

MIOCENE BRYOZOA FROM GUADAL FORMATION AT THE SOUTHERN BORDER OF LAGO GENERAL CARRERA, AYSÉN, REGION OF CHILE, SOUTH AMERICA

KRISTER BROOD

Paleozoologiska sektionen Riksmuseet, 104 05 Stockholm, Sweden

ABSTRACT

Bryozoa from the marine Guadal Formation (Oligocene-Miocene), cropping out at the southern border of Lago General Carrera, Aisen Region (XI) of Chile ($46^{\circ}30' S$; $72^{\circ}W$) are here described.

The Cyclostomatous genera *Tretocycloecia*, *Tubulipora*, *Tennysonia*, *Pustulopora*, *Hornera*, *Crisina* and *Crisia* represented by eight species were found. Four new species are introduced: *Tretocycloecia chil-chicoensis*, *Tubulipora chilensis*, *Neofungella ovata* and *Idmidronea robusta*.

RESUMEN

Se describen Briozoos procedentes de la Formación Guadal (Oligoceno-Mioceno), cuyos afloramientos se extienden al sur del Lago General Carrera, Región de Aisén (XI)-Chile ($46^{\circ}30' S$; $72^{\circ}W$).

Se identifican los siguientes géneros del orden Cyclostomata, representados por ocho especies: *Tretocycloecia*, *Tubulipora*, *Tennysonia*, *Pustulopora*, *Hornera*, *Crisina* y *Crisia*. Además, se introducen como especies nuevas las siguientes formas: *Tretocycloecia chil-chicoensis*, *Tubulipora chilensis*, *Neofungella ovata* e *Idmidronea robusta*.

INTRODUCCION

The Bryozoa discussed in the present paper have been collected from Guadal Formation at two localities outcropping at the southern border of Lago General Carrera (Fig. 1): (1) Western outcrops: near Puerto Guadal; (2) Eastern outcrops: near Chile-Chico town.

The material was collected by Hans Niemeyer, Geologist of the Instituto de Investigaciones Geológicas, in 1974.

The here studied fossiliferous samples consist of lithified, calcareous sandstones, and contain a fair amount of Bryozoa. Bryozoa are an important biological constituent of sedimentary rocks together with molluscs, calcareous algae and porifera. The state of preservation of the bryozoa is reasonably good, but external weathering and recrystallization occur. Thus, preparation of external charac-

ters of the Bryozoa contained in these rock samples is difficult and they have mainly been identified from thin sections and peels. Therefore, only Cyclostomes which can be successfully identified in sections are discussed here, although Cheilostomes are also present in the investigated material.

Bryozoa from the Tertiary of southern South America have been studied earlier by several authors including Ortmann (1902), Canu (1904; 1909) and Conti (1949). Tertiary Southamerican bryozoa species have been commonly considered conspecific with modern and Tertiary species from Europe. These identifications are obviously open to question as a close comparison of Southamerican material and European specimens considered, could reveal conspecific differences.

The following abbreviations are used in this report:

N	: number of measured objects.
x	: arithmetic mean value, given with confidence interval.
V	: coefficient of variation.
s	: standard deviation.
O. R.	: observed range.
azw	: width of autozooeccial aperture.
azp	: width of autozooeccial peristome.
kzw	: width of kenozooeccial aperture.
pw	: width of pore.
z/mm ²	: number of opening zooecia in 1 mm ² .
daf	: distance between fascicles of autozooeccia.

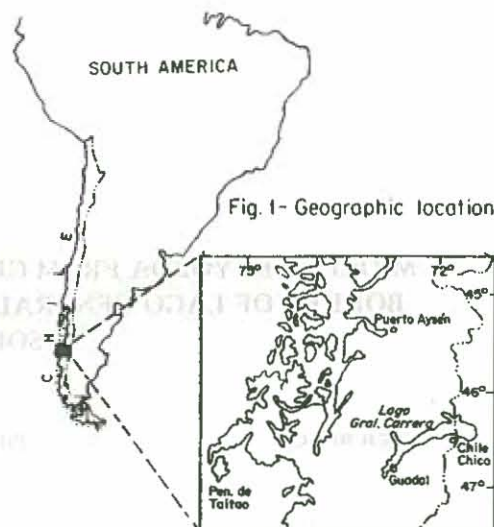


Fig. 1- Geographic location.

The terminology used here is the same as in Brood (1972). The list of synonyms considers records from southern South America only. The

type material (GID 597-610) is deposited in the Geological Institute, University of Stockholm.

PART I: BRYOZOA FROM WESTERN OUTCROPS NEAR PUERTO GUADAL

The material of the westerly outcrops of Lago General Carrera comes from three sections in the limbs of a broad syncline in the Guadal Formation: Pampa Castillo (Field numbers HN-C94-73 and HN-C89-B73), El Manzano (Field number HN-D7-73), and Pampa Guadal (Field number HN-D24-73), (Fig. 2). Table 1 shows the distribution of identified Cyclostomatous bryozoa found in this material, and Plates 1 to 4 illustrate it.

Tretocycloecia roveretoi (Conti), 1949

(Pl. 1, Figs. 1-5 and Pl. 2, Figs. 1-2)

Heteropora roveretoi Conti, 1949, p. 291, Pl. 4, Figs. 1, 4.

Dimensions

N=46	O. R.	x	V	s
aw ...	0.095 - 0.120	0.104 ± 0.002	6.97	0.0073
kw ...	0.030 - 0.075	0.049 ± 0.002	17.33	0.0084
az/mm ²	10 - 15	12.2 ± 0.4	10.18	1.24
kz/mm ²	60 - 74	65.4 ± 1.2	6.13	4.01

TABLE 1

DISTRIBUTION OF IDENTIFIED CYCLOSTOMATOUS BRYOZOA FROM STRATIGRAPHIC SECTION NEAR PUERTO GUADAL.

Sections		Pampa Castillo		El Manzano	Pampa Guadal
Species	Samples	HN-C94-73	HN-C89-B73	HN-D7-73	HN-D24-73
<i>Tretocycloecia roveretoi</i> (Conti)			x		
<i>Tubulipora chilensis</i> n. sp.		x	x	x	
<i>Tennysonia subcylindrica</i> Ortmann		x	x		x
<i>Pustulopora australis</i> Busk			x	x	
<i>Pustulopora</i> sp. A.				x	x
<i>Hornera</i> cf. <i>striata</i> Milne-Edwards				x	
<i>Crisina radians</i> Lamarck			x		
<i>Crisia</i> sp.				x	

