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551.763(161.13/14.45)

# Biostratigrafska istraživanja donje krede Vanjskih Dinarida (II) Gornji alb otoka Korčule

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U kontinuiranom slijedu dojnokrednih naslaga otoka Korčule dokazan je razvoj gornjeg alba na temelju bogate mikrofosilne zajednice kakva do sada još nije registrirana u krškom pojasu Dinarida, a za koju je posebice značajna prisutnost provodnih oblika primitivnih orbitolinida. Prikazane su osnovne lito- i biostratigrafske karakteristike s interpretacijom stratigrafskog položaja pojedinih taksona.

## UVOD

U sklopu litostratigrafskog i biostratigrafskog istraživanja donje krede, a u okviru tematske studije za INA-Naftaplin, obrađen je kontinuirani profil na otoku Korčuli. Trasom profila, sjeveroistočno od Čare, u neprekinutoj superpoziciji presječne su naslage od podinskih dolomi-u gornjojursko-donjoneokomske starosti do dolomitnog pojasa razvijenog između naslaga donje i gornje krede. Kroz ovaj profil utvrđeni su dokumentirani neokom, donji i gornji barem, donji i gornji apt, te donji i gornji alb. Suglasno već najavljenom cilju ovih istraživanja (Sokač & Velić, 1978), s namjerom da se od obrađenih lokaliteta daju samo pojedini najinteresantniji nivoi u svrhu komparativne analize s manje povoljnim lokalitetima, to smo se u ovoj prilici odlučili za prikaz gornjeg alba zbog njegove dobre fosilifernosti i prisutnosti primitivnih orbitolinida, u nas do sada slabo poznatih.

Stupanj istraženosti onog dijela Krčule kojega presjeca obrađeni profil, kao i specifična vrlo uska biostratigrafska problematika ograničena na gornji alb, gotovo da i ne zahtijeva osvrt na ranija istraživanja. Iz tog razloga, unutar većeg broja radova koji tretiraju šire područje, osvrnut ćemo se samo na dvije geološke karte iz dva različita perioda. Koch (1934) dolomite južno i zapadno od Čare pribraja cenomanu, a cjelokupni razvoj vapnenaca sjeverno i sjeveroistočno od ovog mjesta uvrštava u turon. Korolija & Borović (1975) spomenute dolomite okolice Čare označavaju valendis-otrivskim, a vapnencima koji kontinuirano slijede i sežu do dolomita cenomana pridaju raspon barem-alb.

## GORNJI ALB

Prikaz gornjeg alba u spomenutom profilu otoka Korčule osniva se na detaljno prikupljenim i analizirani n uzorcima u području sjeveroistočno od Čare i južno od vrha Klapje.

U kontinuiranom stupu donje krede, kao najviši član u normalnoj superpoziciji, gornji alb zastupan je vapnenačkim, a pri završetku izmjenom vapnenačkih i dolomitnih naslaga. U litološki jednoličnom kompleksu više ili manje fosilifernih vapnenaca, granica donji-gornji alb obilježena je nastupom primitivnih orbitolinida, prve primjerke kojih nalazimo početkom druge trećine cjelokupnog razvoja alba.

Litološka jednoličnost sedimenata izražena je približno podjednakom debljinom slojeva (u prosjeku od 10—30 cm) i najčešće svijetlosmeđom i bijelom bojom. Kroz stup se brzo smjenjuju različiti tipovi mikritnih vapnenaca i vapnenaca sparitnog cementa, s varijabilnim količinama alokema heterogenog sastava i dimenzija, što naglašava monotoniju ovih naslaga. Fosili su zastupljeni uglavnom cjelovitim primjercima i najvećom su množinom vezani za intraklastične vapnence, a u mikritima na poslojke ili manja gnijezda. U najvišim dijelovima, pojava dolomita unutar vapnenaca obilježava postupan prijelaz u dolomitni pojas razvijen između alba i cenomana. Postupnost prijelaza prati se od vapnenaca preko dolomitiziranih vapnenaca u dolomite, čime ovi genetski postaju jasno određeni. S obzirom da su u ovom nivou na nekim drugim lokalitetima (Istra, Vis) razvijeni kvarcni pijesci, interesantno je spomenuti da se u dolomitiziranim vapnencima javljaju sitna zrnca autigenog kvarca, iako ne u znatnijoj količini.

