

IVO VELIĆ and IVAN GUŠIĆ

CUNEOLINA TENUIS N. SP. FROM THE NEOCOMIAN OF MT.
VELIKA KAPELA (CENTRAL CROATIA)

With 2 text-figures and 2 plates

Cuneolina tenuis n. sp., deriving from the lower part of the Lower Cretaceous, is characterized by its delicate and simple structure: a very thin wall and septa, and the almost total absence of secondary structural elements.

INTRODUCTION

Micropaleontologic investigations of the Jurassic and Cretaceous limestone deposits in the region between Ogulin and Plaški, central Croatia (text-fig. 1), revealed the existence of a new species of the genus *Cuneolina* in the lower part of the Lower Cretaceous. The type-locality is situated at the locality Duga Draga, in the SE part of Mt. Velika Kapela, between Jezerane and Modruš (text-fig. 1). Thin-sections are kept at the Institute of Geology, Zagreb, under the designation OG-10680.

SYSTEMATIC DESCRIPTION

Order Foraminiferida

Family Ataxophragmiidae Schwager, 1877

Genus *Cuneolina* d'Orbigny, 1839

Cuneolina tenuis n. sp.

Plates I-II

Holotype: Specimen figured in pl. I, fig. 1, slide No. OG-10680/13.

Paratypes: other specimens figured in plates I-II, slides Nos. OG-10680/1 - OG-10680/13.

Type-locality: Duga Draga, about 2 km NW of elevation point 884 at the road Modruš-Jezerane; x=5516,8; y=4998,9 at sheet Ogulin 4 (1:50.000 after Paris).

Type-stratum: Lower Cretaceous, Neocomian (probably Hauterivian).

Name: *tenuis* = Lat. tender, delicate; after the very thin wall and septa.

Diagnosis: Small, simple *Cuneolina* with a very thin wall and septa, almost deprived of any kind of secondary partitions.

Description: Test calcareous, imperforate, microgranular. No agglutinated foreign grains could be identified, even under high magnification. The wall, which also forms the interchamber partitions by bending inwards, consists of a simple, thin, dark layer of microcrystalline calcite. The size of the calcite grains constituting the wall and the septa amounts to 0.001 – 0.002 mm, contrasting sharply with the white and translucent calcitic grains of the surrounding recrystallized micritic mass,

