

Article

Species Composition and New Records of Diatom Taxa on *Phyllocladus pulcherrimum* (Chlorophyceae) from the Gulf of California

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Abstract: A taxonomic analysis of diatoms found on *Phyllocladus pulcherrimum* yielded a total of 244 diatom taxa (all illustrated) within 27 orders, 45 families, and 86 genera. The Taxa were briefly documented in a list including identification references and morphometric data. Thirty-eight of the taxa identified at the species and infraspecific levels represent new records for the coasts of Mexico. Seven were recorded for the first time on the American continent: *Auricula flabelliformis*, *A. pulchra*, *Campylodiscus scalaris*, *Coscinodiscus mesoleius*, *Dimeregramma fulvum*, *Navicula palpebralis* var. *angulosa*, and *Seminavis barbareae*, and one, *Nitzschia fusiformis*, for the Pacific Ocean. This is the second record of the chlorophyte *P. pulcherrimum* in the north Pacific and the third for Mexican waters. The results confirm that surveying rare macroalgae species as hosts for epiphytic diatoms provides opportunities to seek new records of diatom taxa, or even new taxa, in regions around the world.

Keywords: Bacillariophyta; epiphytes; floristics; Gulf of California; new records

1. Introduction

Benthic diatoms thrive on a great variety of substrates that include both live and inert surfaces [1–3]. Among the former, the surfaces of macroalgae provide, by far, the highest species richness of epiphytic diatoms that may number several hundred species [4]. However, many macroalgae taxa worldwide have yet to be surveyed for epiphytic diatom floristics. The few studies of diatom epiphytes on macroalgae cover hosts of the three main groups: brown, red, and green [5–10]. Specific studies on epiphytic diatoms of green macroalgae that include *Caulerpa taxifolia*, *C. verticillata*, *Chaetomorpha linum*, *Cladophora glomerata*, *Cladophora* sp., *Halimeda tuna*, *H. sp.*, *Ulva intestinalis*, and *U. lactuca* have recorded a total of 300 taxa [5,10–20].

For the Mexican region, the only studies are those by [6,21] that recorded 89 diatom taxa on *Codium* spp. and 51 on *Codium latum* subsp. *palmeri*. Most research on epiphytic diatoms of macroalgae in Mexico has been conducted in the NW region [22], while for the coasts of the Gulf of Mexico only one such study has been published. It deals with rhodophytes, yielding 115 epiphytic diatom taxa from specimens of six rhodophyte species that included six new records for Mexican waters [8]. In contrast, 208 (specific and infraspecific) epiphytic diatom taxa were identified in samples from two specimens of *Laurencia* collected off the Revillagigedo Islands, 16 of which could not be identified at the species level

and so may represent new taxa. Another 52 were new additions to the diatom flora of Mexico's coasts, and three to Mexico's Pacific coast [22].

Considering the numerous macrophyte taxa found on the coasts of the California–Baja California Peninsula, it is clear that studies of epiphytic diatoms in the eastern Pacific are lacking, including works on well-known macroalgae. For example, the absence of the diatom *Pteroncola inane* in other floristic lists in NW Mexico, and a recently-observed high abundance on *Eisenia arborea*, suggest that this host may have specific conditions that favor the growth of this and other new records [23]. Finally, at least 200 epiphytic diatom taxa have been recorded on various macroalgae species in the Gulf of California [6].

In addition, surveying rare macroalgae species as hosts for epiphytic diatoms offers the opportunity to seek new records of diatom taxa, or even new taxa. Recently, a specimen that constitutes the second record of the chlorophyte *Phyllocladion pulcherrimum* in the North Pacific (third for Mexican coasts) was collected off the west coast of the Gulf of California, prompting our interest in the species composition of its epiphytic diatom flora. A fresh inspection of the macroalgal specimen surface showed an epiphytic diatom flora apparently composed exclusively of *Cocconeis* species. However, because epiphytic diatom taxocoenoses are likely the richest in taxonomic diversity, our objective was to identify the diatom taxa found on the specimen of *P. pulcherrimum* collected in the central zone of the west coast of the Baja California Peninsula and describe its potential floristics.

2. Materials and Methods

In July 2019, a single thallus of a green seaweed was collected from the west coast of the central region of the Gulf of California, 4 km south of Santa Rosalia (Baja California Sur, Mexico) at 27°19'66" N, 112°14'00.13" W (Figure 1). The sampling site is characterized by rocky substrata and was occupied by macroalgae of various genera (e.g., *Botryocladia*, *Dictyota*, *Padina*) and fringed by sandy substrata harboring young colonies of black coral *Antipatharia* sp. The green algae specimen was retrieved manually at a depth of 18 m using semiautonomous diving equipment (hookah), and later identified as *P. pulcherrimum*, based on morphological characteristics following [24,25]. The specimen was then housed in the Phycological Herbarium of the Universidad Autónoma de Baja California Sur [FBCS–20172].

During the process of identifying *P. pulcherrimum*, a 3 cm² segment of the thallus was observed under a microscope to describe the cell morphology. This revealed a layer of diatoms, mainly *Cocconeis*-like forms (Figure 2). The segment of algae was processed to separate and clean the diatoms using nitric acid and commercial ethanol (90%) in a test tube at a 2:2 ratio, applying heat with a burner for around 30 s. The oxidized material was transferred to a 15-mL Falcon tube, diluted with deionized water, and centrifuged for 5 min at 4000× g rpm. This was repeated five times until reaching a circumneutral pH. Clean aliquots of the sample were mounted on permanent slides using Zyrax® (RI = 1.7) (made and distributed by Bill Daily, University of Pennsylvania). Six mounted slides were observed under a Zeiss® Axio Lab A1 (Zeiss, Germany) compound microscope equipped with phase contrast and a Canon 5D mark II camera (Canon, Japan). Identification of each taxon was carried out using the reference that appears in the corresponding description.

A formal list of the diatom taxa was constructed following [26], including information on references and morphometrics. Nomenclatural updates were based on AlgaeBase [27] and www.marinespecies.org [28], complemented by an iconographic catalog of all the taxa registered.

To contrast our observations, 14 publications on epiphytic diatom floristics for various green seaweed taxa were reviewed. These included *Caulerpa taxifolia*, *C. verticillata*, *Chaetomorpha linum*, *Cladophora glomerata*, *Cladophora* sp., *Codium latum* subsp. *palmeri*, *Codium* spp., *Halimeda tuna*, *Halimeda* sp., *Ulva intestinalis*, and *U. lactuca* [5,6,9,11–21].



Figure 1. Location of the sampling site off Santa Rosalia, Baja California Sur, Mexico.

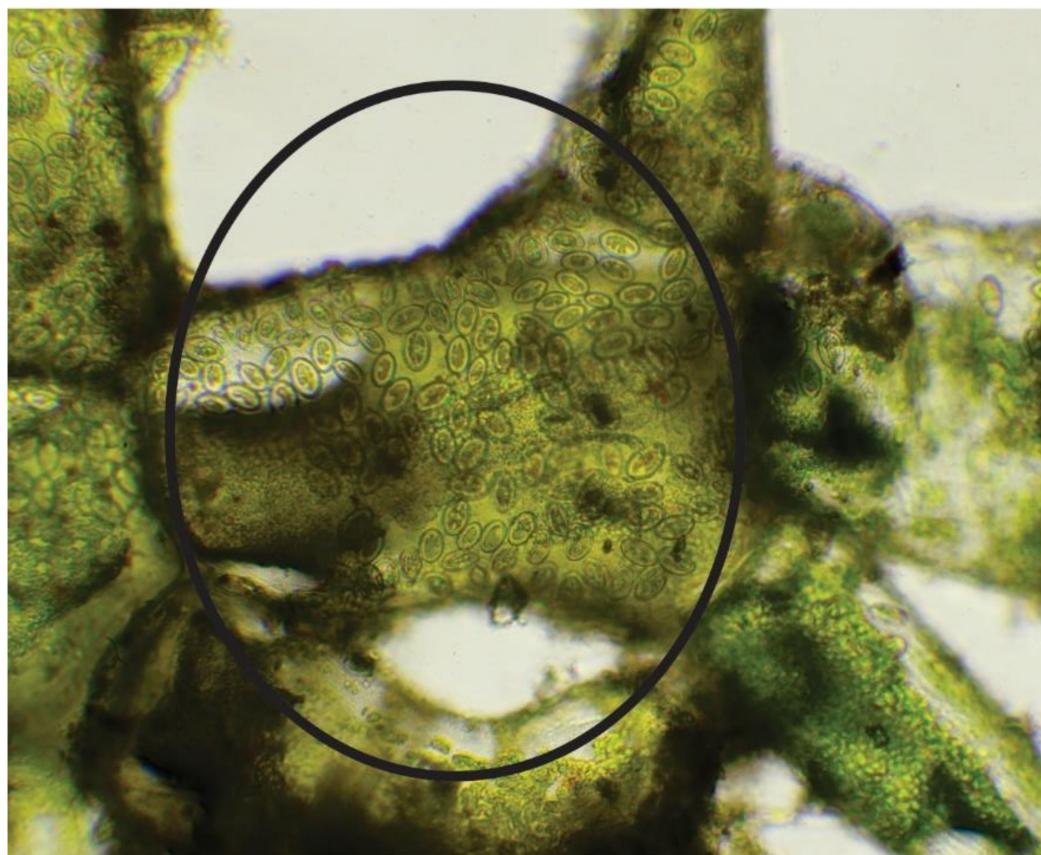


Figure 2. Segment of the thallus of *Phyllocladion pulcherrimum* exhibiting a layer of diatoms, mainly *Cocconeis* spp.

3. Results

A thorough scanning of the six mounted slides yielded 244 specific and infraspecific taxa, belonging to 27 orders, 45 families, and 86 genera. Only three taxa were solely identified at the genus level, and five as cf. All the diatom taxa found on *P. pulcherrimum* are displayed in an iconographic catalogue (Figures 3–46) with 615 images that show distinct focal planes, sizes and views (valve and girdle). The genera best represented were *Nitzschia* (25 taxa), *Amphora* (17), *Diploneis* (15), *Navicula* (13), and *Cocconeis* (12), as they accounted for 34% of all taxa. In contrast, for 49 genera only a single taxon was recorded, representing 57% of all the records collected. Overall, 38 taxa (15.5%) are new records for Mexico's coasts.

At the class level, 68% (25 taxa) of the new records are Bacillariophyceae, 21% (8) are Coscinodiscophyceae, and 11% (4) are Fragilariophyceae. These were included in 26 genera, of which 19 (73%) were represented by a single taxon. *Nitzschia* and *Gyrosigma* had the most taxa—five and three, respectively—while six others had two taxa each (*Auricula*, *Diploneis*, *Navicula*, *Parlibellus*, *Pleurosigma*, and *Synedra*).

Following is a systematic list of epiphytic diatoms (Bacillariophyta) of *Phyllocladion pulcherrimum* from the Gulf of California. * New record for Mexican coasts. + New record for the American Continent. n = number of specimens measured. Slides containing the diatom taxa recorded are referred to the macroalgal specimen housed at the Phycological Herbarium of the Universidad Autónoma de Baja California Sur [FBCS-20172].

CLASS: COSCINODISCOPHYCEAE F.E. Round and R.M. Crawford 1990

Order: Asterolamprales F.E. Round and R.M. Crawford 1990

Family: Asterolampraceae H.L. Smith 1872

ASTEROMPHALUS C.G. Ehrenberg 1844

Asteromphalus arachne (A. Brébisson) J. Ralfs 1861

Reference illustrate (Ref. illus.): Pritchard, A. 1861, p. 837, pl. 5, Figure 66; Hasle, G.R., Syvertsen, E.E. 1996, p. 137, pl. 25.

Diameter 45 µm, areolae 7 in 10 µm ($n = 1$) (Figure 10c).

Order: Biddulphiales H. Krieger 1954

Family: Biddulphiaceae F.T. Kützing 1844

BIDDULPHIA S.F. Gray 1821

Biddulphia biddulphiana (J.E. Smith) C.S. Boyer 1900

Ref. illus.: Hustedt, F. 1930, p. 832, Figure 490; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 25, pl. 8, Figures 8 and 9 (as *B. pulchella*).

Size: 40–65 µm long, 33–102 µm broad, pervalvar axis 85–131 µm, areolae on the mantle 4 to 5 in 10 µm ($n = 7$) (Figure 12c–i).

Remark: Valves elliptic, swollen margin, strongly sculptured, divided into three sections by strong costae. Ends of the valve furnished with large globular process covered with fine pores, areolae arranged in longitudinal and transverse rows, girdle punctate in longitudinal lines.

Biddulphia tridentata C.G. Ehrenberg 1844 *

Ref. illus.: Schmidt, A.W.F. 1888, pl. 118, Figures 13–18.

Size: 90 µm long, 58 µm broad, areolae 5–6 in 10 µm ($n = 1$) (Figure 11d,e).

Remark: Rimoportula in *B. biddulphiana* are located toward the center of the valve, while in *B. tridentata* they are displaced to the margins. Likewise, costae in the latter show a hyaline area but no *B. biddulphiana*.

Biddulphia tridens (C.G. Ehrenberg) C.G. Ehrenberg 1841

Ref. illus.: Roper, F.C.S. 1859, p. 8, pl. 1, Figures 1 and 2; Foged, N. 1975, p. 15, pl. 1, Figures 6 and 7.

Size: 46–106 µm long, 31 µm broad, areolae 6 to 7 in 10 µm ($n = 3$) (Figure 11a–c,f).

Remark: Figure 11a,b show a clear difference in size and form of the pseudo-ocelii, but said variations seem insufficient to render the specimens a distinct species from *B. tridens*. Although in [29] pl. 119, the specimens from Figures 15 and 17 with short-flat pseudo-ocelii (Figure 11a,b) are considered a variety of *B. tridens*, in [30] said variation may be present individually, e.g., Figure 3, which shows classic long-rounded pseudo-ocelii, while Figure 44 (hipovalve) shows short-flat pseudo-ocelii.

LAMPRISCUS A.W.F. Schmidt 1882

Lampriscus shadboltianum (R.K. Greville) H. Peragallo and M. Peragallo 1902

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, p. 389, pl. 106, Figure 1; Navarro, J.N. 1981, p. 618, Figures 33–36; Vidal, L.A.; Ospino-Acosta, K.; Linares-Vargas, K.; García-Urueña, R. 2017, p. 56, Figures 5g and 6a.

Diameter 58–73 µm, pervalvar axis 100 µm, areolae 6–8 in 10 µm ($n = 6$) (Figure 14a–g).

Order: Chaetoceratales F.E. Round and R.M. Crawford 1990

Family Chaetocerotaceae J. Ralfs 1861

BACTERIASTRUM G. Shadbolt 1854

Bacteriastrum hyalinum H.S. Lauder 1864

Ref. illus.: Lauder, H.S. 1864, p. 8, pl. 3, Figure 7a,b; Bosak, S.; Šupraha, L.; Nanjappa, D.; Kooistra, W.H.C.F.; Sarno, D. 2015, p. 135, Figures 18–36.

Diameter 13 µm ($n = 2$) (Figure 10a,b).

Order: Eupodiscales V.A. Nikolaev and D.M. Harwood 2000

Family: Odontellaceae P.A. Sims, D.M. Williams and M.P. Ashworth 2018

ODONTELLA C.A. Agardh 1832

***Odontella obtusa* F.T. Kützing 1844**

Ref. illus.: Kützing, F.T. 1844, p. 137, pl. 18/8, Figures 1–3, 6–8.

