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New dinoflagellate cyst species from the Calafate Formation (Maastrichtian), Austral Basin, Argentina

M. Verónica GULER[1,2], G. Raquel GUERSTEIN[1,2] and Silvio CASADÍO[1,3]

Abstract. The aim of this paper is to erect four new dinoflagellate cyst species from the Maastrichtian Calafate Formation, Austral Basin, Argentina. *Andalusiella spinosa* sp. nov. is strongly acrocavate and possesses a periphragm covered with spines. *Palaeocystodinium pilatum* sp. nov. has a periphragm densely covered with fine, flexuous, hair-like projections, shortening towards the end of the horns, and a finely granulate endophragm. The large peridinialean *Caligodinium perforatum* sp. nov. shows the hypocystal archeopyle typical for the genus, with a simple triplacoid opercular piece and a microfoveolate autophragm surrounded by a perforate flocculent calyptra. *Hafniasphaera australis* sp. nov. is differentiated from other species of the genus *Hafniasphaera* by the presence of a distinctive anterior ventral process which emerges at the junction of paraplates 1′, 4′ and as. These new species characterize the assemblages from deposits related to the South Atlantic transgression that occurred during Maastrichtian times at the southermost part of Argentina

Resumen. QUISTES DE DINOFLAGELADOS DE LA FORMACIÓN CALAFATE (MAASTRICHTIANO), CUENCA AUSTRAL, ARGENTINA. En este trabajo se describen cuatro especies nuevas de quistes de dinoflagelados provenientes de la Formación Calafate (Maastrichtiano), cuenca Austral, Argentina. *Andalusiella spinosa* sp. nov. es fuertemente acrocavada y tiene el perifragma cubierto por espinas. *Palaeocystodinium pilatum* sp. nov. presenta el perifragma cubierto por proyecciones pilosas, finas y flexibles que se acortan hacia los extremos de los cuernos y un endofragma finamente granulado. *Caligodinium perforatum* sp. nov. es una especie del Orden Peridiniales, tiene un arqueopilo hipocistal con una pieza opercular triplacoide simple y un autofragma microfoveolado rodeado por una caliptra amorfa perforada. *Hafniasphaera australis* sp. nov. se diferencia del resto de las especies del género *Hafniasphaera* por la presencia de un proceso anterior ventral distintivo que emerge de la intersección de las paraplacas 1′, 4′ y as. Estas nuevas especies caracterizan las asociaciones provenientes de depósitos de la Formación Calafate relacionados a la transgresión Sud-Atlántica ocurrida durante el Maastrichtiano en el parte más austral de Argentina.

Key words. Dinoflagellate cysts. Maastrichtian. Calafate Formation. Austral Basin. Argentina.

Palabras clave. Quistes de dinoflagelados. Maastrichtiano. Formación Calafate. Cuenca Austral. Argentina.

Introduction

An important Late Cretaceous sedimentary sequence is exposed at the southwestern end of South America. The rocks forming this sequence record a clear progradation of shallow marine and continental facies, which infill the Austral Basin.

Macellari *et al*. (1989) recognized three Late Cretaceous depositional sequences in the Lago Argentino area. The youngest one includes the Calafate Formation, a unit with a debatable age.

Furque (1973), following Feruglio (1949), placed the Calafate Formation in the late Maastrichtian, while Nullo *et al*. (1981) and Macellari *et al*. (1989) assigned it to the Maastrichtian-Paleocene interval. However Malumián and Caramés (1997) demonstrated the absence of Paleocene rocks in the Calafate Formation. This was recently confirmed by Marenssi *et al*. (2004) based mainly on continental palynological data. According to these authors, dinoflagellate cysts indicated an age no older than Maastrichtian (probably late Maastrichtian) for the basal part of the section and a late Maastrichtian age for the middle part of the section.

Malumián (1999) showed that the Calafate Formation is overlain unconformably by the Man Aike

[1]Consejo Nacional de Investigaciones Científicas y Técnicas, Argentina.
[2]Departamento de Geología, Universidad Nacional del Sur, San Juan 670, 8000 Bahía Blanca, Argentina.
vguler@criba.edu.ar, gmguerst@criba.edu.ar
[3]Facultad de Ciencias Exactas y Naturales, Universidad Nacional de La Pampa, Uruguay 151, 6300 Santa Rosa, Argentina.
scasadio@cpenet.com.ar

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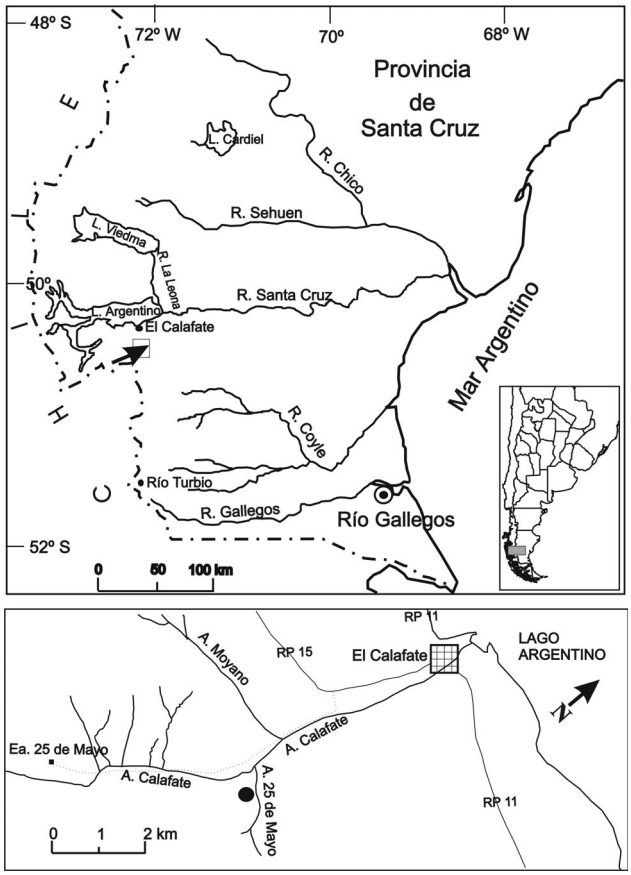