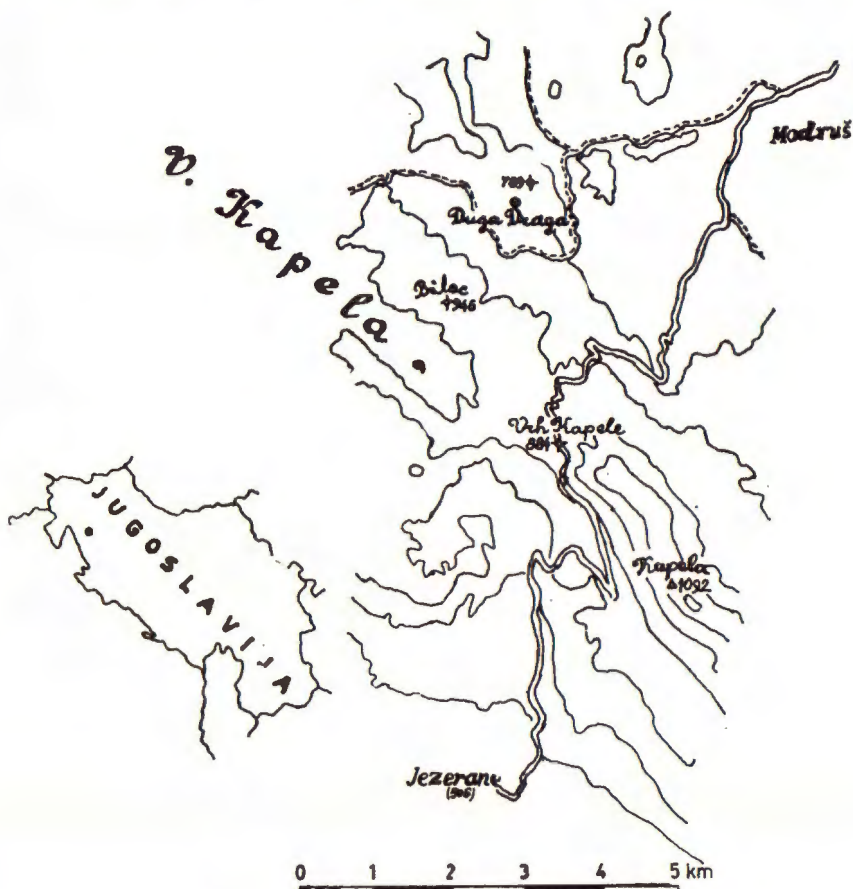


Fig. – Sl. 1. Situation map. – Položajna skica.

which are about 0.01–0.03 mm in size. The general form of the test as in the genus; medially compressed, varying in shape from acutely triangular (apical angle about 35°) over broadly triangular to flabelliform (apical angle over 80° in strongly flabelliform specimens, measured between the lines connecting the apex and the most expanded points of the last chamber).

Megalosphere not very large, measuring $\pm 0,04$ mm in diameter, apparently unilocular; situated only slightly excentrically, almost in the plane of symmetry, viewed in both median (pl. I, figs. 1, 2, 4, 5, 7, 8) and vertical radial sections (pl. I, figs. 10–12; pl. II, figs. 1–4); the initial trochospiral stage seems to be lacking, but this cannot be ascertained with security.

The arrangement of the chambers typical of the genus: two parallel layers of arcuate, sausage-shaped, primary chambers, alternating in position from one layer to the other and increasing gradually in size in the plane of biseriality (= median plane). The wall of each primary chamber is curved inwards and either hook-shaped (pl. II, fig. 6) or, more frequently, merely thickened at its termination; not reaching the peripheral part of the wall of previous opposite chamber, but leaving a free narrow passage between the incurved ends of the opposing primary chambers, which can be seen in vertical radial sections (pl. I, figs. 10–12; pl. II, figs. 1–6).

Radial partitions (= radial septa), dividing each primary chamber into secondary chamberlets, also consist of a simple, thin layer of microcrystalline calcite, but are even considerably thinner than the wall, averaging only about one half of the wall thickness. These do not seem to be equally well developed in all specimens; they tend to be more regularly developed and more numerous in broadly triangular and flabelliform specimens; in acutely triangular specimens radial partitions seem to be totally absent, at least in the first chambers. They are not always exactly in alignment from one primary chamber to the next, but they go perpendicularly through the median zone and hence are common to both layers of chambers, which may be seen in vertical transversal sections (pl. II, figs. 7–12).

Short secondary partitions (both transversal and parallel, i.e., horizontal and vertical) are totally lacking in most specimens; only in a few specimens (pl. II, figs. 5–6) in vertical sections some orimentary sub-epidermal partitions projecting a short distance inwards from the outer wall and staying perpendicularly to both outer surface and radial partitions, can be noticed.

The dimensions and proportional relations need not be discussed at length, since they can be seen in the table with dimensions.

Remarks: Although the aperture has not been observed (which is generally considered to represent the diagnostic characteristic of the genus in respect to the genus *Pseudotextulariella*), a number of characteristic features have convinced us that the new species belongs to the genus *Cuneolina* rather than *Pseudotextulariella*. These are: a strongly flattened and sometimes clearly flabelliform shape of the test; typically arcuate, sausage-shaped chambers; and particularly the kind of the inner structure as it is

seen in vertical radial sections, with typically incurved chamber walls and their thickened or hook-shaped terminations. The wall structure, which is entirely microgranular, may also support this assignment. Therefore this species is here compared with similar Lower Cretaceous forms, all of which have been described as *Cuneolina*; however, the possibility that all the forms concerned – being known only from thin-sections – may have a slit-like aperture, cannot be, as yet, absolutely excluded.