Size: 100–127 µm long, 65–92 µm broad, 5 areolae in 10 µm ($n = 4$) (Figure 13a–d).

***Odontella rostrata* (F. Hustedt) R. Simonsen 1987**

Ref. illus.: Hustedt, F. 1939, p. 591, Figures 5–7; Simonsen, R. 1987, p. 250, pl. 373, Figures 1–11 (both as *Biddulphia rostrata*); Sims, P.A.; Williams, D.M.; Ashworth, M., p. 32, Figures 11–116.

Size: 19 µm long, 8–11 areolae in 10 µm ($n = 2$) (Figure 12a,b).

Remark: According to [31], *O. aurita* differs from *O. rostrata* by having convex valves with elevated central areas, a valve mantle turned towards the margin of the valve, two elevations with a limited perforated plate (ocellus) on each valve, and radial rows of poroid areolae with domed cribum-like veta, with a central granule, ornamenting the valve surface. It also shows many to just a few siliceous radial ribs located between the border of the elevated central area and the mantle, twinned pores and spines relatively well developed and scattered over the valve. There are one or two labiate processes located next to the border of the central area and opposite to the elevations. These are sessile internally but have stout external tubes of varying length.

AMPHITETRAS C.G. Ehrenberg 1840

***Amphitetras antediluviana* C.G. Ehrenberg 1840**

Ref. illus.: Jahn, R.; Kusber, W.H. 2006, p. 528, Figures 1–3.

Size: 35–45 µm long, 38 µm broad, areolae 4–6 in 10 µm ($n = 2$) (Figure 15a,b).

PSEUDICTYOTA P.A. Sims and D.M. Williams 2018

***Pseudictyota dubia* (T. Brightwell) P.A. Sims and D.M. Williams 2018**

Ref. illus.: Hustedt, F. 1930, p. 806, Figure 46; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 42, pl. 8, Figures 4 and 5 (both as *Triceratium dubium*)

Size: 13–31 µm long, areolae 4–5 in 10 µm ($n = 4$) (Figure 13e–k).

Order: Coscinodiscales F.E. Round and R.M. Crawford 1990

Family Aulacodiscaceae (F. Schütt) E. Lemmermann

AULACODISCUS C.G. Ehrenberg, 1844, nom. cons.

***Aulacodiscus* sp.**

Size: 65 µm long, pervalvar axis 31 µm ($n = 1$) (Figure 16i,j).

Remark: Because no valve view was found for this taxon, the characteristics for its specific identification could not be used. However, elements in girdle view are indicative of the genus *Aulacodiscus*.

Family: Coscinodiscaceae F.T. Kützing 1844

COSCINODISCUS C.G. Ehrenberg 1839

***Coscinodiscus gigas* C.G. Ehrenberg 1841**

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, p. 433, pl. 118, Figure 3.

Diameter 246 µm, areolae 3 in 10 µm ($n = 2$) (Figure 5g,h).

***Coscinodiscus mesoleius* P.T. Cleve 1883 *†**

Ref. illus.: Cleve, P.T. 1883, p. 503, pl. 38, Figure 8; Stidolph, S.R.; Sterrenburg, F.A.S.; Smith, K.E.L.; Kraberg, A. 2012, pl. 15, Figure 32, pl. 17, Figure 98.

Diameter 63–77 µm, areolae 12 to 13 in 10 µm ($n = 2$) (Figure 6j,k).

***Coscinodiscus radiatus* C.G. Ehrenberg 1840**

Ref. illus.: Ehrenberg, C.G. 1840, p. 68, pl. 3, Figure 1a–c; Stidolph, S.R.; Sterrenburg, F.A.S.; Smith, K.E.L.; Kraberg, A. 2012, pl. 20, Figure 22; pl. 34, Figure 2, pl. 36, Figure 36, pl. 43, Figures 110 and 111; pl. 44, Figure 2; pl. 46, Figures 1 and 4.

Diameter 54–137 µm, areolae 3–6 in 10 µm ($n = 3$) (Figures 5a–f and 6k,l).

Family: Heliopeltaceae H.L. Smith 1872

ACTINOPTYCHUS C.G. Ehrenberg 1843

***Actinoptychus minutus* R.K. Greville 1866**

Ref. illus.: Greville, R.K. 1866, p. 5, pl. 1, Figure 12; Siqueiros Beltrones, D.A.; Argumedo-Hernández, U. 2015, p. 114, Figure 28.

Diameter 18–25 µm ($n = 2$) (Figure 3e–j).

***Actinoptychus senarius* (C.G. Ehrenberg) C.G. Ehrenberg 1843**

Ref. illus.: Ehrenberg, C.G. 1843, p. 400, pl. 1.1, Figure 27; pl. 1.3, Figure 21; Siqueiros Beltrones, D.A.; Argumedo-Hernández, U. 2015, p. 114, Figure 8.

Diameter 28–46 µm ($n = 4$) (Figure 4a–j).

***Actinoptychus vulgaris* J. Schumann 1867**

Ref. illus.: Desikachary, T.V. 1988, p. 2, pl. 420, Figures 4 and 6; Moreno, J.L.; Licea, S.; Santoyo, H. 1996, p. 19, pl. 8, Figure 1; López-Fuerte, F.O.; Siqueiros Beltrones, D.A.; Navarro, J.N. 2010, p. 17, pl. 10, Figures 1 and 2.

Diameter 35–54 µm ($n = 4$) (Figure 3a–d).

ACTINOCYCLUS C.G. Ehrenberg 1837

***Actinocyclus subtilis* (W.W. Gregory) J. Ralfs 1861**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 22, pl. 4, Figure 1; López-Fuerte, F.O.; Siqueiros Beltrones, D.A.; Navarro, J.N. 2010, p. 14, pl. 6, Figures 1 and 2.

Diameter 31–50 µm ($n = 5$) (Figure 9a–e).

***Actinocyclus tenuissimus* P.T. Cleve 1878**

Ref. illus.: Navarro, J.N. 1981, p. 429, Figures 28 and 29; Lobban, C.S.; Schefter, M.; Jordan, R.W.; Arai, Y.; Sasaki, A.; Theriot, E.C.; Ashworth, M.; Ruck, E.C.; Pennesi C. 2012, p. 249, pl. 5, Figures 1 and 2.

Diameter 38–58 µm, areolae 18 in 10 µm ($n = 2$) (Figure 9f–h).

***Actinocyclus ochotensis* A.P. Jousé 1969 ***

Ref. illus.: Jousé, A.P. 1969, p. 17, pl. 2, Figures 2–5.

Diameter 34 µm, areolae 8 in 10 µm ($n = 1$) (Figure 9i–k).

AZPEITIA M. Peragallo 1912

***Azpeitia nodulifera* (A.W.F. Schmidt) G.A. Fryxell and P.A. Sims 1986**

Ref. illus.: Fryxell, G.A.; Sims, P.A.; Watkins, T.P. 1986, p. 19, Figures 17, 18 and 30; Hasle, G.R.; Syvertsen, E.E. 1996, p. 126, pl. 21.

Diameter 20–58 µm, areolae 4–6 in 10 µm ($n = 4$) (Figure 7a–g).

Family: Hemidiscaceae N.I. Hendey, 1937 emend R. Simonsen, 1975

ROPERIA A. Grunow 1889

***Roperia tessellata* (F.C.S. Roper) A. Grunow 1889**

Ref. illus.: Roper, F.C.S. 1858, p. 19, pl. 3, Figure 1; Hasle, G.R.; Syvertsen, E.E. 1996, p. 130, pl. 22.

Diameter 31–35 µm, areolae 7 to 8 in 10 µm ($n = 2$) (Figure 7m).

Order: Melosirales R.M. Crawford 1990

Family: Hyalodiscaceae R.M. Crawford 1990

MARGARITUM H. Moreira Filho 1968

***Margaritum terebro* (G. Leuduger-Fortmorel) H. Moreira Filho 1968 ***

Ref. illus.: Hendey, N.I. 1957, p. 36, pl. 1, Figures 12 and 13 (as *Podosira tenebro*); Souza-Mosimann, R.M. de; Fernandes, L.F.; Ludwig, T.V. 1997, p. 46, Figures 1–14.

Diameter 30–32 µm ($n = 2$) (Figure 6l–o).

PODOSIRA C.G. Ehrenberg 1840

***Podosira montagnei* F.T. Kützing 1844**

Ref. illus.: Foged, N. 1984, p. 89, pl. 18, Figure 1.

Diameter 23 µm ($n = 1$) (Figure 8o).

***Podosira stelligera* (J.W. Bailey) A.Mann 1907**

Ref. illus.: Hendey, N.I. 1964, p. 90, pl. 22, Figure 6; Navarro, J.N. 1982, p. 11, pl. 2, Figures 4 and 5.

Diameter 17–42 µm ($n = 6$) (Figure 8a–k).

***Podosira variegata* A.W.F. Schmidt 1889 ***

Ref. illus.: Schmidt, A.W.F. 1889, pl. 140, Figure 4.

Diameter 34 µm ($n = 1$) (Figure 8l–n).

Family: Melosiraceae F.T. Kützing 1844

MELOSIRA C.A. Agardh 1824

***Melosira moniliformis* var. *octogona* (A. Grunow) F. Hustedt 1927**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 35, pl. 3, Figures 1 and 2.

Diameter 22 µm ($n = 1$) (Figure 6h,i).

Order: Paraliales R.M. Crawford 1990

Family: Paraliaceae R.M. Crawford 1988

PARALIA P.A.C. Heiberg 1863

***Paralia sulcata* (C.G. Ehrenberg) P.T. Cleve 1873**

Ref. illus.: Hendey, N.I. 1964, p. 73, pl. 23, Figure 5; Hasle, G.R.; Syvertsen, E.E. 1996, p. 91, pl. 14.

Diameter 11–37 µm ($n = 3$) (Figure 10g–l).

Family: Stephanodiscaceae I.V.Makarova 1986

CYCLOTELLA (F.T. Kützing) A. de Brébison 1838

***Cyclotella striata* (F.T. Kützing) A. Grunow 1880**

Ref. illus.: Foged, N. 1984, p. 31, pl. 17 Figure 4; Hasle G.R., Syvertsen E.E. 1996, p. 34, pl. 1.

Diameter 15 µm ($n = 1$) (Figure 10f).

CYCLOSTEPHANOS F.E.Round 1987

***Cyclostephanos* sp.**

Diameter 23 µm ($n = 1$) (Figure 10d).

Remark: According to [27], the distinctive characteristics of this genus are—circular valves with concentric undulations and spines around the margin; valves with radiating lines of areolae, grouped into fascicles around the margin and separated by raised, rounded ridges. The central region of the valve face variously has nodules or is plain. *Cyclostephanos* differs from *Cyclotella* in the extension of the rows of fascicles to the center of the valve and the presence of a single ring of spines around the valve face.

Order: Thalassiosirales Z.I. Glezer and I.V. Makarova 1986

Family: Thalassiosiraceae M.V. Lebour 1930

THALASSIOSIRA P.T. Cleve 1873

***Thalassiosira decipiens* (A. Grunow ex H. Van Heurck) E.G. Jørgensen 1905**

Ref. illus.: Navarro, J.N. 1982, p. 10, pl. 1, Figures 1 and 2; Moreno, J.L.; Licea, S.; Santoyo, H. 1996, p. 133, pl. 33, Figure 7.

Diameter 8–13 µm, areolae 9–14 in 10 µm ($n = 2$) (Figure 6f,g).

***Thalassiosira eccentrica* (C.G. Ehrenberg) P.T. Cleve 1904**

Ref. illus.: Hendey, N.I. 1964, p. 80, pl. 24, Figure 7; Navarro, J.N. 1982, p. 10, pl. 1, Figures 3 and 4; Moreno, J.L.; Licea, S.; Santoyo, H. 1996, p. 133, pl. 33, Figures 8 and 9.

Diameter 23 µm, areolae 8 in 10 µm ($n = 1$) (Figure 6e).

***Thalassiosira lineata* A.P. Jousé 1968**

Ref. illus.: Hasle, G.R.; Syvertsen, E.E. 1996, p. 80, pl. 10; Park, J.S.; Jung, S.W.; Lee, S.D.; Yun, S.M.; Lee, J.H. 2016, p. 410, Figure 19.

Diameter 21–22 µm, areolae 11–12 in 10 µm ($n = 2$) (Figure 6c,d).

***Thalassiosira leptopus* (A. Grunow) G.R. Hasle and G.A. Fryxell 1977**

Ref. illus.: Hasle, G.R.; Fryxell, G.A. 1977, Figures 1–14; Hasle, G.R.; Syvertsen, E.E. 1996, pl. 10; Moreno, J.L.; Licea, S.; Santoyo, H. 1996, p. 134, pl. 33, Figure 11.

Diameter 108 µm, areolae 4 in 10 µm ($n = 1$) (Figure 6a,b).

***Thalassiosira nanolineata* (A. Mann) G.A. Fryxell and G.R. Hasle 1977**

Ref. illus.: Mann, A. 1925, p. 68, pl. 14, Figure 4 (as *Coscinodiscus nano-lineatus*); Javeed, A.; Salleh, S.; Darif, A.; Mohammad, M. 2018, p. 8, Figure 2.

Diameter 19 µm, areolae 11 in 10 µm ($n = 1$) (Figure 7h–j).

Order: Plagiogrammales E.J. Cox 2015

Family: Plagiogrammaceae G. De Toni 1890

DIMEREGRAMMA J. Ralfs 1861

***Dimeregramma fulvum* (W. Gregory) J. Ralfs 1861 *†**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 28, pl. 11, Figures 1 and 2.

Size: 43 µm long, 8 µm broad, 9 to 10 striae in 10 µm ($n = 1$) (Figure 17c,d).

***Dimeregramma minor* (W. Gregory) J. Ralfs 1861**

Ref. illus.: Hendey, N.I. 1964, p. 156, pl. 27, Figure 12; Navarro, J.N. 1982, p. 34, pl. 11, Figures 1–3; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 29, pl. 11, Figures 3–9.

Size: 15–32 µm long, 7 to 8 µm broad, 9 to 10 striae in 10 µm ($n = 3$) (Figure 17e–j).

TALARONEIS W.H.C.F. Kooistra and M. De Stefano 2004

PLAGIOPRAGMMA R.K. Greville 1859

Talaroneis sp.

Ref. illus.: Navarro, J.N. 1982, p. 23, pl. 13, Figures 1 and 2; López-Fuerte, F.O.; Siqueiros Beltrones, D.A.; Navarro, J.N. 2010, p. 19, pl. 13, Figures 4–7 (both as *Plagiogramma interruptum*).

Size: 25–38 µm long, 5–6 µm broad, 20 striae in 10 µm ($n = 2$) (Figure 16a–c).

Remark: This taxon shows the combined characteristics of *Plagiogramma* and *Talaroneis*, but it is quite different from both of the three described species of the latter [32,33]. *Plagiogramma interruptum* in [34] on the other hand, is very similar to our specimen, structurally and morphometrically. In [33], the diagnostic characters of *Talaroneis* are: pores in an apical pore field, round two silica flaps parallel to the valve margin proximal to the apical pore fields. While [9] exhibits *Talaroneis* sp. (Figures 9 and

10) that appears identical to our specimens, albeit thinner, but with clear subapical furrows as in ours that, in contrast with other described species of *Talaroneis*, show a stauros and apparent septa in the central area. The authors of [9] suggest that *Talaroneis* sp., may be a new species; in our case given the similarity with *P. interruptum* as in [34], p. 23, pl. 13, Figures 1, 2 and [35], p. 19, pl. 13, Figures 4–7, a review at the species and genus level may be required.