Figure 1. Location map / *mapa de ubicación.*

Formation. The age of the latter ranges from the Lutetian to the Bartonian on the basis of its planktonic foraminifer assemblages. This unconformity was also described by Marenssi *et al*. (2002) in the cerro Calafate, south of lago Argentino.

In the sampled section, in the Cerro Calafate area (figure 1), the Calafate Formation comprises 260 m of sandstone with occasional conglomerate and sparse mudstone beds (figure 2). These rocks, which were deposited in a nearshore marine environment, show a stacking pattern of asymmetrical coarsening and fining upward cycles. The coarsening upward intervals are thicker than the fining upward cycles. This feature was interpreted by Marenssi *et al*. (2004) as the result of short term transgressive-regressive events. The coarsening upward cycle would represent sedimentary progradation during a time of stable or falling relative sea level interval.

The palynological samples recovered from the Calafate Formation contain spores, pollen, dinoflagellate cysts, acritarchs and other marine algae. The dinoflagellate cyst assemblages are relatively low diverse, while the abundance of specimens is highly variable through the section. Even when dinoflagellate cysts are abundant, the assemblages show high dominance of particular species. These characteristics, along with the individuality of the assemblages, support the marginal marine environmental conditions proposed by the sedimentological analysis.

The aim of the present paper is to describe four new dinoflagellate cyst species belonging to the genera *Andalusiella*, *Caligodinium*, *Hafniasphaera* and *Palaeocystodinium*, from the upper Maastrichtian Calafate Formation.

Material and methods

Twenty samples were processed for palynological study. Treatment included hydrofluoric, hydrochloric acid and screening with a 25 µm mesh sieve. The residues were stained using Bismarck C and mounted on glycerine jelly.

Light microscopy was undertaken using Nikon Eclipse 600 microscope serial n° 772751. Images of specimes were captured by a Nikon Coolpix 950 digital camera; England Finder (EF) references and microscope co-ordinates of the Vernier Scale are provided in the figure explanations. The holotypes and paratypes of the new species and the illustrated specimens are housed in the Palynological Collection, Departamento de Geología, Universidad Nacional del Sur, Bahía Blanca, Argentina, as UNSLP 3425 to 3431. Samples LA51 and LA38 proceed from other section in the study area and are considered equivalent to sample 3425. The nomenclature and the taxonomic classification of the dinoflagellate cyst species correspond to Williams *et al*. (1998) and Fensome *et al*. (1993) updated by Fensome *et al*. (1998), respectively. Timescale corresponds to Gradstein *et al*. (1995).

Systematic palynology

Division DINOFLAGELLATA (Bütschli, 1885)
Fensome *et al*. 1993
Class DINOPHYCEAE Pascher 1914
Order PERIDINIALES Haeckel 1894b
Suborder PERIDIINEAE Autonym
Family PERIDINIACEAE Ehrenberg 1831
Subfamily DEFLANDREOIDEAE
Bujak and Davies 1983.

Genus ***Andalusiella*** (Riegel, 1974) *emend*.
Masure *et al*. 1996

Type species. *Andalusiella mauthei* Riegel, 1974.

Andalusiella spinosa sp. nov.
Figures 4.A-O

Holotype. Slide UNSLP 3431-1 46.5/95, England Finder: W47/0;

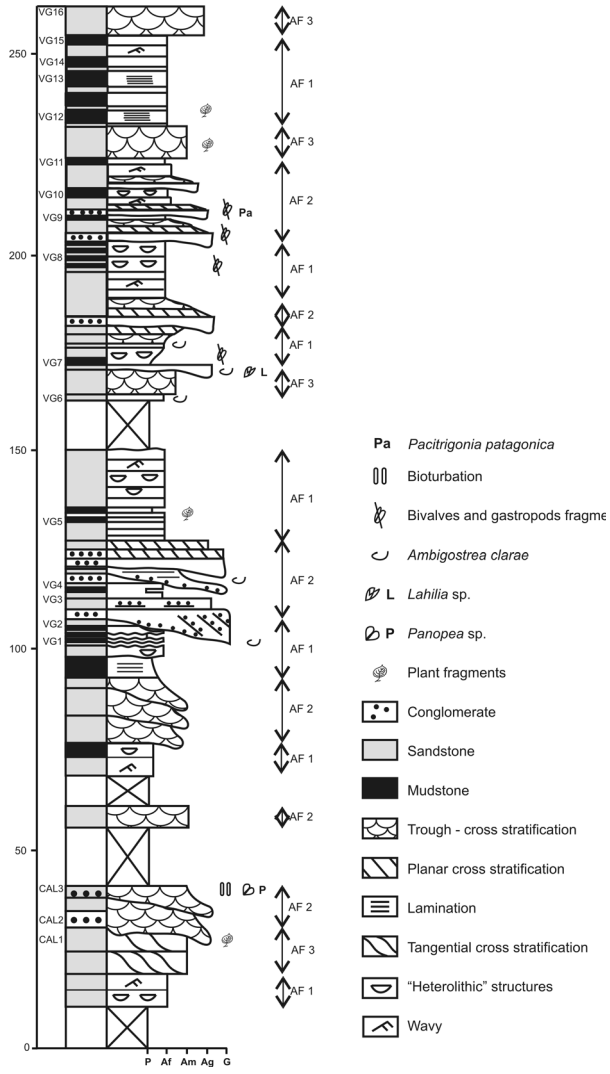


Figure 2. Stratigraphic section of the Calafate Formation at the Estancia 25 de Mayo, Southwest Santa Cruz Province (After Marenssi *et al*., 2004) / *Sección estratigráfica de la Fomación Calafate en la Estancia 25 de Mayo, sudoeste de la provincia de Santa Cruz (Modificado de Marenssi* et al*., 2004).*