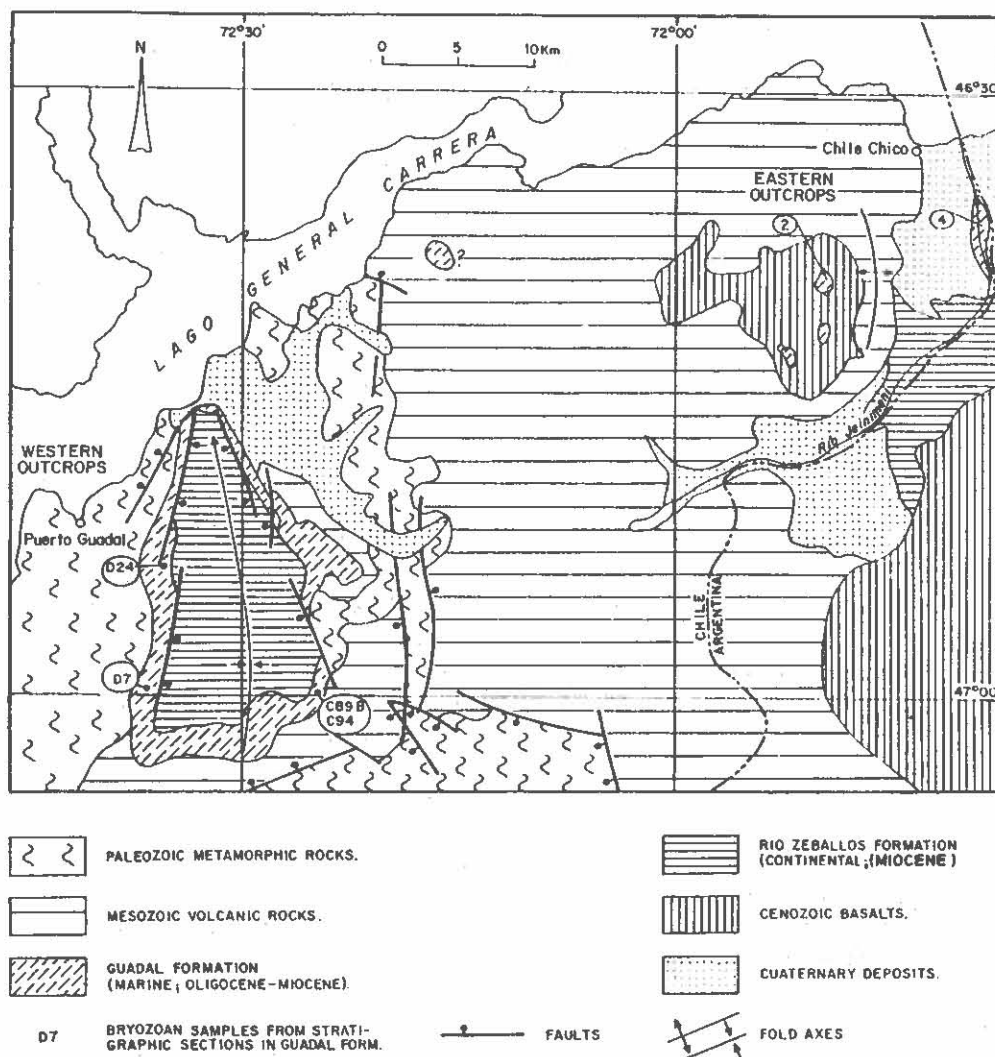


Fig 2 - Simplified geologic map of southern border of Lago General Carrera showing location of bryozoan samples from Guadal Formation (After Niemeyer, 1975).

Description. The colony forms hemispherical masses with short, bifurcating, cylindrical stems. The autozoecia open all over the surface of the colony and the apertures are flush with the surface. The autozoecia are surrounded by the kenozoecia, which are approximately four times as common as the first ones. The stems are approximately 2.8 - 3.2 mm thick. The apertures of the autozoecia are generally circular; the kenozoecial apertures are commonly polygonal or oval, but may also be circular.

As seen in a section, the autozoecia are long and begin in the centre of the stem, their proximal part running parallel with the growing direction

of the stem. The distal end turns abruptly outwards and opens transversely to the surface of the colony. The interzoecial walls are thin (~0.01 mm) in the endozone; they widen in the exozone, where their thickness increases up to 0.05 mm. New zoecia begin in the corners between already existing zoecia without affecting their shape. Numerous interzooidal pores cross the interzoecial walls. Kenozoecia only exist in the exozone.

Ultrastructurally, the skeleton consists of laminar and granular calcite. The main part of the skeleton is formed by tabular laminae, which are approximately 0.4 μ thick and several μ wide. The

central part of the interzooecial walls are commonly occupied by a zone with coarse tabular crystals, of approximately $1\ \mu$. A middle granular layer appears to be generally absent or poorly developed.

The internal surface of the zooecia bears several small spines (Pl. 1, Fig. 5), which are approximately $15\ \mu$ at their base, and consist of a central core of granular calcite surrounded by inclined laminae.

Occurrence. The present species occurs in the Miocene of South America. It is found in the Superpatagonian of Peninsula de Valdés, Argentina (Conti, 1949); and it is also found in the Aisen Region of Chile.

Remarks. The present species is characterized by the small auto- and kenozoecial dimensions and the comparatively high number of kenozoecia.

***Tubulipora chilensis* n. sp.**

(Pl. 2, Figs. 3-4)

Holotype. Specimen GI D 528, illustrated in Pl. 2, Fig. 4.

Type Stratum and Type Locality. The Oligo-Miocene of Guadal in Lago General Carrera area.

Derivation of Name. After the country of Chile.

Material. Approximately 10 specimens. GI D 528 and 529 and several unnumbered sections.

Diagnosis. A *Tubulipora* species with medium sized autozooecia and four to five autozooecia in each fascicle.

Dimensions

N=30	O. R.	x	V	s
az...	0.130 - 0.185	0.153 ± 0.004	7.32	0.0112
pz...	0.150 - 0.235	0.187 ± 0.004	5.57	0.0103

Description. The zoarium is partly erect, composed of bifurcating flattened stems, which appear oval or flattened rhomboidal in cross section. The apertures of the autozooecia open in alternating, transverse fascicles on the frontal side of the stem. The stems are approximately 1.8 - 2.2 mm wide and 0.7 - 0.8 mm thick. The exterior zooecial wall is penetrated by numerous small pseudopores.

Transverse sections show rhombic or polygonal cross sections of the autozooecia. The internal zooecial walls are approximately 0.02 mm and the exterior ones, approximately 0.03 mm thick. In longitudinal section, the zooecial walls are commonly undulating.

Microstructurally, the skeleton consists of laminar and granular calcite. The laminar crystals are approximately $0.5\ \mu$ thick and $3-5\ \mu$ wide. The granular middle layer within the interzooecial walls is poorly developed.

Occurrence. The present species has so far only been found at Guadal in the Aisen region.

Remarks. The present species is characterized by comparatively few autozooecia in the fascicles and undulating interzooecial walls.

***Tennysonia subcylindrica* Ortmann, 1902**

(Pl. 2, Fig. 7)

Tennysonia subcylindrica Ortmann, 1902, p. 69, Pl. 13, Fig. 5.

Tennysonia subcylindrica Ortmann, Canu, 1904, p. 22.

Tennysonia subcylindrica Ortmann, Canu, 1909, p. 320, Pl. 13, Fig. 1.

Remarks. Two section of a double walled, cancellate species have been obtained from the investigated material. These specimens agree well with descriptions and figures of *T. subcylindrica*, which is certainly a double walled form, possibly related to the crisinides.

***Pustulopora australis* Busk, 1852**

(Pl. 2, Figs. 1-6)

Pustulopora australis Busk, 1852, p. 350.

Pustulopora australis Busk, Busk, 1875, p. 21, Pl. 17 A.

Entalophora australis (Busk), Mac-Gillivray, 1887, p. 219.

Entalophora australis (Busk), Borg, 1944, p. 111, Pl. 2, Figs. 1-2.

Remarks. The skeleton is composed of laminar and granular calcite. The laminar layer consists of lath-like crystals, approximately $0.4 - 0.5\ \mu$ thick. The granular middle layer of the interzooecial walls is thin; approximately $2 - 4\ \mu$ thick.

The present species, which is here considered as identical with the modern *P. australis* from the Antarctic and Australia, is characterized by large autozooecia dimensions with a diameter of the autozooecial aperture of approximately 0.25 mm and the presence of numerous pseudopores in the exterior zooecial walls.

