

LOWER CRETACEOUS MARINE ALGAE AND
CALPIONELLIDAE FROM CANDAS (SAN PEDRO)-ASTURIAS
PROVINCE (SPAIN)

BY
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RÉSUMÉ

Dans les calcarénites bioclastiques de San Pedro (Candas) on a rencontré une association d'algues et foraminifères (*Boueina pygmaea*, *Radoiciciella banatica*, *Marinella lugeoni*, *Palorbitolina lenticularis*, *Choffatella decipiens*, *C. cruciensis*, *Arenobulimina* aff. *albiana*, *Tritaxia pyramidata*) d'âge Aptien inférieur (Bedoulien). Des calcarénites micritiques à l'apport détritique réduit on cite l'association d'algues, foraminifères et calpionellides, représentée par *Cylindroporella sugdeni*, *Salpingoporella urladanasi*, *Halicoryne nerae*, *Trocholina lenticularis*, *Palorbitolina lenticularis* (rarement), *Chofatella decipiens* et *Colomiella mexicana* qui atteste l'âge Aptien supérieur-Albien inférieur.

On décrit *Arabicodium cantabricus* n. sp. de la famille Codiaceae.

RESUMEN

En las calcarenitas bioclásticas de San Pedro (Candas) se ha encontrado una asociación de algas y foraminíferos (*Boueina pygmaea*, *Radoiciciella banatica*, *Marinella lugeoni*, *Palorbitolina lenticularis*, *Choffatella decipiens*, *C. cruciensis*, *Arenobulimina* aff. *albiana*, *Tritaxia pyramidata*) de edad Aptense inferior (Bedouliense). En las calcarenitas micríticas con aporte detrítico escaso, se cita una asociación de algas, foraminíferos y calpionellidos, representada por *Cylin-*

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droporella sudgeni, *Salpingoporella urladanasi*, *Halicoryne nerae*, *Trocholina lenticularis*. *Palorbitolina lenticularis* (rara) *Choffatella decipiens* y *Colomiella mexicana* que confirma la edad Aptense superior-Albense inferior.

Se describe *Arabicodium cantabricus* n. sp. de la familia Codiaceae.

INTRODUCTION

The regional character of the Lower Cretaceous transgression favoured a wide areal extent of marine formations in the Cantabrian-Pyrenean chain. Due to this extent, Rat's Urgonian formations, represented by marly-sandy or calcareous facies with varying detrital supply, occur as isolated patches to the west of the Asturian sedimentation basin. These limestone patches are remnants of the carbonate-Urgonian Cantabrian Platform which acted intermittently from the Paleozoic to the end of Cretaceous.

The «Urgonian» may be considered as a phase of stability of the carbonate Cantabrian Platform, being the site of reef, corallgal and lagoon facies; the latter present an important detrital supply of the continental domain which lies to the south and the west of the Asturian sedimentary basin.

The Lower Cretaceous outcrops were first mentioned in the general studies of Verneuil & d'Archiac (1849) and Schulz (1858). Barrois (1879) and Mallada (1904) made descriptions on their lithology and specified their age. Subsequent new data on the biostratigraphy and sedimentology of the Lower Cretaceous deposits of this region were due to Karrenberg (1934), Llopis Llado (1956, 1961), Rat (1959, 1964) and Wiedmann (1962).

Schroeder & Wienands (1966) describe the biostratigraphy of the Lower Cretaceous of the westernmost outcrops lying on the northern coast of Spain, between Avilles and Gijón, Andromero respectively to the SE of Luanco locality. On the Cabo de Penas (Andromero) section, the Lower Cretaceous is 100 m thick and according to some Orbitolinidae species it is Upper Barremian-Aptian in age. Ten lithologic members from a-j were delimited. The index fossil *Palorbitolina lenticularis* (Blumenbach) was reported frequently within the interval a-g; *Praeorbitolina* is reported at the upper part of member g, while *Orbitolinopsis kiliani* presents a vertical occurrence from Upper Barremian to Lower Aptian. Member j supplied *Orbitolina* (*Mesorbitolina*) *texana parva*, an Upper Aptian index fossil, just like *O. (M) texana texana*. According to Schroeder these species occur mostly to the north and east of Spain and are characteristic of the Lower Gargasian. In respect to some of the mentioned authors, in the Luanco

sector, the Lower Aptian/Upper Aptian boundary occurs between members h and i.

