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# *Ectorea stella* gen. et sp. nov. (Bacillariophyta), a cruciform diatom from Quaternary deposits of South America and emended description for *E. inflatissima* comb. nov.

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**Abstract:** *Ectorea stella* Marquardt et C.E.Wetzel, gen. et sp. nov., a cruciform 'araphid' diatom is proposed from Quaternary deposits of the Colônia basin, Southeast Brazil, based on light and scanning electron microscopy observations. Type material of the morphologically most similar species *Fragilaria inflatissima* Hustedt was also examined and a new combination for the taxon is proposed as well. The new genus diagnostic features include valves strongly inflated transapically, presence of a wide hyaline sternum bordered by spines, inconspicuous striae composed of rounded areolae without volae or rotae and restricted to mantle or to the marginal valve face area, girdle composed of at least one open, narrow, non–perforated band, and the non–fimbriated valvocopula. We further call attention to the lack of structures that are usually observed in araphid diatom representatives, such as the apical pore fields, rimoportula, and mantle silica plaques along the valve mantle edge. Differentiation between species includes valve dimensions and morphology. Furthermore, *Ectorea stella* sp. nov. has valve face composed of a flat sternum with short marginal striae, opposite to the rough non striated sternum of *Ectorea inflatissima*, comb. nov. Regarding ecology, the new genus occurs in acidic oligotrophic environments. While *E. inflatissima* occurred in large oligotrophic rivers from the Amazon basin, the new species *E. stella* occurrence suggests a peat bog formation round the lake, and may indicate an increased lake productivity, probably in response to the peatland development in the catchment area.

**Key words:** Colônia basin, fossil diatoms, paleolimnology, Pleistocene, South America, taxonomy

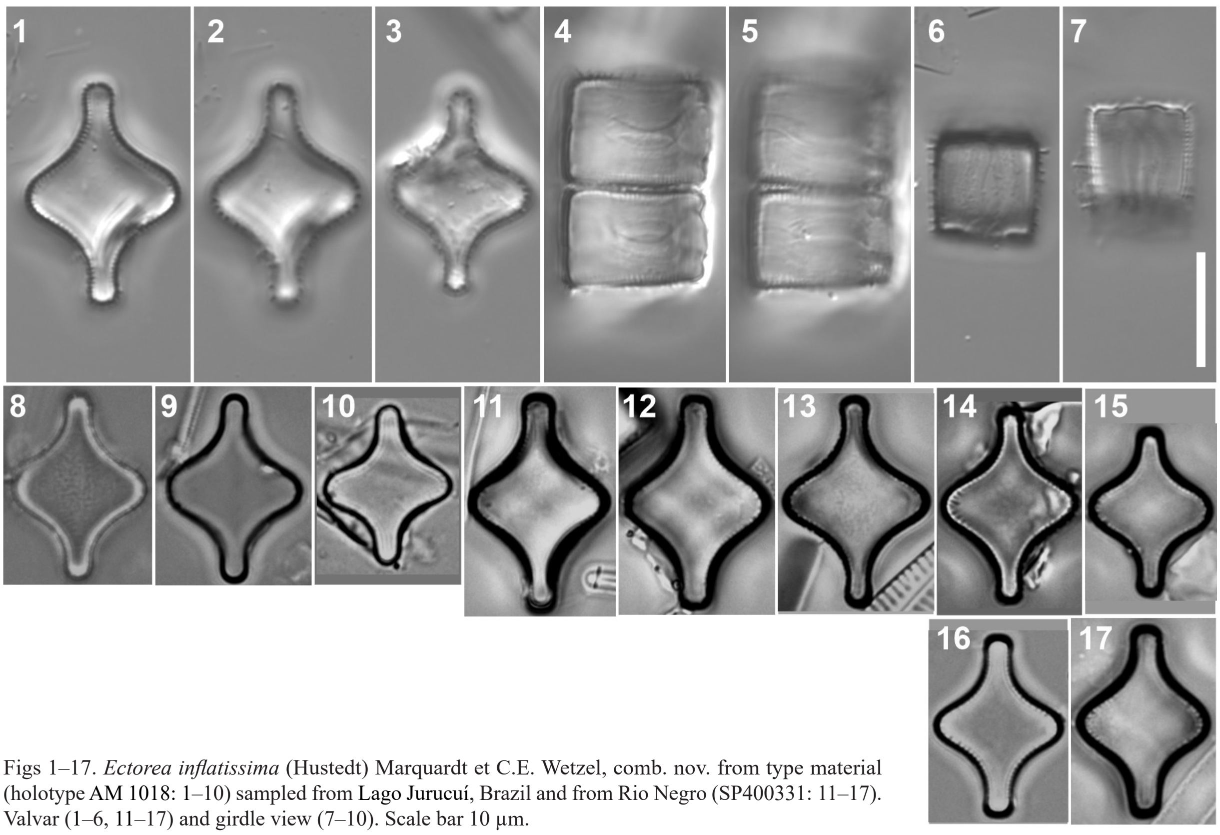
## Introduction

The Colônia basin in Brazil is a sedimentary infill located in the Atlantic Forest biome (São Paulo Metropolitan Region – SPMR). Due to its location close to the Atlantic Ocean, on the top of the Serra do Mar mountain range, its vegetation is highly sensitive to changes in the sea level and air temperature (Ledru et al. 2009). Such characteristics enable long–term tropical paleoecology and paleoclimatic reconstructions of the Quaternary (Riccomini et al. 2011; Ledru et al. 2015). Recently, multiple cores were retrieved from the area resulting in a continuous 5,200 cm composite record dating back to c. 1.5 Ma (Simon et al. 2020). Multi proxy analysis of the sediment cores showed changes in the forest distribution and composition mainly related to glacial/interglacial changes in temperature and moisture rates (Rodríguez–Zorro et al. 2020). In addition, Rodríguez–Zorro et al. (2022) identified three glacial periods and four interglacials between c. 1.5 to 1.3 Ma at the latitude of Colônia, mainly dominated by *Araucaria.* In this, glacial periods were characterized by increases in organic matter input to the lake, semi–deciduous forest, and shore and herbaceous vegetation. Interglacials were marked by increases in evergreen forest and reduced organic matter input.