Mikrofosilna zajednica gornjeg alba otoka Korčule brojem vrsta i primjeraka najbogatija je do sada registrirana u Dinaridima u tom nivou. Određeni su slijedeći oblici:

*»Valdanchella« dercourti* Decrouez & Moullade
*»Coskinolina« brönnimanni* Decrouez & Moullade
*Naupliella insolita* Decrouez & Moullade
*Paracoskinolina fleuryi* Decrouez & Moullade
*Nummoloculina heimi* Bonet
*Scandonea phoenissa* Saint-Marc
*Nezzazata simplex simplex* Omara
*N. gyra gyra* (Smout)
*Trochospira avnimelechi* Hamaoui & Saint-Marc
*Biconcava ?bentori* Hamoui & Saint-Marc
*Valvulammina picardi* Henson
*Chrysalidina gradata* d'Orbigny
*Cuneolina* cf. *camposaurii* Sartoni & Crescenti
*C. laurentii* Sartoni & Crescenti
*C.* cf. *hensoni* Dalbiez
*C. pavonia* d'Orbigny
*C. pavonia parva* Henson
*Pseudotextulariella? scarsellai* (De Castro)
*Sabaudia minuta* (Hofker)
*Salpingoporella turgida* (Radoičić)
*Thaumatoporella parvovesiculifera* (Raineri)

*Cylindroporella* sp.
*Orbitolinopsis* sp.
*Cyclogira* sp.
*Dictyopsella* sp. i
*Gavelinella* sp.

U biostratigrafskom pogledu najznačajnija je skupina primitivnih orbitolinida, prvenstveno zbog pouzdane odredbe stratigrafske pripadnosti razmatranih naslaga gornjem albu. Vrste »*V.*« *dercourti*, »*C*« *brönnimanni*, *N. isolita* i *P. fleuryi* kao zajednica, prema Decrouez & Moullade (1974) i Decrouez (1976), provodne su za gornji alb s. l. (uključujući i vrakon). Njihova prisutnost u završnom dijelu donjokrednih naslaga otoka Korčule omogućila je izdvajanje gornjeg alba kao zasebnog stratigrafskog člana, što je, regionalno gledajući, izuzevši Veliku Kapelu (Velić, 1977), ujedno i novi prilog u detaljnijem biostratigrafskom raščlanjivanju donje krede krškog područja Dinarida.

Posebnu pažnju privlače i oni oblici koji do sada nisu bili poznati u gornjem albu. To su prvenstveno sitne donjokredne ataksofragmiide: *Cuneolina camposaurii, C. laurentii* i *Pseudotextulariella? scarsellai.* Ovime se njihov stratigrafski raspon proširuje na čitavu donju kredu. Sličnu situaciju zapazili smo i u području Biokova. Među nezazatidama značajne su pojave vrsta *N. gyra gyra, T. avnimelechi* i *B. ?bentori,* koje su do sada smatrane uglavnom cenomanskim, gdje i postižu maksimum razvoja (Omara & Strauch, 1965; Hamaoui & Saint-Marc, 1970; i dr.). Kasnije su *T. avnimelechi* i *B. bentori,* kao i većina drugih nezazatida, utvrđeni i u senonu južnih Apenina (Luperto-Sinni, 1976). *N. gyra gyra* u vrakonu Argolida na Peloponezu (Decrouez, 1976), a *T. avnimelechi* i u donjem albu okolice Ogulina (Velić & Sokač, 1978). Sve ovo ukazuje na znatno proširenje stratigrafskog raspona spomenutih oblika od alba do zaključno senona, čemu treba posvetiti izuzetnu pažnju da bi se izbjegle eventualne pogreške u stratigrafskoj interpretaciji onih naslaga u kojima se nađu samo citirane vrste. To se isto i u potpunosti može primijeniti i na primjerke roda *Scandonea,* registrirane u više nivoa gornjeg alba Korčule, za koje držimo da pripadaju vrsti *S. phoenissa,* izvorno opisanoj (i provodnoj) iz gornjeg cenomana Libanona (Saint-Marc, 1974). Spomenutim mikrofisilima pridodat ćemo i nalaze oblika određenih samo generički kao što su *Cyclogira* sp., *Dictyopsella* sp. i *Gavelinella* sp., do sada u Dinaridima poznate iz cenomana i turona (npr. Radoičić, 1972, 1973/1974).

