

BRANKO SOKAČ and LEON NIKLER

LINOPORELLA KAPELENSIS N. SP. (DAASYCLADACEAE)
FROM THE TITHONIAN OF MT. VELIKA KAPELA

With 3 plates

Tithonian limestones of the southwestern slopes of Mt. Velika Kapela have yielded a new species of calcareous algae, which by its morphological characteristics belongs to the genus *Linoporella*.

A new calcareous alga has been found in the Tithonian limestones of the southwestern slopes of Mt. Velika Kapela, among numerous macrofossil remains, e. g., hydrozoans, snails, corals, brachiopods, sponges, etc. This new dasyclad species belongs by its characteristics to the genus *Linoporella*, first of all by the structure and type of its branches. In addition to *Linoporella ellioti* Pratulon, this species, *L. kapelensis* n. sp., is one of the best developed representatives of the genus *Linoporella*.

The main characters of the genus *Linoporella* have been given by Steinman (1899), summarized later by Pia (1927), and accepted recently by Pratulon (1965). Certain characteristics were mentioned also by Cros & Lemoine (1967), and thus it can be said that this genus is quite well known.

Tribe Linoporellae

Genus *Linoporella* Steinmann, 1899

Linoporella kapelensis n. sp.

Plates I-III

Origin of the name: after Mt. Velika Kapela, on whose southwestern slopes the new species has been found.

Type-locality: northwestern slopes of Mt. Velika Kapela, on the road Jasenak-Noví Vinodolski, about 2 km north of the village Ledenica.

Age: Tithonian biosparuditic limestones.

Holotype: longitudinal oblique section, thin-section Breze-1, illustrated in pl. I, fig. 1.

Diagnosis: Calcareous alga with regular cylindrical thallus and with primary and secondary branches. Primary branches are disposed in verticills and directed steeply upwards, thus making an acute angle with the longitudinal axis. Four secondary branches issue from each primary branch, having obvious widenings at their distal ends.

Description: *Linoporella kapelensis* n. sp. is represented in the available material with rather numerous sections, thus facilitating the recognition of its main morphological characteristics. The calcareous skeleton is undivided and of a relatively regular cylindrical shape. The outer surface is more strongly corroded by the destroying of the pores of the secondary branches. The inner margin is uninterrupted and sharp (pl. I, fig. 1; pl. II, figs. 1-2). The main stem occupies somewhat less than a half of the entire diameter. In accordance with the main characters of the genus, this species also possesses primary and secondary branches. The primary branches are arranged in whorls and directed steeply upwards. Some of these show even a more pronounced tendency to bend upwards, after leaving the main stem (pl. I, fig. 1; pl. II, fig. 1), thus forming an angle of 10° - 40° with the longitudinal axis in one and the same specimen. The primary branches show an equal diameter all along their length; no swelling exists where the secondary branches grow out. Four secondary branches issue from each primary branch, having about the same diameter as the primary branch (pl. I, fig. 1). The secondary branches strongly diverge from each other, which is well visible in the plane of the approximately longitudinal section. The upper secondary branch mostly follows the direction of the primary branch, whereas the lower one is always directed slightly downwards and is usually somewhat shorter than the opposite one (pl. I, fig. 1; pl. II, fig. 1). Near the outer surface of the calcareous skeleton the secondary branches widen obviously and rather abruptly (pl. I, fig. 1; pl. II, fig. 1). The spores have not been identified, but according to the main structural pattern, the formation of the spores probably occurred within the main stem.

	Dimensions in mm:
Maximum observed length	14
Outer diameter of the skeleton	2.22-2.59
Inner diameter of the skeleton	1.00-1.40
Distance between the whorls	0.45-0.55
Length of the primary branches	0.40-0.60
Length of the secondary branches	0.28-0.45
Diameter of the primary branches	0.07-0.10
Diameter of the secondary branches	0.04-0.07

	Dimensions in mm:
Diameter of the distal widening of the secondary branches	0.10-0.19
Number of the primary branches in a whorl	35-40?
Number of the secondary branches on each primary branch	4
Angle between the primary branches and the main stem	10°-40°

Similarities and differences: The new species can be compared with the four species of the genus described up to now: *Linoporella capriotica* (Oppenh.) Steinmann, *L. taurica* Pčelincev, *L. elliotti* Praturlon and *L. lucasi* Cros & Lemoine. However, these four species have been described with differing accuracy depending on the different quality of the material available, and from different deposits of relatively widely remote localities.