On the other hand, for the same sector Karrenberg (1934) proves, on lithostratigraphic criteria, that members a-b belong to the Wealdian, c-d to the Lower Bedoulian, e-i to the Upper Bedoulian and the limy j member to the Gargasian.

In a recent paper, Ramírez del Pozo (1971) presents a biostratigraphic and microfacial synthesis of the Jurassic and Cretaceous of northern Spain (Cantabrian region), to the east of the Asturian basin. Numerous lithologic columns and Aptian-Albian microfossil assemblages are described. Within the marine Aptian (Urgonian) the author recognized 4 Orbitolinidae biozones: I. the *Palorbitolina lenticularis* Zone; II. the *Orbitolinopsis simplex* Zone; III. the *Simplorbitolina manasi* Zone, and IV. the *S. conulus* Zone. Zones I and II belong to the Bedoulian, while zones III and IV belong to the Gargasian. The same author mentions that in the case of a calcareous Albian and of a sedimentation continuity with the Aptian, the boundary between the two stages may be stated on palaeontologic grounds only. It is worth mentioning the change which occurred at the beginning of the Aptian in the sedimentation regime of the Cantabrian belt and which entailed the generation of reef carbonate facies within a sedimentation basin of platform type (epicontinental-neritic character) of about 100 m deep. The Aptian microfacies from the north of Spain are practically identical with those described by Cuvillier (1961) in the Aquitaine basin; this could account for the link between the two belts, the French Pyrenees and the Cantabrian Mts. The following Aptian microfacies are described: biohermal limestones with corals, algae, *Bacinella irregularis*, *Coscinophragma cribrosum*, bryozoans and rudists; bioclastic limestones (biomicrites and biopelmicrites) with builder organisms, Orbitolinidae, *Glomospira* sp., *Cuneolina* and *Haplophragmoides*; argillaceous micrites with detrital quartz, *Tritaxia* and sponge spicules and detrital limestones interbedded in terrigenous formations with Orbitolinidae, gastropods and Ostreidae.

In 1975 Aquilar Tomas describes the Albian sedimentology and palaeogeography of the Cantabrian belt (the western boundary is represented by the Santander province) with special reference to the Aptian too.

1. THE CANDAS (SAN PEDRO) LOWER CRETACEOUS

In the neighbourhood of the locality Candas, at Playa de San Pedro, the Paleozoic deposits (Devonian and Carboniferous) are progressively and disconformably overlain by Aptian-Lower Albian formations (Fig. 1).

At the lower part of this sequence there are *grey-whitish calcarenites* with frequent biostromite levels which consist of gastropods, mainly *Nerinea* sp. and *Neoptysis* sp. The calcarenites present a micritic texture, are bioclastic and contain a rather great detrital supply (15-25 %). The quartz grains are slightly sorted and their diameter varies between 0.30-0.45 mm. Besides gastropods, echinoderm fragments and pachiodont remnants do frequently occur. Most fragments and especially the gastropods are covered by algal crusts.

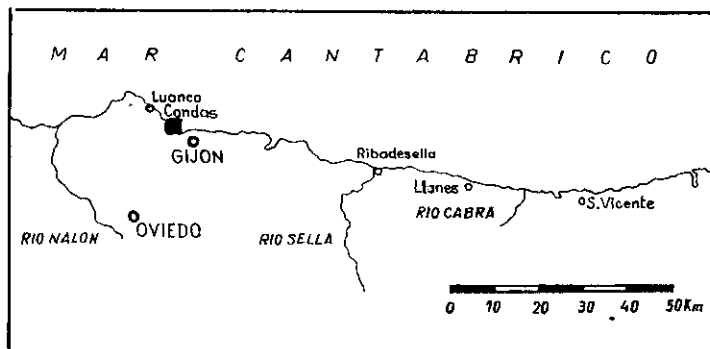


FIG. 1.—Studied Lower Marine Cretaceous outcrop from shore of Asturias Province.