U razmatranju biostratigrafskih karakteristika, zaključno bismo istakli da je navedena mikrofosilna zajednica iz naslaga gornjeg alba Korčule sastavom do sada najbrojnija u krškim terenima Dinarida. Zajednička prisutnost oblika provodnih općenito za donju kredu *(C. camposaurii, C. laurentii, P.? scarsellai)* i onih koji maksimalni razvoj postižu u gornjoj kredi *(N. heimi, S. phoenissa, V. picardi,* spomenute nezzazatide i generički određene forme), daje čitavoj zajednici prijelazni ili »mješoviti« karakter. Neprekinuti slijed sedimentacije iz donje u gornju kredu, odnosno iz alba u cenoman, odražava se tako i u biofacijelnom kontinuitetu postupnim prijelazom u mikrofosilne zajednice cenomana s novim taksonima, koji se počinju pojavljivati već u donjem albu, a posve su jasno izraženi u gornjem albu.

Postignuti rezultati u rješavanju biostratigrafske problematike gornjeg alba na otoku Krčuli i njegovi vrlo slični razvoji u Istri, istočnom Gorskom Kotaru, Kordunu, sjeverozapadnoj Lici i kopnenom dijelu Dalmacije omogućavaju i detaljnija istraživanja i utvrđivanje granice donja-gornja kreda, kao i biostratigrafsku sintezu tog prijelaznog nivoa i u regionalnim okvirima. S obzirom da se u novije vrijeme u zapadnoj literaturi, posebice francuskoj, u stratigrafskom raščlanjivanju alba gotovo redovito izdvaja i vrakon, bilo kao zasebni član ili kao gornji dio gornjeg alba s. l., naša zapažanja u različitim područjima krškog dijela Dinarida pokazala su da bi se stratimetrijskim snimanjem s detaljnim sustavnim uzorkovanjem takva podjela vjerojatno mogla sprovesti i na pojedinim lokalitetima u našim terenima. Istraživanja u tom smislu, kao i ona u vezi s granicom donja-gornja kreda, još su u toku i bit će predmetom posebnog rada koji je za sada u pripremi.

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# Biostratigraphic investigations of the Lower Cretaceous of the Outer Dinarids (II) The Upper Albian of the island of Korčula

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The description of the Upper Albian, which is the subject of the present paper, is based on the samples which have been collected northeast of the place Čara and south of the Klapje hill.

In a continuous Lower Cretaceous sequence, the Upper Albian, being the highest member, is represented by limestones, and in its upper part by the alternation of limestones and dolomites. In the lithologically monotonous sequence of the more or less fossiliferous limestones, the boundary between the Lower and the Upper Albian is marked by the appearance of primitive orbitolinids. First specimens of these forms appear at the beginning of the second third of the whole Albian complex.