Pustulopora sp. A

Remarks. Several specimens of a *Pustulopora* species with small autozooeal dimensions occur in the investigated material. The stems are approximately 0.5 mm wide and the width of the autozooeal aperture is approximately 0.10 mm. The microstructure of the skeleton consists of laminar and granular calcite. The laminae are approximately 0.5 mm thick. These specimens probably belong to a new species.

Hornera cf. *striata* Milne-Edwards, 1838

(Pl. 4, Figs. 1-4)

Hornera striata Milne-Edwards, 1838 (?), p. 213, Pl. 11, Fig. 1.

Hornera striata Milne-Edwards, Canu, 1909, p. 313, Pl. 11, Figs. 1-6.

Description. The zoarium is erect with dichotomously branching stems. The stems are oval in transverse section. The autozooea open irregularly on the frontal side of the stem but tend to become arranged in lateral lines. The autozooeal apertures are circular, with an approximate diameter of 0.08 - 0.09 mm. The exterior side is ornamented with longitudinally arranged, bifurcating and anastomosing ribs. The zoarial walls are penetrated by numerous pores with an approximate diameter of 0.05 mm.

The ultrastructure consists of laminar and granular calcite. Granular calcite is located in the central part of the interzooeal wall and may

be up to 0.02 mm thick, also occurring as central cores of the spinose structures on the reverse side of the stems (Pl. 4, Fig. 1). These cores are approximately 3 μ thick; the laminae are approximately 0.4 - 0.5 μ thick and 4 - 5 μ wide, and they may be up to 50 μ or more in length.

Remarks. This hornerid species, which occurs in several sections, is probably identical with the *Hornera striata* reported from Argentina by Canu (1909). However, the specimens from southern Chile differ from the European specimens in having larger apertures of the autozooea and in showing a tendency to grouping autozooeal apertures in transverse lines. Presumably, the specimens from south Chile belong to a yet undescribed species, but the material here investigated is not sufficient to postulate a new species.

Crisina radians Lamarck, 1816

Remarks. Two specimens of a *Crisina* species are found in the investigated material. They consist of the modern *C. radians* type, and are probably conspecific with it as the dimensions and structure are almost identical. The presence of a *Crisina* species in the investigated material is of interest as this genus has never been reported from South America before (Borg, 1941).

Crisia sp.

Remarks. One specimen of an unidentified *Crisia* species was found.

PART II BRYOZOA FROM EASTERN OUTCROPS NEAR CHILE-CHICO

The material of the easterly outcrops of Lago General Carrera come from two sections: one from Guadal Formation sediments within a basaltic sequence at Meseta Buenos Aires, (Field number HN 2-74) and the other one from an isolated out-

crop of Guadal Formation at Río Geinimeni (Field number HN 4-74) (Fig. 2). Table II shows the distribution of identified Cyclostomatous bryozoa found and Plates 5 and 6 illustrate this material.

TABLE II.
DISTRIBUTION OF IDENTIFIED CYCLOSTOMATOUS BRYOZOA FROM STRATIGRAPHIC SECTIONS NEAR CHILE-CHICO TOWN

Sections	Meseta Buenos Aires	Río Geinimeni
Species	HN 2-74	HN 4-74
<i>Tretocycloecia chile-chicoensis</i> n. sp.	x	
<i>Neofungella ovata</i> n. sp.		x
<i>Idmidronea robusta</i> n. sp.	x	

Tretocycloecia chile-chicoensis n. sp.

(Pl. 5, Figs. 1-5)

Type. GID 598, holotype; GID 599, 600, paratypes.

Type Locality and Type Stratum. Chile-Chico, Lago General Carrera, Aisen region of Chile; Oligocene-Miocene.

Derivation of Name. The present species is named after the town of Chile-Chico.

Material. Two zoaria.

Description. The zoarium is erect, composed of stout, branching cylindrical stems. The surface is smooth. The auto- and kenozoecia open irregularly all over the surface. The kenozoecia are approximately four times more numerous than the autozoecia. The autozoecial aperture is circular and of moderate size; the kenozoecial aperture is generally polygonal and much smaller than the above ones.

The autozoecia are budded from the centre of the stem and curve gently outwards. The zoecia open transversely to the surface of the stem. The endozone is comparatively thick. The interzoecial walls are thin ($\sim 0.020 - 0.030$ mm), and penetrated by numerous interzooidal pores. Apart from the diaphragms formed during the degeneration-regeneration processes, they are rare, but a few basal and intermediate diaphragms may be found in the proximal part of the zoecia. The interzoecial walls are constituted by approximately 0.06μ thick lath-like laminae. No brood-chamber has been observed.

Dimensions

	N=45	O. R.	x	V	s
azw ...	0.100 - 0.120	0.108 $\pm$ 0.001	4.20	0.0045	
kzw ...	0.052 - 0.075	0.060 $\pm$ 0.003	15.73	0.0094	
az/mm ²	17 - 24	20.1 $\pm$ 0.5	8.63	1.735	
kz/mm ²	58 - 88	74.2 $\pm$ 2.7	11.96	8.877	

Remarks. *T. chile-chicoensis* is characterized by its moderate dimensions, thin interzoecial walls with many interzooidal pores, and few diaphragms. It differs from *T. roveretoi* (Conti) in having fewer autozoecia, wider kenozoecia and lacking the internal spines. It differs from *Heteropora bifurcata* Canu, *H. thevenini* Canu, *H. crassa* Canu, and *H. ortmanni* Canu in the much smaller dimensions of the zoecia.

Neofungella ovata n. sp.

(Pl. 5 Fig. 6 and Pl. 6, Figs. 1-3)

Type. GID 597, holotype; GID 595, paratypes.

Type Locality and Type Stratum. Chile-Chico, Lago General Carrera, Aisen region of Chile; Oligocene-Miocene.

Derivation of Name. *Ovatus* (latin) = egg-shaped, referring to shape of the zoarium.

Material. Two colonies.

Description. The zoarium is globular or massive, composed of several superimposed layers, which are approximately 2 mm thick. The autozoecia are generally short and confined to one growth layer only, but some pass through one or more layers. The surface is smooth. Both auto- and kenozoecia open irregularly all over the smooth surface. The kenozoecia are approximately twice as numerous as the autozoecia. The autozoecial aperture is circular and of moderate size. The kenozoecial aperture is smaller and generally circular, but it may also be polygonal in younger stages.

In longitudinal section, the interzoecial walls are thin and 0.02 - 0.03 mm thick. The zoecia generally lack basal and intermediate diaphragms, but terminal diaphragms occur. Interzoecial pores are common. Brood-chambers are not observed.

Dimensions

	N=50	O. R.	x	V	s
azw ...	0.080 - 0.110	0.099 $\pm$ 0.002	7.31	0.0072	
kzw ...	0.046 - 0.075	0.058 $\pm$ 0.002	12.04	0.0070	
az/mm ²	19 - 25	21.7 $\pm$ 0.5	7.32	1.558	
kz/mm ²	36 - 46	41.4 $\pm$ 0.8	6.59	2.72	

Remarks. The present species is characterized by the moderate dimensions of the zoecia and by having twice as many kenozoecia as the autozoecia; this being the difference between *N. ovata* and type species of the genus, *N. claviformis* (Waters). The assignment of the present species to *Neofungella* is therefore tentative.

The skeleton of the present species is recrystallized and the ultrastructure cannot be determined.