Dimensions in mm:

	holotype	other specimens
Radial distance from apex to base	0.50	0.45 — 0.65
Width of last chamber	0.40	0.25 — 0.55
Thickness in adult part of test	—	0.13 — 0.20
Height of chambers	0.050	0.040 — 0.060
Distance between radial partitions	0.040	0.025 — 0.045
Wall thickness	0.005	0.004 — 0.007
Thickness of radial septa	0.0025	0.0025 — 0.0030
Number of primary chambers	11	8 — 13
Number of primary chambers per mm of radius	22	20 — 25
Apical angle (9 measurements)	50°	<35° — >80°

Relations and differences: *Cuneolina tenuis* n. sp. is easily distinguished from all the other representatives of the genus by its much thinner wall and even more thinner radial partitions. Considering its size, it comes most closely to *C. camposaurii* Sartoni & Crescenti, but the wall and the septa in *C. camposaurii* are about twice as thick as in *C. tenuis*. Due to this fact, the number of chambers per mm is almost the same in both species, or only slightly greater in *C. camposaurii*, in spite of the fact that the height of chambers in *C. camposaurii* is only one half of that in *C. tenuis*.

As to *C. laurentii* Sartoni & Crescenti, the differences considering the thickness of the wall and the septa are even more prominent, the wall and the septa in *C. laurentii* being strikingly (more than ten times) thicker than in *C. tenuis*. By approximately the same height of the chambers, *C. laurentii* has less than a half (7–13) chambers per mm, due to very thick interchamber bands, whose thickness may even exceed the height of chambers. In addition, *C. laurentii* has fairly developed short secondary partitions, normally 1–3 per chamber (Sartoni & Crescenti, 1962, p. 277, pl. 48, figs. 7–8), although in the first chambers they may be absorbed by the very thick interchamber partitions.

Cuneolina hensoni Dalbiez (1958), which has been reported to derive from stratigraphically similar levels, i.e. Lowermost Cretaceous, has certain characteristics similar to *C. laurentii* (very thick wall and interchamber

bands, approximately the same number of chambers per mm), and thus, although differing from it in other respects (shape, etc.), the same differences with regard to *C. tenuis* may be quoted. Besides, *C. hensoni* is almost twice as large as *C. tenuis* and nearly always clearly flabelliform, whereas acutely triangular specimens have not been recorded.

The differences between *C. tenuis* and Albian to Upper Cretaceous *Cuneolinas* are obvious (constant presence of secondary structural elements), and therefore need not be explained in detail.

Stratigraphical position: *C. tenuis* has been found, as far, at its type-locality only, in a layer of recrystallized micritic limestone, associated only with numerous *Favreina salevensis* (Paréjas). Considering the superpositional relations of the Upper Malmian-Lower Cretaceous sequence in the area, however, its stratigraphical position can be defined as Neocomian, i. e., the lowest part of the *Cuneolina composaurii* cenozone (Sartoni & Crescenti, 1962). It is possibly Hauterivian, but there is no certainty as to the reliability of this last assertion. This is clearly seen from the stratigraphical column in text-fig. 2, which, indeed, has been compiled from several profiles, since the sequence with *C. tenuis* offered no possibilities for stratimetrical measuring due to many minor faults. In the superpositionally same levels at neighbouring parallel profiles a scarce but characteristic microfossil association, consisting of »*Munieria baconica*« (after Carozzi; = *Verticilloporella* Raviv & Lorch), *Salpingoporella annulata* Carozzi, *Campanellula capuensis* De Castro, etc., has been found. These beds are overlain by well-bedded, mostly micritic limestones, which contain only rare and indeterminable orbitolinids, miliolids, textulariids, verneulinids, etc. Only as far as 350–400 m above the beds with *C. tenuis*, an abrupt and abundant appearance of the dasyclad alga *Salpingoporella dinarica* Radoičić takes place. This species is in the outer Dinarids in general considered a reliable Upper Aptian-Basal Albian marker. In addition, there are also *Cuneolina composaurii* Sartoni & Crescenti, *C. laurentii* Sart. & Cresc., *Pseudotextulariella auruncensis* (Chiocchini & Di Napoli Alliata), *P.?* *scarsellai* (De Castro), *Saubadia minuta* (Hofker), *Orbitolina* sp., etc. Single specimens of the above mentioned species, except *S. dinarica*, may be encountered also in the preceding deposits, but their single finds are not sufficient for establishing a reliable stratigraphic determination. Therefore, summarizing all that has been mentioned above and taking also into account the vertical distance from the underlying beds with aberrant tinninids (= »*Vaginella striata*« of Carozzi, »*Bankia striata*« of Farinacci), the stratigraphic position of the new species may be definitely defined only as Neocomian, possibly Hauterivian.