The lithological uniformity of the deposits is reflected in about the same thickness of beds (mostly from 10 to 30 cm) and in predominantly light brown and white color. These are various types of micritic limestones and of limestones with sparry cement, which frequently alternate, with variable amounts of allochems of heterogeneous composition and size, which emphasizes even more the lithological monotonousness of these deposits. Fossils are mostly represented by entire specimens and connected mostly to intraclastic limestones, while in micrite they occur in intercalations and small lenses. In the uppermost parts, the occurences of dolomite in limestone marks the gradual transition into the dolomite zone between Albian and Cenomanian limestones. Limestones gradually pass into dolomitized limestones and then into dolomites, which makes the latter genetically clearly defined. At some other localities (Istria, island of Vis), quartz sand is developed in this level. With regard to that, it is interesting to note that tiny grains of autigene quartz occur in the dolomitized limestone, though not in a considerable quantity.

The Upper Albian microfossil assemblage at the island of Korčula is the richest recorded up to now in the Dinarids, considering both the number of species and the number of specimens. The full microfossil content is given in the Croatian text, p. 186/7. In the biostratigraphic sense, most important is the group of primitive orbitolinids which define the stratigraphic position of the deposits in question as Upper Albian. The assemblage consisting of *»Valdanchella« dercourti, »Coskinolina« brönnimanni, Naupliella insolita,* and *Paracoskinolina fleuryi* is characteristic of the Upper Albian (in the broader sense, i. e. including the Vraconian), according to Decrouez & Moullade (1974) and Decrouez (1976). Their common presence in the uppermost part of the Lower Cretaceous deposits at the island of Korčula made possible the recognition of the Upper Albian as a separate biostratigraphic member, which is, in a regional sense, a new contribution to a more detailed biostratigraphic subdivision of the Lower Cretaceous in the karst region of the Dinarids, except for the region of Mt. Velika Kapela, where it has been already recognized previously (Velić 1977).

Of a particular interest are, also, the forms which have not been recorded from the Upper Albian up to now. These are, first, small Lower Cretaceous ataxophragmiids, such as *Cuneolina camposaurii, C. laurentii,* and *Pseudotextulariella? scarsellai.* Herewith their stratigraphic range has been enlarged so as to comprise the whole Lower Cretaceous. A similar situation has been observed, also, in the region of Mt. Biokovo. Among the nezzazatids, occurence of *N. gyra gyra, T. avnimelechi,* and *B. bentori?* is significant insofar as these species have mostly been considered to be Cenomanian, where, indeed, they have their maximum development (Omara & Strauch 1965; Hamaoui & Sant-Marc 1970; etc.). Afterwards, later on, *T. avnimelechi* and *B. bentori,* as well as most other nezzazatids, have also been found in the Senonian of the southern Apennines (Luperto-Sinni 1976), *N. gyra gyra* in the Vraconian of the Argolids, on the Peloponese (Decrouez 1976), and *T. avnimelechi* also in the Lower Albian in the environs of Ogulin, Croatia (Velić & Sokač 1978). All these data, taken together, indicate a significant broadening of the stratigraphic ranges of the forms in question, from the Albian up into the Senonian. This is important to note in order to avoid misinterpretations in the stratigraphic position of the deposits containing the above mentioned species.

The same is true for the specimens of the genus *Scandonea*, which we have observed in several levels within the Upper Albian of the island of Korčula and which, we believe, belong to *S. phoenissa*, originally described from and considered to be characteristic of, the Upper Cenomanian of Lebanon (Saint-Marc 1974). To all the above mentioned microfossils, generically determined forms, such as *Cyclogira* sp., *Dictyopsella* sp., and *Gavelinella* sp., may be added, which have been recorded in the Dinarids, from the Cenomanian and Turonian (Radoičić 1972, 1973/74).