Because of their identical stratigraphic position, the differences between *L. kapelensis* n. sp. and *L. capriotica* require definition most urgently. The most obvious difference refers to numerical values, which are considerably higher in *L. capriotica*, except the distance between the two consecutive whorls, what means that the whorls are more densely arranged in *L. capriotica*. In addition, in *L. capriotica* the primary branches are nearly perpendicular to the longitudinal axis of the plant (Steinmann, 1899, p. 149 fig. 13), whereas in *L. kapelensis* there is an acute angle between the primary branches and the longitudinal axis, i. e., 10°-25°. There is also a difference in the outer shape of the skeleton, which is reported by Steinmann (1899) to consist of barrel-shaped segments in *L. capriotica*, whereas in *L. kapelensis* there is a unique, more or less cylindrical thallus. *L. taurica*, from the Kimmerdgian of the Crimea, comes also rather close in its stratigraphical position to the new species, but only an approximate comparison is possible, due to the insufficient first description (Pčelincev, 1925), which caused Praturlon (1965) to suspect the validity of this species. The dimensions of *L. taurica* and *L. kapelensis* seem to be quite similar, as can be seen from the values quoted by Praturlon (1965), which have been indirectly inferred from the original pictures. Nevertheless, *L. taurica* is somewhat larger, which, however, cannot be taken as a diagnostic difference. Judging by Pčelincev's figures (1925, pl. II, fig. 5), it seems that the primary branches in our species are directed considerably more steeply upwards, and the divergence in the directions of the secondary branches is more pronounced, as well as the widenings at the distal ends of the secondary branches, which cannot be observed in *L. taurica*.

The differences between *L. kapelensis* n. sp. and *L. elliotti* are much easier to define, first of all due to much smaller dimensions of *L. elliotti*, which can be considered a constant characteristic feature of the species, since a large number of specimens of both species has been investigated. In

spite of its much smaller dimensions, *L. ellioti* shows generally a coarser structure (Praturlon, 1965, p. 4, fig. 1; p. 5, fig. 2), and in addition, there is a considerable difference in the position of the primary branches: in *L. ellioti* they begin to grow steeply upwards (about 60°–80° of the horizontal plane), but afterwards bend downwards, and so the secondary branches are nearly horizontal, with a slight but obvious widening at their distal ends. In *L. kapelensis*, however, the primary branches tend even to bend more upward, and there is no visible changing of their direction at the point where the secondary branches issue. Further on, the secondary branches, which lie approximately in the plane of the longitudinal section diverge from each other very clearly and abruptly, and one secondary branch continues to grow in the direction of the primary branch, whereas the other grows downwards. In *L. kapelensis* the distal widening of the secondary branches is more strongly pronounced than in *L. ellioti*.

The comparison with *L. lucasi* cannot be treated in detail; it may concern only generally the dimensions of the thallus and the considerably larger central cavity in *L. lucasi*, which, in addition, has a visible swelling in its lower part, which has not been observed in our species. Apart from the differences in dimensions of single elements, the photographs of *L. lucasi* (Cros & Lemoine, 1967, pl. I, figs. 5–6) do not allow to obtain a real picture of its structure, and in our opinion the belonging of this species to the genus *Linoporella* must be considered doubtful.

Stratigraphic position: *Linoporella kapelensis* n. sp. has been found in reef sediments, in an association with *Ellipsactinia caprense* Canavari, *E. ramosa* Canavari, *Sphaeractinia diceratina* Steinmann, *S. kuehni* Germovšek, *Nerinea partschi* Peters, *N. defrancei* var. *posthuma* Zittel, *N. fichteli* Herbich and *Cryptoplocus succedens* (Zittel). This association undoubtedly proves the Tithonian age.