The microfossil assemblage is dominated by the foraminifer *Palorbitolina lenticularis* (Blumenbach). *Choffatella decipiens* Schlumberger, *Ch. cruciensis* (Pictet & Renevier) and *Arenobulimina* aff. *albiana* Woloshyna do also occur.

Among the algae it is to note the frequent occurrence of the Codiaceae represented by *Boueina pygmaea* Pia thallus segments and fragments, as well as by Charophyte oogons (*Atopochara*).

A rather special occurrence is that of *Choffatella cruciensis* (Pictet & Renevier), which according to Cherchi & Schroeder (1981) was described and cited by Mallada (1887) in his note entitled «Sinopsis de las especies fosiles que se han encontrado en España» as supplied by the Lower Aptian at Ermita de la Providencia, Tortosa.

Then follows a calcarenite level in which *Choffatella decipiens* Schlumberger, *Orbitolinopsis kilianii* Silvestri, *Nautilocolina cretacea* Peybernes, *Tritaxia pyramidata* Reuss, *Spiroloculina* sp. and scarce miliolids are frequent. The orbitolinids are broken and fragmentary, pointing to the occurrence of some strong transport currents which favour the reworking of certain benthonic microfossil assemblages, mainly foraminifers.

Besides the above mentioned foraminifer assemblage it is to note the occurrence of Codiaceae algae, *Boueina pygmaea* Pia and Dasycladaceae, *Radoiciciella banatica* Dragastan, Bucur & Demeter which appears as thallus fragments. It is worth mentioning the centimetric levels of slightly argillaceous bioclastic micrites which consist exclusively of Solenoporaceae algae of *Marinella lugeoni* Pfender type with small, tri- or multi-lobed thallus, scarce *Choffatella decipiens* Schlumberger and fragments of Dasycladaceae algae.

Marinella lugeoni is cited from the Lower Cretaceous during the end of Barremian-Albian interval.

The limestone levels which frequently include *Palorbitolina lenticularis*, *Choffatella decipiens*, *Orbitolinopsis kiliani*, *Boueina pygmaea* and *Radoiciciella banatica* are Lower Aptian (Bedoulian) in age.

If we have in view the section described by Schroeder & Wienands (1966) in the Luanco sector, the first limestone level described in the present paper would correspond to member d and the second to member f.

The yellowish limestones occurring at the top of the sequence are represented by micrites and microsparites with slightly sorted angular quartz, the diameter of which varies between 0.10-0.15 mm. This points to slight and rather remote continental influences accompanied by sedimentation in the platform area, at the interference with the basinal domain. This was mentioned by Llopis (1956) who notes that the Cretaceous formations of the Asturian are formed in a parageosynclinal basin. According to Stille, these formations were generated on a continental platform with depths which do not exceed 100 m.

The microfossil assemblage is dominated by benthonic organisms and scarce planktonic pelagic organisms.

The benthonic organisms consist of foraminifers, algae, small gastropods, serpulid colonies and echinoderms. The foraminifers are represented by *Choffatella decipiens* Schlumberger, *Choffatella* sp., *Melatrokerion* sp., *Trocholina lenticularis* Henson, *Glomospira* sp., *Placopsilina* cf. *neocomiana* Bartenstein & Brand, *Sabaudia minuta* Hofker, *Reophax* aff. *guttifera* Brady, *Globulina* cf. *exserata* (Berthelin) and scarce miliolids. It is to note the sporadic occurrence at this level of the species *Palorbitolina lenticularis* (Blumenbach). Most of the above mentioned foraminifer species occur in the Aptian. Some of them are characteristic of wider stratigraphic intervals: *Trocholina lenticularis* occurs in the Aptian-Albian, *Choffatella decipiens* characterizes the Barremian-Aptian and *Sabaudia minuta* the Barremian-Albian intervals.

