

## Observations on the type material of *Gomphonema affine* Kützing (*Gomphonemataceae*, *Bacillariophyceae*)

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*Gomphonema affine* Kützing (1844: 86) was originally described from freshwater habitats in Trinidad [“In süßen Gewässern der Insel Trinidad: Krüger! (Herb. Sonder!)”]. The sample was collected by Hermann Krüger (1818–1864, spelled Krüger in Kützing 1844), a German botanist and pharmacist who spent the last seven years of his life as director of the Botanic Gardens in Port-of-Spain, the capital of Trinidad and Tobago. After his death, he left his collection to the Gardens, but samples were also sent to Berlin and Kew Gardens in London. The Berlin samples most likely were sent to Otto Wilhelm Sonder (1812–1881), another German pharmacist and botanist, who gathered during his life an impressive herbarium of more than 300,000 specimens, mainly from South Africa, tropical South America, and India (‘Herbar Sonder’).

Kützing (1844) described *Gomphonema affine* as follows: *G. turgidulum, elongatum, striatum, marginibus lateris primarii parum curvatis; latere secundario sub lanceolato, apice obtuso, stipite abbreviato, subramoso. Long. 1/30”*. [Weakly inflated, elongated, striped *Gomphonema*, with curved margins, on the primary side only a little bit, the secondary side sublanceolate. Headpole obtuse, on short, branched stalks. Length 75 µm]. He illustrated the new species with several drawings showing frustules on short stalks and two valves in valve face view, however, with acute apices (Kützing 1844, pl. 30: fig. 54).

Curiously enough, Kützing suggested (with doubt as expressed by the “?” behind the name) a possible link with *Gomphonema gracile* Ehrenberg, described in the latter’s *Infusionstierchen* in 1838 based on material from Berlin. Reichardt (2015) published several images of the type material of *G. gracile*, that appear much smaller compared to the three LM photos of the type of *G. affine* in Reichardt (1999, pl. 7: figs 1–3), excluding all conspecificity. Rabenhorst (1864: 286) treated the species to be a variety of *Gomphonema dichotomum* Kützing, a transfer, however, not followed by later authors. Although Van Heurck (1880, pl. 24: figs 8, 9) kept *G. affine* and *G. gracile* separated, De Toni (1891: 426) considered *G. affine* to be a synonym of *G. gracile*. It is interesting to note that the illustrated valves in Van Heurck (1880) were based on material from [Lac de] Tacarigua in Trinidad. In addition, Grunow described a new form *G. affine* f. *major* Grunow, split off based on material from Mexico (Van Heurck 1880, pl. 24: fig. 10).

As the species was clearly tropical, and considered a synonym of the better-known *G. gracile*, it was not mentioned in later European diatom books such as Hustedt (1930). It was only in 1975 that Patrick & Reimer included *G. affine* in their monograph, *Diatoms of the United States* (Patrick & Reimer 1975: 133, pl. 17: fig. 5). Patrick had seen the original Kützing slide from Insel Trinidad, kept in the London Natural History Museum collection and designated BM slide 18653 as lectotype for *G. affine*. The slide was made from sample Kützing 385. Patrick & Reimer added *G. affine* f. *major* as a synonym of *G. affine*. Krammer & Lange-Bertalot (1986, pl. 161: fig. 1) published the first LM photograph of the lectotype, followed in 1999 by Reichardt, showing three other specimens of the type, photographed by Lange-Bertalot (Reichardt 1999, pl. 7: figs 1–3).

The type material from Kützing 385 was, however, never analysed using SEM so that the species remained illustrated only as LM. Germain & Le Cohu (1981) presented two SEM and two TEM

illustrations of a taxon they had identified as *G. affine* from Kerguelen in the Subantarctic, an identification that should be considered very doubtful (Van de Vijver, pers. comm.). Reichardt (1999) used a population from Reunion Island in the Indian Ocean to document the ultrastructure of *G. affine* and although it is possible, given the similar climatic conditions, that the valves belong to *G. affine*, the illustrated material does not represent the ultrastructure of the type material.