Global climate fluctuations, more particularly glacial/interglacial cycles, have major consequences on the distribution of living organisms (Ramírez–Barahona & Eguiarte 2013). Climate changes, among other abiotic factors such as depth, light, wind action, nutrients concentration, ice–cover duration, and water pH, have pronounced influence on aquatic organisms (RÜHLAND et al. 2015; SIENKIEWICZ et al. 2017). Among them, diatoms (class Bacillariophyceae) respond most sensitively to limnological changes, mostly because of their short (sub–annual) life cycles (SMOL et al. 2005). However, their species distribution and autoecology in peatland habitats are still poorly known.

Current sediment analysis in Colônia basin revealed a highly diverse diatom community and a great proportion of unknown taxa, some of them recently published (MARQUARDT et al. 2021a, 2021b). In this sense, we observed some specimens whose features did not match with the diagnosis of any other diatom genus described so far. Among the findings, one araphid diatom morphologically similar to *Fragilaria inflatissima* Hustedt was often observed. This interesting cruciform diatom species allegedly belong to the genus *Fragilaria,* described and illustrated by Hustedt in 1952 (Figures 44–45), from Lake Jurucuí (Tapajós River, Pará State, Brazil) an oligotrophic lake connected to the Tapajós River (BRAUN 1952), during an important account on Brazilian diatoms from the Amazon. The Amazon extensive area was considered by Hustedt ecologically different from any other around the world, particularly in having almost all its waters in the acidic pH range. For that author, this condition favored development of a unique diatom flora for the region that would justify the absence of cosmopolitan species. The Amazon region is commonly considered to be a hotspot for non–cosmopolitan diatoms, and several unusual diatom species have been often described for the area (e.g. FERRARI et al. 2009, WETZEL et al. 2010, 2011a, 2012), including a new monotypic diatoms based on gatherings made by Hustedt in the early 50's: *Burliganiella siolii* (Hustedt) WETZEL & KOCIOLEK (2018), and *Torgania* (CANANI et al. 2021), a needle–shaped genus related to the Eunotiales also originally described as *Fragilaria* Lyngb., Hustedt's original report of *F. inflatissima* describes an araphid diatom with strongly inflated transapically valves, a very wide hyaline central area, and a narrow striate marginal zone: "valvae media parte valdis sime transapicaliter inflata apicibus rostratis, 15–18 μ longae, 9–13 μ latae. Area media latissima hyalina, zona marginalis striata angusta striis radiantibus circiter 28 in 10" (HUSTEDT 1952). A few articles have discussed in detail and/or illustrated *F. inflatissima*. SIMONSEN (1987: pl. 580, fig. 1–6) included six images of the species taken from the type slide. The species was further mentioned by WILLIAMS & ROUND (1987) in a revision of the genus *Fragilaria* Lyngbye. In the latter study, the authors proposed the genus *Pseudostaurosira* D.M.Williams et Round and discussed araphid species that should be transferred to the new genus, all characterized by an wide central area and marginal striae. In that occasion, it was recommended some additional investigation about *F. inflatissima*, whose ultrastructure was still unknown.

Later on, *F. inflatissima* was transferred to *Staurosira* Ehrenberg by METZELTIN & LANGE–BERTALOT



Figs 1–17. *Ectorea inflatissima* (Hustedt) Marquardt et C.E. Wetzel, comb. nov. from type material (holotype AM 1018: 1–10) sampled from Lago Jurucuí, Brazil and from Rio Negro (SP400331: 11–17). Valvar (1–6, 11–17) and girdle view (7–10). Scale bar 10 μm.

(2007). However, images of *F. inflatissima* ultrastructure were only provided by Wetzel (2011b), in his PhD dissertation on the diatom biodiversity from Rio Negro (Brazilian Amazon), which are also shown in the present study. With regard to Brazilian research and despite of the growing number of literature on freshwater araphid diatoms in the country (e.g. Garcia et al. 2010; Ludwig et al. 2015; Almeida et al. 2016, 2017; Wengrat et al. 2016; Marquardt et al. 2021; Osório et al. 2021), no other record of *F. inflatissima* was found.

In this study, a new genus and a new species are proposed based on light (LM) and scanning electron microscope (SEM) observations. Also, *F. inflatissima* type material is presently investigated and a new combination for the new genus is proposed. Comparison with other morphologically similar genera and species is provided.

## Material and Methods

**Colônia basin sediments material.** Colônia basin is located on the southern outskirts of the city of São Paulo, Brazil, near the Atlantic Mountain range (São Paulo, Parelheiros District, 23°52'S, 46°42'20"W, 900 m a.s.l.). The region is characterized by a crater–like structure, with an annular ring of hills reaching 925 m a.s.l. and an inner depression characterized by a wetland and an alluvial plain mainly filled with alluvial sediments (Prado et al. 2019, Riccomini et al. 2011, Rodríguez–Zorro et al. 2022). Detailed information on the Colônia basin geology and history was provided by Ledru et al. (2015).

In the area, a composite record (COL17c, 5200 cm) was retrieved by an International Consortium (Colônia Deep Drilling Project: TROPICOL) during distinct missions (August 2017, May 2018, and May 2019). Regarding the age model, the fine–tuned based on radiocarbon dates, OSL autogenic 10Be/9 Be and paleomagnetism provided an age of 1.5 Ma at the base of the core (Simon et al. 2020). It was presently considered the section corresponding to the 800–1470 cm depth (COL17–1). A sedimentary core corresponding to this interval was obtained using a hand hammering system mounted on a tripod (Simon et al. 2020), which was posteriorly subsampled every 4 cm for diatom analyses. Then, subsample 1326–27 cm liner depth dated at 461.9 ka was selected as it is representative for the taxa of interest.