REFERENCES

- Cros, P. & Lemoine, M. (1967): Dasycladacées nouvelles ou peu connues du Lias inférieur des dolomites et de quelques autres régions méditerranéennes. Rev. Micropal., 9/4, 246–257, Paris.
- Oppenheim, P. (1889): Beiträge zur Geologie der Insel Capri und der Halbinsel Sorrent. Z. deutsch. geol. Ges., 41, 442–458, tab. 19–20. Berlin.
- Pčelincev, V. (1925): Hydrozoen und Dasycladaceen aus den mesozoischen Ablagerungen der Krim. Trav. Soc. Nat. Leningrad, 55/4, Sect. Geol. Min., (refer. 85–86, pl. 2, fig. 5), Leningrad.
- Pia, J. (1920): Die Siphoneae verticillate vom Karbon bis zur Kreide. Abh. Zool. Bot. Gesell. Wien, 11/2, 1–263, 27 text-figs., 8 pls., Wien.
- Pia, J. (1927): in Hirmer: Handbuch der Paleobotanik, I, Thallophyta. München und Berlin.
- Praturlon, A. (1965): A new *Linoporella* (Dasycladacea) from Middle Cretaceous of Marsica (central Apennines). Geol. Rom., 4, 1–6, fig. 1–3. Roma.
- Steinmann, G. (1899): Über fossile Dasycladacen von Cerro Escamela, Mexico. Bot. Ztg. 57, 137–154, 18 figs., Leipzig.

B. SOKAČ i L. NIKLER

LINOPORELLA KAPELENSIS N. SP. IZ TITONSKIH NASLAGA
VELIKE KAPELE

Prilikom istraživanja malmskih naslaga jugozapadnih padina Velike Kapele u titonskim vapnencima među ostacima brojnih makrofosila, kao hidrozoa, gastropoda, koralja, brahiopoda i spužava nađena je u većem broju primjeraka jedna nova vapnenačka alga. Nova vrsta oblikom skeleta, a prvenstveno gradom i tipom ogranaka uklapa se u karakteristike roda *Linoporella*. Uz vrstu *Linoporella elliotti* Pratulon novo opisana vrsta *Linoporella kapelensis* n. sp. jedan je od najizrazitijih predstavnika roda *Linoporella*.

Osnovne karakteristike roda *Linoporella* dao je Steinmann (1899), sumarno ih je iznio Pia (1927), a preuzeo ih je i Pratulon (1965). Neke od značajki roda *Linoporella* navode Cros & Lemoine (1967), pa je ovaj rod u osnovi već dobro poznat.

Tribus Linoporellae

Genus *Linoporella* Steinmann 1899

Linoporella kapelensis n. sp.

Porijeklo imena: Ime vrste vodi porijeklo od planine Velike Kapele na čijim jugozapadnim padinama je opisana vrsta nađena.

Tipični lokalitet: Jugozapadne padine Velike Kapele, na cesti Jasenak-Novi Vinodolski, oko 2 km sjeverno od mjesta Ledenica.

Geološka starost: Biosparruditski vapnenci titonske starosti.

Holotip vrste *Linoporella kapelensis* je uzdužno-kosi presjek u izbrusku Breze-I prikazan na tabli I, sl. 1.

Dijagnoza: Vapnenačka alga pravilnog cilindričnog skeleta sa ograncima prvog i drugog reda. Primarni ogranci smješteni su u pršljene i jako su ustrmljeni, pa s uzdužnom osi zatvaraju kut male vrijednosti. Od svakog primarnog ogranka odvajaju se četiri sekundarna sa vidljivim odebljanjem na distalnom kraju.