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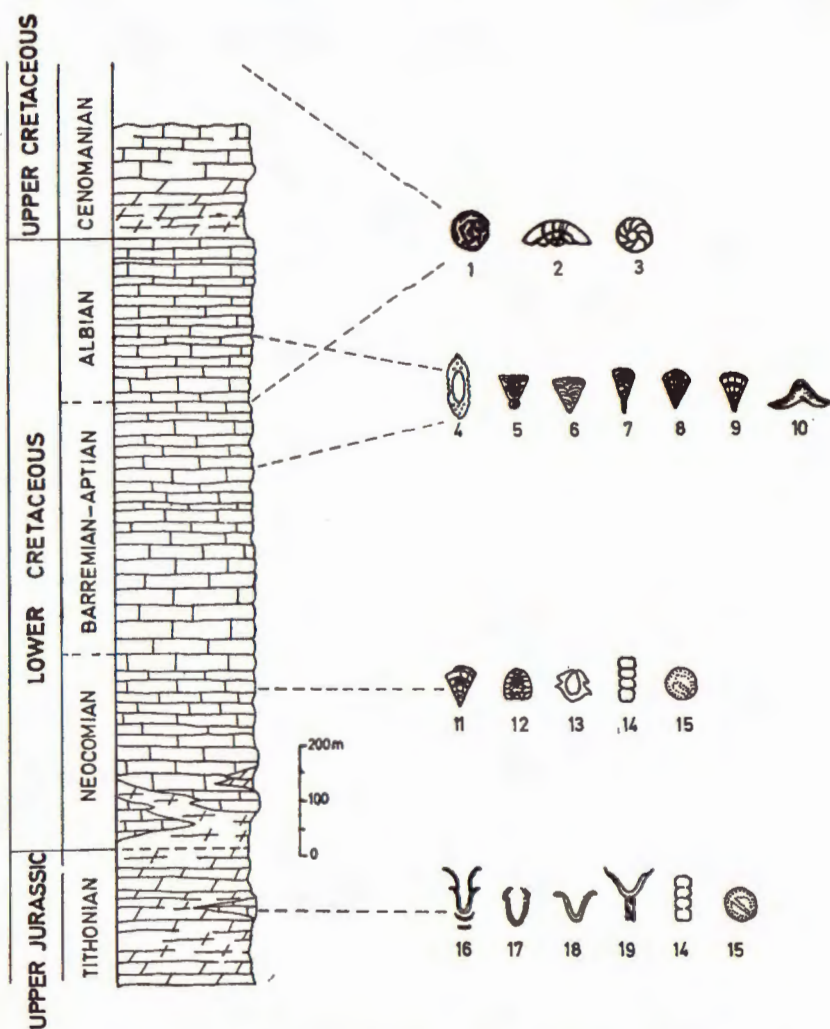


Fig. - Sl. 2. Schematical geological column. - Shematski geološki stup.
 1 = *Nummoloculina heimi* Bonet; 2 = *Nezzazata simplex simplex* O m a r a; 3 = *Valvulammina piccardi* Henson; 4 = *Salpingoporella dinarica* Radoičić; 5 = *Sabaudia minuta* (Hofker); 6 = *Pseudotextulariella auruncensis* (Chiocchini & Di Napoli Alliata); 7 = *P.?* *scarsellai* (De Castro); 8 = *Cuneolina camposaurii* Sartoni & Crescenti; 9 = *C. laurentii* Sart. & Cresc.; 10 = *Orbitolina* sp.; 11 = *Cuneolina tenuis* n. sp.; 12 = *Campanellula capuensis* De Castro; 13 = »*Munieria baconica*«; 14 = *Salpingoporella annulata* Carozzi; 15 = *Favreina salevensis* (Paréjas); 16 = *Campbelliella milesi milesi* Radoičić; 17 = *Metacyclina glandiformis* Radoičić; 18 = *Tintinnopsella simplex* Radoičić; 19 = *Daturellina costata* Radoičić.

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- Sartoni, S. & Crescenti, U. (1962): Ricerche biostratigrafiche nel Mesozoico dell'Appennino meridionale. *Giorn. Geol. (Ann. Museo Geol. Bologna)*, (2), 29, 161-302.