**Preparation and analysis of diatoms samples.** Sediment sample (about 0.5 g) was digested using hydrogen peroxide ($H_2O_2$ 35%) and hydrochloric acid (HCl 37%) according to Battarbee et al. (2001). Permanent slides were mounted using Naphrax (R.I. = 1.74). Diatoms were examined under LM at 1000× magnification with a Zeiss Axioskop 2 plus microscope equipped with phase contrast and an Axiocam ERc5s high–resolution digital camera. Diatoms were quantified at a magnification of 1000× until reaching a minimum of 400 valves per slide (Battarbee et al. 2001) and at least 90% in counting efficiency (Pappas & Stoermer 1996). For SEM, parts of the oxidized suspensions were air dried on aluminum stubs and coated with gold using a Emitech Coating System for 270 s at 15 mA. A high vacuum scanning electron microscope LEO440i (LEO Electron Microscopy Ltd, England) operated at 20 kV, 5 mm work distance and 15 pA of emission current was used for analyses (Instituto de Geociências, Universidade de São Paulo – USP).

Photomicrographs were digitally manipulated and plates containing light and scanning electron microscope images were prepared using CorelDraw X8.

Holotype permanent slides and cleaned samples are deposited at the "Herbário Científico do Estado Maria Eneyda P. Kauffmann Fidalgo" (SP), São Paulo State Department of Infrastructure and Environment, Brazil. Isotype slides are deposited at the Botanic Garden (BR), Meise, Belgium.

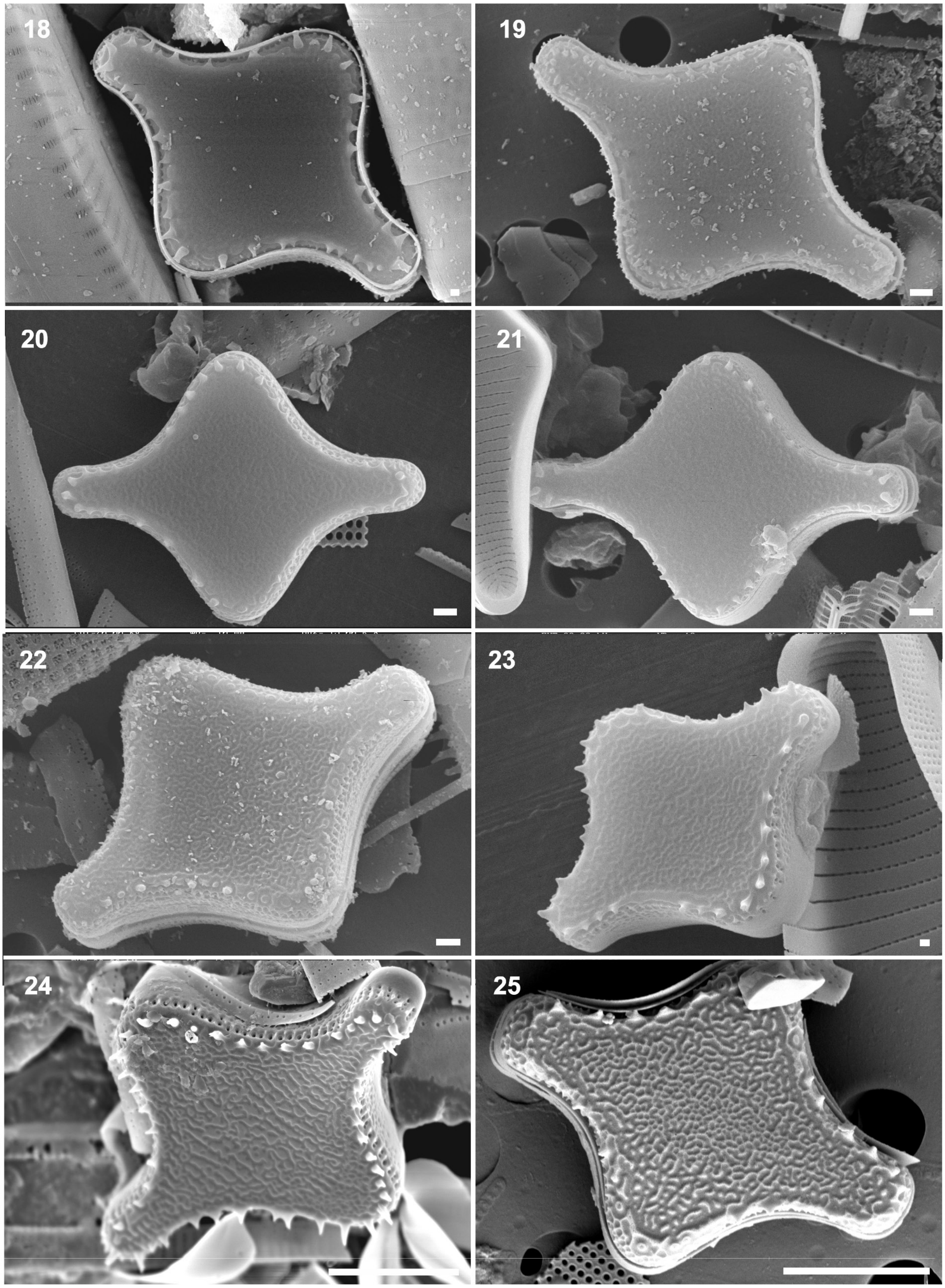
**Analysis of *Fragilaria inflatissima* Hustedt.** Raw material deposited at the Friedrich Hustedt Collection (BRM), Bremerhaven, Germany was examined. *Fragilaria inflatissima* Hustedt (Sample AM1018: "Brasilien. Lago Jurucuí, 25 October 1947, Braun, 265") was observed using SEM. For this, part of the cleaned suspension was filtered and washed through polycarbonate membrane filters with a pore diameter of 3 µm, fixed to aluminum stubs with double–sided tape and sputtered with platinum (40 nm). Observations were performed and photographs taken with a Leica Stereoscan 430i, operated at 15–20 kV and with a Hitachi SU–70 ultra–high–resolution analytical field emission (FE) scanning electron microscope (Hitachi High–Technologies Corporation, Tokyo, Japan) operated at 5 kV and 10 mm distance (Luxembourg Institute of Science and Technology – LIST). Additionally, we include SEM and LM images of periphytic material of *F. inflatissima* from Rio Negro (Sample SP400331: Brazil, Rio Negro, March 2005, Wetzel & Ector, RN116) by Wetzel (2011b), deposited at the Herbário Científico do Estado Maria Eneyda P. Kauffmann Fidalgo (SP), São Paulo State Department of Infrastructure and Environment, Brazil.