Summing up our biostratigraphic considerations, it has to be emphasized, once again more, that the microfossil assemblage found in the Upper Albian of the island of Korčula, in addition to being the richest in the karst region of the Dinarids recognized so far, reveals some important features. That is, the joint presence of the forms characteristic of the Lower Cretaceous in general *(C. camposaurii, C. laurentii, P.? scarsellai)*, and of those which are to reach their maximum development in the Upper Cretaceous (*N. heimi, S. poenissa, V. picardi*, the above mentioned nezzazatids and generically determined forms), gives a transitional, or »mixed«, character to the entire assemblage. Thus the continuous sedimentary sequence, with no interruption between the Albian and the Cenomanian (i. e., between the Lower and Upper Cretaceous, respectively), bears also on the biofacial continuity, gradually developing Cenomanian microfossil assemblages, with new taxa which began to appear already in the Lower Albian and come to be fully pronounced in the Upper Albian.

The results obtained in studying the biostratigraphy of the Upper Albian on the island of Korčula and the possibility of comparing it with the very similar conditions in Istria, eastern Gorski Kotar, Kordun, northwestern Lika, and coastal part of Dalmatia will enable the establishing of the boundary between the Lower and the Upper Cretaceous, as well as a biostratigraphic synthesis of that transitional level on regional scale. Since in the newer western European literature, particularly French, also the Vraconian stage is commonly recognized, either as a separate member or as the uppermost part of the Albian in the broad sense, our observations in various parts of the karst region of the Dinarids showed that such a subdivision could reasonably be applied on at least some localities in the Dinarids, provided that systematic stratimetric measurements with detailed sampling are carried out. These investigations are still being in progress and will be reported in a future paper which is in preparation.

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## TABLA — PLATE I

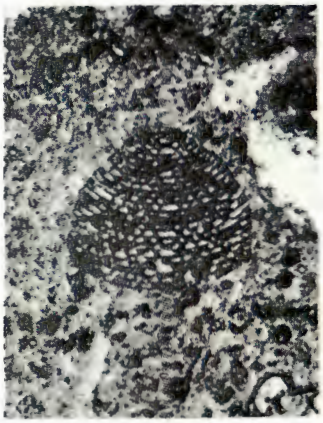
1—2. »*Coskinolina*« *brönnimanni* Decrouez & Moullade (1 = 14 x, 2 = 22 x).

3—4. »*Valdanchella*« *dercourti* Decrouez & Moullade (3 = 55 x, 4 = 30 x).

5. *Paracoskinolina fleuryi* Decrouez & Moullade (50 x).

6—7. *Naupliella insolita* Decrouez & Moullade (6 = ca 60 x, 7 = 40 x).

8. *Orbitolinopsis* sp. (30 x).



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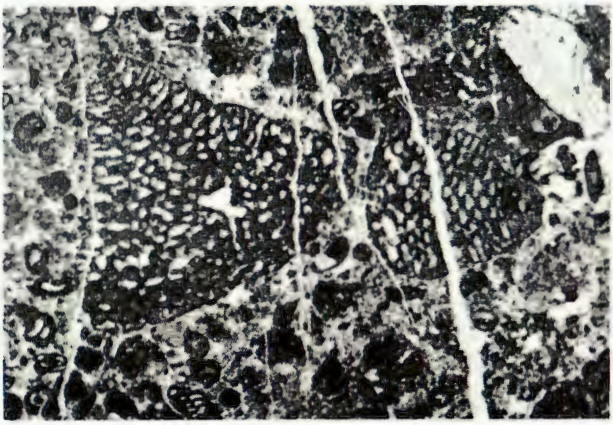

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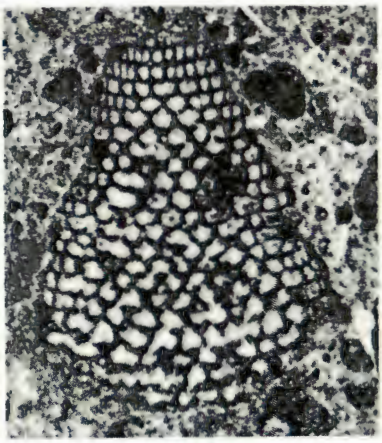