Kützing's diatom collection is mainly dispersed between the collections of the Natural History Museum in London, UK (**BM**), and the Van Heurck collection, part of the collection in Meise Botanic Garden, Belgium (**BR**) with smaller portions present in **B**, **W** and **L**. In the Van Heurck collection, a series of samples is present collected by Hermann Crüger (Krüger) in Trinidad, including sample 385 from St. Ann's River in Trinidad (coll. date XII 1842).

Here, we detail observations on specimens of *G. affine* from sample 385 using LM and SEM based upon isolectotype material in BR.

*Gomphonema affine* Kützing (Figs 1–29)

Original description: Kützing *Die kieselschaligen Bacillarien oder Diatomeen*, p. 86, plate 30, fig. 54, 1844

Homotypic synonyms: *Gomphonema dichotomum* var. *affine* (Kützing) Rabenhorst 1864

*Gomphonema lanceolatum* var. *affine* (Kützing) A. Cleve 1932

Heterotypic synonym: *Gomphonema affine* f. *major* Grunow (in Van Heurck 1880)

Lectotype (designated by Patrick & Reimer (1975:133): Slide **BM** 18653 (Natural History Museum London, UK)

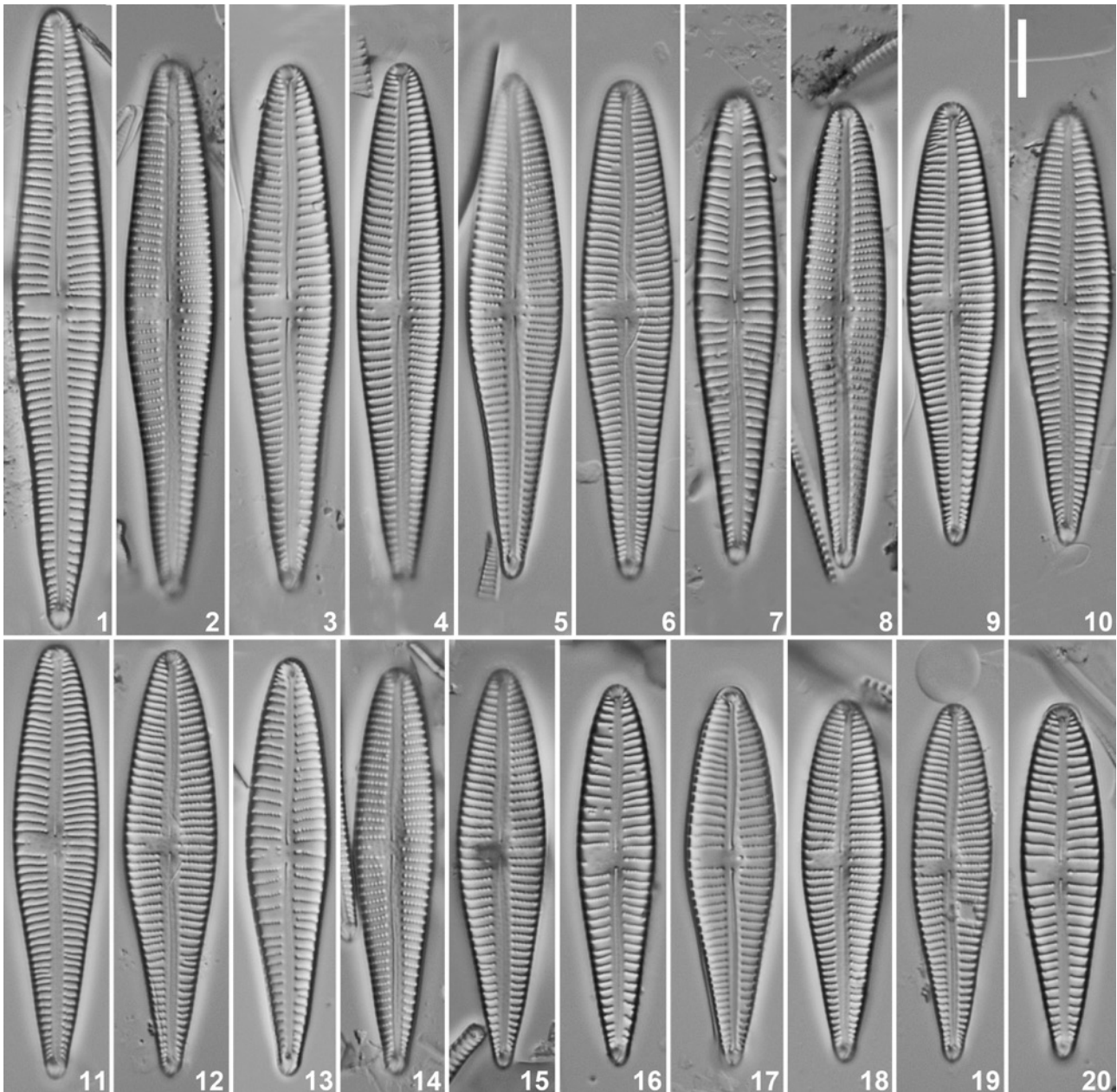
Isolectotype: **BR**-4806 (Meise Botanic Garden, Belgium).