Idmidronea robusta n. sp.

(Pl. 6, Figs. 4-9)

Type. GID 605, holotype; GID 606-610, paratypes.

Derivation of Name. Robustus (latin) = robust, referring to the large dimensions of the zoarium. *Type Locality and Type Stratum.* Chile-Chico, Lago Genral Carrera, Aisen region of Chile; Oligocene-Miocene.

Material. One very large zoarium with hundreds of stems.

Description. The zoarium is erect, composed of dichotomously branching stems. The latter are rounded-triangular in cross section and approximately 1 mm wide. The autozooeceia open in alternating, lateral fascicles consisting of six to eight zooeceia each. The autozooeceial aperture is of moderate size. The back side of the stem is smooth and rounded. No kenozooeceia are present on the back side of the stems except for the basal part of the zoarium. The gonozooeceium is not observed.

In thin section the autozooeceia are moderately long. They are budded from the dorsal side. The interzooeceial walls are thin in the proximal and

middle parts (approximately 10μ) but thicken in the distal end. The interzooeceial walls are formed by two laminar layers separated by a thin middle granular layer which is approximately 4μ thick. Each laminae is approximately 0.6μ thick. The exterior walls are thick, approximately 40μ , and penetrated by numerous pseudopores, while interior walls are penetrated by interzooidal pores. Basal and intermediate diaphragms rarely occur.

Dimensions

N=41	O. R.	x	V	s
azw ...	0.080 - 0.108	0.094 ± 0.002	6.96	0.0066
azp ...	0.110 - 0.135	0.122 ± 0.005	13.49	0.0165
daf ...	0.40 - 0.65	0.55 ± 0.02	10.49	0.057

Remarks. The present species is characterized by its thick stems with many autozooeceia in the fascicles, a smooth rounded back side and numerous pseudopores in the exterior walls.

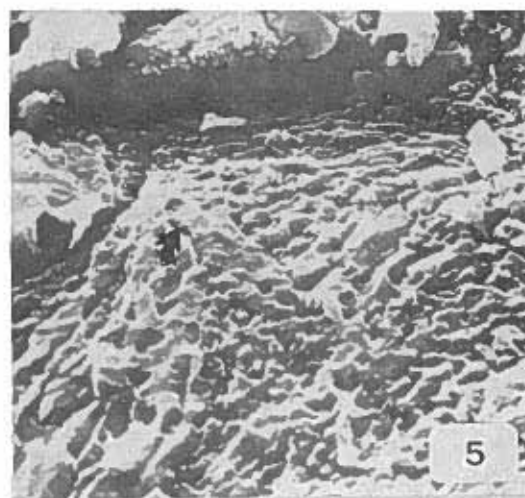
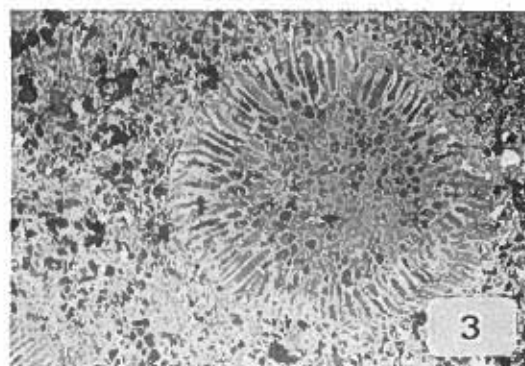
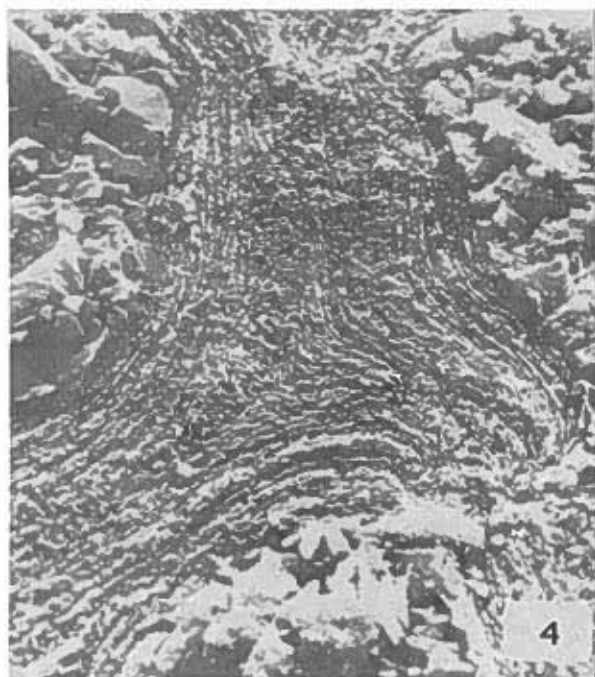
REFERENCES

- BANTA, W. 1967. A new species of *Neofungella* (Bryozoa, Stenolaemata) from southern California. Vol. 66, No. 1, p. 35-38.
- BORG, F. 1933. A revision of the recent Heteroporidae. Uppsala Zool. Bidrag., Vol. 14, p. 253-394.
- BORG, F. 1941. On the structure and relationships of *Crisina* (Bryozoa, Stenolaemata). Ark. F. Zool., Vol. 33 A, No. 11, p. 1-46.
- BORG, F. 1944. The Stenolaematous Bryozoa. Further Zool. Results Studies Swed. Ant. Exp. 1901-1903, Vol. 5, 276 p.
- BROOD, K. 1972. Cyclostomatous Bryozoa from the Upper Cretaceous and Danian in Scandinavia. Stockh. Contr. Geol., Vol. 26, 464 p.
- BUSK, G. 1875. Catalogue of Marine Polyzoa in the collection of the British Museum. Part. 3: Cyclostomata. London.
- CANU, F. 1904. Les Bryozoaires de Patagonien. Echelle de Bryozoaires pour les terrains Tertiaires. Mém. Pal. Soc. Géol. France, Vol. 12, No. 33, p. 61-87.
- CANU, F. 1909. Iconographie de Bryozoaires de l'Argentine. Mus. Nat. Buenos Aires, An., Vol. 3, No. 10, p. 245-341.
- CANU, F.; BASSLER, R. S. 1923. North American Later Tertiary and Quaternary Bryozoa. U.S. Natl. Mus., Vol. 125, 302 p.
- CONTI, S. 1949. I Briozoi dell'Aonichense (Superpatagoniano) di S. José nella Penisola di Valdez (Argentina). Civ. Mus. di Nat., Ann., Vol. 63, p. 283-293.
- HOFFSTETTER, R. 1957. Lexique Stratigraphique International. Vol. 5, No. 7: Chile, 444 p.
- MAC-GILLIVRAY, P. H. 1887. A Catalogue of The Marine Polyzoa of Victoria. Roy. Soc. Victoria, Trans. and Proc., Vol. 23.
- MILNE-EDWARDS, M. H. 1838. Mémoire sur les Crisies, les Hornères et plusieurs autres Polypes vivants ou fossiles dont l'organisation est analogue a celle des Tubulipores. Sc. Nat. Zool. Ann., Vol. 2, No. 9. Paris.
- NIEMEYER, H. 1975. Geología de la Región Compreendida entre el Lago General Carrera y el Río Chacabuco, Provincia de Aisén-Chile. Memoria de Título, Univ. Chile, Depto. Geol., 309 p. Santiago.
- ORTMANN, A. E. 1902. Tertiary Invertebrates. Princeton Univ., Exp. Patagonia 1896-1899, Reports, Vol. 4, No. 2, p. 45-332.
- WATERS, A. W. 1884. On fossil cyclostomatous Bryozoa from Australia. Geol. Soc., Q. J., No. 40, p. 674-697.
- WATERS, A. W. 1887. On Tertiary cyclostomatous Bryozoa from New Zealand. Geol. Soc., Q. J., No. 43, p. 337-350.