Opis: *Linoporella kapelensis* n. sp. predstavljena je u materijalu sa više različitih presjeka što omogućuje da se odrede njezine osnovne morfološke odlike. Vapnenački skelet je cjelovit i relativno pravilnog cilindričnog oblika. Vanjska površina nešto je više korodirana razaranjem pora sekundarnih ogranaka. Unutarnji rub cjelovit je i oštar (tab. I, sl. 1; tab. II, sl. 1 i 2). Matična stanica zaprema nešto manje od polovine ukupnog dijametra. U skladu s osnovnim karakteristikama roda i ova vrsta posjeduje primarne i sekundarne ogranke. Primarni ogranci smješteni su u pršljene i jako su ustrmljeni prema gore. Pojedini od ovih ogranaka nakon izlaska iz matične stanice pokazuju tendenciju povijanja i daljnjeg ustrmljavanja na gore (tab. I, sl. 1; tab. II, sl. 1) pa s uzdužnom osi biljke zatvaraju kut od 10°-40° na istom primjerku. Primarni ogranci u cijeloj dužini pokazuju jednaki dijаметar bez vidljivog odebljanja na mjestu izrastanja sekundarnih ogranaka. Od svakog primarnog ogranka odvajaju se četiri ogranaka približno podjednakog dijametra kao i primarni ogranci (tab. I, fig. 1). Sekundarni ogranci brzo se udaljuju jedan od drugog, pa u ravni približno uzdužnog presjeka par suprotnih ogranaka pokazuje izrazitu divergenciju. Gornji ogranak najčešće nastavlja smjer primarnog ogranka dok niži redovito raste prema dolje i obično je nešto kraći od sebi suprotnog ogranka (tab. I,

sl. 1; tab. II, sl. 1). Uz površinu vapnenačkog skeleta sekundarni ogranci vidljivo se i dosta naglo šire (tab. I, sl. 1; tab. II, sl. 1). Prisustvo spora nije utvrđeno, ali je vjerojatno s obzirom na građu, da su se one razvijale u matičnoj stanici.

	Dimenzije u mm:
Maksimalna promatrana dužina	14
vanjski dijametar skeleta	2,22-2,59
unutarnji dijametar skeleta	1,00-1,40
udaljenost između pršljena	0,45-0,55
dužina primarnih ogranaka	0,40-0,60
dužina sekundarnih ogranaka	0,28-0,45
dijametar primarnih ogranaka	0,07-0,10
dijametar sekundarnih ogranaka	0,04-0,07
dijametar distalnog proširenja sekundarnih ogranaka	0,10-0,19
broj primarnih ogranaka u pršljenu	35-40?
broj sekundarnih ogranaka na jednom primarnom	4
kut primarnog ogranaka sa uzdužnom osi	10 ⁰ -40 ⁰

Sličnost i razlike: Usporedba ovdje prikazane vrste moguća je sa dosada četiri poznate: *Linoporella capriotica* (Oppenheim) Steinman, *L. taurica* Pčelincev, *L. elliotti* Praturlon i *L. lucasi* Gros & Lemoine koje su opisane na različito kvalitetnom materijalu i iz različitih naslaga relativno udaljenih lokaliteta.

S obzirom na identičan stratigrafski položaj vrste *L. capriotica* i *L. kapelensis* od značenja su njihove međusobne razlike. Očita razlika vidljiva je iz numeričkih vrijednosti pojedinih elemenata koji su znatno veće kod vrste *L. capriotica*, osim međusobne udaljenosti susjednih pršljena, što ukazuje da su oni gušće pakovani kod vrste *L. capriotica*. Kod vrste *L. capriotica* položaj primarnih ogranaka u odnosu na uzdužnu os stabljike blizu je okomitom (Steinmann 1899, str. 149, sl. 13) dok je kod ovdje opisane vrste kut što ga zatvara pravac primarnog ogranaka i uzdužne osi izrazito male vrijednosti (od 10⁰-25⁰). Razlika postoji i u vanjskom obliku skeleta za kojega u vrste *L. capriotica* Steinmann (1899) navodi raščlanjenost na bačvaste segmente, a koji je kod novo opisane vrste manje više pravilno cilindričan. Stratigrafskom položaju naše vrste bliska je i *L. taurica* iz kimeridža Krima. Međutim usporedba sa ovom vrstom tek je približno moguća uslijed manjkavog opisa (Pčelincev 1925), pa je pitanje validnosti ove vrste istaknuo Praturlon (1965). Iz vrijednosti dobivenih posrednim putem koje navodi Praturlon (1965) prema originalnim fotografijama, dimenzije vrste *L. taurica* i *L. kapelensis* su dosta slične iako je prva vrsta nešto veća, što međutim nije prihvatljiv kriterij za njihovo prepoznavanje. Na osnovu priložene fotografije Pčelinceva (1925 tab. II, sl. 5), čini se da je kod naše vrste ustrmljenost primarnih ogranaka znatno veća, a divergentnost sekundarnih ogranaka izrazitije naglašena kao i njihovo odebljavanje na distalnom kraju, što se ne može uočiti i kod vrste *L. taurica*.