Fig. 4.C. **Paratype.** Slide UNSLP 3431-2 31.5/107.2, England Finder: J31 4; Figs. 4.I-J.

Type locality. Estancia 25 de Mayo, Cerro Calafate, south of the Lago Argentino, Austral Basin.
Type horizon. Sample VG16, 260 m above the base of the section; late Maastrichtian.
Etymology. From *spinosus* = spiny, in reference to the short spines covering the periphragm.
Diagnosis. Proximate, acrocavate dinoflagellate cyst with a rhomboidal central body, long apical and left antapical horns. Periphragm densely covered by fine spines. Parasulcus with flagellar scar. Assumed peridinioid paratabulatation indicated only by the cingulum and archeopyle.
Description. Proximate cyst with a rhomboidal to ovoidal central body. One long apical horn, and one well-developed left antapical horn with an incipient right antapical horn, indicated by a poorly developed bulge. The apical horn is longer than the longest antapical horn. Wall composed of a smooth endophragm and a delicate periphragm bearing fine spines, densely distributed, up to 2 µm in length. Endophragm extends almost up to the tip of the horns, typical of strongly acrocavate cysts. A few specimens show thickenings of the endophragm at the base of the apical horn (epistomia). The assumed peridinioid paratabulation is reflected by the archeopyle, cingulum and occasionally by incomplete sutural features. Cingulum slightly offset, indicated by two parallel crests. The sulcus has a bean-shaped flagellar scar. The archeopyle is intercalary type I/I, standard 2a hexa, isodeltaform, with a generally adherent operculum.
Dimensions. Overall length: 75 (84) 110 µm; central body length: 40 (48) 55 µm, width: 38 (43.5) 52 µm; length of apical horn: 13 (24) 40 µm; length of left antapical horn: 8 (13) 20 µm (20 specimens measured).
Comparisons. *Andalusiella spinosa* differs from other species of *Andalusiella* in having a periphragm covered by fine spines. According to the original diagnosis of *Andalusiella* (*Svalbardella*) *rhomboides* by Boltenhagen (1977) the periphragm is completely covered by micro-spines. However, according to the emendation of Masure *et al*. (1996) the wall is described being composed of a verrucose periphragm and endophragm. Moreover *A. rhomboides* is slightly acrocavate to cornucavate which distinguishes it from *A. spinosa* sp. nov. which is strongly acrocavate.
Stratigraphic occurence. Frequent at sample GV16.

Genus ***Palaeocystodinium*** Alberti, 1961

Type species. *Palaeocystodinium golzowense* Alberti, 1961.

Palaeocystodinium pilosum sp. nov.
Figures 6.F-R

Holotype. UNSLP 3425-1 30.5/104.2 England Finder: M30/3; Figs. 6.J-K. **Paratype.** UNSLP 3425-2 44/107, England Finder: J44/4; Fig. 6.R.

Type locality. Estancia 25 de Mayo, Cerro Calafate, South of Lago Argentino, Austral Basin.
Type horizon. Sample VG5, 130 m above the base of the section; Maastrichtian (probably late Maastrichtian)
Etymology. From *pilosus* (Latin): hair, in reference to the periphragm which is densely covered by hair-like projections.
Diagnosis. Proximate, cornucavate dinoflagellate cysts with an elongate ovoidal central body. Apical and antapical horns are distally acuminate. Peri-

phragm densely covered with fine hairs, endophragm granulate. Intercalary archeopyle, type 2a.

Description. Fusiform cyst with long, slender, tapering, acuminate apical and antapical horns. Apical horn longer and slightly sharper than the antapical one. Cornucavate, with an elongate ellipsoidal endocyst. Periphragm densely covered with fine, flexuous, hair-like projections which are up to 2 µm long, which become shorter towards the end of the horns. Endopragm finely granulate. No parasutural features. Paratubulation only indicated by an intercalary, steno-deltaform archeopyle, type 2a; operculum generally attached.

Dimensions. Overall length 175 (204) 240 µm. Central body: length 65 (79) 98 µm; width 40 (41) 48 µm. Length of apical horn 65 (75) 85 µm, antapical horn 50 (65) 80 µm (15 specimens measured)

Comparisons. *Palaeocystodinim pilosum* differs from other previously described species of *Palaeocystodinium* by having a periphragm completely and densely ornamented with hair-like projections and a granulate endophragm. *P. benjaminii* Drugg, 1967 is similar in size and shape, and is ornamented with fine hair-like projections but these are restricted to the horn areas. *P. bulliforme* Ioannides, 1986 is cornucavate to circumcavate, whith a smooth to finely granular periphragm and an endophragm that is smooth and may possess an indentation on the antapical horn. *P. hampdenense* (Wilson, 1977) Wrenn and Hart, 1988 has a microreticulate periphragm and endophragm and *P. granulatum* (Wilson, 1967) Lentin and Williams, 1976 presents a densely granulate periphragm and a smooth endophragm.

