strongly only at their distal ends; in *S. biokoviensis* SOKAČ & VELIĆ (SOKAČ & VELIĆ, 1979) the ramifications widen in two distinct steps and appear as square-shaped pores on the outer surface. Values of the inner and outer diameters are similar to those in *S. pygmaea* (PIA), but there are pronounced differences regarding the shape of the ramifications and their number in a whorl. Equally so, visible differences exist with regard to *S. steinhauseri* CONRAD, PRATURLON & RADOIČIĆ, *S. turgida* (RADOIČIĆ), and the Upper Cretaceous species *S. milovanovici* RADOIČIĆ (RADOIČIĆ, 1978) and *S. polsaki* SOKAČ & JELASKA (SOKAČ & JELASKA, 1991). All these species, except *S. turgida*, are much smaller and show more or less pronounced differences in the shape of ramifications, the appearance of the pores at their distal end, and/or the number of ramifications in a whorl and their mutual distance. This species differs from *S. croatica* SOKAČ (SOKAČ, 1992) by its somewhat larger size and clearly alternating arrangement of ramifications in consecutive whorls.

## 2. STRATIGRAPHIC POSITION

*Salpingoporella robusta* n.sp. was found in beds of intraclastic limestone (algal-foraminiferal wackestones to packstones). These beds form approximately 10 m thick intercalations, within recrystallised lime mudstones. The position of the algal-bearing sample is 10 m below the thicker-bedded Orbitolina-limestone containing the first appearance of *Palorbitolina lenticularis* (BLUMENBACH). Accompanying microfossils include *Triploporella marsicana* PRATURLON, *Suppiluliumaella polyreme* ELLIOTT, *Salpingoporella biokoviensis* SOKAČ & VELIĆ, *Cylindroporella ivanovici* (SOKAČ) which was assigned to that genus by MASSE & LUPERTO-SINNI (1989), and the

foraminifers *Vercorsella scarsellai* (DE CASTRO), *Debarina hahoumerensis* FOURCADE et al., *Nezzazata simplex* OMARA. Other, less stratigraphically significant forms, have also been found. On the basis of the above mentioned assemblage it can be concluded that the stratigraphical position of the type locality is within the range from the Uppermost Barremian to the transition to the Lower Aptian.

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*Salpingoporella robusta* n.sp. (Dasycladaceae) iz gornjeg barema - donjeg apta  
Biokova, Hrvatska

B. Sokač

Familija Dasycladaceae KÜTZING, 1843  
Rod *Salpingoporella* PIA in TRAUTH, 1918  
*Salpingoporella robusta* n.sp.  
Pl. I

**Podrijetlo imena:** vezano je na masivnu, grubu građu debelih vapnenačkih stijenka skeleta i isto tako debele na izgled nezgrapne ogranke.

**Tipski lokalitet:** u masivu planine Biokova na izdancima uz staru cestu oko 1 km udaljeno od križanja kod kuća Šošići prema Stazi. Koordinate po Greenwich-u 17°10'7''E, 43°14'50''N.

**Tipski slojevi:** smeđi tanje uslojeni foraminifersko-algalni packstone do grainstone koji su uloženi unutar stijena mikritne osnove s onkolitima i kršjem fosila. Uži interval u kojem je sadržana opisana vapnenačka alga može se označiti prelazom subtidal-lagunarne sredine u sredinu zatvorenog plićaka i back reefa. Stratigrafska pozicija lokaliteta s ovom algom definira se kao prelazni nivo barem-apt.

**Holotip:** Kosi presjek prikazan na tab. I, sl.7, sadržan u preparatu B-126/5. Izbrusci s opisanom vrstom čuvaju se u Institutu za geološka istraživanja, Zagreb.

**Dijagnoza:** Cilindričan skelet odlikuje se debelim vapnenačkim stijenkama i uskom središnjom šupljinom. Nepodijeljeni, relativno krupni floioforni ogranaci zdjeljasti već u bazi lagano se proširuju prema vanjskom kraju ili nakon kratke slabo izražene drške vidljivo odebljavaju. Ogranaci susjednih pršljena alternirajućeg su rasporeda i okruglastog do romboidnog oblika na vanjskoj površini talusa.

**Opis:** Masivan cilindričan skelet izgrađuje zamučeni rekristalizirani kalcit. Vanjska površina talusa jasno je ocrтана i ravna, jednako kao i uska središnja šupljina. Unutrašnja površina perforirana je sitnim porama naizmjeničnog položaja u skladu s alternirajućim rasporedom ogranaka. Središnja šupljina zaprema 25 do najviše 30% od ukupnog dijametra. Jednostavni krupni floioforni ogranaci dosežu do vanjske površine talusa, ali

čini se, ne izlaze izvan vapnenačkog skeleta. Iz središnje šupljine u stijenku skeleta ogranaci ulaze kroz sitnu poru, proširuju se u bazi i dalje prema distalnom kraju lagano odebljavaju (tab. I, sl. 5, 13-14). Kod pojedinih primjeraka vidljiva je slabo izražena kratka drška nakon koje ogranak odebljava (tab. I, sl. 7). Pojedini presjeci sugeriraju da su oba slučaja moguća i na istom primjerku. Medusobni raspored ogranaka susjednih pršljenâ izrazito je alternirajući (tab. I, sl. 1-3, 7, 10, 14). U tangencijalnom presjeku blizu vanjske površine pore ogranaka su okruglaste (tab. I, sl. 1,9), a uz samu površinu ocrtavaju se pravilnim rompskim likovima (tab. I, sl. 3, 7, 14). Položaj ogranaka u odnosu na smjer rasta talusa je okomit ili subokomit. Rijetko vidljive ciste razvijale su se unutar proširenih dijelova ogranaka.

