

***Lacuneolimna gabrielae*, sp. nov. a new species from the Brazilian Amazon and transfer of two African species to the genus *Lacuneolimna* Tudesque, Le Cohu & Lange-Bertalot (*Sellaphoraceae*, *Bacillariophyceae*)**

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The designation “*Lacuneolimna*” Tudesque, Le Cohu & Lange-Bertalot in Tudesque & al. (2015: 21, figs 2–42) was proposed based upon the designation “*Eolimna zalokariae*” Metzeltin & Lange-Bertalot (1998: 39, pl. 167: figs 1, 2) as the intended type, originally described from the tropical Rio Tapajós in Brazil. Tudesque & al. (2015) argued that several ultrastructural features distinguished it from *Eolimna* Schiller & Lange-Bertalot (in Lange-Bertalot & al. 2024: 1), initially proposed by Schiller & Lange-Bertalot (1997: 168, figs 2, 6–12), on the basis of: (i) the coarse relief of the valve's outer face, featuring grooves and markedly raised virgae; (ii) multiseriate striae; (iii) the presence of a network of cross-bars between the virgae; and (iv) the enlargement of the striae, forming depressions or isolated cavities on either side of the sternum.

The genus *Lacuneolimna* Tudesque, Le Cohu & Lange-Bertalot was recently validated (Tudesque & al. 2024) and only two species are recognized currently within the genus: the type species *Lacuneolimna zalokariae* Tudesque, Le Cohu & Lange-Bertalot (2024: 1) and *Lacuneolimna novagallia* Tudesque & Le Cohu (in Tudesque & al. 2024: 1; see also Tudesque & al. 2015: 24, figs 43–71), both reported from the Neotropics.

Two years prior to the description of this new genus, Cocquyt & al. (2013) described a similar species as *Cavinula lilandae* Cocquyt, de Haan & Taylor (2013: 158, figs 2–11, 16–21), from acidic riverine habitats with a pH of 4.65 and conductivity of 12.5–15.0 $\mu\text{S cm}^{-1}$ in an almost pristine tropical rainforest of the Congo Basin in Central Africa, near the village of Lilanda. This species, also reported from Lupososhi River in northwest Zambia, agrees well with the description of the genus *Lacuneolimna* as described by Tudesque & al. (2015), particularly with respect to the irregularly large to small areolar foramina with sunken sieve membranes (interpreted as the diffuse points along the axial area in LM).

During a survey of the freshwater diatoms of the Rio Negro hydrographic basin, Brazil (Wetzel 2011), specimens initially identified as “*Eolimna* sp. 3” were observed. These specimens, listed in Table 1, are deposited at SP (Instituto de Pesquisas Ambientais, São Paulo, Brazil)

The observed specimens (Figs 2–22) showed considerable similarity to those illustrated by Cocquyt & al. (2013). However, the species from the Rio Negro differs in its shape, showing more round and smaller specimens (Figs 2–13), and narrower axial area. The striae show high variability in SEM, including multi-areolae (up to three) and the depressions along the axial area fitting the definition by Tudesque & al. (2015) for the circumscription of the genus *Lacuneolimna*. The morphological differences justify the description of this unknown taxon as a new species.

***Lacuneolimna gabrielae* C.E.Wetzel, sp. nov. (Figs 2–22)**

LM observations (Figs 2–13): valves elliptical with rounded apices; length: 10–14 μm ; width: 6.0–7.0 μm . Striae radiate, sometimes becoming parallel or slightly convergent, 15–20 in 10 μm , composed of 50–60 round areolae in 10 μm . Axial area narrow, slightly expanded near the

central area, ornamented with a series of irregular depressions parallel to the raphe (Figs 2–13), visible only externally. Raphe straight, central raphe endings slightly expanded. Striae radiate never parallel and not continuing over the valve face–mantle junction.

SEM observations (Figs 14–22): striae highly variable, uniseriate (Figs 14–16) to irregularly biseriate (Figs 17–19) with irregularly formed areolae. Central area with a few shorter striae (Figs 14–19). At the apices, one row of a few irregular elongated areolae present at the valve face/mantle junction; the middle areola round and not elongated, and distinctly separated from the other four to five areolae on each side (Fig. 18). Valve face flat, curving fairly abruptly into the valve mantle. Mantle shallow with areolae absent. Central raphe endings externally slightly expanded (Figs 14–16), internally unexpanded and straight (Figs 20–22). Externally, distal raphe fissures unilaterally abruptly curved; internally, terminal raphe endings terminating onto small helictoglossae (Figs 20–22). Girdle bands open, lacking transverse rows of areolae or any other ornamentation (Fig. 16).