Remarks. The granulate endophragm was only observed in those few specimens with a free perioperculum.

Stratigraphic occurence. Common in samples VG2 and VG5, rare in VG3, VG5, VG6 and VG16.

Family UNCERTAIN

Genus ***Caligodinium*** Drugg 1970 *emend*. Manum and Williams 1995

Type species. *Caligodinium amiculum* Drugg 1970.

Caligodinium perforatum sp. nov.
Figures 3.A-C, 5.A-L

Holotype. Slide 3427(2): 101/25.5. England Finder Reference: L52/0; Figs. 3.A-C, 5.E-H. **Paratype.** Slide 3427(2): 102/28.5. England Finder Reference: M48/1, Figs. 5.C-D.

Type locality. Estancia 25 de Mayo, Cerro Calafate, South of Lago Argentino, Austral Basin.

Type horizon. Sample VG6, 165 m. height; late Maastrichtian.

Etymology. From the latin *perforatus* = perforate, in reference to the perforate calyptra.

Diagnosis. A large spheroidal to subspheroidal species of *Caligodinium* with a microfoveolate autophragm surrunded by a perforate flocculent calyptra. Antapical archeopyle; free simple triplacoid operculum.

Description. Proximate, spheroidal to sub-spheroidal cyst. Autophragm about 1.5 µm thick, microfoveolate. A perforate adherent flocculent calyptra up to 3 µm thick surrounds the cyst; perforations varying in diameter. Paratabulation expressed by the antapical archeopyle margin and short accesory sutures along the principal archeopyle margin. Operculum free, single-piece, triplacoid, occasionally in place and represented by two small antapical paraplates and one large postsulcal paraplate (figures 3.C; 5.K-L). The margin of the archeopyle and the accesory sutures reflect the presence of five postcingular paraplates and the two small sulcal paraplates rs and ls (figure 3.A-B). Other indication of paratabulation absent.

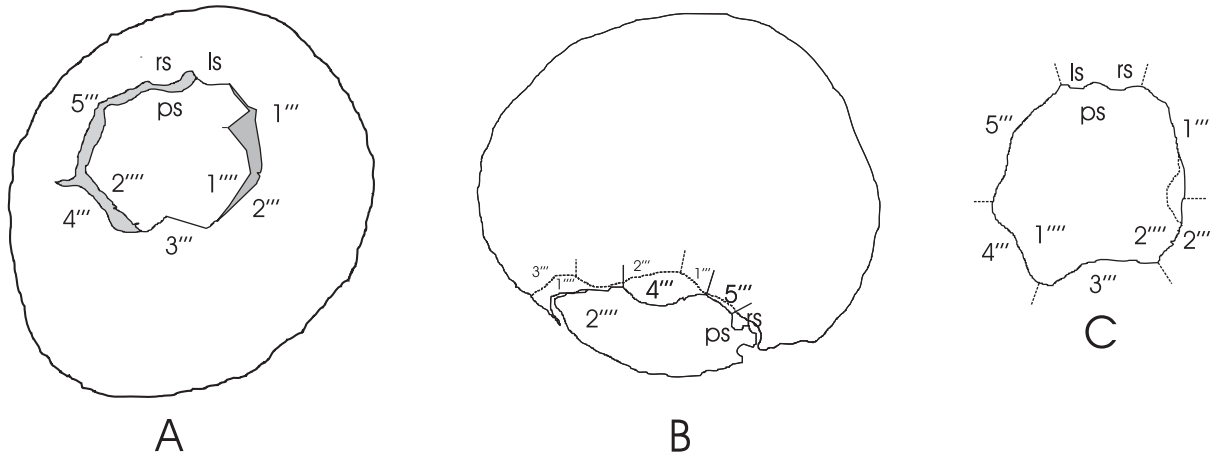


Figure 3. Line drawing of *Caligodinium perforatum* sp. nov. / *esquema de* Caligodinium perforatum *sp. nov.* / **A,** Reconstruction of the antapical surface in external view / *reconstrucción de la superficie antapical, en vista externa.* **B,** right lateral surface, external view / *superficie lateral derecha en vista externa.* **C,** operculum in internal view / *opérculo en vista interna.*