I. VELIĆ i I. GUŠIĆ

CUNEOLINA TENUIS N. SP. IZ NEOKOMA VELIKE KAPELE

Mikropaleontološkom obradom krednih sedimenata na jugoistočnim padinama Velike Kapele (sl. 1) utvrđena je prisutnost jedne nove vrste roda *Cuneolina* u donjem dijelu donje krede. Tipično nalazište nalazi se na lokalitetu Duga Draga, između Jezerana i Modruša (sl. 1). Svi izbrusci koji sadrže opisani materijal čuvaju se u Institutu za geološka istraživanja u Zagrebu pod oznakom OG-10680.

Red Foraminiferida

Familija Ataxophragmiidae Schwager, 1877

Rod *Cuneolina* d'Orbigny, 1839

Cuneolina tenuis n. sp.

Table I-II

Holotip: primjerak prikazan na tab. I, sl. 1, izbrusak br. OG-10680/13.

Paratipovi: ostali primjerci prikazani na tab. I i II, izbrusci OG-10680/1 - OG-10680/13.

Locus typicus: Duga Draga, oko 2 km SZ od kote 884 na cesti Modruš-Jezerane; x=5516,8; y=4998,9; list Ogulin 4 (1:50.000 po Parizu).

Stratum typicum: Donja kreda, neokom (vjerojatno hauterive).

Nomen: *tenuis* = lat. nježan, tanak; prema vrlo tankoj stijenci i septima.

Diagnosis: Mala, jednostavna *Cuneolina* s vrlo tankom stijjenkom i septima, gotovo bez ikakvih sekundarnih sepata.

Opis: Kućica vapnenačka, imperforatna. Stijenka, koja povijanjem prema unutra tvori i pregratke između primarnih klijetaka, sastoji se od jednog jednostavnog, tankog, tamnog sloja izgrađenog od kalcitnih zrnaca veličine oko 0,001 do najviše 0,002 mm, koja stoje u oštroj opreci sa prozirnim kalcitnim zrnima rekristalizirane okolne mikritske osnove, koja su velika oko 0,01-0,03 mm. Niti pod jakim povećanjem nisu mogla biti ustanovljena aglutinirana zrna nekog stranog materijala. Opći izgled kućice karakterističan za rod: medijalno spljoštena, trokutasta ljušturica; oblik varira od usko trokutastog (apikalni kut oko 35°), preko širokog trokutastog, do lepezastog (apikalni kut preko 80° u široko lepezastih primjeraka, mjeren između spojnica vrha i na jširih dijelova posljednje klijetke).

Megalosferična početna klijetka oko 0,04 mm u promjeru; smještena je tek znatno ekscentrično u odnosu na medijalnu ravninu, a gotovo potpuno u radijalnoj ravnini simetrije; početni trohospiralni stadij čini se da nedostaje, no to se ne može posve sigurno utvrditi. Mikrosferična početna klijetka nije zapažena.

Raspored klijetaka tipičan za rod: dva usporedna sloja lučnih primarnih klijetaka, svaka pojedina klijetka ima približno kobasičast oblik, ili kao isječak prstena, a položaj im je naizmjeničan u odnosu na klijetke suprotnog niza. Veličina klijetaka

postepeno se povećava u medijalnoj ravnini. Stijenka svake primarne klijetke povija prema unutra i u unutrašnjosti završava bilo u obliku kukice (tab. II, sl. 6) ili samo odebljanjem. Završetak stijenske ne dodiruje stijenkuprotnu prethodnu klijetku, nego ostavlja uzak prolaz između, kako se to vidi u vertikalnim radijalnim presjecima.

Radijalna septa također se sastoje od jednostavnog, tankog sloja mikrokristaličnog kalcita, a još su tanja od stijenske: njihova debljina iznosi prosječno pola debljine stijenske. Ona dijele primarne klijetke u sekundarne klijetke, no izgleda da nisu uvijek podjednako dobro razvijena u svim primjercima; čini se da su redovitije i ravnomjernije razvijena u široko trokutastim i lepezastim primjercima, a u usko trokutastim primjercima kao da mogu i nedostajati, barem u početnim klijetkama. Radijalna septa nisu uvijek poravnata u liniju, idući iz jedne primarne klijetke u slijedeću; ona okomito presijecaju medijalnu zonu i na taj su način zajednička za oba sloja klijetaka, što se vidi u poprečnim vertikalnim presjecima, tj. onim koji su približno okomiti na radijus (tab. II, sl. 7-12).