GLYPHODESMIS R.K. Greville 1862

Glyphodesmis rhombica (P.T. Cleve) R. Simonsen 1974 *

Ref. illus.: Mann, A. 1925, p. 78, pl. 16, Figures 2 and 3 (as *G. acus*); Simonsen, R. 1974, p. 35, pl. 23, Figure 1; Foged, N. 1978, p. 67, pl. 7, Figure 20.

Size: 26–48 µm long, 9 to 10 µm broad, 14 to 15 striae in 10 µm ($n = 3$) (Figure 25a–j).

Order: Triceratiales F.E. Round and R.M. Crawford 1990

Family: Triceratiaceae (F. Schütt) E. Lemmermann 1899

RALFSIELLA P.A. Sims, D.M. Williams and M. Ashworth 2018

Ralfsiella smithii (J. Ralfs) P.A. Sims, D.M. Williams and M. Ashworth 2018

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, p. 398, pl. 112, Figures 4 and 5; Hustedt, F. 1930, p. 861, Figure 513 (all as *Cerataulus smithii*); Sims, P.A., Williams, D.M.; Ashworth, M. 2018, p. 42, Figures 148–151.

Diameter 44 µm, 9 to 10 areolae in 10 µm ($n = 1$) (Figure 11g–j).

TRICERATIUM C.G. Ehrenberg 1839

Triceratium balearicum f. *biquadrata* (C. Janisch) F. Hustedt 1930

Ref. illus.: Schmidt, A.W.F. 1886, pl. 98, Figures 4–6; Hustedt, F. 1930, p. 815, Figure 477.

Size: 33–86 µm long ($n = 6$) (Figure 15c–g).

CLASS: FRAGILARIOPHYCEAE F.E. Round 1990

Order: Ardissonales F.E. Round 1990

Family: Ardissonaceae F.E. Round 1990

ARDISSONEA G. De Notaris 1870

Ardissonea formosa (C.A. Hantzsch) A. Grunow 1880

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 43, pl. 30, Figure 12.

Size: 331 µm long, 18–20 µm broad, 9 striae in 10 µm ($n = 2$) (Figure 18a).

Order: Climacospheniales F.E. Round 1990

Family: Climacospheniaceae F.E. Round 1990

CLIMACOSPHENIA C.G. Ehrenberg 1841

Climacosphenia elongata J.W. Bailey 1854

Ref. illus.: Round, F.E. 1982, Figures 4–6, 14; Stidolf, S.R.; Sterrengurg, F.A.S.; Smith K.E.L.; Kraberg, A. 2012, pl. 7, Figure 152, pl. 16, Figure 93; Al-Handal, A.Y.; Compère, P.; Riaux-Gobin, C. 2016, p. 12, pl. 6, Figures 1 and 2.

Size: 300 µm long, 18 µm broad, striae 36 in 10 µm ($n = 1$) (Figure 18b).

Order: Cyclophorales F.E. Round and R.M. Crawford 1990

Family Cyclophoraceae F.E. Round and R.M. Crawford 1990

CYCLOPHORA F. Castracane 1878

Cyclophora tenuis F. Castracane 1878

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, pl. 1, Figures 27–32; Navarro, J.N. 1982, Figures 9–17; Navarro, J.N.; Lobban, C.S. 2009, Figures 59 and 60; Lobban, C.S.; Jordan, R.W. 2010, Figure 5b; Ashworth, M.P.; Ruck, E.C.; Lobban, C.S.; Romanovicz, D.K.; Theriot, E.C. 2012, p. 686, Figures 1, 5, 6 and 14–18.

Size: 52 µm long, 12 µm broad, striae not resolvable ($n = 1$) (Figure 37i).

Order: Fragilariales P.C. Silva 1962

Family: Fragiliaceae R.K. Greville 1833

OPEPHORA P. Pettit 1888

***Opephora pacifica* (A. Grunow) P. Pettit 1888**

Ref. illus.: 1995, p. 244, Figures 45–53; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000 p. 72, pl. 25, Figures 18–26; Al-Handal, A.Y.; Compère, P.; Riaux-Gobin, C. 2016, p.8, pl. 4, Figures 12 and 13.

Size: 15–23 µm long, 5 to 6 µm broad, striae 9 in 10 µm ($n = 2$) (Figure 16a–c).

GEDANIELLA Chunlian Li, A. Witkowski and M.P. Ashworth 2018

***Gedaniella mutabilis* Chunlian Li and A. Witkowski, nom. illeg. 2018**

Ref. illus.: Sabbe, K.; Vyverman, W. 1995, p. 241, Figures 13–28; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 72, pl. 25, Figures 10–17; Al-Handal, A.Y.; Compère, P.; Riaux-Gobin, C. 2016, p. 7, pl. 4, Figure 11.

Size: 15 µm long, 4 µm broad, striae 9 in 10 µm ($n = 1$) (Figure 16k).

STAUROSIRELLA D.M. Williams and F.E. Round 1987

***Staurosirella guenter-grassii* (A. Witkowski and H. Lange-Bertalot) E.A. Morales, C.E. Wetzel and L. Ector 2019 ***

Ref. illus.: Sabbe, K.; Vyverman, W. 1995, p. 2, Figures 29–42, 66–71; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 70, pl. 24, Figures 40–44 (both as *Opephora guenter-grassii*).

Size: 8 µm long, 3 µm broad, striae 14 in 10 µm ($n = 1$) (Figure 16l).

SYNEDRA C.G. Ehrenberg 1830

***Synedra gaillonii* var. *macilenta* cf. (A. Grunow) H. Peragallo 1881 ***

Ref. illus.: Van Heurck, H. 1881, pl. 40, Figure 1.

Size: 139–148 µm long, 8 µm broad ($n = 2$) (Figure 20a,b).

***Synedra tabulata* var. *rostrata* (H. Juhlin-Dannfelt) A. Cleve-Euler 1953 ***

Ref. illus.: Juhlin-Dannfelt, H. 1882, p. 43, pl. 3, Figures 29 and 31 (as *S. affinis* var. *rostrata*); Cleve-Euler, A. 1953, p. 71, Figure 392g–h (as *S. tabulata* Λ *hybrida*).

Size: 33–38 µm long, 4 to 5 µm broad, striae 15 to 16 in 10 µm ($n = 3$) (Figure 20m–o).

HYALOSYNEDRA D.M. Williams and F.E. Round 1986

***Hyalosynedra laevigata* (A. Grunow) D.M. Williams and F.E. Round 1986**

Ref. illus.: Foged, N. 1984, p. 97, pl. 28, Figure 13; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 62, pl. 17, Figure 22; pl. 29, Figures 6–10; pl. 30, Figures 30–23.

Size: 204 µm long, 6 µm broad, striae not resolvable ($n = 1$) (Figure 20c).

FRAGILARIA H.C. Lyngbye 1819

***Fragilaria barbatula* (F.T. Kützing) H. Lange-Bertalot 1993**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 79, pl. 30, Figures 13 and 14 (as *Synedra barbatula*).

Size: 35–73 µm long, 4–7 µm broad, striae 18–20 in 10 µm ($n = 7$) (Figure 20j,p,q).

TABULARIA (F.T. Kützing) D.M. Williams and F.E. Round 1986

***Tabularia fasciculata* (C.A. Agardh) D.M. Williams and F.E. Round 1986**

Ref. illus.: Williams, D.M.; Round, F.E. 1986, p. 326; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 80, pl. 30, Figures 4 and 5 (as *Synedra fasciculata*).

Size: 30 µm long, 5 µm broad, striae 17 to 18 in 10 µm ($n = 1$) (Figure 20l).

***Tabularia investiens* (W. Smith) D.M. Williams and F.E. Round 1986**

Ref. illus.: Cleve-Euler, A. 1953, p. 44, Figure 354a–d (as *Fragilaria investiens*); Williams, D.M.; Round, F.E. 1986, p. 324, Figures 39–45.

Size: 45 µm long, 3 to 4 µm broad, striae 8 to 9 in 10 µm ($n = 2$) (Figure 20g,h,k).

***Tabularia parva* (F.T. Kützing) D.M. Williams and F.E. Round 1986**

Ref. illus.: Williams, D.M.; Round, F.E. 1986, Figures 33–38; Lobban, C.S.; Scheffer, M. 2012, p. 257, pl. 13, Figures 6 and 7.

Size: 35–55 µm long, 4–7 µm broad, striae 18–20 in 10 µm ($n = 4$) (Figure 20i).

***Tabularia tabulata* (C.A. Agardh) P.J.M. Snoeijs 1992**

Ref. illus.: Snoeijs, P.J.M. 1992, p. 343, Figures 38–48; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 81, pl. 30, Figures 1 and 2 (as *Syndra tabulata* var. *tabulata*).

Size: 113–134 µm long, 5 µm broad, striae 12 in 10 µm ($n = 3$) (Figure 20d–f).

Order: Licmophorales F.E. Round 1990

Family: Licmophoraceae F.T. Kützing 1844

LICMOPHORA C.A. Agardh 1827

***Licmophora abbreviata* C.A. Agardh 1831**

Ref. illus.: Hustedt F. 1931–1959, p. 66, Figure 590; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 63, pl. 20, Figures 3–5.

Size: 87 µm long, 21 µm perivalvar axis, striae 16 in 10 µm ($n = 1$) (Figure 19h).

***Licmophora ehrenbergii* (F.T. Kützing) A. Grunow 1867**

Ref. illus.: Hustedt, F. 1931–1959, p. 70, Figure 593; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 64, pls. 18, Figure 11; pl. 20, Figure 16.

Size: 72–145 µm long, 25–31 µm broad, striae 10–12 in 10 µm ($n = 2$) (Figure 19a,b).

***Licmophora gracilis* var. *anglica* (F.T. Kützing) H. Peragallo and M. Peragallo 1901**

Ref. illus.: Peragallo, H.; Peragallo, M. 1901, p. 346, pl. 84. Figure 13; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 65, pl. 20, Figures 11–13.

Size: 23–28 µm long, 5 µm broad, striae 24 in 10 µm ($n = 2$) (Figure 19f,g).

***Licmophora paradoxa* (H.C. Lyngbye) C.A. Agardh 1828**

Ref. illus.: Hustedt F. 1931–1959, p. 76, Figure 605; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 67, pl. 18, Figures 4–10.

Size: 69–75 µm long, 8 µm broad, striae 16 in 10 µm ($n = 2$) (Figure 19c,d).

***Licmophora pfannkuchae* M.H. Giffen 1970**

Ref. illus.: Giffen, M.H. 1970, p. 278, Figures 41 and 42; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 67, pls. 18, Figure 6.

Size: 108–119 µm long, 6–8 µm broad, striae 23 in 10 µm ($n = 2$) (Figure 19e).

Order: Rhabdonematales F.E. Round and R.M. Crawford 1990

Family: Rhabdonemataceae F.E. Round and R.M. Crawford 1990

HYALOSIRA F.T. Kützing 1844

***Hyalosira tropicalis* J.N. Navarro 1991**

Ref. illus.: Navarro, J.N.; Williams, D.M. 1991, p. 328, Figures 1–14; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 62, pl. 21, Figures 16 and 17.

Size: 11 to 12 µm long, 3–5 µm broad, striae 22–25 in 10 µm ($n = 2$) (Figure 19i–k).

RHABDONEMA F.T. Kützing 1844

***Rhabdonema adriaticum* F.T. Kützing 1844**

Ref. illus.: Hustedt, F. 1931–1959, p. 23, Figure 552; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 76, pl. 13, Figures 10–12.

Size: 135–169 µm long, striae 10 in 10 µm ($n = 2$) (Figure 16m,n).

Order: Rhaphoneidales F.E. Round 1990

Family: Psammodiscaceae F.E. Round and D.G. Mann 1990

PSAMMODISCUS F.E. Round and D.G. Mann 1980

***Psammodiscus nitidus* (W. Gregory) F.E. Round and D.G. Mann 1980**

Ref. illus.: Hustedt, F. 1930, p. 414, Figure 221 (as *Coscinodiscus nitidus*); Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 75, pl. 23, Figures 12–14.

Diameter 31 µm, areolae 5 in 10 µm ($n = 1$) (Figure 10e).

Family: Rhaphoneidaceae A. Forti 1912

DELPHINEIS G.W. Andrews 1977

***Delphineis minutissima* (F. Hustedt) R.R. Simonsen 1987**

Ref. illus.: Hustedt, F. 1939, p. 599, Figures 14 and 15; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 45, pl. 22, Figures 11–14.

Size: 17 µm long, 8 µm broad, striae 13 in 10 µm ($n = 1$) (Figure 17k).

Family: Ulnariaceae E.J. Cox 2015

FALCULA M. Voigt 1960

***Falcula media* M. Voigt 1960**

Ref. illus.: Voigt, M. 1960, p. 87; pl. 1, Figures 6–8; pl. 2, Figures 6–10.

Size: 63–69 µm long, 7 to 8 µm broad ($n = 3$) (Figure 17a,b).

Order: Striatellales F.E. Round 1990

Family: Striatellaceae F.T. Kützing 1844

GRAMMATOPHORA C.G. Ehrenberg 1840

***Grammatophora hamulifera* F.T. Kützing 1844**

Ref. illus.: Hustedt, F. 1931–1959, p. 40, Figure 566.

Size: 25 µm long, 6 µm broad, striae 16 in 10 µm ($n = 4$) (Figure 21l,n–r).

***Grammatophora macilenta* W. Smith 1856**

Ref. illus.: Hustedt, F. 1931–1959, p. 47, Figure 574; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 58, pl. 15, Figures 16–18.

Size: 98–108 µm long, 8 µm broad, striae 22 in 10 µm ($n = 7$) (Figure 20r and Figure 21a,b).

***Grammatophora marina* (H.C. Lyngbye) F.T. Kützing 1844**

Ref. illus.: Hustedt, F. 1931–1959, p. 43, Figure 569; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 58, pl. 15, Figures 9–12.

Size: 17–77 µm long, 5 to 6 µm broad, pervalvar axis 16–42 µm, striae 15–20 in 10 µm ($n = 14$) (Figure 21k).

***Grammatophora oceanica* C.G. Ehrenberg 1840**

Ref. illus.: Hustedt, F. 1931–1959, p. 45, Figure 573; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 59, pl. 15, Figures 13–14; pl. 16, Figure 12; pl. 17, Figures 3 and 4.

Size: 57–62 µm long, pervalvar axis 6 µm, striae 3 in 10 µm ($n = 3$) (Figure 21c–f,j).

***Grammatophora undulata* var. *gallopagensis* A. Grunow**

Ref. illus.: Van Heurck, H. 1880–1881, pl. 53, Figure 20; López-Fuerte, F.O.; Siqueiros Beltrones, D.A.; Jakes-Cota U.; Tripp-Valdés, A. 2019, p.103, Figure 2h,i.

Size: 49–116 µm long, 8–10 µm broad, striae 27 to 28 in 10 µm ($n = 5$) (Figure 21g–i,m).

Order: Toxariales F.E. Round 1990

Family: Toxariaceae F.E. Round 1990

TOXARIUM J.W. Bailey 1854

***Toxarium undulatum* J.W. Bailey 1854**

Ref. illus.: Hustedt, F. 1931–1959, p. 224, Figure 714; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 83, pl. 31, Figures 5 and 6.