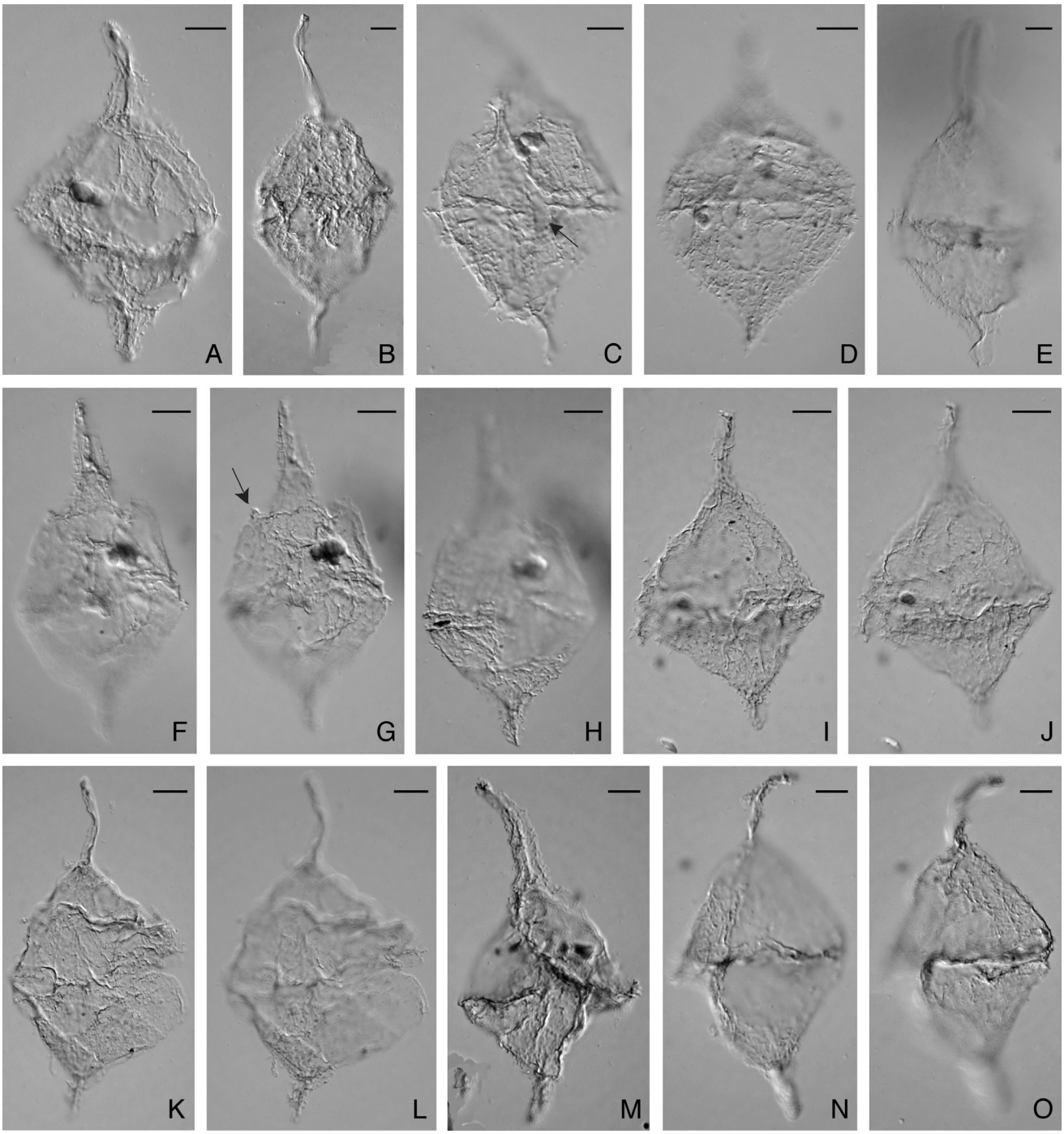
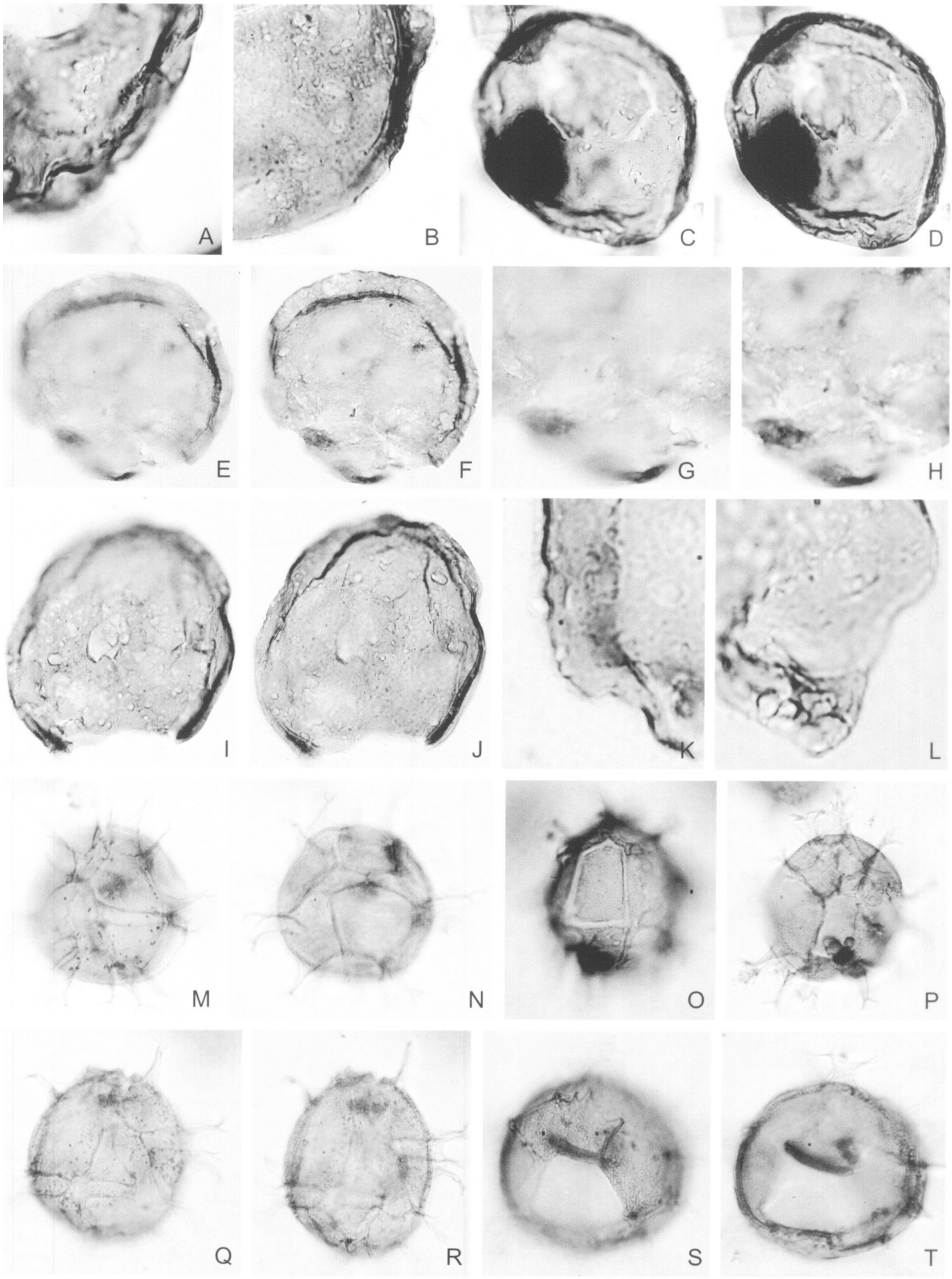