Kratka sekundarna (=subepidermalna) septa (i poprečna i uzdužna, tj. i horizontalna i vertikalna) potpuno su odsutna u gotovo svim primjercima; jedino u jednom ili dva primjerka (tab. II, sl. 5-6) mogu se u vertikalnim presjecima primijetiti kratke subepidermalne pregradice, okomite i na vanjsku površinu stijenske i na radijalna septa.

Dimenzije i odnosi razabiru se iz tabele s dimenzijama.

N a p o m e n a: Premda nismo mogli odrediti oblik ušća – što se smatra glavnom dijagnostičkom razlikom između rodova *Cuneolina* i *Pseudotextulariella* – niz drugih karakterističnih osobina uvjerio nas je da novu vrstu treba pribrojiti rodu *Cuneolina*, a ne *Pseudotextulariella*. To su: izrazito spljošten i katkada jasno lepezast oblik kućice; tipično lučne, kobasičaste klijetke; i pogotovo izgled u vertikalnim radijalnim presjecima, s tipično povijenim stijenkama primarnih klijetki i njihovim odebljalim ili kukičastim završecima. Čista sitnokristalična struktura stijenske može se također uzeti kao prilog takvoj odredbi. Zato smo ovu vrstu usporedili sa sličnim donjokrednim oblicima, koji su svi opisani kao kuneoline, premda se mogućnost da svi ti oblici – poznati samo iz presjeka u izbruscima – mogu imati pukotinsko ušće, ne može, bar za sada, potpuno isključiti.

O d n o s i i r a z l i k e: *Cuneolina tenuis* n. sp. jasno se razlikuje od svih ostalih vrsta tog roda svojom vrlo tankom stijenkom i čak još tanjim radijalnim septima. Po veličini najbliža je vrsti *C. camposaurii* Sartoni & Crescenti, ali stijenska i septa kod *C. camposaurii* su otprilike dvaput deblji nego kod *C. tenuis*. Zbog toga je broj klijetaka na mm približno jednak kod obje vrste, ili samo neznatno veći kod *C. camposaurii*, i to usprkos činjenici da je visina klijetaka u *C. camposaurii* za pola manja nego u *C. tenuis*.

Prema vrsti *C. laurentii* Sart. & Cresc. razlike u debljini stijenske i septata još su naglašenije, jer su stijenska i septa u *C. laurentii* i do deset puta deblji nego u *C. tenuis*. Kod približno iste visine pojedinih klijetaka *C. laurentii* ima manje od polovice broja klijetaka na mm (svoga 7-13) zbog veoma debelih pregradaka između primarnih klijetaka, koji su čak deblji nego što je slobodna visina klijetaka. Osim toga, *C. laurentii* ima razmjerno dobro razvijena kratka sekundarna septa, obično 1-3 po klijetki (Sartoni & Crescenti, 1962, str. 277, tab. 48, sl. 7-8), premda u početnim klijetkama ona mogu biti resorbirana vrlo debelom stijenkom, koja tvori pregradke između primarnih klijetaka.

Cuneolina hensoni Dalbierz (1958), koja prema navodima autora potječe iz stratigrafski bliskih horizonata, tj. najdonjih dijelova krede, ima izvjesne osobine slične *C. laurentii* (vrlo debelu stijenkup, koja time tvori isto tako debele tamne »trake« (u presjecima) između primarnih klijetaka; otprilike jednak broj klijetaka na mm), tako da, premda se od nje razlikuje po drugim osobinama (oblik i dr.), u odnosu na debljinu stijenske i septata mogu se navesti iste razlike prema *C. tenuis*. Osim toga, *C. hensoni* gotovo je dvaput veća i gotovo uvijek izrazito lepezastog oblika.

Razlike prema albskim i gornjokrednim kuneolinama toliko su očite (stalno prisutni sekundarni strukturalni elementi), da ih ne treba posebno tumačiti.