Size: 400 µm long, 3–8 µm broad, striae 10–12 in 10 µm ($n = 3$) (Figure 18c,d).

CLASS: BACILLARIOPHYCEAE E. Haeckel 1878

Order: Achnanthales P.C. Silva 1962

Family: Achnanthaceae F.T. Kützing 1844

ACHNANTHES J.B.G.M. Bory de Saint-Vincent 1822

***Achnanthes* cf. *fimbriata* (A. Grunow) R. Ross 1963**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 88, pls. 51, Figures 9 and 10; Siqueiros Beltrones, D.A.; Argumedo-Hernández, U.; López-Fuerte, F.O. 2017, p. 32, Figure 5b.

Size: 26–50 µm long, 14–16 µm broad, striae 12–16 in 10 µm ($n = 2$) (Figure 22j,l,m).

***Achnanthes citronella* (A. Mann) F. Hustedt 1937**

Ref. illus.: Riaux-Gobin, C. 2015, p. 104, Figures 15–17, 25, 26, 33, 35–38.

Size: Long, sternum valve 35–40 µm, raphe valve 41 µm. Broad; sternum valve 18–19 µm, raphe valve 20–22 µm. Striae, sternum valve 11 in 10 µm, raphe valve 17–20 in 10 µm ($n = 7$) (Figure 22a–i).

***Achnanthes groenlandica* var. *phinneyi* C.D. McIntire and C.W. Reimer 1974**

Ref. illus.: McIntire, C.D.; Reimer, C.W. 1974, p. 172, pl. 2, Figure 3a–c; pl. 3, Figure 3a,b; Majewska, R.; De Stefano, M.; Ector, L.; Bolaños, F.; Frankovich, T.A.; Sullivan, M.J.; Ashworth, M.P.; Van de Vijver, B. 2017, p. 314, Figures 100–109.

Size: 43–54 µm long, 7 µm broad, striae 10 to 11 in 10 µm ($n = 2$) (Figure 22p,q).

***Achnanthes parvula* F.T. Kützing 1844**

Ref. illus.: Hustedt, F. 1931–1959, p. 426, Figure 877f–i (as *A. brevipes* var. *parvula*); Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 93, pl. 43, Figures 6 and 7; pl. 45, Figures 6–8, pl. 47, Figure 9. Size: 16–21 µm long, 4–6 µm broad, striae 10 to 11 in 10 µm ($n = 2$) (Figure 22n,o,u).

***Achnanthes pseudogroenlandica* N.I. Hendey 1964**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 94, pl. 44, Figures 16–23; Majewska, R.; De Stefano, M.; Ector, L.; Bolaños, F.; Frankovich, T.A.; Sullivan, M.J.; Ashworth, M.P.; Van de Vijver, B. 2017, p. 314, Figures 110–136.

Size: 25 µm long, perivalvar axis 7 µm, striae 8 to 9 in 10 µm ($n = 1$) (Figure 22r,t).

***Achnanthes subconstricta* (M. Meister) K. Toyoda 2003 ***

Ref. illus.: Toyoda, K.; Nagumo, T.; Osada, K.; Tanaka, J. 2003, p. 369; Lee, S.D.; Park, J.S.; Lee, J.H. 2011, p. 4, Figure 2G,N, Figure 5B–F.

Size: 38–75 µm long, 14 µm broad, striae 5–7 in 10 µm ($n = 2$) (Figure 22k–v).

***Achnanthes yaquinensis* C.D. McIntire and R.W. Reimer 1974**

Ref. illus.: McIntire, C.D.; Reimer, R.W. 1974, p. 174, pls. 2, Figure 1a,b, pl. 3, Figure 1a,b.

Size: 44 µm long, 10 µm broad, striae 9 to 10 in 10 µm ($n = 1$) (Figure 22s).

AMPHICOCCONEIS M. De Stefano and D. Marino 2002

***Amphicocconeis discrepans* (A.W.F. Schmidt) C. Riaux-Gobin, A. Witkowski, L. Ector and A. Iggersheim 2018**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 106, pl. 41, Figures 35–40; pl. 42, Figures 26 and 27 (as *Cocconeis discrepans*); Riaux-Gobin, C., Ector, L., Witkowski, A. and Iggersheim, A. 2018, p. 576, Figures 9–22.

Size: 19 µm long, 8 µm broad, striae 14 in 10 µm ($n = 1$) (Figure 25v).

***Amphicocconeis disculoides* (F. Hustedt) M. De Stefano and D. Marino 2003**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 106, pl. 42, Figures 28–33 (as *Cocconeis disculoides*); De Stefano, M.; Marino, D. 2003, p. 362, Figures 1–32.

Size: 15–16 µm long, 8 µm broad, striae 9–11 in 10 µm ($n = 2$) (Figure 23s,t).

ASTARTIELLA A. Witkowski, H. Lange-Bertalot and D. Metzeltin 1998

***Astartiella bahusiensis* (A. Grunow) A. Witkowski, H. Lange-Bertalot and D. Metzeltin 1998 ***

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Stachura, K. 1998, p. 359, Figure 80: 1–3; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 99, pl. 52, Figures 22–31.

Size: 18 µm long, 8 µm broad, striae 24 in 10 µm ($n = 1$) (Figure 17p).

KARAYEVIA F.E. Round and L. Bukhtiyarova 1998

***Karayevia amoena* (F. Hustedt) L. Bukhtiyarova 1999**

Ref. illus.: Chang, T.P. 1992, p. 401, Figures 3a–d, 4a–h, 5a–i; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 85, pl. 51, Figures 34–36 (both as *Achnanthes amoena*).

Size: 12 µm long, 5 µm broad, sternum valve striae 18–19 in 10 µm, raphe valve 26 in 10 µm ($n = 5$) (Figure 17m–o).

PLANOTHIDIUM F.E. Round and L. Bukhtiyarova 1996

***Planothidium campechianum* (F. Hustedt) A. Witkowski, H. Lange-Bertalot and D. Metzeltin 2000**

Ref. illus.: Hustedt, F. 1952, p. 389, Figures 87–90 (as *Achnanthes campechianum*); Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 118, pl. 48, Figures 3–9.

Size: 26 µm long, 8 µm broad, striae 16 in 10 µm ($n = 1$) (Figure 25s).

***Planothidium delicatulum* (F.T. Kützing) F.E. Round and L. Bukhtiyarova 1996 ***

Ref. illus.: Hustedt, F. 1931–1959, p. 389, Figure 836 (as *Achnanthes delicatula*); Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 118, pl. 46, Figures 28 and 29; pl. 48, Figures 1 and 2.

Size: 17–21 µm long, 9–10 µm broad, sternum valve striae 9 in 10 µm, raphe valve 11 in 10 µm ($n = 2$) (Figure 25q,t,u).

***Planothidium hauckianum* (A. Grunow) F.E. Round and L. Bukhtiyarova 2008**

Ref. illus.: Hustedt, F. 1931–1959, p. 388, Figure 834 (as *Achnanthes hauckiana*); Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 120, pl. 48, Figures 39–41.

Size: 14–21 µm long, 6 to 7.5 µm broad, striae 10 to 11 in 10 µm ($n = 5$) (Figure 25w).

***Planothidium lilljeborgei* (A. Grunow) A. Witkowski, H. Lange-Bertalot and D. Metzeltin 2000**

Ref. illus.: Hustedt, F. 1931–1959, p. 394, Figure 843 (as *Achnanthes lilljeborgei*); Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 121, pl. 49, Figure 1; pl. 51, Figures 27–29.

Size: 20 µm long, 7 µm broad, striae 10 in 10 µm ($n = 1$) (Figure 25p).

***Planothidium polare* (E. Østrup) A. Witkowski, H. Lange-Bertalot and D. Metzeltin 2000**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 123, pl. 47, Figures 1–4; pl. 49, Figures 37–39 (as *P. polaris*).

Size: 42 µm long, 14 µm broad, striae 14 in 10 µm ($n = 1$) (Figure 25r).

Family: Coccconeidaceae F.T. Kützing 1844

COCCONEIS C.G. Ehrenberg 1838

***Coccconeis californica* A. Grunow 1880**

Ref. illus.: Hustedt, F. 1931–1959, p. 343, Figure 796; Poulin, M.; Berard-Therriault, L.; Cardinal, A. 1984, p. 49, Figures 5–11.

Size: 10–16 µm long, 5–10 µm broad, striae 15–17 in 10 µm ($n = 5$) (Figure 23q,r).

***Coccconeis contermina* A.W.F. Schmidt 1894**

Ref. illus.: Schmidt, A.W.F. 1894, pl. 196, Figure 21; Siqueiros Beltrones, D.A.; Argumedo Hernández, U.; Landa Cansigno, C. 2016, p. 70, Figure 59.

Size: 38 µm long, 28–30 µm broad, striae 15–17 in 10 µm ($n = 2$) (Figure 24c–f).

***Coccconeis convexa* M.H. Giffen 1967**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 104, pls. 37, Figures 5 and 6; pl. 41, Figures 1–4. Sar, E.A.; Romero, O.E.; Sunesen, I. 2003, p. 81, Figures 2–6.

Size: 18–28 µm long, 12–22 µm broad, sternum valve striae 28–47 in 10 µm, raphe valve 22 in 10 µm ($n = 4$) (Figure 24g–j).

***Coccconeis dirupta* W. Gregory 1857**

Ref. illus.: Kobayasi H.; Nagumo, T. 1985, p. 99, Figure 2: 16–27; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 105, pls. 39, Figures 1–5; pl. 51, Figures 5 and 8.

Size: 15–62 µm long, 8–47 µm broad, sternum valve striae 18–27 in 10 µm, raphe valve striae 18–24 in 10 µm ($n = 18$) (Figure 23a–g).

***Coccconeis guttata* F. Hustedt and A.A. Aleem 1951**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 108, pl. 40, Figures 13–18; Sar, E.A.; Romero, O.E.; Sunesen, I. 2003, p. 86, Figures 16–21.

Size: 23–30 µm long, 15–18 µm broad, sternum valve striae 6 to 7 in 10 µm ($n = 2$) (Figure 24o,p).

***Coccconeis heteroidea* C.A. Hantzsch 1863**

Ref. illus.: Hustedt, F. 1931–1959, p. 356, Figure 811; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 108, pl. 35, Figures 4 and 5.

Size: 38–45 µm long, 28–31 µm broad, sternum valve striae 23–26 in 10 µm, raphe valve striae 20 in 10 µm ($n = 2$) (Figure 23k–m).

***Coccconeis krammeri* H. Lange-Bertalot and D. Metzeltin 1996**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 109, pl. 33, Figures 1–5; pl. 34, Figures 4 and 5; pl. 42, Figure 34.

Size: 22–27 µm long, 18–14 µm broad, sternum valve striae 25–30 in 10 µm, raphe valve striae 23–28 in 10 µm ($n = 2$) (Figure 24k–n).

***Coccconeis lineata* C.G. Ehrenberg 1849**

Ref. illus.: Ehrenberg, C.G. 1849, p. 301, pl. 5, Figure 44; p. 4, Romero, O.; Jahn, R. 2013, Figures 1–8.

Size: 55 µm long, 44 µm broad, striae 17 to 18 in 10 µm ($n = 1$) (Figure 24a,b).

***Cocconeis peltoides* F. Hustedt 1939**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 112, pl. 38, Figures 1–9; Sar, E.A.; Romero, O.E.; Sunesen, I. 2003, p. 91, Figures 34–41.

Size: 15–21 µm long, 9–12 µm broad, sternum valve striae 13 in 10 µm ($n = 2$) (Figure 25m,n).

***Cocconeis pseudomarginata* W. Gregory 1857**

Ref. illus.: Hustedt, F. 1931–1959, p. 359, Figure 813; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 113, pl. 34, Figures 8 and 9; pl. 35, Figures 1–4.

Size: 42–56 µm long, 32–36 µm broad, sternum valve striae 19–22 in 10 µm, raphe valve striae 19 in 10 µm ($n = 2$) (Figure 24q–t).

***Cocconeis scutellum* C.G. Ehrenberg 1838**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 114, pl. 36, Figures 1–7; pl. 38, Figure 11; Sar, E.A.; Romero, O.E.; Sunesen, I. 2003, p. 95, Figures 44–50.

Size: 29 to 30 µm long, 18 µm broad, sternum valve striae 8 in 10 µm, raphe valve striae 10–12 in 10 µm ($n = 5$) (Figure 25k,l).

***Cocconeis scutellum* var. *parva* (A. Grunow) P.T. Cleve 1895**

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, p. 20, pl. 4, Figure 3; Poulin, M.; Berard-Theriault, L.; Cardinal, A. 1984, p. 56, Figures 49–53.

Size: 12–16 µm long, 6–9 µm broad, sternum valve striae 13–16 in 10 µm, raphe valve striae 12 to 13 in 10 µm ($n = 30$) (Figure 23n–p).

Order: Bacillariales N.I. Hendey 1937

Family: Bacillariaceae C.G. Ehrenberg 1831

BACILLARIA J.F. Gmelin 1791

***Bacillaria socialis* (W. Gregory) J. Ralfs 1861**

Ref. illus.: Poulin, M.; Berard-Theriault, L.; Cardinal, A. 1984, p. 75, Figures 2–4, 8; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 357, pl. 196, Figures 5–7; pl. 207, Figure 9.

Size: 57–156 µm long, 7 to 8 µm broad, fibulae 6 to 7 in 10 µm, striae 14 to 15 in 10 µm ($n = 9$) (Figure 44a,y,z).

CYMBELLONITZSCHIA F. Hustedt 1924***Cymbellonitzschia banzuensis* J.G. Stepanek, S.E. Hamsher, S. Mayama, D.H. Jewson and J.P. Kociolek 2016**

Ref. illus.: Stepanek, J.G., Hamsher, S.E., Mayama, S., Jewson, D.H. and Kociolek, J.P. 2016, p. 28, Figures 1–22.

Size: 15–38 µm long, 2 to 3 µm broad, fibulae 7–9 in 10 µm, striae 15–17 in 10 µm ($n = 5$) (Figure 44n–r).

CYLINDROTHECA L. Rabenhorst 1859***Cylindrotheca closterium* (C.G. Ehrenberg) B.E.F. Reimann and J.C. Lewin 1964**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 374, pl. 212, Figures 4–6.

Size: 112–223 µm long, 7–12 µm broad, fibulae 12–37 in 10 µm ($n = 2$) (Figure 45j).

FRAGILARIOPSIS F. Hustedt 1913***Fragilariopsis doliolus* (G.C. Wallich) L.K. Medlin and P.A. Sims 1993**

Ref. illus.: Hasle, G.R.; Syvertsen, E.E. 1996, p. 303, Figure 69; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 360, pl. 213, Figures 38 and 39.

Size: 50–65 µm long, 8 µm broad, striae 11 in 10 µm ($n = 5$) (Figure 25o).

HANTZSCHIA A. Grunow 1877

***Hantzschia marina* (A.S. Donkin) A. Grunow 1880**

Ref. illus.: Krammer, K.; Lange-Bertalot, H. 1988, p. 132, pl. 93, Figures 1–3; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 363, pl. 178, Figures 9–11.

Size: 32–86 µm long, 5–8 µm broad, fibulae 4–6 in 10 µm, striae 7 to 8 in 10 µm ($n = 2$) (Figure 45d–g).