Figure 4. A-O, ***Andalusiella spinosa*** sp. nov. **A,** sample VG16, UNSLP 3431-1 32 / 92, EF: Z32, dorsal surface, high focus / *superficie dorsal, foco alto*. **B,** sample VG16, UNSLP 3431-1 46 / 111, EF: E47 / 3, dorsal surface, high focus / *superficie dorsal, foco alto*. **C,** sample VG16, UNSLP 3431-1 46.5 / 95, EF: W47, holotype, ventral surface, high focus; arrow indicates the flagellar scar / *holotipo, superficie ventral, foco alto; la flecha indica la cicatriz flagelar*. **D,** sample VG16, UNSLP 3431-1 31.5 / 105.8, EF: K31 / 4, dorsal surface, high focus / *superficie dorsal, foco alto*. **E,** sample VG16, UNSLP 3431-1 41.5 / 113, EF: C41 / 1, dorsal surface, high focus / *superficie dorsal, foco alto*. **F-H,** sample, VG16, UNSLP 3431-1 19 / 94.7, EF: W18 / 4. **F,** dorsal surface, high focus / *superficie dorsal, foco alto*. G, intermediate focus, showing the thickening of the endophragm at the base of the apical horn (arrowed) / *foco intermedio, mostrando el engrosamiento del endofragma en la base del cuerno apical (señalado)*. **H,** ventral surface, low focus / *superficie ventral, foco bajo*. **I-J,** sample VG16, 3431-2 31.5 / 107.2, EF: J31 / 4, paratype / *paratipo*. **I,** ventral surface, high focus / *superficie ventral, foco alto*. **J,** dorsal surface, low focus / *superficie dorsal, foco bajo*. **K-L,** sample VG16, UNSLP 3431-1 30 / 108, EF: H30 / 3. **K,** ventral surface, high focus / *superficie ventral, foco alto*. **L,** dorsal surface, low focus / *superficie dorsal, foco bajo*. **M,** sample VG16, UNSLP 3431-1 45 / 106.5, EF: K45 / 2, ventral surface, high focus / *superficie ventral, foco alto*. **N-O,** sample VG16, UNSLP 3431-1 50.5 / 95, EF: W51 / 2, left lateral view, high and low focus respectively / *vista lateral izquierda, foco alto y bajo respectivamente*. Scale bar: 10 µm / *escala gráfica*: 10 µm.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Dimensions. Length of the cyst: 98 (111) 125 µm; width of the cyst: 100 (113) 120 µm (25 specimens measured).

Comparisons. *Caligodinium perforatum* sp. nov. differs from other species of *Caligodinium* in having a foveolate to microfoveolate autophragm, a simple operculum and an adherent perforate calyptra giving a spongeous appearance. *C. göeranii* Slimani, 1994 is microfoveolate to microreticulate and lacks an outer flocculent calyptra. The autophragm is microreticulate in *C. aceras* Manum and Cookson, 1964, finely punctuate in *C. amiculum* Drugg, 1970, retirugulate in *C. pychnum* Biffi and Manum, 1988 and finely reticulate to punctoreticulate in *C. endoreticulum* Stover and Hardenbol, 1994; all of these species have a variably developed veil-like calyptra. Based on descriptions and illustrations of *C. amiculum*, *C. endoreticulum*, *C. pychnum* and *C. göeranii* it is possible to observe separated opercular pieces. According to Manum and Williams (1995, p. 187), the opercular pieces in *C. aceras* remains together and have a weak tendency to break up. In the new species herein described none of the observed specimens showed separated opercular plates nor boundaries between the paraplates 1´´´´, 2´´´´ and ps. Morover, the new species is considerably larger in size than other species of *Caligodinium*.

Stratigraphic ocurrence. Rare in sample VG3 and abundant in VG6.

Order GONYAULACALES Taylor 1980
Suborder GONYAULACINEAE Autonym
Family GONYAULACACEAE Lindemann 1928
Subfamily Gonyaulacoideae Autonym

Genus ***Hafniasphaera*** Hansen 1977

Type species. *Hafniasphaera hyalospinosa* Hansen 1977.

Hafniasphaera australis sp. nov.
Figures 5.M-T, 6.A-E

Holotype. Slide UNSLP 3427-1 37.1/95, EF: W37; Figs. 5.M-N.
Paratype. Slide UNSLP 3427-1 48/103.5, EF: N48/4; Figs. 5.S-T.

Type locality. Estancia 25 de Mayo, Cerro Calafate, south of Lago Argentino, Austral Basin.

Type horizon. Sample VG6, 165 m above the base of the section.