PLATE I

Tretocycloecia roveretoi (Conti), 1949

- 1 Longitudinal section through bifurcating stem showing arrangement of autozooecia. GI D 525. X 15.
- 2 Tangential section showing auto- and kenozooecia and interzooecial pores. Stereoscan 5326. X 450.
- 3 Transverse section of stem showing budding pattern of zooecia. GI D 526. X 15.
- 4 Transverse section of interzooecial wall showing arrangement of laminae. Stereoscan 5326. X 1800.
- 5 Spine with calcareous rod of granular calcite (at arrow). Stereoscan 5216. X 2000.



TRETOCYCLOECIA

PLATE II

***Tretocycloecia roveretoi* (Conti), 1949**

- 1 Longitudinal section through interzooecial wall showing interzooecial pore and spine (at arrow) with calcareous rod. Stereoscan 5315. X 900.
- 2 Longitudinal section showing budding pattern of zooecia. GI D 527. X 8.

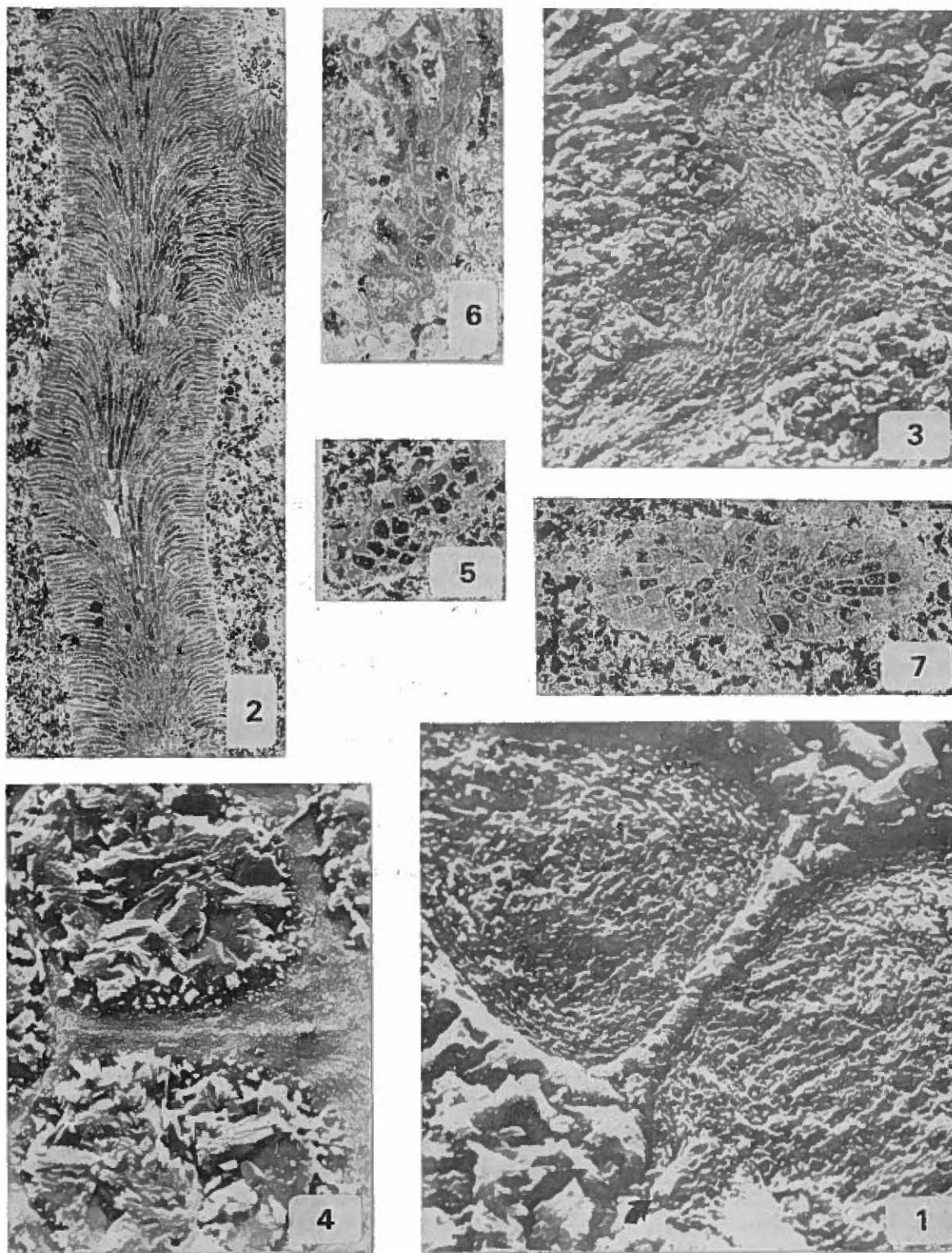
***Tubulipora chilensis* n. sp.**

- 3 Distal end of interzooecial wall showing connection between interzooecial and exterior wall. Steroscan 5408. X 400.
- 4 Transverse section of autozooecia showing interzooecial wall at centre and exterior walls to the right. Stereoscan 4816. X 200.
- 5 Transverse section of stem showing autozooecial arrangement. GI D 528. X 15.
- 6 Oblique longitudinal section of stem showing undulating interzooecial walls. GI D 529. X 15.

***Tennysonia subcylindrica* Ortmann, 1902**

- 7 Transverse section through bifurcating stem. GI D 530. X 15.