Holotype: Slide **SP**-400295 deposited at the Herbário Científico do Estado Maria Eneyda P. Kauffmann Fidalgo, São Paulo, Brazil; represented by Fig. 9.

Isotypes: Slide **BR** 4191, Meise Botanic Garden, Belgium; slide **BM** 101399, Natural History Museum, London, UK.

Type locality: Brazil, Amazonas, Santa Isabel do Rio Negro, 0°26'06.8"S; 63°19'15.5"W. 'Igapó Adairá', Negro River hydrographical basin. Collected from hyaline embedded mucilage as epiphyte on submerged unidentified macrophytes by C.E. Wetzel and L. Ector, sample RN80, on 3rd March 2005. Mean pH value is 4.5 ($n = 41$) and low conductivity values with a mean of 17.98 $\mu\text{S cm}^{-1}$ ($n = 29$), see Wetzel & al. (2012).

Etymology: The epithet honours my wife, Gabriela Judica Wetzel, who provided wonderful support during my thesis work and for whom this species is named.

Registration: <http://phycobank.org/104474>

Besides *L. novagalliae*, *L. zalokariae* and *C. lilandae*, two species exhibit morphological characteristics like those of *Lacuneolimna* species, such as small size, coarse and distinct areolae that form radiate striae, and a row of areolae adjacent to the axial area. The first, originally named "*Navicula farta*" Hustedt (in Schmidt & al. 1934: pl. 397, figs 7-9), *nom. inval.*, was validated as *Eolimna metafarta* by Kulikovskiy & Lange-Bertalot (in Kulikovskiy & al. 2015: 200, figs 1-54, 59-68). This species is found in Asia, particularly in Japan, and in mountain lakes of Central Asia. The second species, *Sellaphora aboensis* (Cleve) Genkal (2022: 31), is distributed across the Holarctic region. It is a rare species found in Karelian lakes in Russia and in North America, mainly along the east coast of the United States. There are, however, a few exceptions, with reports from the northern Rocky Mountains and southern Alaska (Polaskey & Ripple 2019).

Navicula malica J.R.Carter & Denny, a similar species described from Sierra Leone by Carter & Denny (1982: 308), is here for the first time illustrated in LM.

Two nomenclatural transfers are here proposed:

Lacuneolimna lilandae (Cocquyt, M.de Haan & J.C.Taylor) C.E.Wetzel, *comb. nov.*

Basionym: *Cavinula lilandae* Cocquyt, M.de Haan & J.C.Taylor, *Diatom Research* 28(2): 158, figs 2–11, 16–21, 2013.

Registration: <http://phycobank.org/104475>

Notes: Based on the SEM and information available in Cocquyt & al. (2013), the following transfer is proposed for the species described from the Congo.

Lacuneolimna malica (J.R.Carter & Denny) C.E.Wetzel, *comb. nov.*

Basionym: *Navicula malica* J.R.Carter & Denny, *Nova Hedwigia Beihefte* 73: 308, figs 202–204, 1982.

Registration: <http://phycobank.org/104476>

Notes: The only report of this species is from the original publication by Carter & Denny (1982) from the phytoplankton of the River Jong (Taia) at Njala, Sierra Leone with a pH 6.7 and conductivity of 25.0 $\mu\text{S cm}^{-1}$. Specimens from slide **BM** 78107! shows specimens with very similar structures and morphology with the other known *Lacuneolimna*, and despite the lack of SEM images, based on the morphology of the valves the transfer is proposed. No register in the literature was found.

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Table 1. List of 21 samples of *Lacuneolimna gabrielae* deposited at **SP**, Brazil. All samples collected at the Rio Negro hydrographical basin, Brazilian Amazon. See also Wetzel & al. (2012) for information regarding the sampling. SEM images here presented were taken from the samples in **bold**.