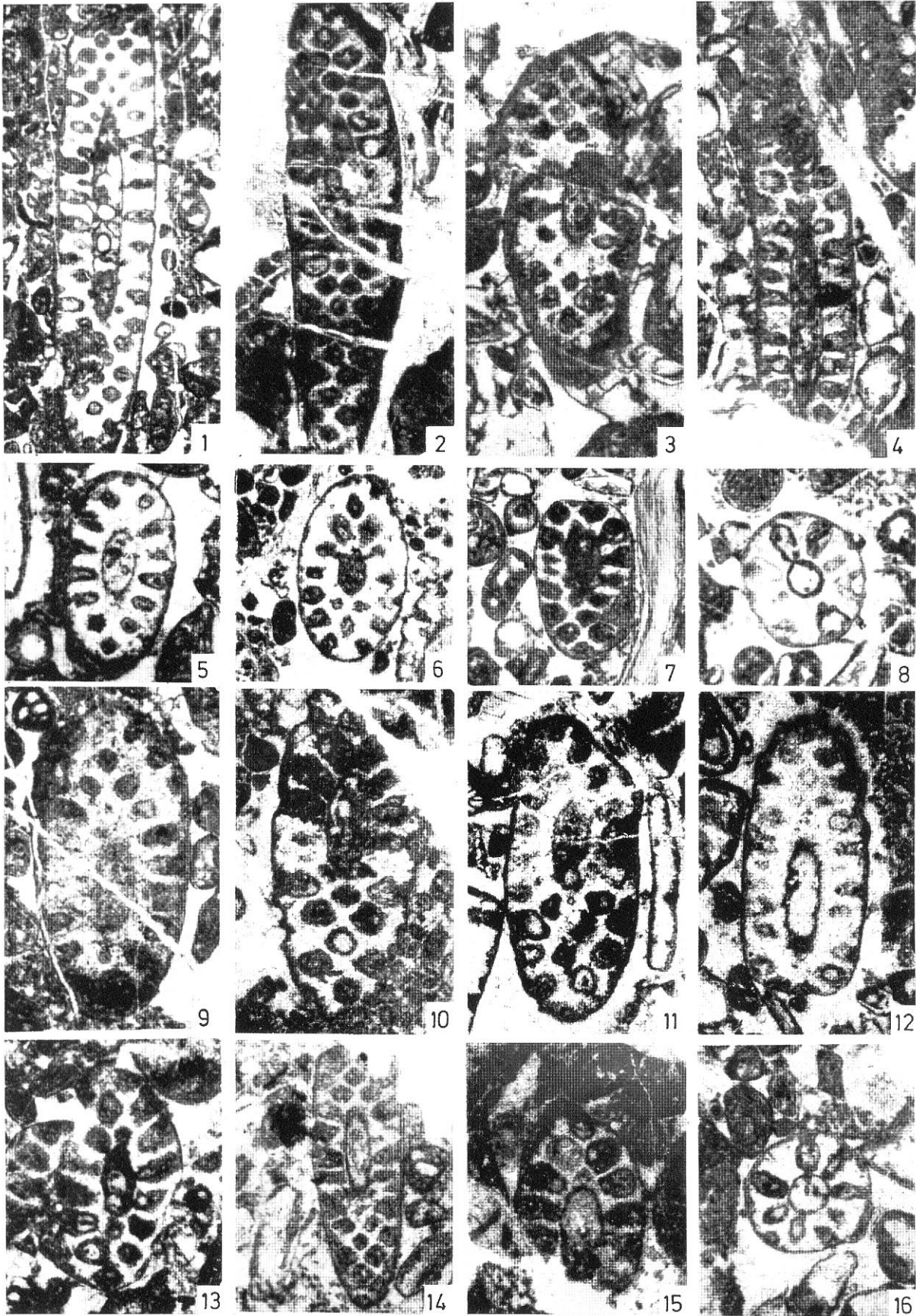
Dimenzije su navedene u engleskom tekstu.

**Sličnosti i razlike:** Pribrajanje ove vrste rodu *Salpingoporella* temeljeno je na identičnosti za rod primarnih značajki. Manje značajna ali ipak prisutna karakteristika oblikovanja ogranaka na distalnom kraju također je bliska drugim vrstama ovoga roda. Usporedba te vrste s dosada opisanim (preko 30) vrstama ovoga roda u rasponu od dogera do u gornju kredu ocrtava njezine specifičnosti koje je čine lako prepoznatljivom.