NAGUMOEA J.P. Kocielek and A. Witkowski 2011

***Nagumoea vallis* (V.A. Nikolaev) R. Majewska and B. Van de Vijver 2020 ***

Ref. illus.: Nikolaev, V.A. 1969, p. 30, pl. 1, Figures 3–8 (as *Anaulus vallis*); Sullivan, M.J. 2010, p. 175, Figures 1, 2, 4–6, 7 and 8 (as *Denticula vallis*).

Size: 16–20 µm long, 2 µm broad, fibulae 5 in 10 µm ($n = 2$) (Figure 17r).

NITZSCHIA A.H. Hassall 1845

***Nitzschia agnita* F. Hustedt 1957**

Ref. illus.: Krammer, K.; Lange-Bertalot, H. 1988, p. 117, Figure 82: 1–5; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 367, pl. 210, Figures 22 and 23.

Size: 23 µm long, 5 µm broad, fibulae 17 in 10 µm ($n = 1$) (Figure 44m).

***Nitzschia amabilis* H. Suzuki 2010**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 387, pl. 189, Figures 13–15, pl. 190, Figures 1–6 (as *Nitzschia laevis*); Suzuki, H.; Nagumo, T.; Tanaka, J. 2010, p. 223, Figure 1.

Size: 8–12 µm long, 4 to 5 µm broad, fibulae 10–14 in 10 µm ($n = 2$) (Figure 44u,v).

***Nitzschia angularis* W. Smith 1853**

Ref. illus.: Hendey, N.I. 1964, p. 281, Figure 39: 6; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 368, pl. 199, Figures 5 and 6.

Size: 142 to 143 µm long, 13–15 µm broad, fibulae 4 in 10 µm ($n = 2$) (Figure 44f,g).

***Nitzschia bicapitata* P.T. Cleve 1901**

Ref. illus.: Fryxell, G. 2000, p. 46, Figures 1–11.

Size: 24 µm long, 5 µm broad, fibulae 12 in 10 µm, striae 25 in 10 µm ($n = 2$) (Figure 44k,l).

***Nitzschia carnicobarica* T.V. Desikachary and P. Prema 1987**

Ref. illus.: Desikachary, T.V.; Prema, P. 1987, p. 8, Figure 304: 5; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 373, pl. 183, Figures 9 and 10.

Size: 28–38 µm long, 8–11 µm broad, fibulae 11–12 in 10 µm ($n = 3$) (Figure 42m,n and Figure 43l).

***Nitzschia composita* M.H. Giffen 1971 ***

Ref. illus.: Giffen, M.H. 1971, p. 8, Figures 42 and 43; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 376, pl. 211, Figure 12.

Size: 42–45 µm long, 7 µm broad, fibulae 9–11 in 10 µm ($n = 2$) (Figure 45o,p).

***Nitzschia costata* J. Pantocsek 1892 ***

Ref. illus.: Pantocsek, J. 1892, pl. 41, Figure 566.

Size: 128 µm long, 7–9 µm broad, costae 5 in 10 µm ($n = 1$) (Figure 45s).

***Nitzschia distans* W. Gregory 1857**

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, p. 283, pl. 73, Figure 3; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 378, pl. 203, Figures 7–9.

Size: 69 µm long, 7 µm broad, fibulae 4 in 10 µm ($n = 1$) (Figure 44x).

***Nitzschia frustulum* (F.T. Kützing) A. Grunow 1880**

Ref. illus.: Krammer, K.; Lange-Bertalot, H. 1988, p. 94, pl. 68, Figures 1–9; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 382, pl. 209, Figures 13–17.

Size: 7–15 μm long, 2 μm broad, fibulae 10–16 in 10 μm ($n = 2$) (Figure 44s,t).

***Nitzschia fusiformis* A. Grunow 1880 ***

Ref. illus.: Lange-Bertalot, H.; Krammer, K. 1987, p. 20, pl. 28, Figures 4–10; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 382, pl. 197, Figures 17–20; pl. 198, Figures 1–3.

Size: 108 μm long, 5 μm broad, fibulae 10 to 11 in 10 μm , striae 24 in 10 μm ($n = 1$) (Figure 45a).

***Nitzschia gracilis* C.A. Hantzsch 1860**

Ref. illus.: Lange-Bertalot, H. 1988, p. 93, pl. 66, Figures 1–11.

Size: 46–62 μm long, 3 to 4 μm broad, fibulae 11 to 12 in 10 μm , striae 26 in 10 μm ($n = 3$) (Figure 43p,q).

***Nitzschia hybrida* A. Grunow 1880**

Ref. illus.: Krammer, K.; Lange-Bertalot, H. 1988, p. 61, pl. 46, Figures 3–6; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 385, pl. 191, Figures 12–14.

Size: 65–77 μm long, 5–8 μm broad, fibulae 5–8 in 10 μm ($n = 2$) (Figure 45k,m).

***Nitzschia incrassans* A. Grunow 1862 ***

Ref. illus.: Krammer, K.; Lange-Bertalot, H. 1988, p. 26, pl. 7, Figures 9 and 10a; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 386, pls. 203, Figures 1–3.

Size: 11–15 μm long, 4 to 5 μm broad, fibulae 5 to 6 in 10 μm ($n = 3$) (Figure 43t,u).

***Nitzschia incurva* var. *lorenziana* R. Ross 1986**

Ref. illus.: Krammer, K.; Lange-Bertalot, H. 1988, p. 125, pl. 86, Figures 6–10; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 392, pls. 210, Figures 24 and 25; pl. 211, Figure 3; pl. 212, Figures 1–3.

Size: 138 μm long, 7 μm broad, fibulae 7 in 10 μm , striae 18 in 10 μm ($n = 1$) (Figure 45h).

***Nitzschia insignis* W. Gregory 1857**

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, p. 295, pl. 75, Figure 5; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 387, pl. 202, Figure 5, pl. 204, Figures 1–7.

Size: 119 μm long, 8 μm broad, fibulae 2–5 in 10 μm , striae 10–14 in 10 μm ($n = 4$) (Figure 42d,e and Figure 45r).

***Nitzschia lanceolata* W. Smith 1853**

Ref. illus.: Krammer, K.; Lange-Bertalot, H. 1988, pl. 16, Figures 1–8; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 389, pl. 194, Figures 1–5.

Size: 69 μm long, 8 μm broad, fibulae 10 in 10 μm ($n = 1$) (Figure 45n).

***Nitzschia linearis* W. Smith 1853**

Ref. illus.: Hustedt, F. 1930, p. 409, Figure 784.

Size: 100 μm long, 5 μm broad, fibulae 8 in 10 μm ($n = 1$) (Figure 45l).

***Nitzschia longa* A. Grunow 1880**

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, p. 279, pl. 72, Figure 5; Stidolph, S.R.; Sterrenburg, F.A.S.; Smith, K.E.L.; Kraberg, A. 2012, pl. 25, Figure 84.

Size: 162 μm long, 8 μm broad, fibulae 4 in 10 μm , striae 12 to 13 in 10 μm ($n = 1$) (Figure 44b,c).

***Nitzschia longissima* (A. Brébisson) A. Pritchard 1861**

Ref. illus.: Pritchard, A. 1861, p. 783, pl. 4, Figure 23; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 391, pl. 207, Figures 6 and 7.

Size: 200–500 µm long, 5–8 µm broad, fibulae 6–10 in 10 µm ($n = 5$) (Figure 45i).

***Nitzschia martiana* (Agardh) H. Van Heurck 1896**

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, p. 282, pl. 72, Figure 20; Lobban, C.S.; Mann, D.G. 1987, p. 2397, Figures 1–13.

Size: 240–262 µm long, 3 to 4 µm broad, fibulae 5 to 6 in 10 µm ($n = 2$) (Figure 45t).

***Nitzschia sicula* (F. Castracane) F. Hustedt 1958**

Ref. illus.: Hasle, G.R.; Syvertsen, E.E. 1996, p. 327, pl. 75, Figures a–d.

Size: 30 µm long, 7 µm broad, striae and fibulae 10 in 10 µm ($n = 1$) (Figure 43r,s).

***Nitzschia sigma* (F.T. Kützing) W. Smith 1853**

Ref. illus.: Krammer, K.; Lange-Bertalot, H. 1988, pl. 23, Figures 1–9; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 404, pl. 206, Figures 1–10.

Size: 69–77 µm long, 6 to 7 µm broad, fibulae 9 in 10 µm, striae 30 in 10 µm ($n = 2$) (Figure 45b,c).

***Nitzschia spathulata* W. Smith 1853**

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, p. 284, pl. 53, Figure 4.

Size: 50–135 µm long, 5–8 µm broad, fibulae 6 to 7 in 10 µm ($n = 2$) (Figure 44h,w).

***Nitzschia cf. spectabilis* var. *americana* A. Grunow 1880 ***

Size: 121 µm long, 5 µm broad, fibulae 8 in 10 µm, striae 25 in 10 µm ($n = 1$) (Figure 45q).

***Nitzschia valdestriata* A.A. Aleem and F. Hustedt 1951**

Ref. illus.: Krammer, K.; Lange-Bertalot, H. 1997, p. 121, pl. 84, Figures 9–12; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 407, pls. 203, Figures 19–21; pl. 207, Figures 14–16.

Size: 17 µm long, 3 µm broad, fibulae 8 in 10 µm, striae 14 to 15 in 10 µm ($n = 1$) (Figure 44i,j).

TRYBLIONELLA W. Smith 1853***Tryblionella bathurstensis* (M.H. Giffen) D.G. Mann 1990 ***

Ref. illus.: Giffen, M.H. 1970, 287 (as *Nitzschia bathurstensis*); Mann, D.G. 1990, p. 678.

Size: 18 µm long, 8 to 9 µm broad, fibulae 12 to 13 in 10 µm, striae 22 in 10 µm ($n = 2$) (Figure 43e,f,i).

***Tryblionella coarctata* (A. Grunow) D.G. Mann 1990**

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, p. 268, pl. 69, Figures 26 and 27 (as *Nitzschia puncta* var. *coarctata*).

Size: 15–44 µm long, 7–16 µm broad, striae 12 in 10 µm ($n = 5$) (Figure 43a–d,g,h).

***Tryblionella hungarica* (A. Grunow) J. Frenguelli 1942**

Ref. illus.: Krammer, K.; Lange-Bertalot, H. 1988, p. 42, pl. 34, Figures 1–3; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 385, pl. 188, Figures 10 and 11 (as *Nitzschia hungarica*).

Size: 31–58 µm long, 6 to 7 µm broad, fibulae 10 to 11 in 10 µm, striae 22 in 10 µm ($n = 3$) (Figure 43j,k).

***Tryblionella lanceola* A. Grunow 1878**

Ref. illus.: Krammer, K.; Lange-Bertalot, H. 1988, pl. 38, Figures 11 and 12; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 388, pl. 212, Figures 13–17 (both as *Nitzschia lanceola*).

Size: 28 µm long, 8 µm broad, striae 9 to 10 in 10 µm ($n = 1$) (Figure 43n–o).

Order: Cymbellales D.G. Mann 1990

Family: Rhoicospheniaceae J. Chen and H. Zhu 1983

RHOICOSPHENIA A. Grunow 1860

***Rhoicosphenia abbreviata* (C.A. Agardh) H. Lange-Bertalot 1980**

Ref. illus.: Krammer, K.; Lange-Bertalot, H. 1986, p. 381, pl. 91, Figures 20–28; Witkowski, A.;

Lange-Bertalot, H.; Metzeltin, D. 2000, p. 345, pl. 212, pl. 58, Figures 4–7.

Size: 25 µm long, 4 µm broad, striae 16 to 17 in 10 µm ($n = 1$) (Figure 38p).

GOMPHOSEPTATUM L.K. Medlin 1986

***Gomphoseptatum aestuarii* (P.T. Cleve) L.K. Medlin 1986**

Ref. illus.: Medlin, L.K.; Round, F.E. 1986, p. 212, Figures 16–18; Witkowski, A.; Lange-Bertalot, H.;

Metzeltin, D. 2000, p. 222, pl. 61, Figures 17 and 18.

Size: 21 µm long, 3 µm broad, striae 14 to 15 in 10 µm ($n = 1$) (Figure 17l).

Order: Eunotiales P.C. Silva 1962

Family: Eunotiaceae F.T. Kützing 1844

COLLICULOAMPHORA D.M. Williams and G. Reid 2006

***Colliculoamphora reichardtiana* (A. Grunow) Williams and Reid 2006**

Ref. illus.: Williams, D.M., Reid, G. 2006, p. 153, Figures 11–19; Williams, D.M. 2016, p. 81, Figures 1–14.

Size: 15 µm long, 5 µm broad, striae 15 in 10 µm ($n = 1$) (Figure 17q).

Remark: Our specimen is slightly shorter and narrower than in the references; 17–52 µm long, 7–13 µm broad, and may be mistaken for *C. minima*, but the number of striae in 10 µm is 18 for this taxon.

Family: Lyrellaceae D.G. Mann 1990

LYRELLA N.I. Karayeva 1978

***Lyrella approximatooides* (F. Hustedt) D.G. Mann 1990**

Ref. illus.: Hustedt, F. 1930–1966, p. 426, Figure 1498; Foged, N. 1984, p. 60, pl. 49, Figure 1 (both as *Navicula approximatooides*).

Size: 58 µm long, 27 µm broad, striae 8–9 in 10 µm ($n = 1$) (Figure 28i,j).

***Lyrella atlantica* (A.W.F. Schmidt) D.G. Mann 1990**

Ref. illus.: Hustedt, F. 1961–1966, p. 509, Figure 1555 (as *Navicula lyra* var. *atlantica*); Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 231, pls. 96, Figure 6; pl. 98, Figure 5.

Size: 50 µm long, 25 µm broad, striae 11 in 10 µm ($n = 1$) (Figure 28h).

***Lyrella clavata* var. *caribaea* (P.T. Cleve) D.A. Siqueiros Beltrones 2017**

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, p. 138, pl. 24, Figures 3 and 4 (as *Navicula clavata* var. *caribaea*); Siqueiros Beltrones, D.A.; Argumedo-Hernández, U.; López-Fuerte, F.O. 2017, Figures 2–12, 14–19, 21 and 22.

Size: 50 µm long, 24 to 25 µm broad, striae 11–12 in 10 µm ($n = 2$) (Figure 28d–g).

***Lyrella hennedyi* (W. Smith) A.J. Stickle and D. G. Mann 1990**

Ref. illus.: Hustedt, F. 1961–1966, p. 453, Figure 1516; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 233, pl. 95, Figure 3; pl. 98, Figure 4.

Size: 77 µm long, 38 µm broad, striae 10 in 10 µm ($n = 1$) (Figure 28a–c).

Order: Mastogloiales D.G. Mann 1990

Family: Mastogloaceae C. Mereschkowsky 1903

MASTOGLOIA G.H.K. Thwaites 1856

***Mastogloia binotata* (A. Grunow) P.T. Cleve 1895**

Ref. illus.: Moreno, J.L.; Licea, S.; Santoyo, H. 1996, p. 89, pl. 24, Figure 3; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 240, pl. 75, Figures 15–17.

Size: 22 µm long, 14 to 15 µm broad, striae 13 in 10 µm ($n = 3$) (Figure 28k–l).

Mastogloia chersonensis A.W.F. Schmidt 1893

Ref. illus.: Schmidt, A.W.F. 1893, pl. 186, Figures 31 and 32; Hustedt, F. 1933, p. 565, Figure 999a.

Size: 28 µm long, 9 µm broad ($n = 1$) (Figure 28o).