The sporadic occurrence at this level of the species *Palorbitolina lenticularis* is normal if we have in view its last occurrences during the Upper Aptian (lower part of Gargasian). This fact accounts for Jaffrezo's (1980) diagram according to which the *Mesorbitolina texana* biozone characteristic of the Gargasian includes, at its lower part, the *Palorbitolina lenticularis* subzone.

The algae occur frequently at this level and are represented by Codiaceae and Dasycladaceae. Out of these we mention *Cylindroporella sugdeni* Elliott, *Salpingoporella urladanasi* Conrad & Peybernes & Radoicic, *Halicoryne nerae* Dragastan, Bucur & Demeter and *Arabico-dium cantabricus* n. sp. This assemblage characterizes the Upper Aptian-Lower Albian interval.

Cylindroporella sugdeni occurs mainly in the Lower Cretaceous, Barremian-Albian (Clansayesian) respectively. Ramalho & Rey (1981) have recently reported it at the top of the Porta de Mos (Algarve) Formation, in the Albian.

Salpingoporella urladanasi reported from the Spanish Pyrenees (Navarra-Languedoc) and the Kosovo region (Serbia) occurs in the Upper Barremian-Bedoulian-Gargasian-Lower Albian interval. However, it is predominant in the uppermost Gargasian and may be a biozone characteristic of this stage in the Cantabrian-Pyrenean area.

Halicoryne nerae is characteristic of the Upper Barremian-Lower Aptian interval (O. Dragastan *et al.*, 1978).

The great amount of algae is not in agreement with Rat's (1959) assumption according to which the calcareous algae are extremely rare in the studied outcrops (Aptian-Albian) and pelagic organisms are absent.

A novelty within the mentioned assemblage are the Calpionellids. Their occurrence has stratigraphic and paleogeographic implications. The occurrence of the species *Colomiella mexicana* Bonet points to influences from the basinal pelagic planktonic domain. This species was first reported by Bonet (1956) from the Barremian-Aptian of Mexico, then by Sigal & Lys (1963) from the Barremian-Aptian to the east of Bellgarde (France), by Trejo (1976) from the Upper Aptian-Lower Albian of Mexico and was rediscovered on the European continent in the Albian of Aquitaine and West Pyrenees (Magné & Malmoustier, 1968), in the Upper Albian of Bethic Cordilleras (Alicante province) (Azéma, Magné & Sigal, 1966) and recently in the Upper Aptian and Lower Albian of the West Carpathians (Borza, 1979).

In Asia and Africa, *Colomiella mexicana* was reported from the Aptian-Albian interval, in Tunisia (Bolze, Colom, Sigal, 1959), Somaliland and Iran (Prestat, 1970).

The pointing out of this species in the western extremity of the Cantabrian Mts, at Candas (San Pedro), accounts for the occurrence of the Lower Albian at the top of the Urgonian limestones (sensu Rat). On the other hand, according to Schroeder & Wienands (1966) the Asturian basin was separated from the Cantabrian basin by a wide local threshold trending southwards, which did not allow the deposition of the Albian in this basin that lay westwards. If we refer our samples to the lithostratigraphic scheme of the above mentioned authors, the calcareous j member of Luanco includes the Lower Albian as well and seems to have also included the Urgonian complex recognized by Rat (1959). This contradicts the definition of the Urgonian adopted by the International Colloquium on the Lower Cretaceous Stratigraphy held at Lyon (1963), according to which the Urgonian is a calcareous facies corresponding to the Barremian-Aptian interval and excluding the Albian. Thus, the Aptian/Albian boundary is still a problem to be solved (Ramírez del Pozo, 1971). This boundary could be stated by means of Orbitolinids and Calpionellids. It is known that the «boundary species» *Colomiella mexicana* is characteristic of the Upper Aptian-Lower Albian and is included in the limestones of member j (sensu Schroeder & Wienands, 1966).