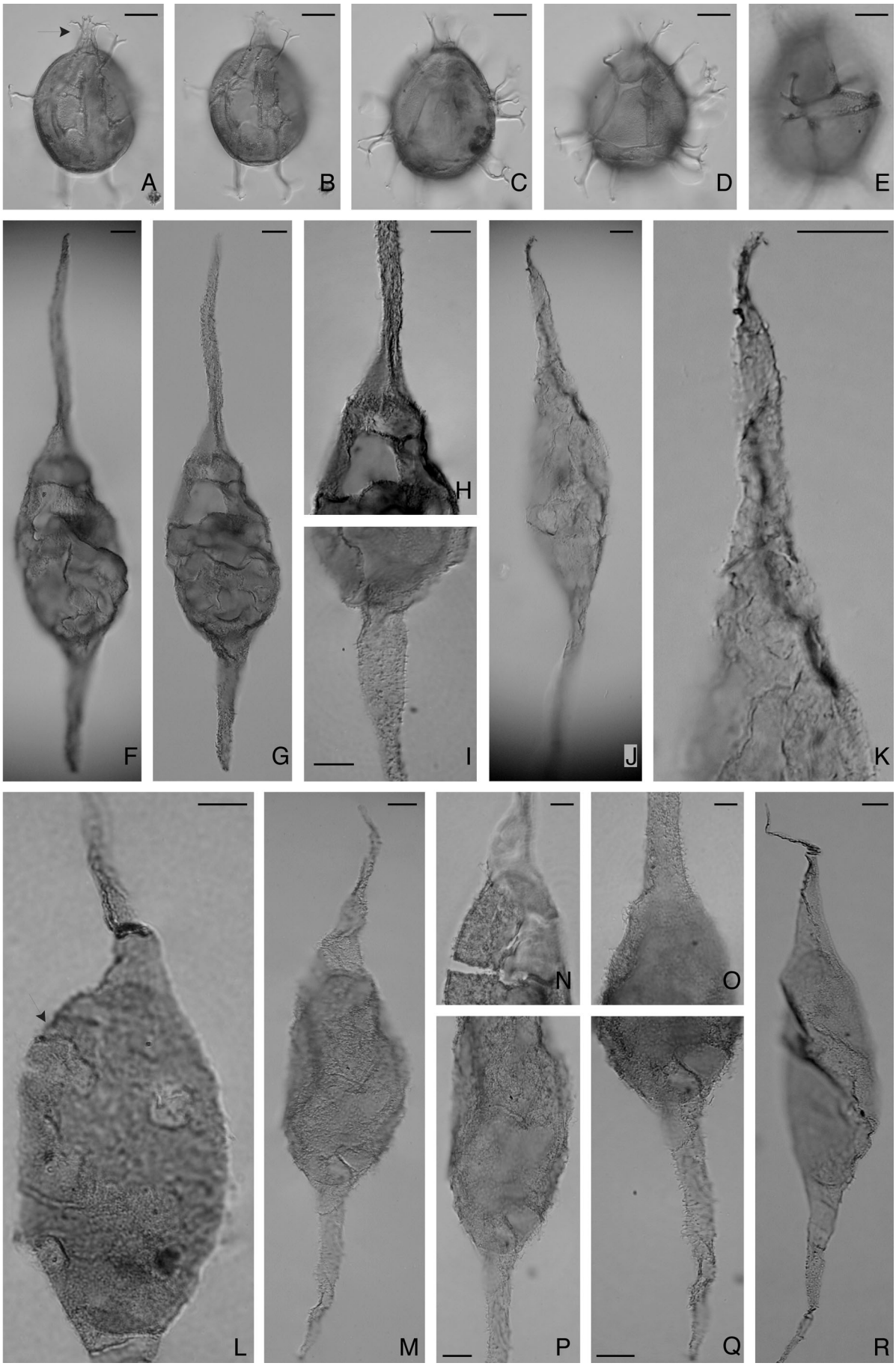
Etymology. Named after the Austral Basin, in reference to the provenance of the type material.

Diagnosis. A species of *Hafniasphaera* with spherical to subspherical, thick-walled central body, containing densely distributed vesicles about 0.5 µm in diameter. Gonal processes trifurcate, bifid with a prominent anterior ventral process emerging from the junction of the 1', 4' and as paraplates.

Description. Proximo-chorate to chorate cyst with a spherical to subspherical central body. Endophragm and periphragm appressed except at the base of the processes. Cyst wall with numerous, evenly distributed vesicles about 0.5 µm in diameter. Vesicles are interconnected, forming a fine internal reticulum. Processes contain a variable number of vesicles which are generally larger than the vesicles in the central body. Simple gonal processes only, trifurcate, bifid. Cingular processes are frequently connected by membranes, ramified in more complex ways (figure 5, Q-R). Central body with a paratabulation typical for the genus: 4´, 6´´, 6c, 5´´´, 1p, ps, 1´´´´. Paraplates 1' and 4' separated by a suture that is hardly observable. A distinctive process characterizes the ventral anterior area, rising from the junction of the 1', 4' and as paraplates. Archeopyle precingular (3''), operculum free, sometimes *in situ*.

Dimensions. Central body: length 42 (47.2) 55 µm; width 40 (42.9) 50 µm. Length of processes 8 to 20 µm (25 specimens measured).