Mastogloia ciskeiensis M.H. Giffen 1967

Ref. illus.: Giffen, M.H. 1967, p. 264, Figures 43–45; Foged, N. 1975, p. 29, pl. 16, Figures 16 and 23; Foged, N. 1978, p. 78, pl. 18, Figure 7.

Size: 32 µm long, 7 µm broad ($n = 1$) (Figure 28m,n).

TETRAMPHORA C. Mereschkowsky 1903

Tetramphora decussata (A. Grunow) J.G. Stepanek and J.P. Kociolek 2016

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, pl. 49, Figure 24; Lobban, C.S.; Scheffter, M. 2012, p. 298, pl. 1, Figures 7–9; pl. 54, Figure 5; pl. 55, Figures 1–3 (both as *Amphora decussata*).

Size: 46 µm long, 8 µm broad, dorsal striae 13–15 in 10 µm, ventral striae 21–22 in 10 µm ($n = 1$) (Figure 36f–h).

Remark: Our specimen is smaller than other records, 60 µm long and 10 µm broad; the morphometrics coincide with that of *Amphora acuta* var. *parva*, but the dorsal striae are distinctively oblique relative to both raphe and fascia which differentiate our specimens from other records.

Tetramphora intermedia (P.T. Cleve) J.G. Stepanek and J.P. Kociolek 2016

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, p. 224, pl. 50, Figure 3, Wachnicka, A.H.; Gaiser, E.E. 2007, p. 419, Figure 118 (both as *Amphora rhombica* var. *intermedia*).

Size: 77–100 µm long, 19 µm broad, dorsal striae 13–19 in 10 µm, ventral striae 16 in 10 µm ($n = 5$) (Figure 36a–c).

Tetramphora securicula (H. Peragallo and M. Peragallo) J.G. Stepanek and J.P. Kociolek 2016 *

Ref. illus.: Peragallo, H. and Peragallo, M. 1897–1908. p. 224, pl. 50, Figure 2.

Size: 62 µm long, 15 µm broad, dorsal striae 11 to 12 in 10 µm, ventral striae 14 in 10 µm ($n = 1$) (Figure 35p).

Remark: Our specimen is broader than the one reported in [36], who report a valve breadth of 8–10 µm. However, the authors of [37] record it as 15 µm wide and 70 µm long, with 12 striae in 10 µm.

Order: Naviculales C.E. Bessey 1907

Family: Amphipleuraceae A. Grunow 1862

AMPHIPRORA C.G. Ehrenberg 1843

Amphiprora pseudoduplex (K. Osada and H. Kobayasi) G. Hällfors 2004

Ref. illus.: Osada, K.; Kobayasi, H. 1990, p. 165, Figures 4, 5 and 32–42 (as *Entomoneis pseudoduplex*).

Size: 25 µm long, 7 µm broad ($n = 1$) (Figure 37h).

HALAMPHORA (P.T. Cleve) Z. Levkov 2009

Halaphora acutiuscula (F.T. Kützing) Z. Levkov 2009

Ref. illus.: Krammer, K.; Lange-Bertalot, H. 1986, p. 348, pl. 151, Figure 6 (as *Amphora coffeaeformis* var. *acutiuscula*); Wah, T.T.; Wee, Y.C. 1988, Figures 11 and 12; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 128, pl. 161, Figures 10–13.

Size: 28 µm long, 6 µm broad, dorsal striae 14 in 10 µm ($n = 1$) (Figure 34q).

***Halamphora capitata* (R. Hagelstein) I. Álvarez-Blanco and S. Blanco 2014**

Ref. illus.: Hagelstein, R. 1938, pl. 3, Figure 7; Wachnicka, A.H.; Gaiser, E.E. 2007, p. 415, Figures 98 and 99 (both as *Amphora bigibba* var. *capitata*).

Size: 17 µm long, 4 µm wide, dorsal striae 24 in 10 µm ($n = 1$) (Figure 34i).

***Halamphora coffeiformis* (C.A. Agardh) C. Mereschkowsky 1903**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 133, pl. 161, Figures 21–25 (as *Amphora coffeiformis* var. *coffeiformis*).

Size: 34–36 µm long, 5 to 6 µm broad, dorsal striae 13 in 10 µm, ventral striae 14 to 15 in 10 µm ($n = 2$) (Figure 34o,p).

***Halamphora costata* (W. Smith) Z. Levkov 2009**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 134, pl. 169, Figure 9 (as *Amphora costata*); Levkov, Z. 2009, p. 181, pl. 92, Figure 14.

Size: 45–89 µm long, 6–12 µm broad, dorsal striae 7 to 8 in 10 µm ($n = 6$) (Figure 33m–q).

***Halamphora cuneata* (P.T. Cleve) Z. Levkov 2009**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 135, pl. 167, Figures 20 and 21 (as *Amphora cuneata*); Levkov, Z. 2009, p. 182, pl. 105, Figures 1–6; pl. 243, Figures 5 and 6.

Size: 29–52 µm long, 5 to 6 µm broad, dorsal striae 12–14 in 10 µm ($n = 2$) (Figure 33c–f).

Remark: The morphometrics of Figure 31 c–f coincide better with *Amphora maletracta* var. *constricta*, but lack the wide hyaline area separating striae bands on the dorsal margin.

***Halamphora exigua* (W. Gregory) Z. Levkov 2009**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 137, pl. 161, Figures 15–17 (as *Amphora exigua*).

Size: 44 µm long, 6 µm broad, dorsal striae 11 in 10 µm ($n = 1$) (Figure 35g).

***Halamphora wisei* (M.M. Salah) I. Álvarez-Blanco and S. Blanco 2014**

Ref. illus.: Simonsen, R. 1962, p. 94, pl. 3, Figure 2; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 154, pl. 162, Figures 18 and 19 (both as *Amphora wisei*).

Size: 16 µm long, 5 µm broad, dorsal striae 14 in 10 µm ($n = 2$) (Figure 34m,n).

Family: Berkeleyaceae D.G. Mann 1990

PARLIBELLUS E.J. Cox 1982

***Parlibellus delognei* (H. Van Heurck) E.J. Cox 1988**

Ref. illus.: Hustedt, F. 1961–1966, p. 302, Figure 1422 (as *Navicula grevillii*); Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 321, pl. 104, Figures 1–5.

Size: 26–34 µm long, 8–12 µm broad, striae 18–19 in 10 µm ($n = 2$) (Figure 30n–p).

***Parlibellus rhombicula* (F. Hustedt) A. Witkowski 2000**

Ref. illus.: Hustedt, F. 1961–1966, p. 327, Figure 1422; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 325, pl. 103, Figure 3.

Size: 51–94 µm long, 11–19 µm broad, striae 16–18 in 10 µm ($n = 1$) (Figure 30g,h,k–m).

***Parlibellus rhombicus* (W. Gregory) E.J. Cox 1988 ***

Ref. illus.: Cox, E.J. 1988, p. 25, Figures 17, 33–38.

Size: 73 µm long, 12 µm broad, striae 17–19 in 10 µm ($n = 1$) (Figure 30i,j).

***Parlibellus weissflogii* (A. Grunow) E.J. Cox 1988 ***

Ref. illus.: Cleve, P.T. 1878, p. 7; pl. 1, Figure 9 (as *Brebissonia weissflogii*)

Size: 52–66 µm long, 22–31 µm broad, striae 14–18 in 10 µm ($n = 2$) (Figure 30a–f).

Family: Diadesmidaceae D.G. Mann 1990

DIPLONEIS C.G. Ehrenberg 1844

***Diploneis bombus* (C.G. Ehrenberg) C.G. Ehrenberg 1853**

Ref. illus.: Hustedt, F. 1931–1959, p. 704, Figure 1086a–c; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 183, pl. 86, Figures 1–29; pl. 2, Figures 1–3.

Size: 102 µm long, 19 µm broad, striae 8 in 10 µm ($n = 1$) (Figure 26a).

***Diploneis chersonensis* (A. Grunow) P.T. Cleve 1892**

Ref. illus.: Schmidt, A.W.F. 1892, pl. 174, Figure 14; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 184, pl. 86, Figure 10.

Size: 92 µm long, 31 µm broad, striae 8 in 10 µm ($n = 1$) (Figure 26b,c).

***Diploneis crabro* (C.G. Ehrenberg) C.G. Ehrenberg 1854**

Ref. illus.: Hustedt, F. 1931–1959, p. 616, Figure 1028; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 184, pl. 93, Figures 18–21.

Size: 39–51 µm long, 15–18 µm broad, striae 7–9 in 10 µm ($n = 5$) (Figure 26d–i).

***Diploneis incurvata* (W. Gregory) P.T. Cleve 1894**

Ref. illus.: Hustedt, F. 1931–1959, p. 593, Figure 1012b–d; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 187, pl. 86, Figures 5–6; pl. 87, Figure 4.

Size: 25–35 µm long, 8.9–12 µm broad, striae 12 to 13 in 10 µm ($n = 2$) (Figure 27o,p).

***Diploneis gruendleri* (A.W.F. Schmidt) P.T. Cleve 1894**

Ref. illus.: Hustedt, F. 1931–1959, p. 702, Figure 1084; Navarro, J.N. 1982, p. 34, pl. 22, Figure 5; Cremer, H.; Sangiorgi, F.; Wagner-Cremer, F.; McGee, V.; Lotter, A.F.; Visscher, H. 2007, p. 35, pl. 8, Figure 76.
Size: 51 µm long, 23 µm broad, striae 9 in 10 µm ($n = 1$) (Figure 26j).

***Diploneis litoralis* (A.S. Donkin) P.T. Cleve 1894**

Ref. illus.: Hendey, N.I. 1964, p. 226, pl. 32, Figure 9; Foged, N. 1984, p. 36, pl. 41 Figure 5.

Size: 36 µm long, 12 µm broad, striae 12 in 10 µm ($n = 2$) (Figure 27d).

***Diploneis litoralis* var. *clathrata* (E. Østrup) P.T. Cleve 1896**

Ref. illus.: Hustedt, F. 1931–1959, p. 666, Figure 1062b,c; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 188, pl. 89, Figures 5 and 7–13.

Size: 22–24 µm long, 8–10 µm broad, striae 19–21 in 10 µm ($n = 2$) (Figure 27k,l).

***Diploneis nitescens* (W. Gregory) P.T. Cleve 1894**

Ref. illus.: Hustedt, F. 1931–1959, p. 640, Figure 1047; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 189, pl. 90, Figures 1–3; pl. 94, Figure 1.

Size: 49 µm long, 18 µm broad, striae 8 in 10 µm ($n = 1$) (Figure 27q,r).

***Diploneis novaezealandiae* (A.W.F. Schmidt) F. Hustedt 1937 ***

Ref. illus.: Hustedt, F. 1931–1959, p. 681, Figure 1073; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 190, pl. 94, Figure 11.

Size: 31 µm long, 9 µm broad, striae 11 in 10 µm ($n = 1$) (Figure 27s).

***Diploneis papula* (A.W.F. Schmidt) P.T. Cleve 1894**

Ref. illus.: Hustedt, F. 1931–1959, p. 680, Figure 1071a–c; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 190, pls. 86, Figures 14 and 15; pl. 89, Figures 22–25.

Size: 21 µm long, 11 µm broad, striae 14 to 15 in 10 µm ($n = 1$) (Figure 27n).

***Diploneis smithii* P.T. Cleve 1894**

Ref. illus.: Hustedt, F. 1931–1959, p. 647, Figure 1051; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 193, pl. 88, Figures 2–5; pl. 89, Figure 1.

Size: 35–53 µm long, 19–27 µm broad, striae 8 to 9 in 10 µm ($n = 4$) (Figure 26a–c).

***Diploneis suborbicularis* (W. Gregory) P.T. Cleve 1894**

Ref. illus.: Lobban, C.S.; Scheffter, M.; Jordan, R.W.; Arai, Y.; Sasaki, A.; Theriot, E.C.; Ashworth, M.; Ruck, E.C.; Pennesi, C. 2012, p. 291, pl. 46, Figures 2–4; Pennesi, C.; Caputo, A.; Lobban, C.S.; Poulin, M.; Totti, C. 2017, Figures 51–57; Park, J.; Lobban, C.; Lee, K. 2018, p. 117, Figures 74 and 75.

Size: 36 µm long, 22 µm broad, striae 10 to 11 in 10 µm ($n = 1$) (Figure 27d,e).

***Diploneis suspecta* (A.W.F. Schmidt) N.I. Hendey 1958 ***

Ref. illus.: Schmidt, A.W.F. 1873, pl. 11, Figures 12, 13, 26, 27 (as *Navicula suspecta*).

Size: 30 µm long, 9 µm broad, striae 13 in 10 µm ($n = 1$) (Figure 27t).

***Diploneis vacillans* var. *renitens* (A. W. F. Schmidt) P.T. Cleve 1894**

Ref. illus.: Hustedt, F. 1931–1959, p. 663, Figure 1060e–g; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 196, pl. 90, Figures 13 and 14.

Size: 30–38 µm long, 10–13 µm broad, striae 10–13 in 10 µm ($n = 6$) (Figure 27f–j).

***Diploneis vacillans* var. *vacillans* (A.W.F. Schmidt) P.T. Cleve 1894**

Ref. illus.: Hustedt, F. 1931–1959, p. 662, Figure 1060a–d; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 196, pl. 89, Figure 14; pl. 90, Figures 11 and 12; pl. 91, Figures 9 and 10.

Size: 20–35 µm long, 7 to 8 µm broad, striae 18 in 10 µm ($n = 4$) (Figure 27m,u,v).

CALONEIS P.T. Cleve 1894***Caloneis elongata* (A. Grunow) C.S. Boyer 1927**

Ref. illus.: Navarro, J.N. 1982, p. 33, pl. 21, Figure 8; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 164, pl. 152, Figure 10.

Size: 88 µm long, 11 µm broad, striae 17 in 10 µm ($n = 1$) (Figure 17z).

***Caloneis linearis* (A. Grunow) C.S. Boyer 1927**

Ref. illus.: Hendey, N.I. 1964, p. 230, pl. 29, Figure 3; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 166, pl. 160, Figure 12.

Size: 50–55 µm long, 6–8 µm broad, striae 20 in 10 µm ($n = 3$) (Figure 17y).

Family: Naviculaceae F.T. Kützing 1844

NAVICULA J.B.G.M. Bory de Saint-Vincent 1822

***Navicula arenaria* var. *rostellata* H. Lange-Bertalot 1985**

Ref. illus.: Krammer, K.; Lange-Bertalot, H. 1985, p. 56, pl. 22, Figure 1; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 267, pl. 116, Figures 18–20; pl. 129, Figure 29.

Size: 59 µm long, 12 µm broad, striae 8 in 10 µm ($n = 1$) (Figure 31d).

***Navicula cancellata* A.S. Donkin 1872**

Ref. illus.: Hendey, N.I. 1964, p. 203, pl. 30, Figures 18–20; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 271, pl. 138, Figures 1–3; pl. 144, Figures 1–7.

Size: 42–76 µm long, 8 µm broad, striae 6–9 in 10 µm ($n = 3$) (Figure 31e,f and Figure 32c,g).

***Navicula cluthensis* W. Gregory 1854**

Ref. illus.: Hustedt, F. 1961–1966, p. 651, Figure 1653a–d; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 273, pl. 100, Figure 8.

Size: 33 μm long, 22 μm broad, striae 14 in 10 μm ($n = 1$) (Figure 31j).

***Navicula diversistriata* F. Hustedt 1955**

Ref. illus.: Hustedt, F. 1955, p. 28, pl. 9, Figures 6–9; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 275, pl. 136, Figures 1 and 2.