Type locality: Saint Ann's River, Port of Spain, Trinidad, Dec. [18]42, 'In süßen Gewässern der Insel Trinidad'

Description: Frustules rectangular, weakly clavate. Valves lanceolate, gomphonemoid-clavate with broadly convex margins. Head pole broadly rounded, not protracted. Foot pole acutely rounded, distinctly narrowing from the valve middle to the apex. Valve dimensions (n=25): length 44–80 µm, width 10–12 µm, the largest width in or slightly above the valve middle. Axial area linear, moderately broad, about 1/6 of the total valve width. Multiple shallow depressions present in the axial area (Figs 21, 23, 24). Central area asymmetrical with shortened stria(e) on one side, and one long stria on the other terminating in a large, rounded, isolated pore. Occasionally two isolated pores present (Fig. 5). Raphe distinctly lateral. External raphe branches weakly undulating (Fig. 21). Central raphe endings terminating in small round-like, almost straight central pores (Figs 23, 24). Terminal raphe fissures elongated, curved to one side, continuing onto valve mantle at both poles (Figs 21, 22). Apical pore field at footpole large, composed of small, rounded pores, extending slightly onto the valve face, bisected by terminal raphe fissure (Figs 21, 22, 26). Striae uniseriate, (slightly) radiate, becoming more radiate towards poles. Stria density usually 10–12 in 10 µm, but valves with stria density as low as 7 striae in 10 µm also observed (Fig. 13). Striae composed of mainly areolae with c-shaped (Figs 22–24), very rarely e-shaped or slit-like external foramina. Areolae always discernible in LM. Striae running without interruption onto the valve mantle where the foramina become smaller, slit-like to finally dot-shaped or slightly elongated (Figs 30, 31). Internally, terminal raphe endings terminating onto well-developed deflected helictoglossae (Figs 27, 29). Pseudosepta present at both poles (Figs 27, 29), most developed at the foot pole. Central raphe endings distinctly unilaterally bent with reversed ending (Fig. 28). Internal isolated pore transversely elongated (Fig. 28). Siliceous struts separating areolae interrupted (Fig. 28). Areolae at the bottom of shallow grooves, with rounded foramina. Girdle composed of at least three, rather narrow, perforated, open bands (Figs 25, 26).