Jasno je razgraničena od vrstâ kao što su *Salpingoporella annulata* CAROZZI, *S. grudii* (RADOIČIĆ) itd., kod kojih su ogranaci na distalnim krajevima izrazito razvučeni smjerom osi rasta talusa ili vrstâ kod kojih su ogranaci razvučeni smjerom okomitom na os rasta talusa kao što su: *S. melitae* RADOIČIĆ, *S. dinarica* RADOIČIĆ, *S. hasi* CONRAD et al., *S. genevensis* (CONRAD) i *S. urladanasi* CONRAD et al. (CONRAD et al., 1976). U odnosu na navedene vrste razlika je izražena i generalno znatno užom središnjom šupljinom u *S. robusta*. Manja sličnost između *S. robusta* i *S. katzeri* CONRAD & RADOIČIĆ (CONRAD & RADOIČIĆ, 1978) vidljiva je samo u slučaju ako se uspoređi tangencijalni presjek uz distalnu površinu kod

PLATE - TABLA I

1 - 16	<i>Salpingoporella robusta</i> n. sp.
1, 2, 14	Oblique-tangential sections (koso-tangencijalni presjeci), fig. 1 x18, figs. 2, 14 x22
3, 5-7, 9-13, 15	Oblique sections, fig. 7 Holotype (kosi presjeci, sl. 7, holotip); figs. 3, 5-7, 9, 11, 13 x22, figs. 10, 12, 15 x24
4	Longitudinal - tangential section (uzdužno-tangencijalni presjek); x22
8, 16	Transverse sections (poprečni presjeci); x22



*S. robusta* s tangencijalnim presjekom kroz približno središnji dio vapnenačke stijenke kod *S. katzeri* kada se pore ogranaka ocrtavaju približno podjednakim romboidnim likovima. Ova sličnost nestaje u vanjskom tangencijalnom presjeku gdje pore ogranaka u *S. katzeri* postaju poligonske i razvučene smjerom horizontalne ravnine. Opisana vrsta vrijednošću unutarnjeg dijametra približava se vrsti *S. adriatica* (GUŠIĆ) što je i jedina sličnost uz dobro izražene razlike u pogledu vanjskog dijametra, broja ogranaka u pršljenu i njihove međusobne udaljenosti. Jasno vidljiva je razlika i prema stratigrafski bliskim vrstama *S. muehlbergii* (LORENZ) u koje do izrazitijeg širenja ogranaka dolazi tek na njihovu distalnom kraju ili prema vrsti *S. biokoviensis* SOKAČ & VELIĆ (SOKAČ & VELIĆ, 1979) kod koje se ogranci proširuju u dva stupnja s kvadratičnim porama na vanjskoj površini. Neke sličnosti koje se odnose na vrijednosti vanjskog i unutarnjeg dijametra zapažaju se između ove vrste i *S. pygmaea* (PIA) uz razlike naglašene u oblikovanju ogranaka i njihovog broja u pršljenu. Razlike su vidljive i prema vrstama *S. steinhauseri* CONRAD, PRATURLON & RADOIČIĆ, *S. turgida* (RADOIČIĆ) te gornjokrednim vrstama *S. milovanovici* RADOIČIĆ (RADOIČIĆ, 1978) i *S. polsaki* SOKAČ & JELASKA (SOKAČ & JELASKA, 1991) koje su izuzevši *S. turgida* znatno manje uz veća

ili manja odstupanja u obliku ogranaka, izgledu njihovih pora na distalnom kraju ili broju ogranaka u pršljenu i njihove međusobne udaljenosti. Od *S. croatica* SOKAČ (SOKAČ, 1992) ova vrsta se razlikuje nešto većim dimenzijama i izrazito alternirajućim rasporedom ogranaka susjednih pršljenâ.

**Stratigrafski položaj:** *Salpingoporella robusta* n.sp. nađena je u slojevima intraklastičnih vapnenaca tipa algalno-foraminiferskih vekstona i pekstona koji se kao interkalacija debljine oko 10 m nalaze unutar rekristaliziranih vapnenaca madstonskog tipa. Uzorak s ovom algom superpozicijski leži gotovo neposredno ispod deblje uslojenih orbitolinskih vekstona s prvim pojavama *Palorbitolina lenticularis* (BLUMENBACH). U istom nivou s ovom algom nađene su *Triploporella marsicana* PRATURLON, *Suppiluliumaella polyreme* ELLIOT, *Salpingoporella biokoviensis* SOKAČ & VELIĆ, *Cylindroporella ivanovici* (SOKAČ) koju su ovom rodu pribrojili MASSE & LUPPERTO-SINNI (1989). Od foraminifera nađene su: *Vercorsella scarsellai* (DE CASTRO), *Debarina hahounerensis* FOURCADE et al., *Nezzazata simplex* OMARA i druge manje značajne. Na temelju ove zajednice i šire analiziranog raspona nivoa s ovom algom može se zaključiti da je stratigrafska pripadnost tipskog lokaliteta u rasponu vršnog barema s prelazom u donji apt.

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