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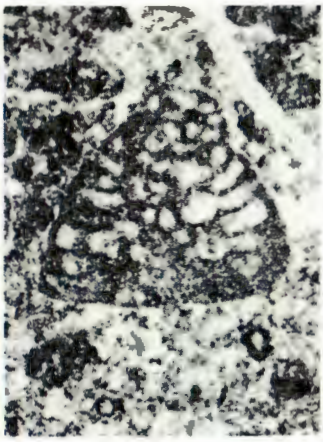

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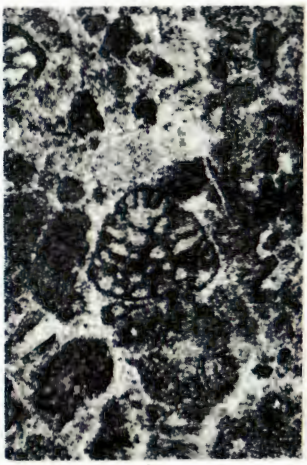

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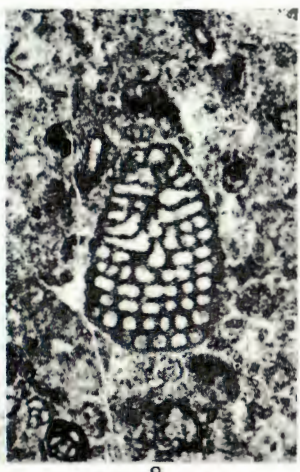

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TABLA — PLATE II

1. *Nummoloculina heimi* Bonet (55 x).
2. *Chrysalidina gradata* d'Orbigny (25 x).
3. *Valvulammina picardi* Henson (ca 65 x).

4—5. *Scandonea phoenissa* Saint-Marc (4 = 60 x, 5 = 70 x).

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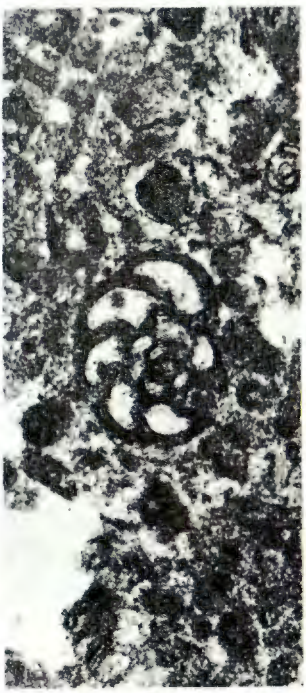

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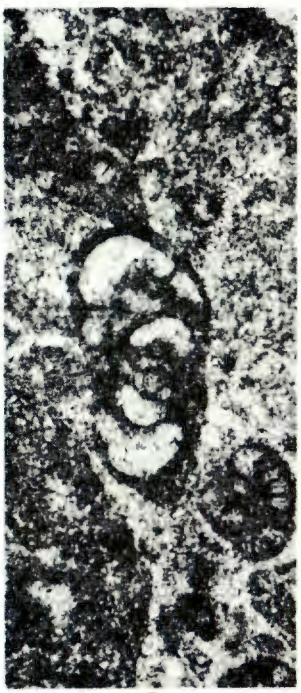

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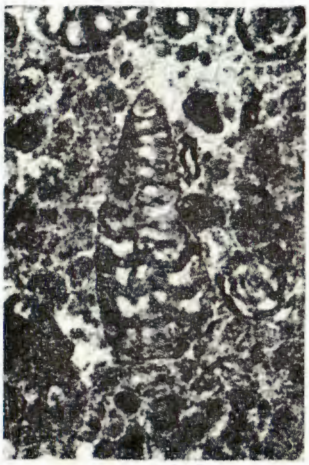
TABLA — PLATE III

1. *Pseudotextulariella? scarsellai* (De Castro) (35 x).
2. *Cuneolina pavonia parva* Henson (35 x).
3. *Cuneolina hensoni* Dalbiez (35 x).
4. *Nezzazata simplex simplex* Omara (85 x).
5. *Nezzazata gyra gyra* (Smout) (85 x).
6. *Trochospira avnimelechi* Hamaoui & Saint-Marc (85 x).
7. *Biconcava* sp. (*?B. bentori* Hamaoui & Saint-Marc, 85 x).
8. *Dictyopsella* sp. (130 x).
9. *Gavelinella* sp. (85 x).