Odnos *L. kapelensis* prema vrsti *L. elliotti* mnogo je jasniji, i to izrazito manjim dimenzijama vrste *L. elliotti*, što s obzirom na veći broj istraženih primjeraka možemo donekle smatrati i jednom od konstantnih osobina ovih vrsta. Unatoč znatno manjih dimenzija, *L. elliotti* općenito je nešto grublje građe (Praturlon 1965, str. 4, sl. 1, str. 5, sl. 2), a veća razlika postoji i u položaju primarnih i sekundarnih ogranaka koji u vrste *L. elliotti*, premda u donjem dijelu ustrmljeni (60-80⁰ prema horizontali), distalno povijaju na dolje, pa se sekundarni ogranci približavaju horizontalnom položaju, uz lagano ali vidljivo širenje na distalnom kraju. Međutim kod vrste

L. kapelensis povijanje primarnih ogranaka u odnosu na njihov proksimalni kraj gravitira prema gore bez vidljivog savijanja u točki odvajanja sekundarnih ogranaka. Nadalje sekundarni ogranci koji leže u ravnini približno uzdužnog presjeka pokazuju međusobno naglo razilaženje, od kojih jedan sekundarni ogranak nastavlja se smjerom primarnog ogranaka dok drugi raste prema dolje. U vrste *L. kapelensis* postoji i jasnije odebljavanje distalnog kraja sekundarnog ogranaka prema vrsti *L. elliotti*.

Usporedba *L. kapelensis* s vrstom *L. lucasi* moguća je samo generalno u veličini talusa i znatno većoj centralnoj šupljini kod vrste *L. lucasi*, kod koje je na donjem dijelu prisutno i vidljivo zadebljanje, što nije primijećeno kod naše vrste. Neovisno od navedenih dimenzija pojedinih elemenata, kod vrste *L. lucasi* na osnovi priloženih fotografija (Cros & Lemoine 1967, tab. I, sl. 5 i 6) nismo mogli dobiti pravu sliku njezine građe, i prema našem mišljenju neizvjesno je da li ova vrsta stvarno pripada rodu *Linoporella*.

Stratigrafski položaj: *Linoporella kapelensis* n. sp. nađna je u grebenskim sedimentima u zajednici s: *Ellipsactinia ellipsoidea* Steinmann, *E. caprense* Canavari, *E. ramosa* Canavari, *Sphaeractinia diceratina* Steinmann, *S. kuehni* Germovšek, *Nerinea partschi* Peters, *N. defrancei* var. *posthuma* Zittel, *N. fichteli* Herbich i *Cryptoplocus succedens* (Zittel), što nesumnjivo utvrđuje titonsku starost opisane vrste.

Received (Primljeno): 05. 04. 1973.

Institute of Geology
Institut za geološka istraživanja
Zagreb, Beogradska 113

PLATE - TABLA I

1 - 3. *Linoporella kapelensis* n. sp.

1. Holotype: Oblique-tangential section (koso-tangencijalni presjek), Breze 1, x 13,8.
2. Oblique-cross section (poprečno-kosi presjek), Breze 3, x 26, 3.
3. Slightly oblique cross section (malo kosi poprečni presjek), Breze 3 x 24,6.

Foto Ž. Mikša



PLATE - TABLA II

1 - 2. *Linoporella kapelensis* n. sp.

1. Longitudinal-tangential section (uzdužno-tangencijalni presjek), Breze 5, x 18.
2. Oblique section (kosi presjek), Breze 3, x 18,6.