Figure 5. A-L, *Caligodinium perforatum* sp. nov. **A,** sample VG6, UNSLP 3427-2 25.5 / 105.5, EF: L25 / 2; antapical surface, low focus / *superficie antapical, foco bajo*. **B,** sample VG6, UNSLP 3427-2 28.8 / 104.5, EF: M28 / 2; antapical surface, high focus / *superficie antapical, foco alto*. **C-D,** sample VG6, UNSLP 3427-2 28.5 / 102, EF: M48 / 1; paratype, antapical surface, low focus / *paratipo, superficie antapical, foco bajo.* **E-H,** sample VG6, UNSLP 3427-2 25.5 / 101, EF: Q25 / 2; holotype, lateral view / *holotipo, vista lateral.* **E-F,** high and low focus, respectively / *foco alto y bajo, respectivamente.* **F,** low focus / *foco bajo.* **G-H,** detail of the archeopyle, operculum *in situ*; high and low focus, respectively / *detalle del arqueopilo, opérculo* in situ*, foco alto y bajo, respectivamente*. **I-J,** sample VG6, UNSLP 3427-2 29 / 96.5, EF: U29 / 3, lateral view; high and low focus, respectively / *vista lateral; foco alto y bajo, respectivamente*. **K,** sample VG6, UNSLP 3427-1 52 / 99.5, EF: R52 / 4; simple triplacoid operculum, external surface / *opérculo simple triplacoide, superficie externa*. **L,** sample VG6, UNSLP 3427-1 27.5 / 96.5, EF: U27 / 4; simple triplacoid operculum, internal view / *opérculo simple triplacoide, vista interna.* **M-T, *Hafniasphaera australis*** sp. nov. **M-N,** sample VG6, UNSLP 3427-1 37.1 / 95, EF: W37, holotype / *holotipo.* **M,** ventral surface, high focus / *superficie ventral, foco alto.* **N,** dorsal surface, low focus / *superficie dorsal, foco bajo.* **O,** sample VG6, UNSLP 3427-2 36.2 / 100, EF: Q37 / 4, dorsal surface, high focus; operculum *in situ* / *superficie dorsal, foco alto, opérculo* in situ. **P,** sample VG6, UNSLP 3427-1 43.3 / 109.5, EF: G44 / 3, apical surface, high focus; membranous ventral process emerging from 1', 4', 6'' and as paraplates junction (arrow) / *superficie apical, foco alto; la flecha señala el proceso ventral membranoso que emerge desde la intersección de las placas 1', 4', 6'' y as*. **Q-R,** sample VG6, UNSLP 3427-1 37 / 99.2, EF: S37 / 2. **Q,** right oblique ventral surface, high focus / *superficie ventral oblicua derecha, foco alto.* **R,** cross section / *corte óptico*. **S-T,** sample VG6, UNSLP 3427-1 48 / 103.5, EF: N48 / 4, paratype, apical surface / *paratipo, superficie apical*. **S,** high focus / *foco alto*. **T,** intermediate focus, arrow indicates the membranous ventral process / *foco intermedio, la flecha señala el proceso ventral membranoso.* Scale bar: 10 µm / *escala gráfica:* 10 µm.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Remarks. The specimens described above are similar to *Hafniasphaera fluens* Hansen, 1977 but differ by the presence of the distinctive process emerging from the anterior ventral area.

Assemblages from an equivalent section to the studied area contain specimens of *Hafniasphaera australis* sp. nov. associated with *Chattangiella tripartita* (Cookson and Eisenack, 1960) Lentin and Williams, 1985 *emend*. Cookson and Manum, 1964.

Stratigraphic occurrence. Common to abundant in samples VG2, VG5, VG6 and VG7.

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Figure 6. A-E, *Hafniasphaera australis* sp. nov. **A-D,** sample VG6, UNSLP 3427-1 53 / 108, EF: H53 / 4. **A,** ventral surface, high focus; ventral process emerging from 1', 4', 6'' and as plates junction (arrow) / *superficie ventral, foco alto; la flecha indica el proceso ventral que emerge de la intersección de las placas 1', 4', 6'' y as.* **B,** ventral surface, intermediate focus / *superficie ventral, foco intermedio*. **C,** cross section / *corte óptico*. D, dorsal surface, low focus; operculum attached / *superficie dorsal, foco bajo; opérculo adherido*. **E,** sample VG6, UNSLP 3427-1 43.3 / 109.5, EF: G43 / 2, left lateral surface, high focus / *superficie lateral izquierda, foco alto*. **F-R, *Palaeocystodinium pilosum*** sp. nov. **F-H,** UNSLP LA51 40.5 / 109, EF: G40. **F,** ventral surface, low focus / *superficie ventral, foco bajo.* **G,** dorsal surface, high focus / *superficie dorsal, foco alto*. **H,** detail of the archeopyle / *detalle del arqueopilo*. I, UNSLP LA38 40,5 / 102.5, EF: O40 / 2, detail of the antapical horn / *detalle del cuerno antapical*. **J-K,** sample VG2, UNSLP 3425-1 30.5 / 104.2 EF:M30 / 3; holotype / *holotipo*. **J,** general view / *vista general.* **K,** detail of the apical horn / *detalle del cuerno apical.* **L,** UNSLP LA 51 34.5 / 94.5, EF: detail of the central body showing the archeopyle sutures / *detalle del cuerpo central mostrando las suturas del arqueopilo.* **M, P-Q,** UNSLP LA51 45.5 / 94 EF: W45 / 4. **M,** general view / *vista general.* **P-Q,** detail of the hypocyst and antapical horn respectively / *detalle del hipoquiste y del cuerno antapical respectivamente.* **N,** UNSLP LA51 39.5 / 98.5 EF: S39 / 2, detail of the epicyst / *detalle del epiquiste*. **O,** UNSLP LA38 43.5 / 94 EF: X44 / 1, detail of the epicyst / *detalle del epiquiste.* **R,** sample VG2, UNSLP 3425-2 44 / 107, EF: J44 / 4; paratype / *paratipo*, general view / *vista general*. Scale bar: 10 µm / *escala gráfica*: 10 µm.

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