Photomicrographs were digitally manipulated and plates containing SEM images were prepared using CorelDraw X8. Morphological terminology follows Barber & Haworth (1981) and Morales et al. (2012, 2019).

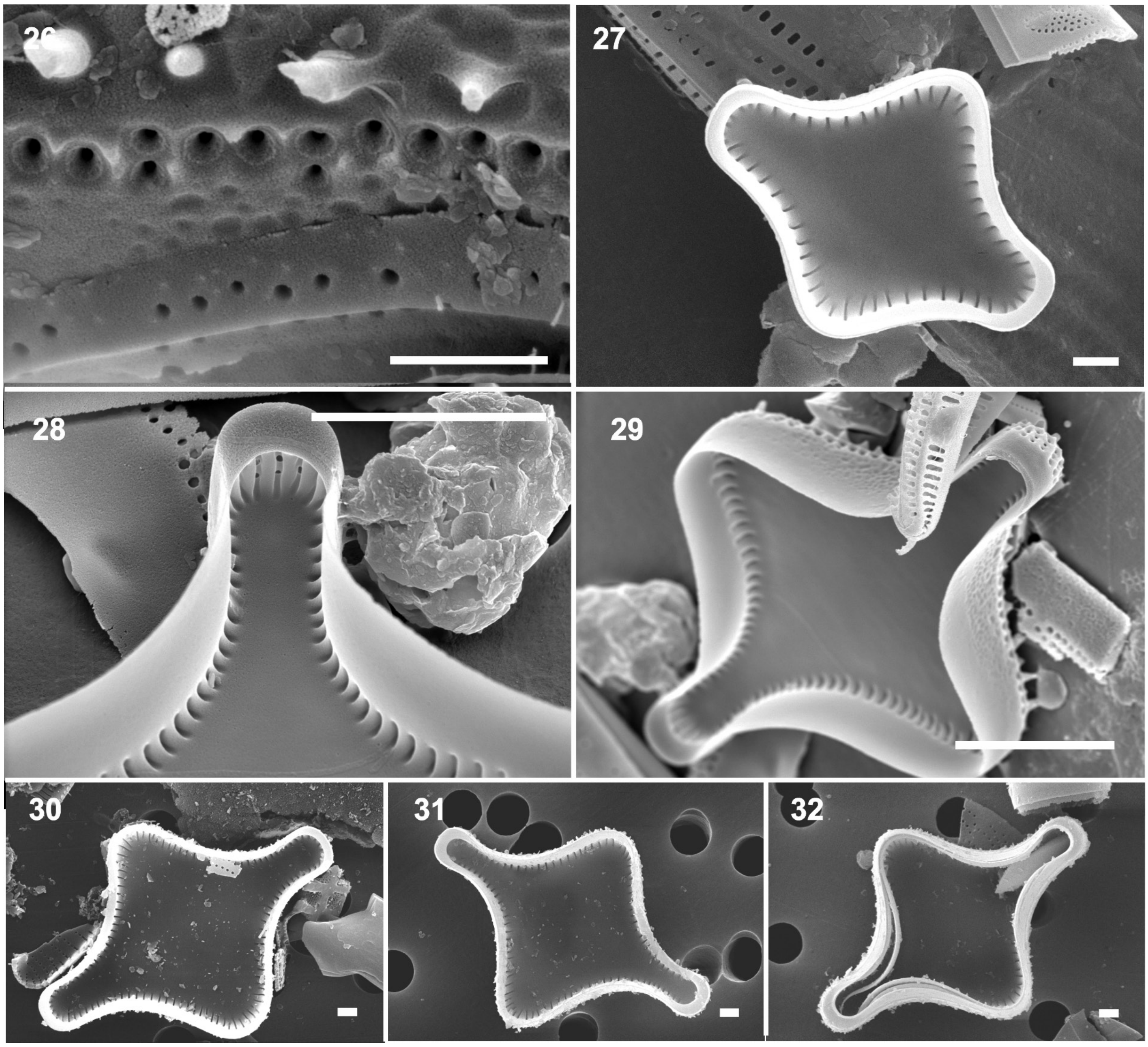
## Taxonomic description

***Ectorea* Marquardt et C.E.Wetzel gen. nov.**
**Description:** Isopolar araphid frustules with cruciform to quadrangular shape, with elongated, narrowly rostrate, tapering apices. Valve face is flat, abruptly transitioning from the valve face to the mantle. Sternum very wide, hyaline. Striae very short, uniseriate, typically composed of one to six rounded areolae restricted to mantle or/and to the marginal valve valve face. Valve face to the mantle interrupted by spines. Mantle is shallow. Internally, areolae from valve face and mantle open in a transapically elongated depression. Girdle composed of one open, narrow, non–perforated band and the valvocopula.

**Typus generis:** *Ectorea inflatissima* (Hustedt) Marquardt et C.E.Wetzel
**Etymology:** The new genus is dedicated in memory of our dearest colleague Luc Ector (17 October 1962–28 April 2022), for his outstanding contributions and legacy to diatom research.




Figs 18–25. SEM micrographs of *Ectorea inflatissima* (Hustedt) Marquardt et C.E. Wetzel, comb. nov. from type material (holotype AM 1018) sampled from Lago Jurucuí, Brazil and from Rio Negro (SP400331: 20, 23). Overall characteristics of the valve face outer surface (18–25). Notice the rough non striate sternum (18–25). Scale bar 300 nm (12, 17), 1 µm (13–16), 5 µm (18, 19).