Stratigrafski položaj: *C. tenuis* nađena je, do sada, samo na tipičnom nalazištu, u rekrystaliziranom mikritskom vapnencu s mnogobrojnim *Favreina salevensis* (Paréjas). Prema superpozicijskim odnosima gornjomalmskih i donjokrednih naslaga u širem području, moguće je njen stratigrafski položaj odrediti kao neokom, odnosno donji dio cenozone *Cuneolina camposaurii* (Sartoni & Crescenti, 1962). Vjerojatno se radi o hauterive-u, ali to se ne može posve pouzdano utvrditi. Takav njen položaj jasno se vidi i u stratigrafskom stupu (sl. 2), koji je prikazan na osnovi superpozicijskih odnosa u širem području. U odgovarajućim nivoima bočno, na susjednim paralelnim profilima, nađena je oskudna ali ipak karakteristična mikrofilsna zajednica, koja se sastoji od: »*Munieria baconica*« (prema Carozzi-u; = *Verticilloporella Raviv & Lorch*), *Salpingoporella annulata* Carozzi, *Garnpanellula capuensis* De Castro i dr. Na tim naslagama slijede dobro uslojeni, uglavnom mikritski vapnenci s rijetkim i neodredivim orbitolinidama, miliolidama, tekstulariidama, verneilinidama i dr. Istom 350-400 m iznad slojeva s *C. tenuis* nalazimo obilnu pojavu vrste *Salpingoporella dinarica* Radoičić, koja se u vanjskim Dinaridima općenito smatra provodnom vrstom za gornji apt i prelazne slojeve u alb. Uz nju dolaze još *Cuneolina camposaurii* Sartoni & Crescenti, *C. laurentii* Sart. & Cresc., *Pseudotextulariella auruncensis* (Chiocchini & Di Napoli Alliata), *P. scarsellai* (De Castro), *Sabaudia minuta* (Hofker), *Orbitolina* sp. i dr. Pojedinačni primjerci ovih vrsta (osim *S. dinarica*) mogu se naći već i u naslagama koje prethode ovorn nivou, ali to nije dovoljno za pouzdaniju stratigrafsku odredbu. Prema tome, uzevši u obzir sve što je do sada navedeno, a isto tako i vertikalnu udaljenost od naslaga s aberantnim tintinidima u podini, stratigrafski položaj nove vrste možemo sigurno označiti samo kao neokom, a najvjerojatnije hauterive.

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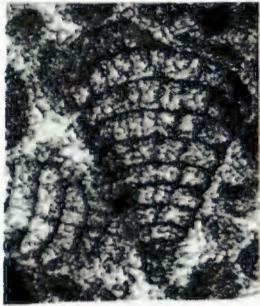
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PLATE - TABLA I
Cuneolina tenuis n. sp. x 80

- 1-8. Median (=equatorial) sections. Medijalni (=ekvatorijalni) presjeci. 1=OG-10680/13, holotype (holotip); 2=OG-10680/8; 3=OG-10680/13; 4=OG-10680/9; 5=OG-10680/13; 6=OG-10680/12; 7=OG-10680/9; 8=OG-10680/12.
9. Oblique section, cut approximately between median and vertical radial sections. Kosi presjek, približno između medijalnog i vertikalnog radijalnog presjeka. OG-10680/12.
- 10-12. Vertical radial sections. Vertikalni radijalni presjeci.
10= OG-10680/2; 11= OG-10680/8; 12= OG-10680/9.

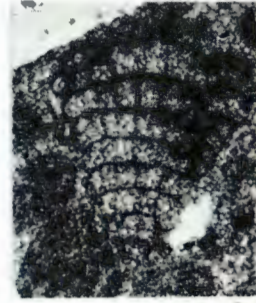
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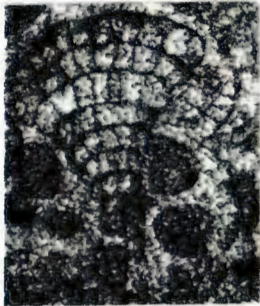
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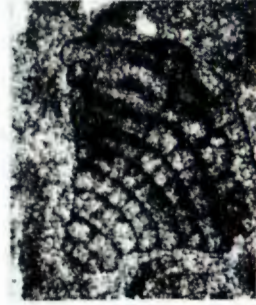
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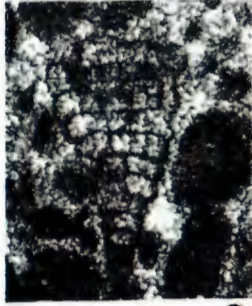
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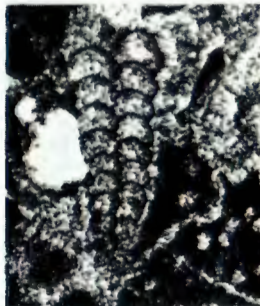
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8