Basin	Herbarium n° (SP!)	Sample code	Coordinates
Rio Negro, Brazilian Amazon	SP 400266	RN50	1°26'10.4"S; 61°35'26.1"W
	SP 400267	RN51	1°55'16.7"S; 61°23'47.0"W
	SP 400277	RN62	0°23'06.1"S; 63°18'42.1"W
	SP 400286	RN71	0°25'05.2"S; 63°18'45.5"W
	SP 400287	RN72	0°25'05.2"S; 63°18'45.5"W
	SP 400288	RN73	0°25'05.2"S; 63°18'45.5"W
	SP 400294	RN79	1°55'29.3"S; 61°23'53.2"W
	SP 400295	RN80	0°26'06.8"S; 63°19'15.5"W
	SP 400315	RN100	0°29'18.3"S; 64°36'46.4"W
	SP 400318	RN103	0°29'18.3"S; 64°36'46.4"W
	SP 400320	RN105	0°29'18.3"S; 64°36'46.4"W
	SP 400360	RN145	0°22'25.7"S; 65°22'56.9"W
	SP 400390	RN175	0°17'11.2"S; 66°35'18.1"W
	SP 400403	RN188	0°19'36.5"S; 66°35'12.9"W
	SP 400404	RN189	0°20'05.1"S; 66°35'28.7"W
	SP 400418	RN203	0°18'20.4"S; 66°40'42.4"W
	SP 400433	RN218	0°07'52.2"S; 67°05'23.9"W
	SP 400460	RN245	0°01'33.7"N; 67°14'31.9"W
	SP 400470	RN255	0°17'35.7"S; 65°53'31.7"W
	SP 400475	RN260	0°25'18.7"S; 63°36'48.1"W
	SP 400496	RN283	1°18'45.7"S; 61°52'27.0"W