Figs 26–32. SEM micrographs of *Ectorea inflatissima* (Hustedt) Marquardt et C.E. Wetzel, comb. nov. from type material (holotype AM 1018) sampled from Lago Jurucuí, Brazil from Rio Negro (SP400331: 27): Detail of rounded areolae without occlusions, mantle and hyaline sternum bordered by spines (26). Overall characteristics of the inner valve surface (27–32). Notice valve face areolae and mantle opening in a transapically elongate depression (27–32). Notice girdle composed of at least one open, narrow, unperforated band and lacking ligulae (32). Scale bar 1 µm (26, 27, 30, 31, 32), 4 µm (28), 5 µm (29).

***Ectorea inflatissima* (Hustedt) Marquardt et C.E.Wetzel comb. nov. (Figs 1–17 LM, 18–32 SEM)**
**Basionym:** *Fragilaria inflatissima* Hustedt, Botaniska Notiser 1952: 379, fig. 44–45. 1952.
**Type locality:** Brasilien. Lago Jurucuí.

**Emended description**
**LM (Figs 1–17):** Valves isopolar, araphid, cruciform in shape, with elongated, narrowly rostrate, tapering apices (Figs 1–6, 11–17). Length 15.3–22 µm, width 10–13 µm, inconspicuous striae. Sternum very wide, hyaline (Figs 1–6, 11–17). Striae very short, bordering the valve margin (Figs 1–6, 11–17). Frustules are nearly squared in shape in girdle view, irregular due the prominent median inflation (Figs 7–10) and grow in short chains of a few cells (Figs 7–8). Colonies are joined face to face with the aid of linking spines (Figs 7–10).
**SEM (Figs 18–32):** Valve face flat with abrupt transition from valve face to mantle (Figs 18–25). Valve face with no striae, composed by a wide rough sternum (Figs 18–25). Valve face to valve mantle interrupted by sharp spines (Figs 18–26). Striae composed of 1–3 round areolae located on the valve mantle (Figs 23–26), striae density 30–35 in 10 µm. Mantle shallow. Internally, areolae from valve face and mantle open in a transapically elongate depression (Figs 27–32). Girdle composed of one open, narrow, non–perforated band and the valvocopula, lacking ligulae (Fig. 32).

***Ectorea stella* Marquardt et C.E.Wetzel sp. nov. (Figs 33–53 LM, 54–67 SEM)**
**Description**
**LM (Figs 33–53):** Valves isopolar, araphid, cruciform to quadrangular in shape, with elongated, narrowly rostrate, tapering apices (Figs 33–53). Eventually, valves appear

Table 1. Comparison of morphological characteristics of *Ectorea stella* Marquardt et C.E.Wetzel, gen. nov., and morphologically similar genera.

| | ***Ectorea* Marquardt et C.E.Wetzel gen. nov.** | ***Pseudostaurosiropsis*** | ***Staurosira*** | ***Staurosirella*** | ***Pseudostaurosira*** | ***Fragilariforma*** | ***Nanofrustulum*** | ***Stauroforma*** |
|---|---|---|---|---|---|---|---|---|
| Volae origin | absent | absent | present, inner perimeter of the areola | present, inner perimeter of the areola | present, inner perimeter of the areola | present | inner perimeter of the areola | inner perimeter of the areola |
| Rotae production | absent | present, originating from a single point within the areola | absent | absent | absent | absent | absent | absent |
| Areolae shape | round | round to elliptical | round to apically elliptical | apically oriented lineolae | round to transapically elliptical | round | round to transapically elliptical | round to apically elliptical |
| Girdle element structure | valvocopula: open, without fimbriae. copula: open | valvocopula: open, without fimbriae. copula: open | valvocopula: closed, without fimbriae. copula: open | valvocopula: open or closed, with fimbriae. copula: open or closed | valvocopula: open, without fimbriae. copula: open | valvocopula: open, with fimbriae (*F. javanica*). copula: open | valvocopula: open, without fimbriae. copula: quasifract, open, ligulae in valvocopulae and copulae diferent in morphology | valvocopula: open, without fimbriae. copula: entire, open |
| References | This study | Morales (2001) Morales et al. (2019) Morales (2022) | Williams & Round (1987b) Morales et al. (2010) Morales et al. (2019) | Williams & Round (1987b) Morales et al. (2019) | Williams & Round (1987b) Morales et al. (2019) | Williams & Round (1987b) Wetzel et al. (2013) | Morales et al. (2019) | Morales et al. (2019) |

irregular in shape, with apices of different lengths (Figs. 43, 49). Length 8.5–11 µm, width 8.5–13.0 µm, inconspicuous striae. Sternum very wide, hyaline (Figs 33–53).
**SEM (Figs 54–67):** Valve face flat with abrupt transition from valve face to mantle (Figs 54–61). Striae uniseriate, very short, bordering the valve margin (Figs 54–67). Striae density 28–30 in 10 µm. Striae composed of 1–5 round areolae arranged in a variable pattern on the valve face (Figs 54–61), 1–4 row of round areolae on the valve mantle (Figs 59–61). Valve face to valve mantle interrupted by short spines, located along the virgae (Figs 54–61). Mantle shallow. Internally, areolae from valve face and mantle open in a transapically elongate depression (Figs 62–67). Girdle composed of one narrow, non–perforated band and the valvocopula (Fig. 67).