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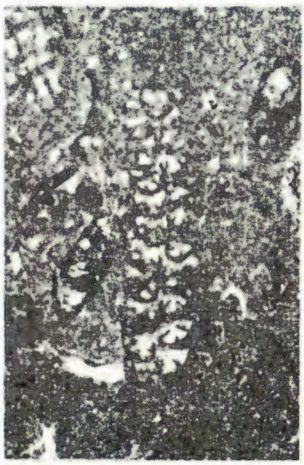

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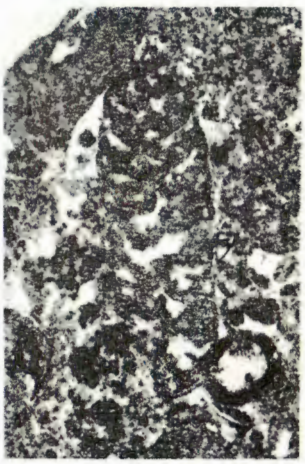

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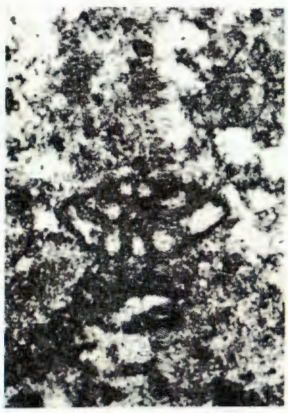

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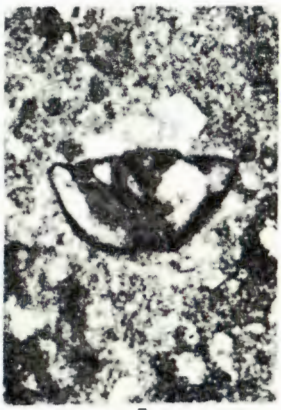

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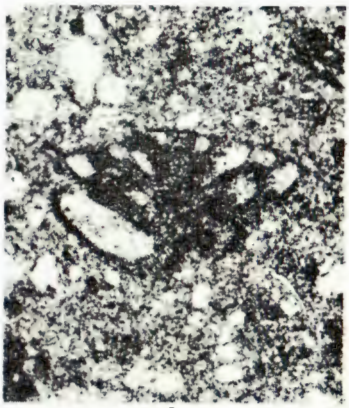

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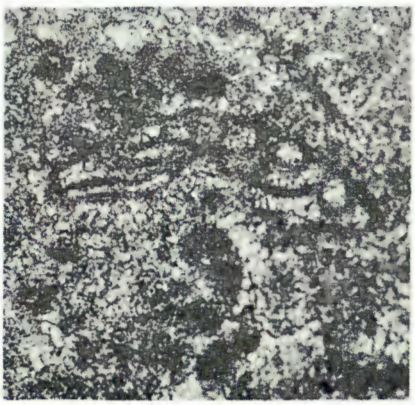

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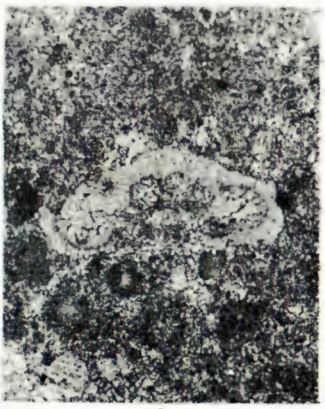

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