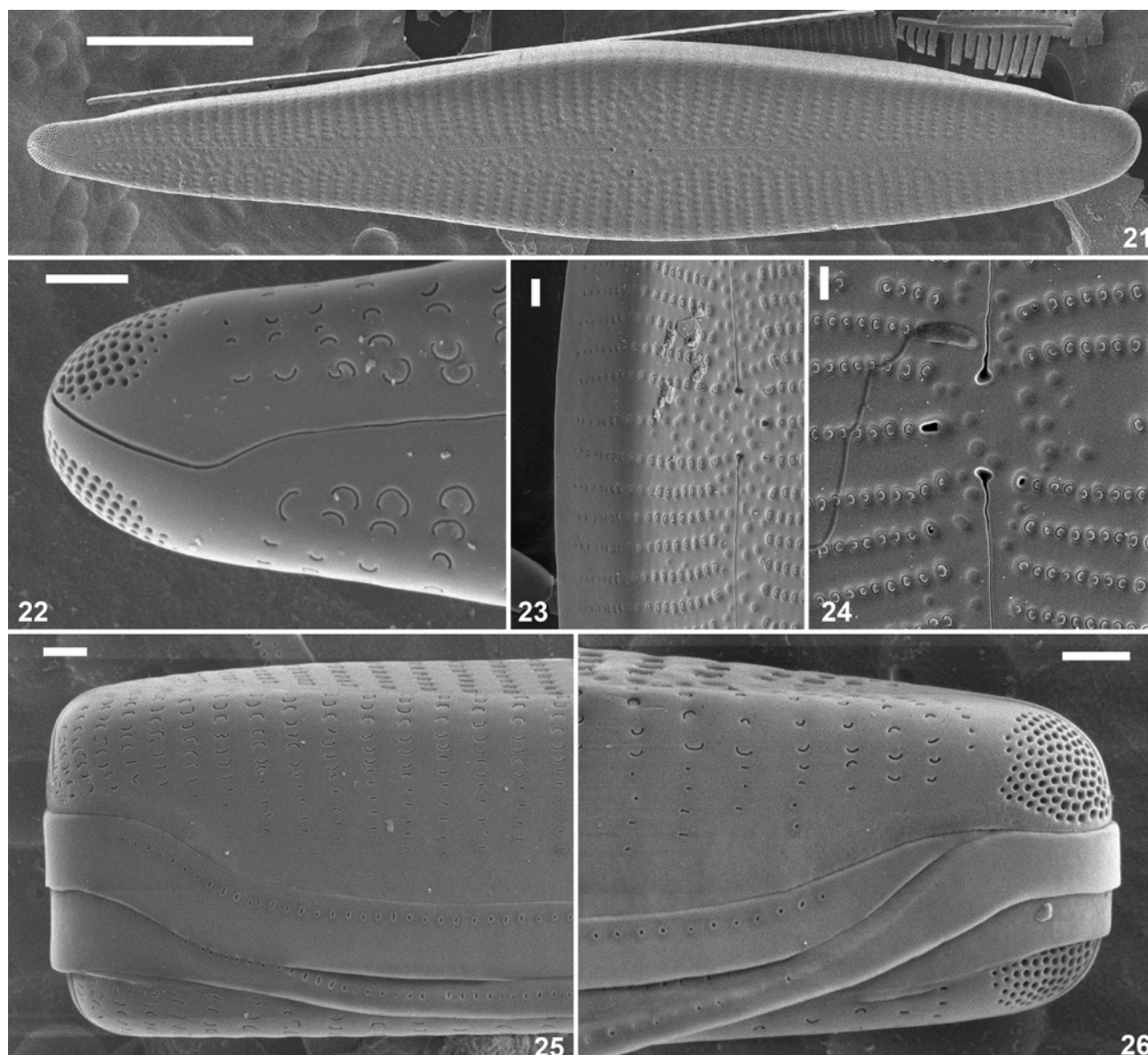
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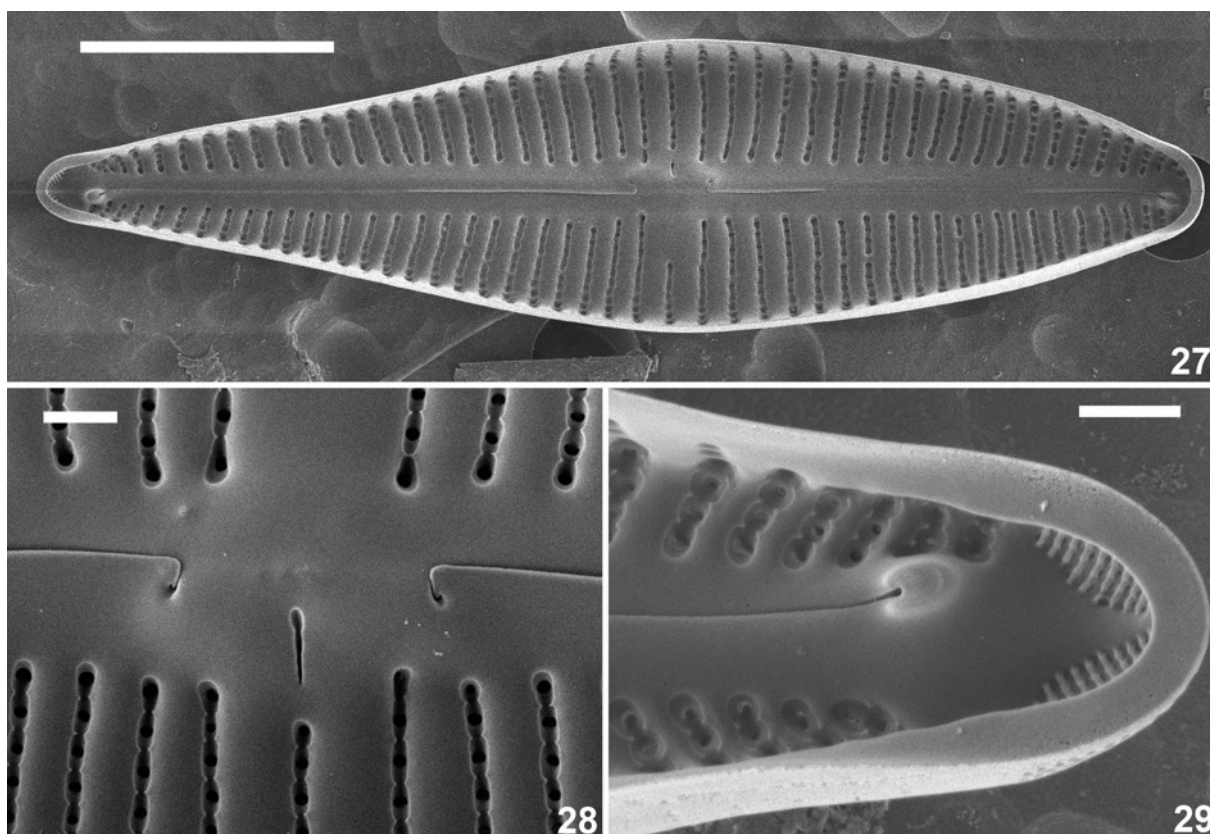