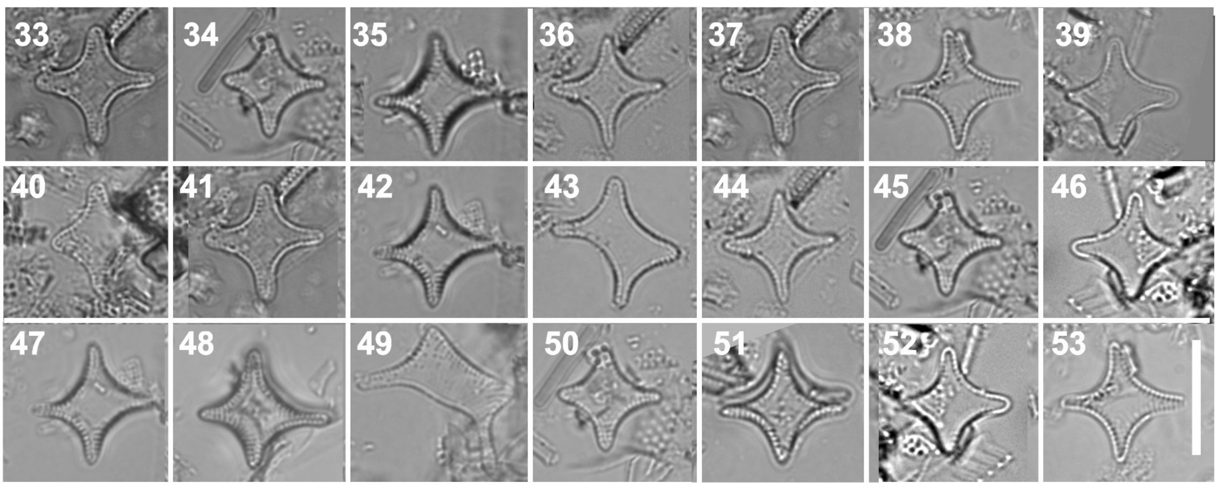
**Holotype:** SP!, slide SP365547 (Herbário Científico do Estado "Maria Eneyda P. Kauffmann Fidalgo", São Paulo, from 1326–27 cm liner depth (~461.9 ka) in the COL17–1 core, Brazil, here depicted in Figs 27–47). The holotype specimen is shown in Fig. 27.
**Isotype:** BR! slide BR4768 (Meise Botanic Garden, Meise, Belgium).
**Type locality:** Brazil, São Paulo, Parelheiros District: Colônia basin (23°52'S, 46°42'20"W, 900 m a.s.l.), sediment core, present at the 1326–27 cm liner depth, dated at ~ 461.9 ka, leg. M.–P. Ledru & A.O. Sawakuchi, Aug. 2017.
**Etymology:** The epithet refers to the 4–pointed star shape that resembles the new species typical outline.

**Associated diatom species:** The new species was observed in several samples at different depths in the sedimentary core (COL17–1) from Colônia basin. Populations from the type material had a maximum relative abundance of 4.2%. The associated diatom flora was composed of *Aulacoseira granulata* (Ehrenberg) Simonsen (63.5%), *Staurosirella* sp. (13.4%), *Fragilaria* sp. (3%), *Aulacoseira herzogii* (Lemmermann) Simonsen (2.5%), naviculoid forms (2.5%) and *Pseudostaurosira crateri* Marquardt et C.E.Wetzel (2%).