Another important problem consists in the specification on the regional structural background of the transgression and regression moments within the «Urgonian» complex sensu Rat. Does the marine transgression start with the Barremian or with the Aptian? Does the first transgression phase correspond to the Barremian-Lower Aptian and the second one to the Upper Aptian-Lower Albian? It is also possible that the margin of the Urgonian carbonate Platform correspond to the narrow shelf line of the Cantabrian Sea with the basinal domain located in the Aptian-Albian, to the north of this line.

All these problems are to be solved in the future by detailed microfacial and sedimentologic studies on the Lower Cretaceous marine deposits.

2. SYSTEMATIC DESCRIPTION

Family *Codiaceae*.

Genus *Arabicodium* Elliott, 1957.

Arabicodium cantabricus n. sp.

Pl. I, Fig. 1, Pl. II, Fig. 1.

1971 *Arabicodium* sp. - Ramírez del Pozo, lam. 33/2, Aptian.

Holotype: Pl. I, Fig. 1, Upper Aptian-Lower Albian, Candas (San Pedro), Asturias province, Coll. LPB no. 0087.

Syntypes: Pl. II, Fig. 1, Upper Aptian-Lower Albian, Candas (San Pedro), Asturias province, Coll. LPB no. 0088.

Derivatio nominis: «Cantabricus» from the Cantabrian Mts.

Description: Cylindrical thallus with long segments, not tapered. The medular zone of segments is rather narrow and does not preserve medular threads. The cortical wall is robust and crossed by fine cortical pores with big diameters (0.030 mm) to the median part and smaller diameters to the exterior (0.008 mm). The tangential sections present 36 small and fine pores on 0.30 mm². Thallus fragments in the cortical walls are also frequent; they characterize the genus *Arabicodium*.

Dimensions in mm

Length of segments - 3.0-3.3.

Width of segments (diameter) - 1.2-1.5.

Diameter of medular zone - 1.0-1.4.

Diameter of cortical pores - in the median part - 0.015-0.030.
- to the exterior - 0.006-0.008.

Differences: *Arabicodium cantabricus* differs from the Lower Cretaceous species by the morphology of segments which presents or not a single slight constriction, as well as by the great thickness of the cortical wall to the detriment of the medular zone. Its dimensions are similar to those of the Cenomanian species *A. texana* Johnson, 1968. There are obvious morphologic differences from *A. orientalis* Dragastan, 1971 (thallus with cylindrical segments and numerous constrictions), *A. elongatus* Dragastan, 1971 (thallus with elongated segments) and *A. aegrapioides* Elliott, 1957 with cylindrical segments that exhibit bifurcate endings and narrow cortical walls.

Remarks: Bakalova (1978) transfers *Cayeuxia anae* Dragastan, 1971 to the genus *Arabicodium* and it becomes *A. anae* (Dragastan, 1971) nova comb.

The rather indefinite description and the unrelevant photographs (Pl. II, Figs. 1, 3, 5) do not show a morphological structure which corresponds to the generic features of the genus *Arabicodium* Elliott, 1957. Thus, the «thallus» is crossed by bi- and trifurcate threads which come together into a single thread, parallel along the segment, with equal diameters, without differentiating into medular and cortical threads which characterize the Codiaceae algae.

In Elliott's key to internal characters of some genera of Codiaceae, presented in 1970, the genus *Arabicodium* is characterized by fine longitudinal medular threads (skeinlike), radial or oblique cortical threads, generally branched and exhibiting widely opened endings in the hypodermic area.

Due to this we do not agree on Bakalova's assignment of the species *anae* to the genus *Arabicodium*. Our material is to be revised, but we think it is a new genus of the Codiaceae family: *Carpathocodium* n. gen.

Family *Colomiellidae* Bonet, 1956.

Genus *Colomiella* Bonet, 1956.

Calpionella mexicana Bonet, 1956.

Pl. IV, Fig. 1.

1956 *Calpionella mexicana* nov. sp. Bonet, p. 42, lams. XIX y XX [see synonyms in Borza (1978), Geologicky Zbornik-Geologica Carpathica, 29, 2, Bratislava].