Foto Ž. Mikša

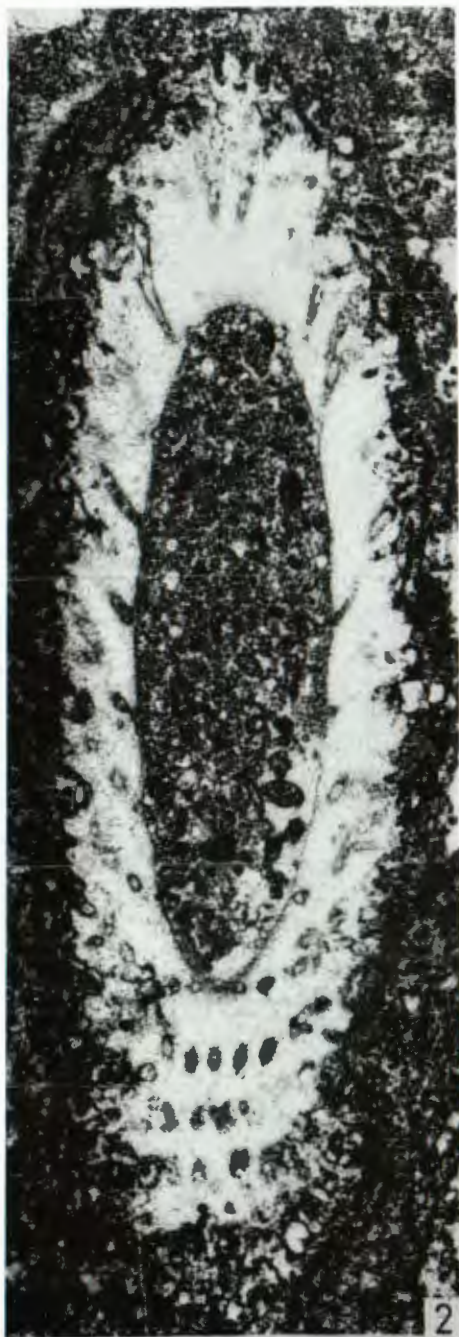
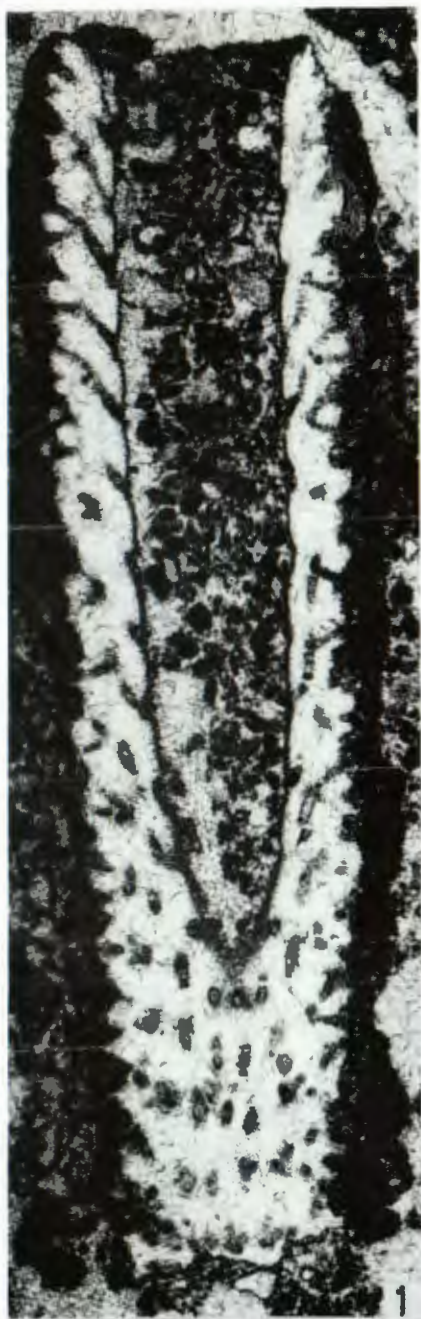


PLATE - TABLA III

1 - 4 *Linoporella kapelensis* n. sp.

1. Tangential section (tangencijalni presjek), Breze 6, x 23,3.
2. Slightly oblique cross section (malo kosi poprečni presjek), Breze 1, x 23,1.
3. Slightly oblique cross section (malo kosi poprečni presjek), Breze 3, 24,2.
4. Oblique section (kosi presjek), Breze 2, x 25.

Foto Ž. Mikša