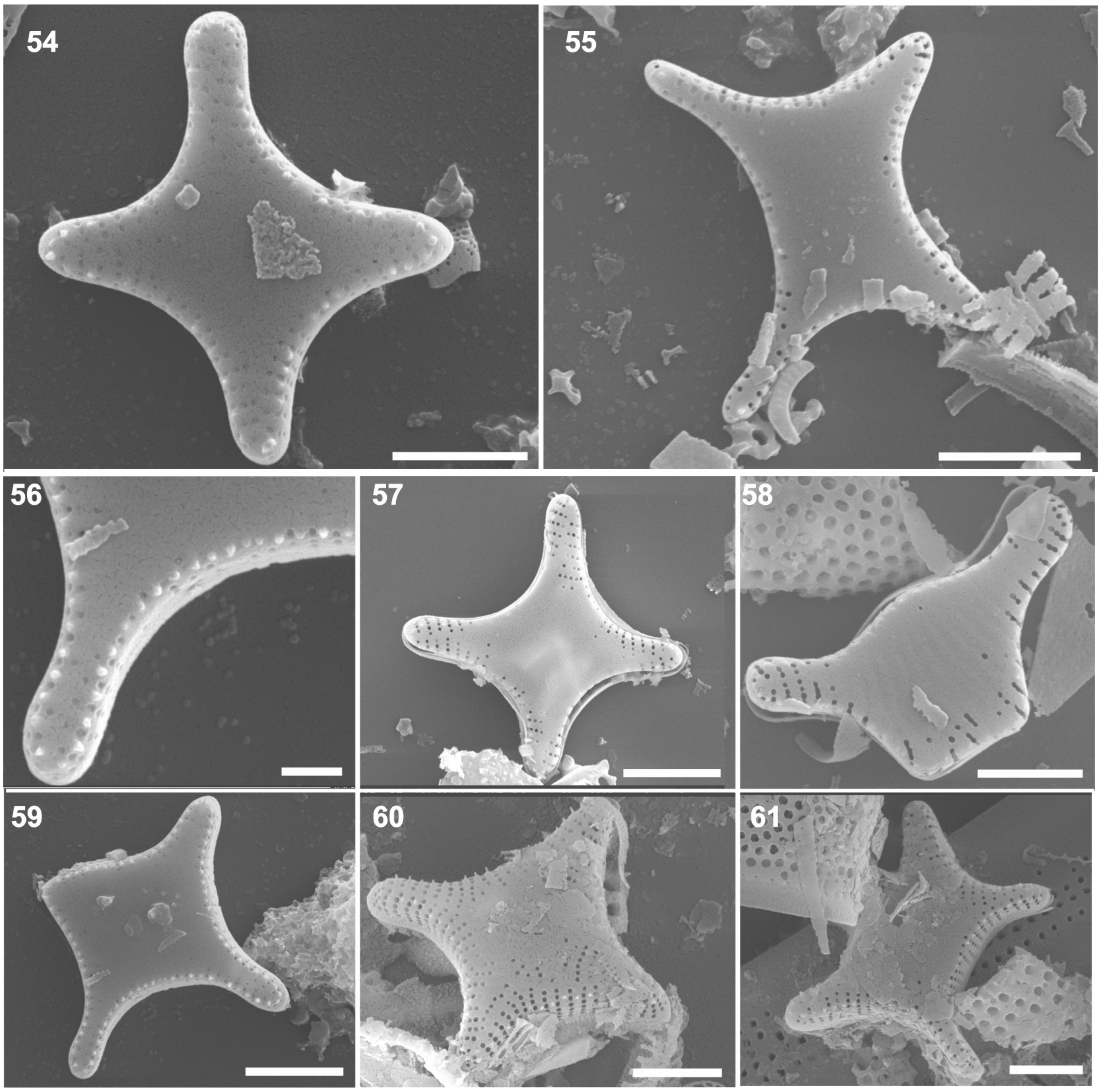
## Discussion

*Ectorea* has a very distinctive shape with valves strongly inflated transapically. However, SEM observations are required to discriminate its diagnostic features, which include the presence of a wide hyaline sternum bordered by spines, inconspicuous striae composed by rounded areolae without volae or rotae and restricted to mantle or to the marginal valve zone, and girdle composed of one open, narrow, non–perforated band and the valvocopula without fimbriae. Additionally, attention is called to the lack of structures that are usually observed in araphid diatoms representatives, such as the apical pore fields, rimoportula, and mantle plaques or depositions along the valve mantle edge.

*Ectorea* is easily distinct from other small araphid genera (Table 1). Presence of open valvocopula whithout fimbriae and entire open copula are observed in many araphid genera. However, round areolae, without volae is only observed in *Pseudostaurosiropsis* E.Morales (Morales et al. 2019). Nevertheless, an important distinguishing feature of *Pseudostaurosiropsis* is the presence of rotae, originating from a single point within areolae. The potential erosion of the Colônia material offers a plausible explanation for the absence of volae and rotae structures. Nevertheless, the compelling evidence provided by the most recent materials from Hustedt and Rio Negro substantiates their absence, as numerous individuals were meticulously observed. Despite the suboptimal preservation of this structure, particularly evident in the Colônia basin material, no evidence of volae or rotae has been found within the newly discovered genus. Other characteristics traditionally used to




Figs 33–53. LM micrographs of *Ectorea stella* Marquardt et C.E.Wetzel, gen. et sp. nov. from type material (holotype SP365547; 1326–27 cm liner depth, ~ 461.9 ka in the COL17–1 core) sampled from Colônia Basin, São Paulo, Brazil. Valvar view. Scale bar 10 µm.

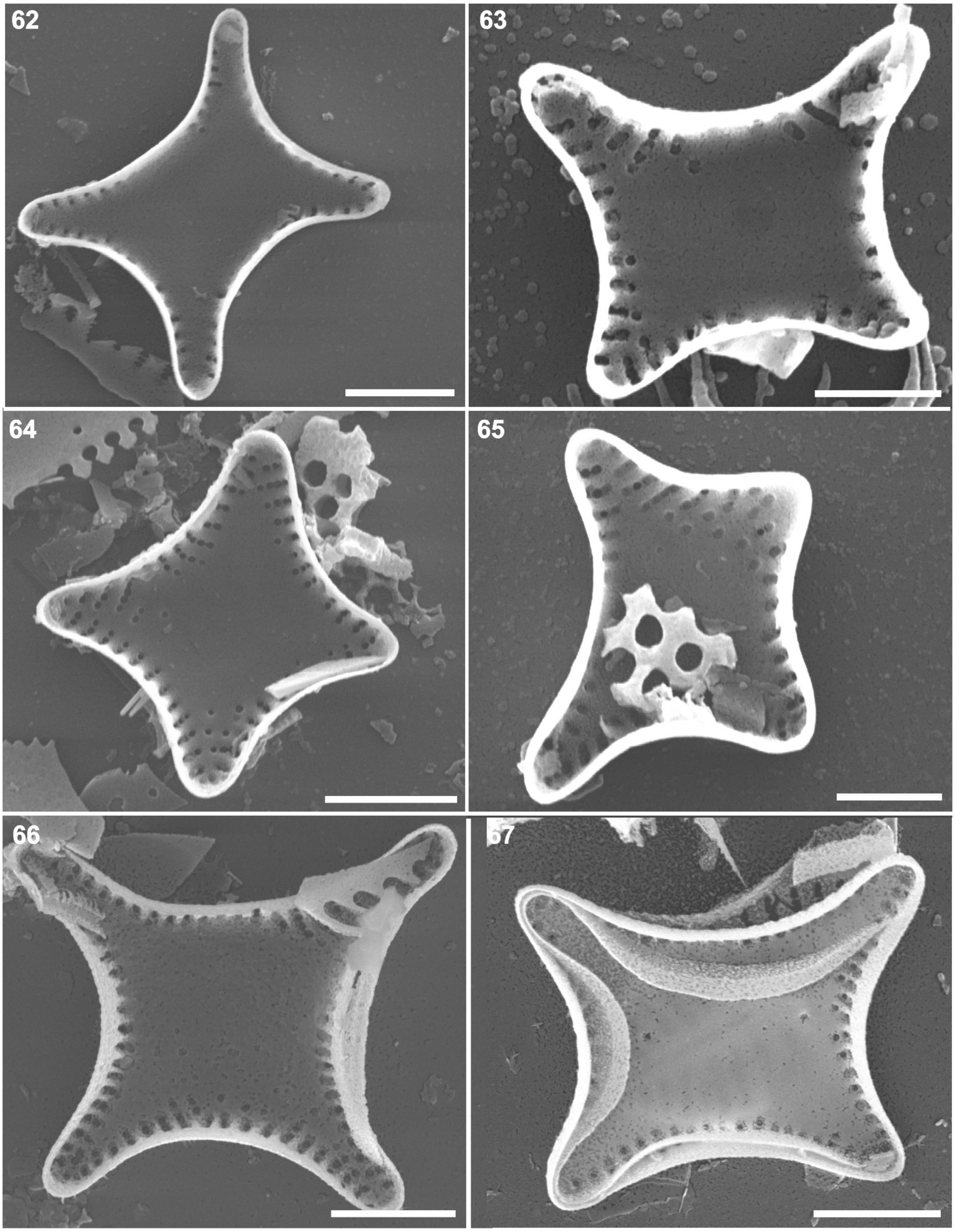



Figs 54–61. SEM micrographs of *Ectorea stella* Marquardt et C.E.Wetzel, gen. et sp. nov. from type material (holotype SP365547; 1326–27 cm liner depth, ~ 461.9 ka in the COL17–1 core) sampled from Colônia Basin, São Paulo, Brazil: Overall characteristics of the valve face outer surface (54–61). Notice wide hyaline sternum bordered by spines, absence of apical pore field and rimoportula (54–61). Detail of rounded areolae restricted to the marginal valve zone (56). Scale bar 1 µm (56), 3 µm (54, 58, 60, 61), 4 µm (55, 57, 59).