Description: Cordiform lorica through axial section similar to the lorica of the genus *Calpionella*. Maximum width of the lorica is below the collars. The collar is cylindrical and short in the case of the Candas (San Pedro) specimens (2). Curved and continuous caudal zone.

Dimensions in mm

Maximum length - 0.10-0.15.

Collar length - 0.015-0.030.

Width - 0.075-0.090.

Locus typicus: Upper Aptian-Lower Albian, Candas (San Pedro), Asturias province.

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PLATE I

FIG. 1.—*Arabicodium cantabricus* n. sp. (oblique longitudinal section), holotype LPB-V nr. 0087, Upper Aptian-Lower Albian, Candas (San Pedro), Asturias Province. $\times 30$.



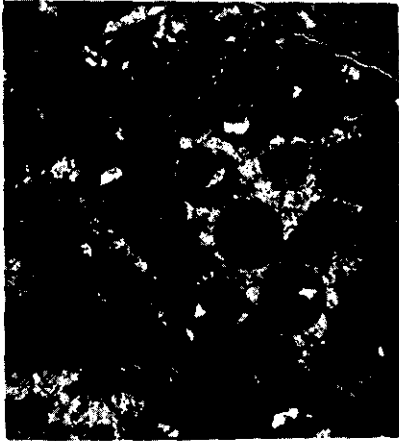
PLATE II

FIG. 1.—*Arabicodium cantabricus* n. sp. (tangential section), syntype LPB-V nr. 0088, Upper Aptian-Lower Albian, Candas (San Pedro), Asturias Province. × 30.

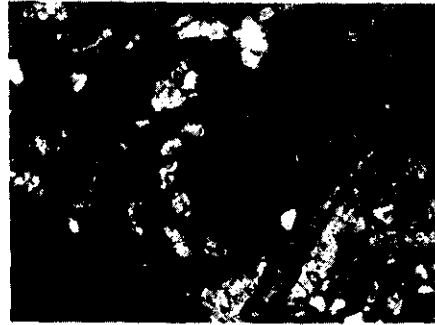


PLATE III

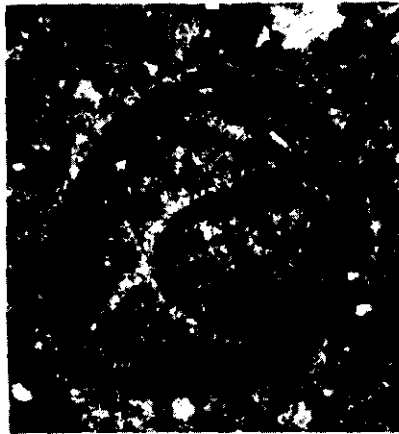
- FIG. 1.—*Cylindroporella sugdeni* Elliott, Upper Aptian-Lower Albian.
FIG. 2.—*Melathrokerion sp.*, Upper Aptian-Lower Albian.
FIG. 3.—*Choffatella decipiens* Schlumberger, Lower Aptian.
FIG. 4.—*Haplophragmium aequale* (Roemer), Lower Aptian.
FIG. 5.—*Palorbitolina lenticularis* (Blumenbach), Upper Aptian (Lower Gargasian).
FIGS. 1-5.—Candas (San Pedro), Asturias Province. $\times 20$.