**Figs 1–20.** *Gomphonema affine* Kützing. LM pictures taken from the isolectotype material (BR 4806, Saint Ann's River, Trinidad, sample Kützing 385, leg. Crüger, XII 1842). Note the variability in stria density in some valves. Scale bar represents 10  $\mu\text{m}$ .





**Figs 21–26.** *Gomphonema affine* Kützing. SEM pictures taken from the isoelectotype material (BR 4806, Saint Ann's River, Trinidad, sample Kützing 385, leg. Crüger, XII 1842). **Fig. 21.** SEM external view of an entire valve with the typical markings in the axial area. **Fig. 22.** SEM external detail of the footpole with the apical pore field bisected by the terminal raphe fissure. **Fig. 23.** SEM external detail of central area in oblique view showing the central raphe endings and the shallow depressions in the axial and central areas. **Fig. 24.** SEM external detail of the central area showing the raphe endings and the shallow depressions. Areolae are also positioned with surface depressions. **Fig. 25.** SEM external detail of the head pole in girdle view showing the mantle areolae and the girdle bands. **Fig. 26.** SEM external detail of the foot pole in girdle view showing the apical pore field and the girdle bands. Scale bar = 10 µm (Fig. 21) and 1 µm (Figs 22–26).



**Figs 27–29.** *Gomphonema affine* Kützing. SEM pictures taken from the isolectotype material (BR 4806, Saint Ann's River, Trinidad, sample Kützing 385, leg. Crüger, XII 1842). **Fig. 27.** SEM internal view of an entire valve with the small pseudosepta and the deflected helictoglossae. **Fig. 28.** SEM internal detail of the central area with the central raphe endings and the slit-like internal opening of the isolated pore. Note the interrupted siliceous struts. **Fig. 29.** SEM internal detail of the foot pole with the distinct pseudoseptum, the apical pore field and the deflected, well-developed helictoglossa. Scale bar = 10  $\mu\text{m}$  (Fig. 27) and 1  $\mu\text{m}$  (Figs 28–29).