Size: 26–34 μm long, 11–17 μm broad, striae 10 to 11 in 10 μm ($n = 2$) (Figure 31m–p).

***Navicula johanrossi* M.H. Giffen 1975**

Ref. illus.: Giffen, M.H. 1967, p. 268, Figures 63 and 64; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 284, pl. 129, Figure 18; pl. 137, Figures 1–10; pl. 147, Figure 7.

Size: 44 μm long, 12 μm broad, striae 12 in 10 μm ($n = 1$) (Figure 31g).

***Navicula longa* var. *longa* (W. Gregory) J. Ralfs 1861**

Ref. illus.: Navarro, J.N. 1982, p. 45, pl. 28, Figure 5; Foged, N. 1984, p. 66, pl. 45, Figure 4.

Size: 105 μm long, 18 μm broad, striae 5 in 10 μm ($n = 1$) (Figure 32e,f).

***Navicula longa* var. *irregularis* F. Hustedt 1955**

Ref. illus.: Hustedt, F. 1955, p. 28, pl. 9, Figure 1; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 288, pl. 135, Figures 8–12.

Size: 162 μm long, 17 to 18 μm broad, striae 5 to 6 in 10 μm ($n = 2$) (Figure 32a,b).

***Navicula lusoria* M.H. Giffen 1975**

Ref. illus.: Giffen, M.H. 1975, p. 84, Figures 75–77; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 289, pl. 129, Figures 11–14.

Size: 21 μm long, 8 μm broad, striae 13 in 10 μm ($n = 1$) (Figure 31h,i).

***Navicula palpebralis* var. *angulosa* (W. Gregory) H. Van Heurck 1885 *[†]**

Ref. illus.: Gregory, W. 1856, p. 42, pl. 10, Figure 22; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 294, pl. 140, Figures 4–7.

Size: 36–39 μm long, 10 μm broad, striae 10 to 11 in 10 μm ($n = 3$) (Figure 32h,i).

***Navicula pavillardi* F. Hustedt 1939**

Ref. illus.: Hustedt, F. 1939, p. 635, Figures 86–90; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 295, pl. 116, Figures 5 and 6; pl. 130, Figure 18; pl. 131, Figures 2–6.

Size: 31–71 μm long, 8–11 μm broad, striae 8–11 in 10 μm ($n = 2$) (Figure 31c,k,l).

***Navicula pennata* A.W.F. Schmidt 1876**

Ref. illus.: Hendey, N.I. 1964, p. 203, pl. 30, Figure 21; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 296, pl. 141, Figures 27 and 28.

Size: 62–77 μm long, 12 μm broad, striae 7 in 10 μm ($n = 2$) (Figures 31b and 32d).

***Navicula transitans* P.T. Cleve 1883**

Ref. illus.: Cleve, P.T. 1883, p. 467, pl. 36, Figure 31; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 309, pl. 127, Figures 6–8.

Size: 79 μm long, 13 μm broad, striae 8 in 10 μm ($n = 1$) (Figure 31a).

***Navicula valida* var. *minuta* P.T. Cleve 1883 ***

Ref. illus.: Poulin, M.; Cardinal, A. 1982, p. 2840, Figure 29; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 312, pl. 128, Figures 14–16.

Size: 24 μm long, 12 μm broad, striae 9 in 10 μm ($n = 1$) (Figure 31q,r).

SEMINAVIS D.G. Mann 1990

***Seminavis barbara* A. Witkowski, H. Lange-Bertalot and D. Metzeltin 2000 *[†]**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 348, pl. 166, Figures 1–4 (as *S. barbara*).

Size: 45 µm long, 4 µm broad, dorsal striae 22 in 10 µm, ventral striae 20 in 10 µm ($n = 1$) (Figure 35m).

***Seminavis basilica* D.B. Danielidis 2003**

Ref. illus.: Danielidis, D.B.; Mann, D.G. 2003, p. 22, Figures 1–19.

Size: 49–55 µm long, 8 µm broad, dorsal striae 26 to 27 in 10 µm, ventral striae 25 in 10 µm ($n = 1$) (Figure 35k).

***Seminavis macilenta* (W. Gregory) D.B. Danielidis and D.G. Mann 2002**

Ref. illus.: Gregory, W. 1857, p. 510, Figure 65 (as *Amphora macilenta*); Danielidis, D.B.; Mann, D.G. 2002, p. 443, Figures 54–68.

Size: 68 µm long, 8 µm broad, dorsal striae 13 in 10 µm, ventral striae 13 in 10 µm ($n = 1$) (Figure 36e).

***Seminavis robusta* D.B. Danielidis and D.G. Mann 2002**

Ref. illus.: Danielidis, D.B.; Mann, D.G. 2002, p. 440, Figures 39–53; Wachnicka, A.H.; Gaiser, E.E. 2007, p. 442, Figures 221–225.

Size: 52 µm long, 8 µm broad, dorsal striae 17 in 10 µm, ventral striae 16 in 10 µm (Figures 35j and 36d).

TRACHYNEIS P.T. Cleve 1894

***Trachyneis aspera* (C.G. Ehrenberg) P.T. Cleve 1894**

Ref. illus.: Hendey, N.I. 1964, p. 236, pl. 29, Figure 13; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 355, pl. 159, Figures 1–6 and 9.

Size: 62–226 µm long, 15–43 µm broad, striae 9–13 in 10 µm ($n = 10$) (Figure 29a–e).

***Trachyneis velata* (A.W.F. Schmidt) P.T. Cleve 1894**

Ref. illus.: Hustedt, F. 1931–1959, p. 751, Figure 17; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 356, pl. 159, Figures 7 and 8.

Size: 52–75 µm long, 15–22 µm broad, striae 12–16 in 10 µm ($n = 2$) (Figure 29f,g).

Family: Plagiotropidaceae D.G. Mann 1990

PLAGIOTROPIS E. Pfitzer 1871

***Plagiotropis australis* (M. Peragallo) T.B.B. Paddock 1988 *[†]**

Ref. illus.: Peragallo, M. 1921, p. 59, pl. 3, Figure 13 (as *Pseudoamphiprora australis*); Paddock, T.B.B. 1988, p. 36, pl. 11, Figures 1–9.

Size: 226 µm long, 23 µm broad, striae 13 in 10 µm ($n = 1$) (Figure 34i).

Family: Pleurosigmataceae C. Mereschkowsky 1903

DONKINIA J. Ralfs 1861

***Donkinia carinata* (A.S. Donkin) J. Ralfs 1861**

Ref. illus.: Foged, N. 1984, p. 48, pls. 40, Figures 1 and 2; pl. 41, Figure 1.

Size: 109–150 µm long, 9–22 µm broad, striae 20 in 10 µm ($n = 2$) (Figure 38j–l).

GYROSIGMA A.H. Hassall 1845

***Gyrosigma balticum* (C.G. Ehrenberg) L. Rabenhorst 1853**

Ref. illus.: Hendey, N.I. 1964, p. 284, pl. 35, Figure 9; Foged, N. 1978, p. 73, pl. 21, Figure 1.

Size: 112 µm long, 12 µm broad, striae 14 in 10 µm ($n = 1$) (Figure 40b).

***Gyrosigma parvulum* F. Hustedt 1955 ***

Ref. illus.: Hustedt, F. 1955, p. 34, pl. 10, Figure 10.

Size: 61–93 µm long, 5–7 µm broad, striae 20 in 10 µm ($n = 4$) (Figure 39e–g).

Remark: Our specimens are larger than those reported in [38], 45–50 µm long, 4 µm broad, striae 40 in 10 µm.

***Gyrosigma peisonis* (A. Grunow) F. Hustedt 1930**

Ref. illus.: Hustedt, F. 1955, p. 34, pl. 10, Figures 4 and 5; Navarro, J.N. 1982, p. 37, pl. 23, Figures 5 and 6.

Size: 104 µm long, 11 µm broad, striae 17 in 10 µm ($n = 1$) (Figure 40c).

***Gyrosigma reversum* (W. Gregory) N.I. Hendey 1986 ***

Ref. illus.: Gregory, W. 1857, p. 530, pl. 14, Figures 105, 105b (as *Pleurosigma reversum*); Sterrenburg, F.A.S. 2000, p. 301, Figures 1–4.

Size: 92 µm long, 6 µm broad, striae 19 to 20 in 10 µm ($n = 1$) (Figure 40d).

Remark: Our specimen is smaller than the recorded by [39] 160–250 µm long, 12–15 wide.

***Gyrosigma tenuissimum* var. *hyperboreum* (A. Grunow) P.T. Cleve 1894 ***

Ref. illus.: Grunow, A. 1880, p. 58, pl. 4, Figure 77 (as *Pleurosigma tenuissimum* var. *hyperborea*),

Size: 127 µm long, 8 µm broad, striae 19 in 10 µm ($n = 1$) (Figure 40a).

PLEUROSIGMA W. Smith 1852

***Pleurosigma formosum* W. Smith 1852**

Ref. illus.: Moreno, J.L.; Licea, S.; Santoyo, H. 1996, p. 113, pl. 28, Figure 18; Sterrenburg, F.A.S.; Sar, E.A.; Sunesen, I. 2014, p. 2, Figures 1a–h and 3a.

Size: 235 µm long, 29 µm broad, transapical striae parallel 16 in 10 µm, oblique striae 12 in 10 µm ($n = 1$) (Figure 41a).

***Pleurosigma cf. gracile* F. Hustedt 1955 ***

Ref. illus.: Hustedt, F. 1955, p. 35, pl. 10, Figure 11.

Size: 120–128 µm long, 16–18 µm broad, transapical striae parallel 21 in 10 µm, oblique striae 20 in 10 µm ($n = 2$) (Figure 39d,e).

Remark: Description in [38] gives 30 transapical parallel striae in 10 µm and 36 oblique striae 10 µm.

***Pleurosigma naviculaceum* A. Brébisson 1854**

Ref. illus.: Shadbolt, G. 1853, p. 16, pl. 1, Figure 9; Foged, N. 1975, p. 50, pl. 17, Figure 4.

Size: 84 µm long, 15 µm broad, transapical striae parallel 19 to 20 in 10 µm, oblique striae 24 in 10 µm ($n = 2$) (Figure 40e,f).

Remark: According to [40], *P. diverse-striatum* may be differentiated from *P. inflatum* because the latter shows an H-like depression on the ventral area of the valve, and by the angle of the raphe, +10–13°, whilst in *P. diverse-striatum* the angle is +17–21°. However, according to [27], *P. naviculaceum* is a synonym of *P. inflatum*, whilst in [28] *P. naviculaceum* is valid.

***Pleurosigma patagonicum* var. *paucistriatum* E.A. Sar, F.A.S. Sterrenburg and I. Sunesen 2013**

Ref. illus.: Sar, E.A.; Sterrenburg, F.A.S.; Lavigne, A.S.; Sunesen, I. 2013, p. 35, Figures 15a–f, 16a–f and 17a–f.

Size: 125–146 µm long; 14 to 15 broad µm, transapical striae 20 to 21 in 10 µm, oblique striae 16 to 17 in 10 µm ($n = 2$) (Figure 39a,b).

***Pleurosigma rigidum* W. Smith. 1853**

Ref. illus.: Smith, W. 1853, p. 64, pl. 20, Figure 198; Sterrenburg, F.A.S. 2001, p. 124, Figures 7–10 and 19–22.

Size: 162 μm long; 26 broad μm , transapical striae 19 in 10 μm , oblique striae 17 in 10 μm ($n = 4$) (Figures 39c and 41b–d).

***Pleurosigma subsalinum* H. Peragallo 1891 ***

Ref. illus.: Peragallo, H. 1891: 24; pl. 8, Figures 16 and 17.

Size: 140 μm long, 14 broad μm , transapical striae 18 in 10 μm , oblique striae 15 in 10 μm ($n = 1$) (Figure 39f).

Family: Proschkiniaeae D.G.Mann 1990

PROSCHKINIA N.I. Karayeva 1978

***Proschkinia complanata* (A. Grunow) D.G. Mann 1990**

Ref. illus.: Hustedt, F. 1955, p. 60, pl. 9, Figure 21; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 341, pl. 60, Figures 29–32; pl. 147, Figures 8–11.

Size: 37–66 μm long, 5–8 μm broad, striae 20–40 in 10 μm ($n = 2$) (Figure 38n,o).

Family: Scoliotropidaceae C. Mereschkowsky 1903

BIREMIS D.G. Mann and E.J. Cox 1990

***Biremis lucens* (F. Hustedt) Sabbe, Witkowski and Vyverman 1995**

Ref. illus.: Simonsen, R. 1987, p. 174, pl. 275, Figures 27–29; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 159, pl. 155, Figures 9–15.

Size: 17 μm long, 4 μm broad, striae 11 in 10 μm ($n = 1$) (Figure 17s).

Family: Sellaphoraceae C. Mereschkowsky 1902

FALLACIA A.J. Stickle and D.G. Mann 1990

***Fallacia litoricola* (F. Hustedt) D. G. Mann 1990**

Ref. illus.: Navarro, J.N. 1982, p. 45, pl. 28, Figure 6 (as *Navicula litoricola*); Moreno, J.L.; Licea, S.; Santoyo, H. 1996, p. 72, pl. 21, Figure 3.

Size: 23–27 μm long, 7–9 μm broad, striae 18–20 in 10 μm ($n = 3$) (Figure 17v).

***Fallacia vittata* (P.T. Cleve) D. G. Mann 1990**

Ref. illus.: Hustedt, F. 1961–1966, p. 371, Figure 1461 (*Navicula vittata*).

Size: 14–26 μm long, 8–12 μm broad, striae 17 to 18 in 10 μm ($n = 2$) (Figure 17w,x).

Order: Thalassiophysales D.G. Mann 1990

Family: Catenulaceae C. Mereschkowsky 1902

AMPHORA C.G. Ehrenberg 1844

***Amphora americana* A.H. Wachnicka and E.E. Gaiser 2007 ***

Ref. illus.: Wachnicka, A.H.; Gaiser, E.E. 2007, p. 398, Figures 29–34.

Size: 48–52 μm long, 4 μm broad, dorsal striae 27 in 10 μm ($n = 4$) (Figure 35h).

***Amphora angustissima* H. Heiden 1928**

Ref. illus.: Simonsen, R. 1992, pl. 69, Figures 1–8; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 128, pl. 156, Figure 6.

Size: 20–40 μm long, 4–6 μm broad, striae 12–16 in 10 μm ($n = 4$) (Figure 33g–l).

***Amphora beaufortiana* F. Hustedt 1955**

Ref. illus.: Hustedt, F. 1955, p. 38, pl. 14, Figures 1–5; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 131, pl. 168, Figures 10 and 11.

Size: 31 μm long, 5 μm broad, striae 22 to 23 in 10 μm ($n = 1$) (Figure 35l).

***Amphora bigibba* A. Grunow 1875**

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, p. 227, pl. 50, Figure 36; Foged, N. 1978, p. 32, pl. 35, Figure 4; pl. 36, Figure 13.

Size: 18–22 μm long, 4 to 5 μm broad, striae 19–21 in 10 μm ($n = 4$) (Figure 34f–h,j).

***Amphora bigibba* var. *interrupta* (A. Grunow) P.T. Cleve 1895**

Ref. illus.: Hustedt, F. 1955, p. 40, pl. 14, Figures 19–25; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 131, pl. 163, Figures 27–30.

Size: 50 μm long, 12 μm broad, striae 16 in 10 μm ($n = 1$) (Figure 34k,l).