1



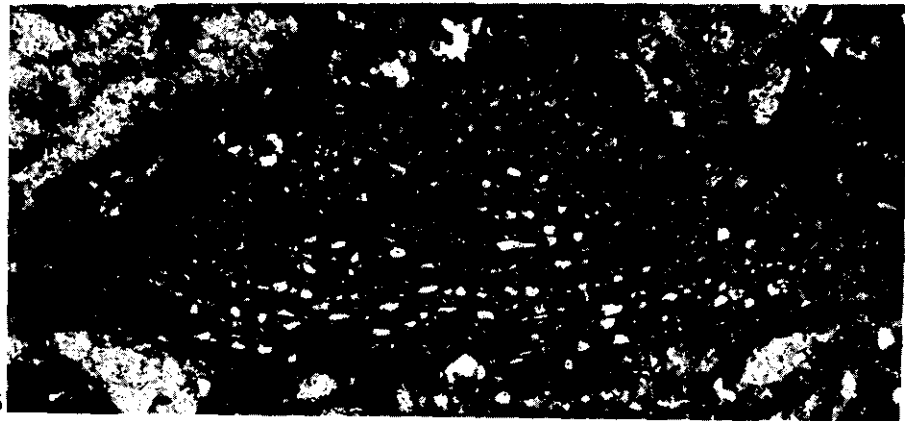
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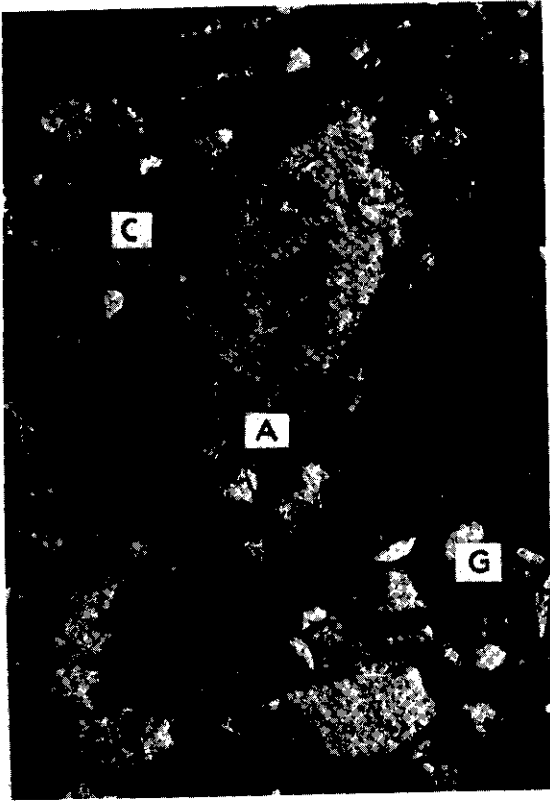
5

PLATE IV

FIG. 1.—*Colomiella mexicana* Bonet (C), *Arabicodium cantabricus* n. sp. (fragments) (A), *Glomospira* sp. (G) and pelecypods, Upper Aptian-Lower Albian, Candas (San Pedro), Asturias Province. × 40.

FIG. 2.—*Arenobulimina aff albiana* Woloshyna, Lower Aptian, Candas (San Pedro), Asturias Province. × 20.

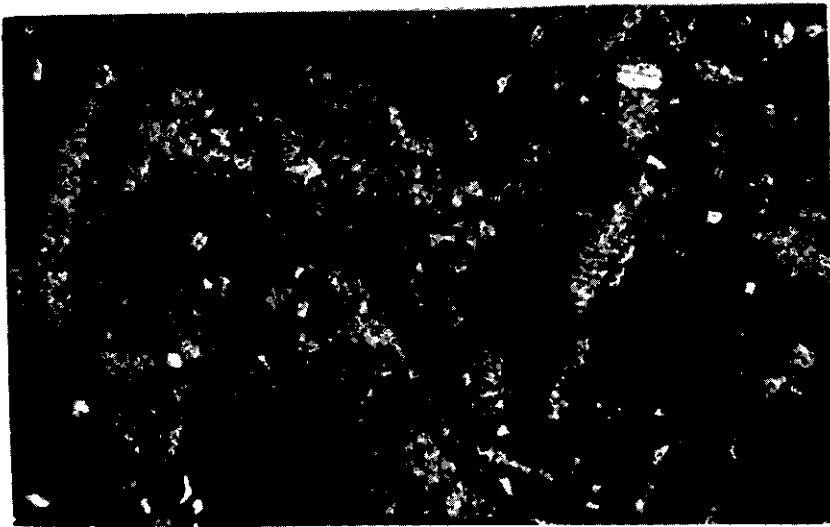
FIG. 3.—Typical fragment of *Arabicodium cantabricus* n. sp. and gastropods, Upper Aptian-Lower Albian, Candas (San Pedro), Asturias Province. × 20.



1



2



3