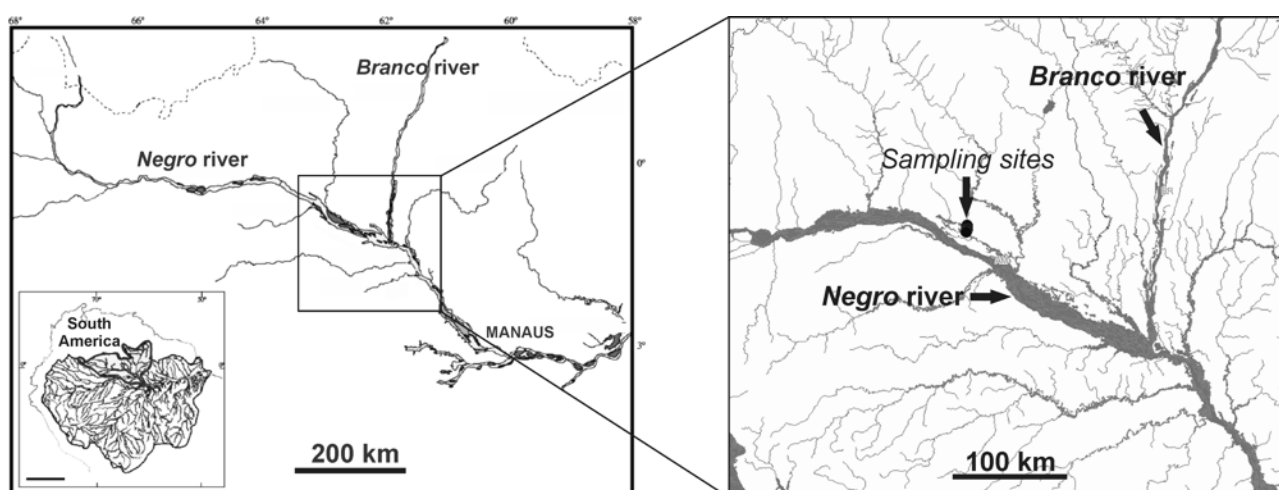
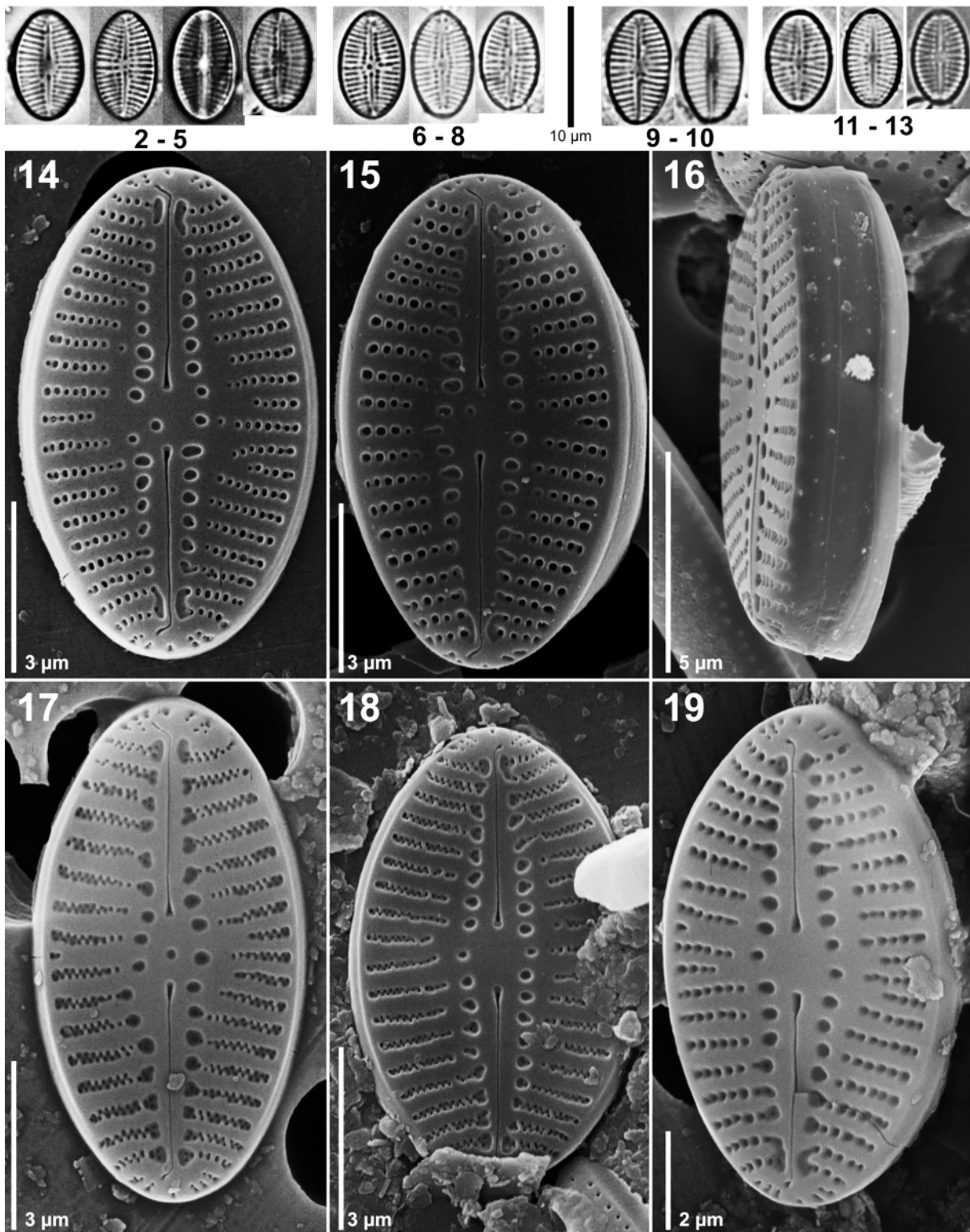
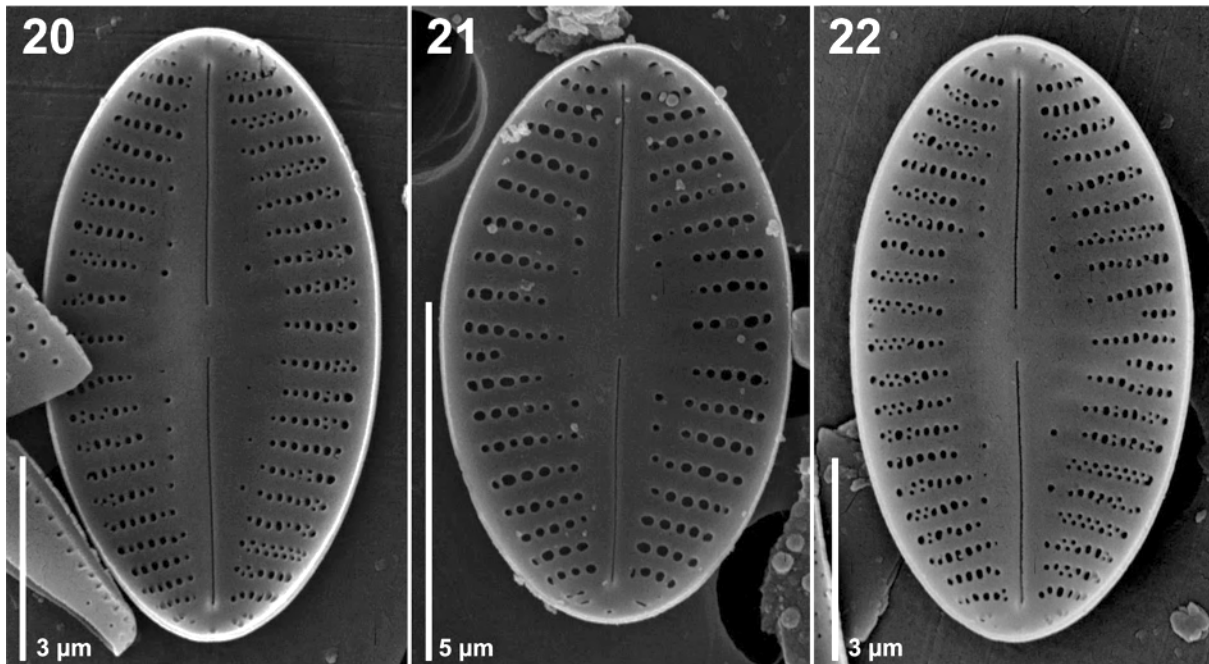