distinguish small araphid genera were discussed in detail by MORALES et al. (2019). Lastly, the genus *Frankophila* Lange–Bertalot (1997) is distinguished by its small chain–forming diatoms, where the frustules are bound together by interdigitating marginal spines, traditionally found on virgae. Despite de wide axial area and short striae, both valves within this genus exhibit a very short raphe at their distal ends (FUREY et al. 2012).

Cruciform strongly inflated transapically valves are also found in *Fragilariforma horstii* described in MORALES et al. (2012) from streams of northern United States. In addition to the *Fragilariforma* diagnostic features, *F. horstii* clearly have striae at the central sternum. Therefore, the latter species may be easily distinguished from species of *Ectorea* due to their central sternum with marginally restricted or absent striae. Furthermore, *F. horstii* is reported to sometimes produce mantle depositions along the valve mantle margin, not reported for *Ectorea*.

Another cruciform diatom species, *Staurosirella grunowii* (Pantocsek) E.Morales, Buczkó et Ector, was originally described from fossil material from Slovakia. The species is characteristic by the quadrangular shape never observed in any other staurosirelloid diatom (MORALES et al. 2014). However, *S. grunowii* may be separated from *Ectorea* representatives by all features that will relate it to other species currently ascribed to *Staurosirella*, such as striae composed of areolae delimited




Figs 62–67. SEM micrographs of *Ectorea stella* Marquardt et C.E.Wetzel, gen. et sp. nov. from type material (holotype SP365547; 1326–27 cm liner depth, ~ 461.9 ka in the COL17–1 core) sampled from Colônia Basin, São Paulo, Brazil: Overall characteristics of the inner valve surface. Notice areolae from valve face and mantle opening in a transapically elongate depression (62–67). Scale bar 2 µm (63, 65), 3 µm (62, 64, 66, 67).

by well–developed vimines, the thick virgae–bearing spines, the apical pore fields composed of simple round poroids, the girdle bands with distinguishable pars interior and exterior, and valvocopula bearing fimbriae. Despite we did not clearly observe fimbriae, the present two *Ectorea* species have rounded areolae not forming well–developed vimines or virgae.

*Ectorea stella* and *Staurosirella tigris* Harper et al. (2022)*,* clearly belong to separate genera. However, when considering the valvar shape, we can highlight the main morphological characteristics that differentiate them. For example, *E. stella* has isopolar valves that are cruciform to quadrangular in shape with elongated, narrowly rostrate, and tapering apices, and the striae are very short, bordering the valve margin. On the other hand, *S. tigris* has rectangular frustules in girdle view, occasionally linked valve face to valve face, forming short filaments, and the valves are linear, dog–bone–shaped with ends having two lateral lobes, each terminating in broadly rounded apices. Additionally, the striae in *S. tigris* are composed of lineolate areolae, parallel along the valve face longitudinal axis and more radiate towards the apices.

The present study is the first to investigate the ultrastructure of *Ectorea inflatissima* (Hustedt) Marquardt et C.E.Wetzel, comb. nov. Analyses have shown that the latter species is clearly separated from *Ectorea stella*. Both taxa differ in valve dimensions and morphology. *Ectorea stella* has smaller valve dimensions (length 8.6–10.9 µm, width 8.5–13.1 µm *vs* length 15.3–22 µm, width 10–13 µm) and quadrangular valve shape, with the four elongated ends tapering almost equally making impossible to differ between apical and transapical planes. On the other hand, *E. inflatissima* has the valve middle region inflated, enlarged and rounded, contrasting to the narrowly tapered valvar ends. Moreover, *Ectorea stella* has the valve face composed of a flat sternum with short marginal striae composed of up to 5 rounded areolae whereas *E. inflatissima* has a rough non striated sternum in which the striae are restricted to the valve mantle. There is variability in the presence of spines at the edge of the valve face and valve mantle between these species. According to Morales et al. (2019), the presence of spines, a traditionally used to differentiate among small araphid genera, is not a useful feature for this purpose. However, we believe it is a helpful feature to distinguish between *E. stella* and *E. inflatissima*. In *E. stella*, short, incipient spines are situated along the virgae. On the other hand, in *E. inflatissima*, sharp spines are present, but their positioning is independent of virgae or any other structures like vimines or interrupting striae, as the striae in this species are exclusively located on the mantle.

In addition to the type locality, *E. inflatissima* was also recorded in the Negro River hydrographical basin, whose waters are usually oligotrophic and characteristic by the presence of humic acids due to the decomposition of flooded vegetation during the rainy season (Oliveira et al. 2007). Comparatively, the Colônia fossil species were recorded in samples of the upper part of the composite core (COL17–c), characterized by an ombrotrophic peatland section (Simon et al. 2020). This suggests acidic conditions in the lake due to the peat bog formation around the lake, with greater turbidity and particulate material. The most abundant diatom species associated to the new species was *Aulacoseira granulata*, a planktonic species often associated to the water column mixing (Zalat & Vildary 2005) and high flood conditions. Furthermore, *A. granulata* is also associated to erosion events (Costa–Bödddeker et al. 2012) and occurs in a wide range of trophic conditions (Bicudo et al. 2006). *Aulacoseira granulata* occurrence may point to increased lake productivity, probably in response to soil (peatland) development in the catchment. Present study finally contributes to the knowledge of the past diatoms biodiversity existing before human impact (reference condition), and their use in paleoenvironmental reconstruction.

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