PLATE II

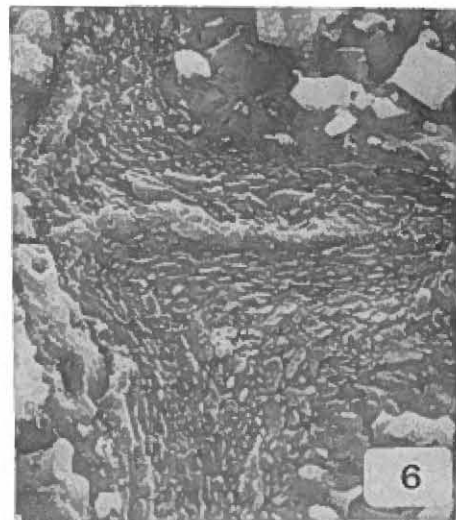
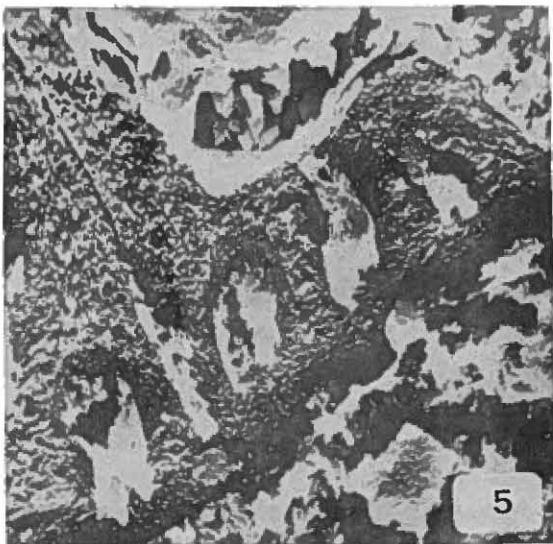
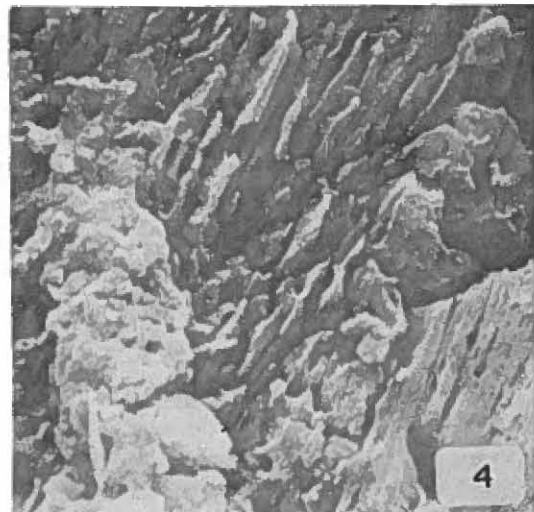
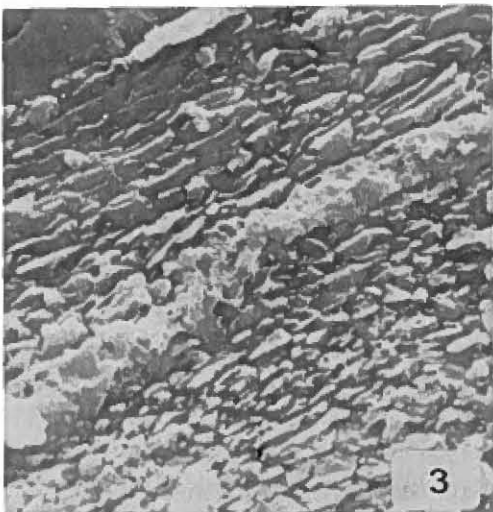
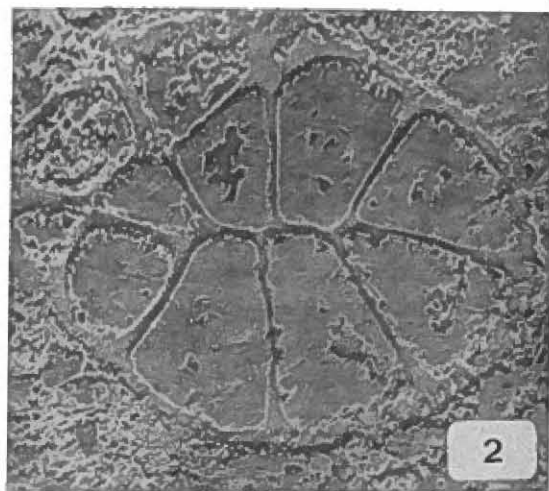
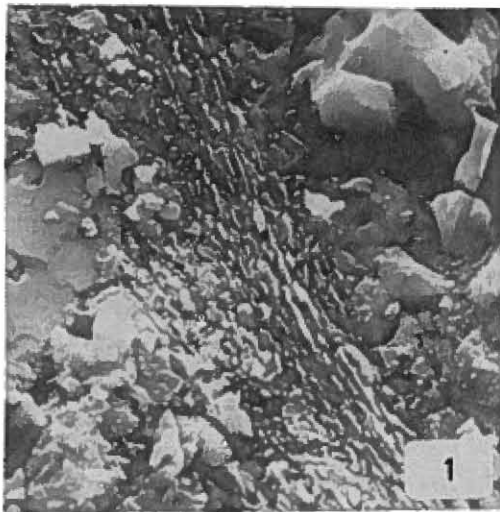


TRETOCYCLOECIA—TUBULIPORA—TENNYSONIA

PLATE III

***Pustulopora australis* Busk, 1852**

- 1 Longitudinal section through exterior wall showing tabular crystals of laminar layer. GI D 4912. X 1000.
- 2 Transverse section through stem showing arrangement of auto-zooecia. Stereoscan 4911. X 45.
- 3 Section through interzooecial wall showing granular middle layer and flanking laminar layer. Stereoscan 4830. X 2000.
- 4 Section through exterior wall showing pseudopore to the left and crystals from the laminar layer. Stereoscan 4809. X 4000.
- 5 Section through exterior wall showing several close grouped pseudopores. Stereoscan 4924. X 350.
- 6 Section through interzooecial wall passing into exterior wall, showing middle granular layer of interzooecial wall and laminar layer. Stereoscan 5201. X 900.



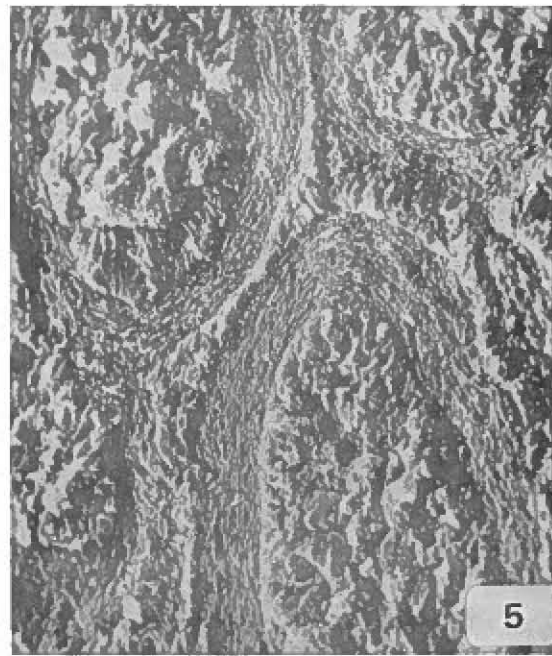
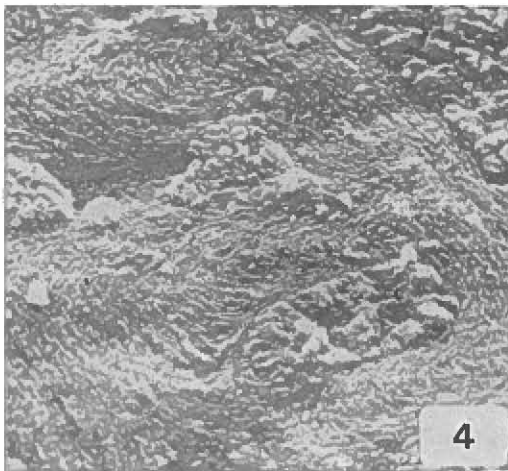
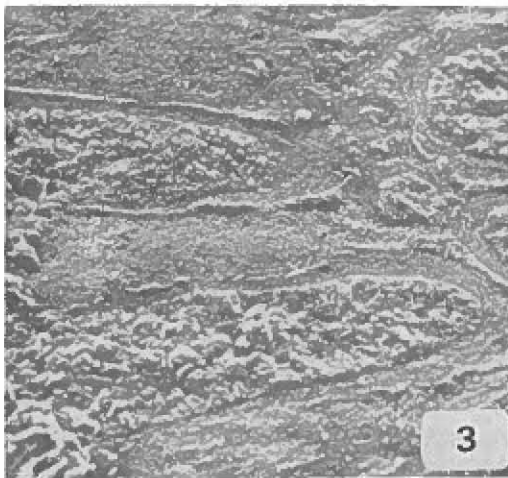
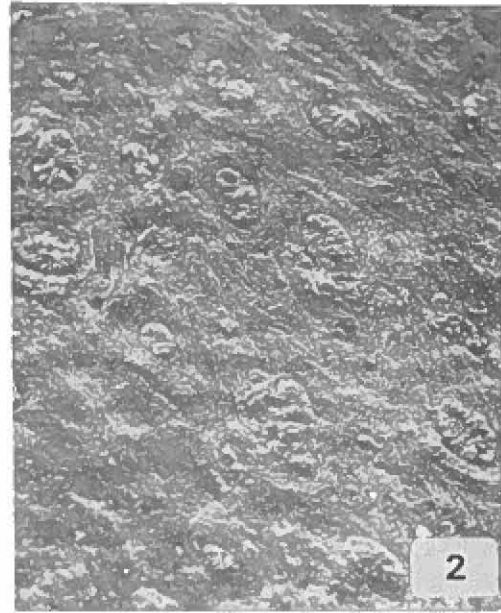
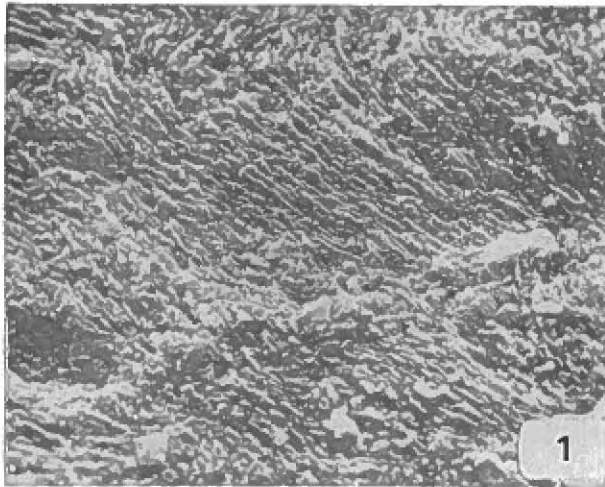
PUSTOLOPORA