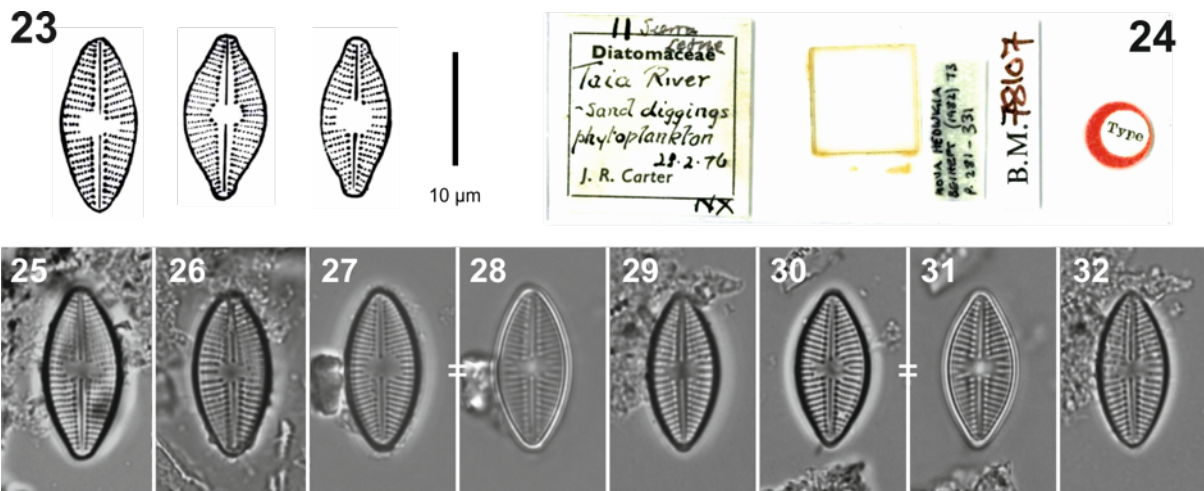
Fig. 1. Location of sampling sites (holotype gathering RN80) located in a tributary from the left bank of the Negro River, Brazilian Amazon, South America.



Figs 2–19. *Lacuneolimna gabrielae* C.E. Wetzel, *sp. nov.* Figs 2–13. Light microscopy of distinct populations. Figs 14–19. SEM image. Valve face showing the irregular depressions in the axial area, the terminal raphe endings and the uniseriate striae becoming irregularly biseriate. Figs 2-5, 17-19 (SP-400295), figs 6-8, 14 (SP-400390), figs 9-10, 15-16 (SP-400315).



Figs 20–22. *Lacuneolimna gabrielae* C.E.Wetzel, *sp. nov.* Valves showing straight central raphe endings and small helictoglossae at the poles. Figs 20: SP-400295, Fig. 21: SP-400315, Fig. 22: SP-400390.



Figures 23–32. *Lacuneolimna malica* (J.R.Carter & Denny) C.E.Wetzel, *comb. nov.* Fig. 23. Carter & Denny's (1987), figs 202–204), showing axial area with the typical depressions, and rounded central area. Figs 24: Holotype slide BM 78107, from where the Figures 25–32 were taken. Notice the same variability of the apices as depicted by Carter & Denny (1987).