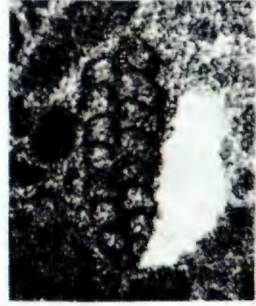
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10



11

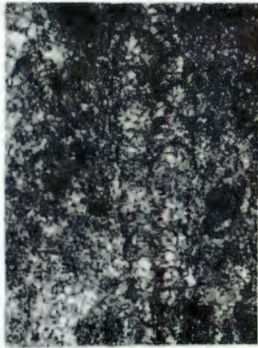


12

PLATE -- TABLA II
Cuneolina tenuis n. sp. x 80

- 1-4. Vertical radial sections. -- Vertikalni radijalni presjeci.
1=OG-10630/6; 2=OG-10680/10 3=OG-10680/3; 4=OG-10680/1.
- 5-6. Vertical sections showing hook-shaped terminations of chamber walls and sub-epidermal partitions. Vertikalni presjeci; vide se kukičasti završeci stijenki i kratka subepidermalna septa.
5=OG-10680/10; 6=OG-10680/7.
- 7-12. Vertical transversal sections, approximately perpendicular to radius, going from near the apex gradually towards the base. 10-12 are somewhat oblique in relation to radius, thus showing also a part of incurved inner parts of chamber walls as in vertical radial section.
Vertikalni poprečni presjeci, približno okomiti na radijus, idući od vrha postupno prema bazi (=ušću). 10-12 su jače kosi u odnosu na radijus, tako da se vidi i dio stijenki zakrivljenih prema unutra, kao u vertikalnim radijalnim presjecima.
7=OG-10680/4; 8=OG-10680/1; 9=OG-10680/1; 10=OG-10680/2;
11=OG-10680/7; 12=OG-10680/1

Photo by (snimio): M. MIKŠA



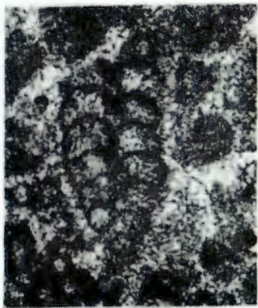
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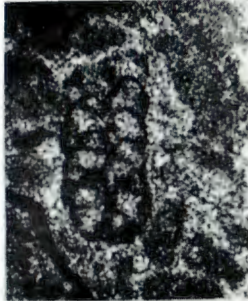
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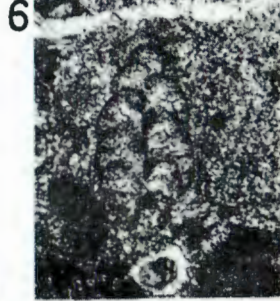
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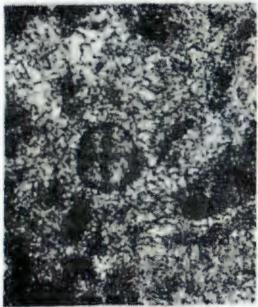
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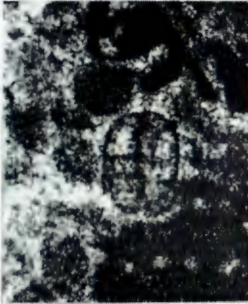
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6



7



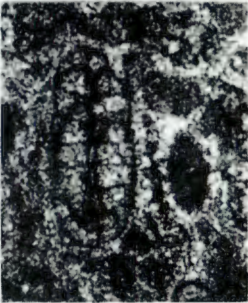
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11



12