PLATE IV

***Hornera cf. striata* Milne-Edwards, 1838**

- 1 Longitudinal section through back side of stem showing laminar zoarial layer crossed by calcareous rods with granular structure. Stereoscan 5429. X 1800.
- 2 Tangential section showing pores penetrating the zoarial laminar layer. Stereoscan 5412. X 180.
- 3 Transverse section of distal end of autozooecia showing granular middle layer surrounded by flanking laminar layers. Stereoscan 5420. X 180.
- 4 Longitudinal section through back side of stem showing pores surrounded by laminar calcite. Stereoscan 5426. X 450.
- 5 Transverse section of interzooecial walls showing well developed middle granular layer and flanking laminar layers. Stereoscan 5419. X 400.

PLATE IV



HORNERA

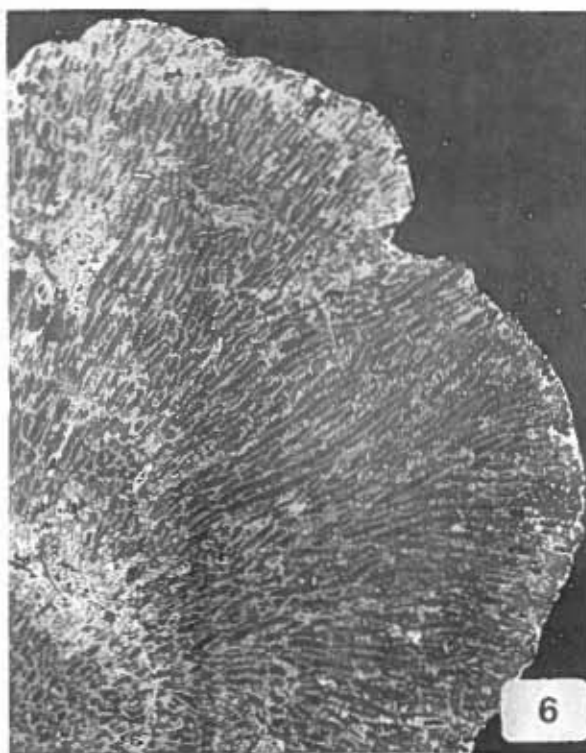
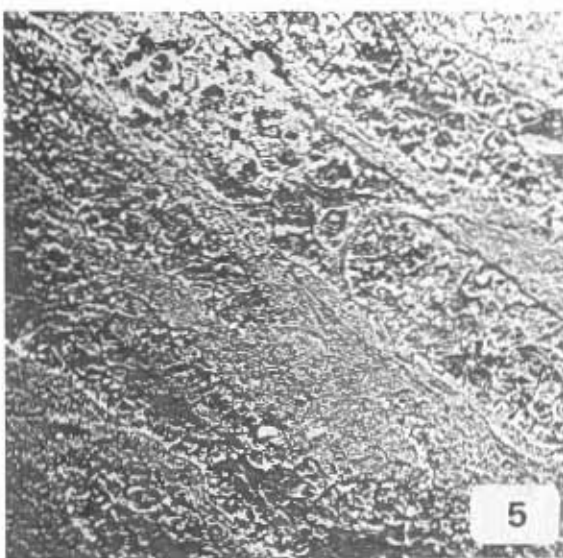
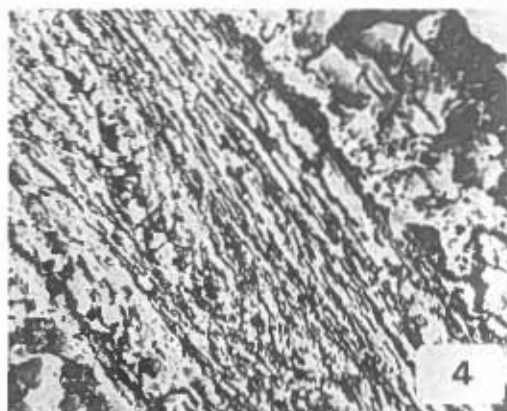
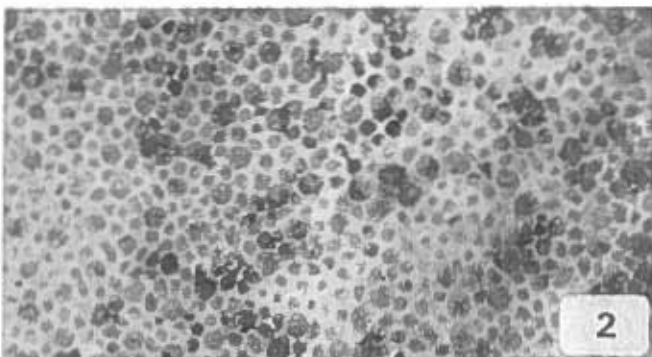
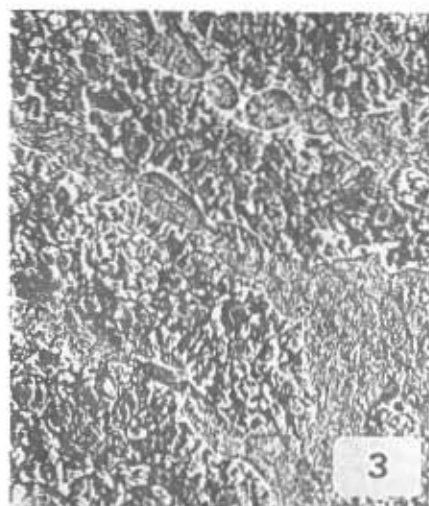
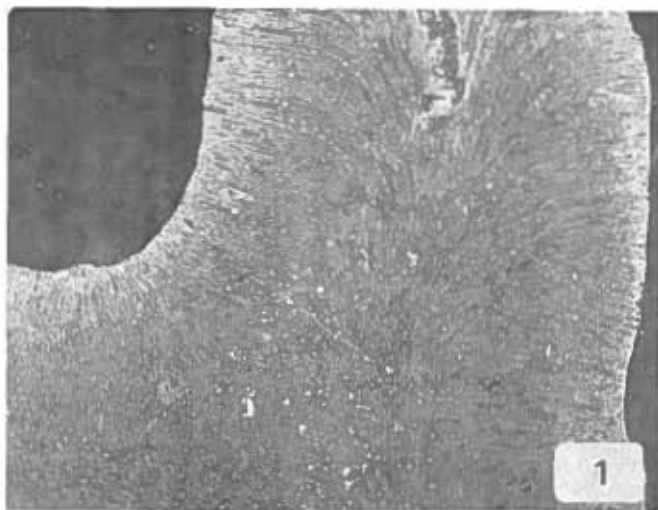
PLATE V

Tretocycloecia chile-chicoensis n. sp.

- 1 Longitudinal section showing shape of autozooecia. GID 598, holotype. X 10.
- 2 Tangential section showing auto- and kenozooecia. GID 598, holotype. X 22.
- 3 Longitudinal section through zooecia showing regeneration zone at lower part of picture and interzooecial walls penetrated by interzoooidal pores. GID 598, holotype, X 200.
- 4 Longitudinal section of interzooecial wall showing laminae. GID 598. X 1000.
- 5 Longitudinal section showing diaphragm near regeneration zone. GID 598, X 200.

Neofungella ovata n. sp.

- 6 Deep tangential section showing auto- and kenozooecia without diaphragms. GID 597, holotype. X 10.



TRETOCYCLOECIA-NEOFUNGELLA

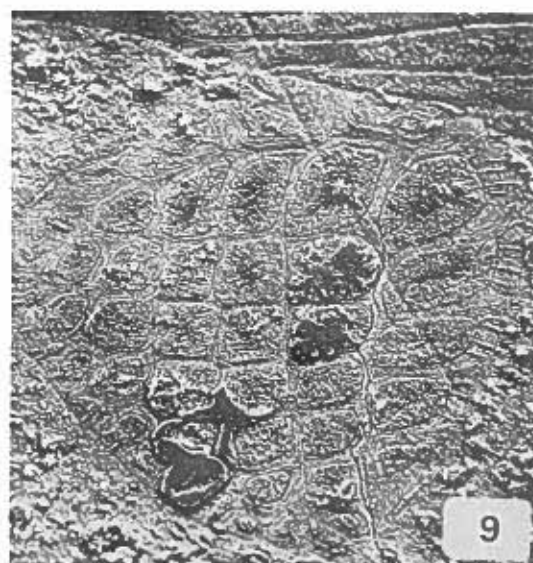
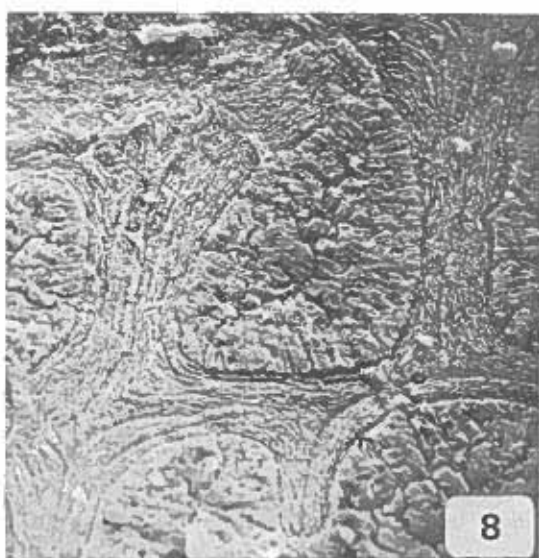
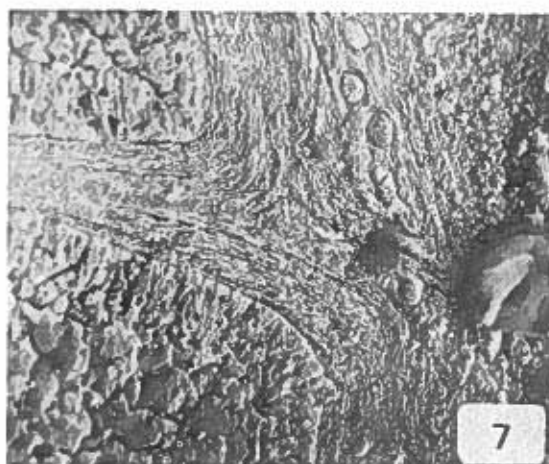
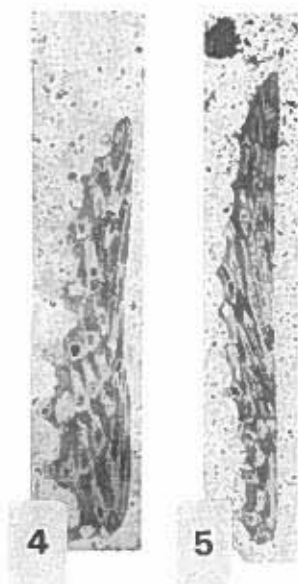
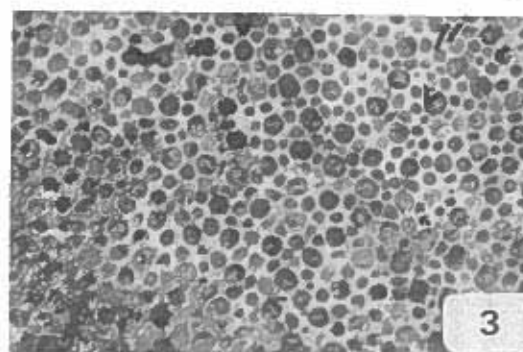
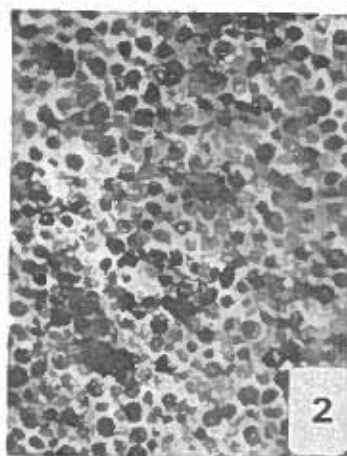
PLATE VI

***Neofungella ovata* n. sp.**

- 1 Longitudinal section showing several growth layers. GID 597 b, paratype. X 18.
- 2 Surface of holotype showing auto- and kenozoecia. GID 597. X 20.
- 3 Tangential section showing auto- and kenozoecia. GID 597, holotype. X 22.

***Idmidronea robusta* n. sp.**

- 4 Lateral section showing autozoecia. GID 606 b. X 12.
- 5 Longitudinal section showing autozoecia. GID 606 b. X 10.
- 6 Transverse sections. GID 606 c. X 10.
- 7 Transverse section of distal end of autozoecium showing granular middle layer and flanking laminar layers of interzooidal wall and exterior wall penetrated by pseudopores. GID 605, holotype. X 450.
- 8 Transverse section of autozoecia showing granular middle layer and flanking laminar layers. Note interzooidal pores. GID 605, holotype. X 450.
- 9 Transverse section showing autozoecia. GID 605, holotype. X 100.



NEOFUNGELLA-IDMIDRONEA