***Amphora cingulata* P.T. Cleve 1875**

Ref. illus.: Cleve, P.T. 1894–1895, p. 133, pl. 3, Figure 39; Foged, N. 1984, p. 17, pl. 52, Figure 6.

Size: 52–133 μm long, 9–22 μm broad ($n = 2$) (Figure 35a,b).

***Amphora crassa* W. Gregory 1857**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 134, pl. 169, Figures 5–7.

Size: 48 μm long, 8 μm broad, striae 6 in 10 μm ($n = 1$) (Figure 35o).

***Amphora cf. cymbamphora* B.J. Cholnoky 1960**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 136, pl. 164, Figures 26–28.

31–47 μm long, 5 to 6 μm broad, striae 17 in 10 μm ($n = 4$) (Figure 35i).

***Amphora graeffeana* N.I. Hendey 1973**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 138, pl. 166, Figure 24; pl. 172, Figures 6–9.

Size: 52 μm long, 11 μm broad, striae 16 in 10 μm ($n = 1$) (Figure 35e,f).

***Amphora immarginata* T. Nagumo 2003**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, pl. 162, Figure 20; Nagumo 2003, pp. 22 to 23, pls. 38–42; Wachnicka, A.H.; Gaiser, E.E. 2007, p. 429, Figures 161 and 162.

Size: 37–62 μm long, 7–15 μm broad, striae 13–15 in 10 μm ($n = 4$) (Figure 34b–e).

***Amphora laevissima* W. Gregory 1857**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 142, pl. 168, Figures 5–7.

Size: 42–46 μm long, 6–8 μm broad ($n = 2$) (Figure 35c,d).

***Amphora marina* W. Smith 1857**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 144, pls. 162, Figures 8–14; pl. 166, Figures 9–11.

Size: 37–62 μm long, 7–15 μm broad, dorsal striae 13 in 10 μm , ventral striae 12 in 10 μm ($n = 1$) (Figure 34s,t).

***Amphora obtusa* W. Gregory 1857**

Ref. illus.: Schoeman, F.R.; Archibald, R.E.M. 1987, p. 126, 127, Figures 1–12; Wachnicka, A.H.; Gaiser, E.E. 2007, p. 435, Figure 186.

Size: 42 μm long, 7 μm broad ($n = 1$) (Figure 35n).

***Amphora proteus* W. Gregory 1857**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 148, pls. 161, Figures 1 and 2; pl. 162, Figures 5 and 6.

Size: 62–68 µm long, 9 to 10 µm broad, dorsal striae 13 in 10 µm, ventral striae 15 in 10 µm ($n = 1$) (Figure 34u,v).

***Amphora proteus* var. *contigua* P.T. Cleve 1895**

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, pl. 44; Wachnicka, A.H.; Gaiser, E.E. 2007, p. 429, Figures 157–160.

Size: 30 µm long, 5 µm broad, dorsal striae 17 in 10 µm, ventral striae 15 in 10 µm ($n = 1$) (Figure 34r).

***Amphora studeri* C. Janisch 1876**

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, p. 214, pl. 47, Figure 18; López-Fuerte, F.O.; Siqueiros Beltrones, D.A.; Jakes-Cota U.; Tripp-Valdés, A. 2019, p. 108, Figure 3 d, e (both as *A. formosa* var. *studeri*).

Size: 68 µm long, 9 µm broad, dorsal striae 23 to 24 in 10 µm, ventral striae 23 in 10 µm ($n = 1$) (Figure 33a,b).

***Amphora spectabilis* W. Gregory 1857**

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 150, pl. 166, Figure 8; pl. 167, Figures 25 and 26.

Size: 88 µm long, 16 µm broad, dorsal striae 8 in 10 µm, ventral striae 15 in 10 µm ($n = 1$) (Figure 34a).

Family: Thalassophysaceae D.G. Mann 1990

THALASSIOPHYSA P.S. Conger 1954

***Thalassophysa hyalina* (R.K. Greville) T.B.B. Paddock and P.A. Sims 1981**

Ref. illus.: Greville, R.K. 1865, p. 6, pl. 5, Figure 11 (as *Amphiprora hyalina*); Schmidt, A.W.F. 1876, pl. 40, Figures 2 and 3 (as *Amphora insecta*).

Size: 65 µm long, 12 µm broad ($n = 1$) (Figure 38m).

Order: Surirellales D.G. Mann 1990

Family: Auriculaceae Hendey, N.I. 1964

AURICULA F. Castracane 1873

***Auricula flabelliformis* M. Voigt 1960 *†**

Ref. illus.: Ruck, E.C.; Kocielek, J.P. 2004, pl. 2, Figure 5; pl. 6, Figure 3; Park, J.S.; Lee, S.D.; Kang, S.E.; Lee, J.H. 2014, p. 238, Figures 3b,c, 4i; Lobban, C.S. 2015, p.3, Figures 10 and 12.

Size: 95–108 µm long, 62–69 µm broad, 16–18 striae in 10 µm ($n = 2$) (Figure 37a).

***Auricula pulchra* (R.K. Greville) P.T. Cleve 1894 *†**

Ref. illus.: Cleve, P.T. 1894, p. 20, pl. 2, Figure 23.

Size: 73–83 µm long, 9–12 (45) µm broad, 22 striae in 10 µm ($n = 3$) (Figure 37b–g).

Family: Entomoneidaceae C.W. Reimer 1975

ENTOMONEIS C.G. Ehrenberg 1845

***Entomoneis paludosa* (W. Smith) C.W. Reimer 1975**

Ref. illus.: Peragallo, H.; Peragallo, M. 1897–1908, pl. 38, Figures 12–15; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 199, pl. 109, Figures 26 and 27; pl. 173, Figure 8.

Size: 45–138 µm long, 12–25 µm broad, striae 19–23 in 10 µm ($n = 6$) (Figure 38a–i).

Family: Surirellaceae F.T. Kützing 1844

CAMPYLODISCUS C.G. Ehrenberg 1844

***Campylodiscus bicostatus* W. Smith 1854**

Ref. illus.: Krammer, K.; Lange-Bertalot, H. 1988, p. 215, pl. 178, Figures 1–6; Al-Handal, A.Y.; Thomas, E.W.; Pennesi, C. 2018, p. 143, Figure 103.

Size: 19 μm long, 20 μm broad, striae 12 in 10 μm ($n = 1$) (Figure 46f).

Remark: *C. bicostatus* is a freshwater species but is also found in marine water [41,42].

Campylodiscus fastuosus C.G. Ehrenberg 1845

Ref. illus.: Ruck, E.C.; Kociolek, J.P. 2004, p. 34, pls. 39, Figures 1–6; pl. 40, Figure 7; pl. 41, Figure 17;

Lobban 2015, p. 3, Figures 13, 14, 16 and 18–20; Park, J.; Lobban, C.; Lee, K. 2018, p. 132, Figure 175.

Size: 38–45 μm long, 35–42 μm broad, costae 3 to 4 in 10 μm , striae 9–11 in 10 μm ($n = 2$) (Figure 46h,i).

Campylodiscus neofastuosus E.C. Ruck and T. Nakov 2016

Ref. illus.: Navarro, J.N. 1983, p. 402, Figures 69–71; Lobban, C.S.; Schefter, M.; Jordan, R.W.; Arai, Y.;

Sasaki, A.; Theriot, E.C.; Ashworth, M.; Ruck, E.C.; Pennesi, C. 2012, p. 307, pl. 67, Figures 2 and 3;

pl. 68, Figures 1–3 (both as *Surirella fastuosa*); Park, J.; Lobban, C.; Lee, K. 2018, p. 134, Figures 177–180.

Size: 35–68 μm long, 25–50 μm broad, striae around central area 24–28 in 10 μm ($n = 4$) (Figure 46a–c).

Campylodiscus ralfsii W. Smith 1853

Ref. illus.: Foged, N. 1984, p. 27, pl. 60, Figure 5; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000,

p. 413, pl. 214, Figure 16; Navarro, J.N.; Lobban, C.S. 2009, p. 150, Figures 128 and 129.

Size: 38–40 μm long, 39 μm broad, costae 9 in 10 μm ($n = 2$) (Figure 46j,k).

Campylodiscus scalaris (M.H. Giffen) C.S. Lobban and J.S. Park 2018 *,†

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 416, pl. 215, Figures 4–6;

Hein, M.K.; Winsborough, B.M.; Sullivan. 2008, pl. 64, Figure 4; Lobban, C.S.; Schefter, M. 2012, p. 308,

pl. 68, Figures 4–6; pl. 69, Figures 1 and 2 (all as *Surirella scalaris*).

Size: 18 μm long, 14 μm broad ($n = 1$) (Figure 46l,m).

Campylodiscus simulans W. Gregory 1857

Ref. illus.: Schmidt, A.W.F.; Schmitz, M.; Fricke, F.; Müller, O.; Heiden, H.; Hustedt, F. 1874–1959, pl. 17, Figures 12–14.

Diameter 21 μm , 4 costae in 10 μm (margin), central striae 11 in 10 μm (Figure 46g).

CORONIA (C.G. Ehrenberg) C.G. Ehrenberg 1912

Coronia ambigua (R.K. Greville) E.C. Ruck and M.D. Guiry 2016

Ref. illus.: Schmidt, A.W.F.; Schmitz, M.; Fricke, F.; Müller, O.; Heiden, H.; Hustedt, F. 1874–1959, pl. 18, Figures 23–26; Williams, D.M. 1988, pl. 26, Figures 1 and 2; Ruck, E.C.; Kociolek, J.P. 2004, pls. 36–38; Lobban, C.S.; Schefter, M. 2012, p. 305, pl. 63, Figures 5–7; pl. 64, Figure 1 (all as *Campylodiscus ambiguus*).

Diameter 55 μm ($n = 2$) (Figure 46d,e).

PSAMMODICTYON D.G. Mann 1990

Psammodictyon panduriforme (W. Gregory) D.G. Mann 1990

Ref. illus.: Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 397, pl. 184, Figures 13 and 14; pl. 186, Figures 1–3 (as *Nitzschia panduriformis*); Lobban, C.S.; Schefter, M. 2012, p. 304, pl. 62, Figures 3 and 4.

Size: 68–136 μm long, 28–34 μm broad, striae 14 to 15 in 10 μm ($n = 7$) (Figure 42a–d,k,l,o).

Psammodictyon panduriforme var. *continuum* (A. Grunow) P. Snoeijs 1998

Ref. illus.: Krammer. K. Lange-Bertalot, H. 1988, pl. 38, Figures 6 and 7; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 398, pl. 183, Figure 6 (both as *Nitzschia panduriformis* var. *continua*).

Size: 12 μm long, 6 μm broad, striae 19 in 10 μm ($n = 1$) (Figure 42i,j).

Psammodictyon pustulatum (M. Voigt) C.S. Lobban 2015 *

Ref. illus.: Lobban, C.S. 2015, p. 12, Figures 118–128.

Size: 41 μm long, 19 μm broad, fibulae 9 to 10 in 10 μm , striae 16–18 in 10 μm ($n = 1$) (Figure 42e–g).

***Psammodictyon roridum* (M.H. Giffen) D.G. Mann 1990**

Ref. illus.: Giffen, M.H. 1975, p. 90, Figures 103 and 104; Witkowski, A.; Lange-Bertalot, H.; Metzeltin, D. 2000, p. 403, pl. 184, Figures 9–12 (both as *Nitzschia rorida*).

Size: 49 μm long, 12 μm broad, fibulae 10 in 10 μm , striae 24 in 10 μm ($n = 1$) (Figure 42h).

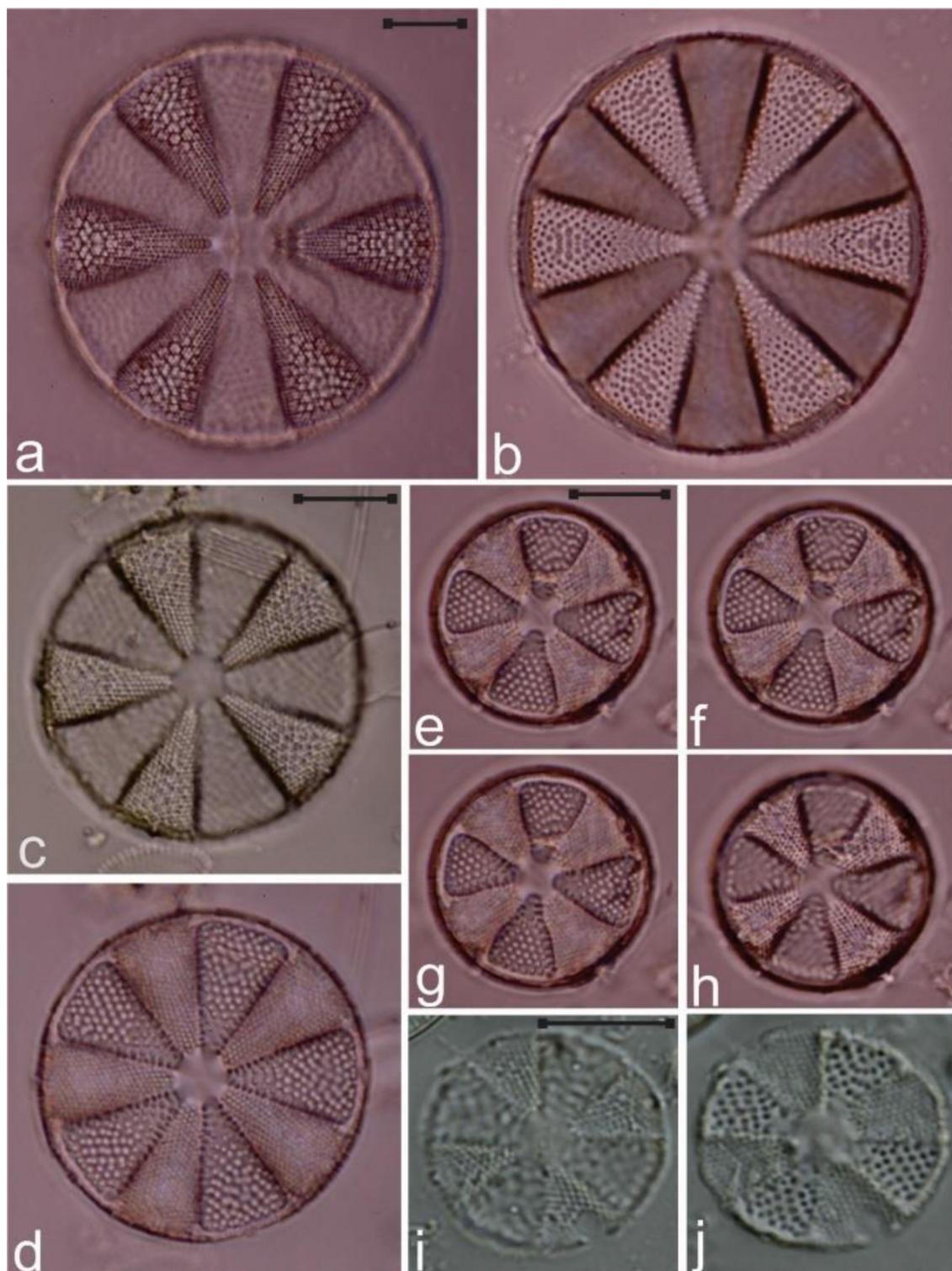


Figure 3. (a–d) *Actinoptychus vulgaris* in different focal planes; (e–j) *A. minutus*. Scale bar = 10 μm .

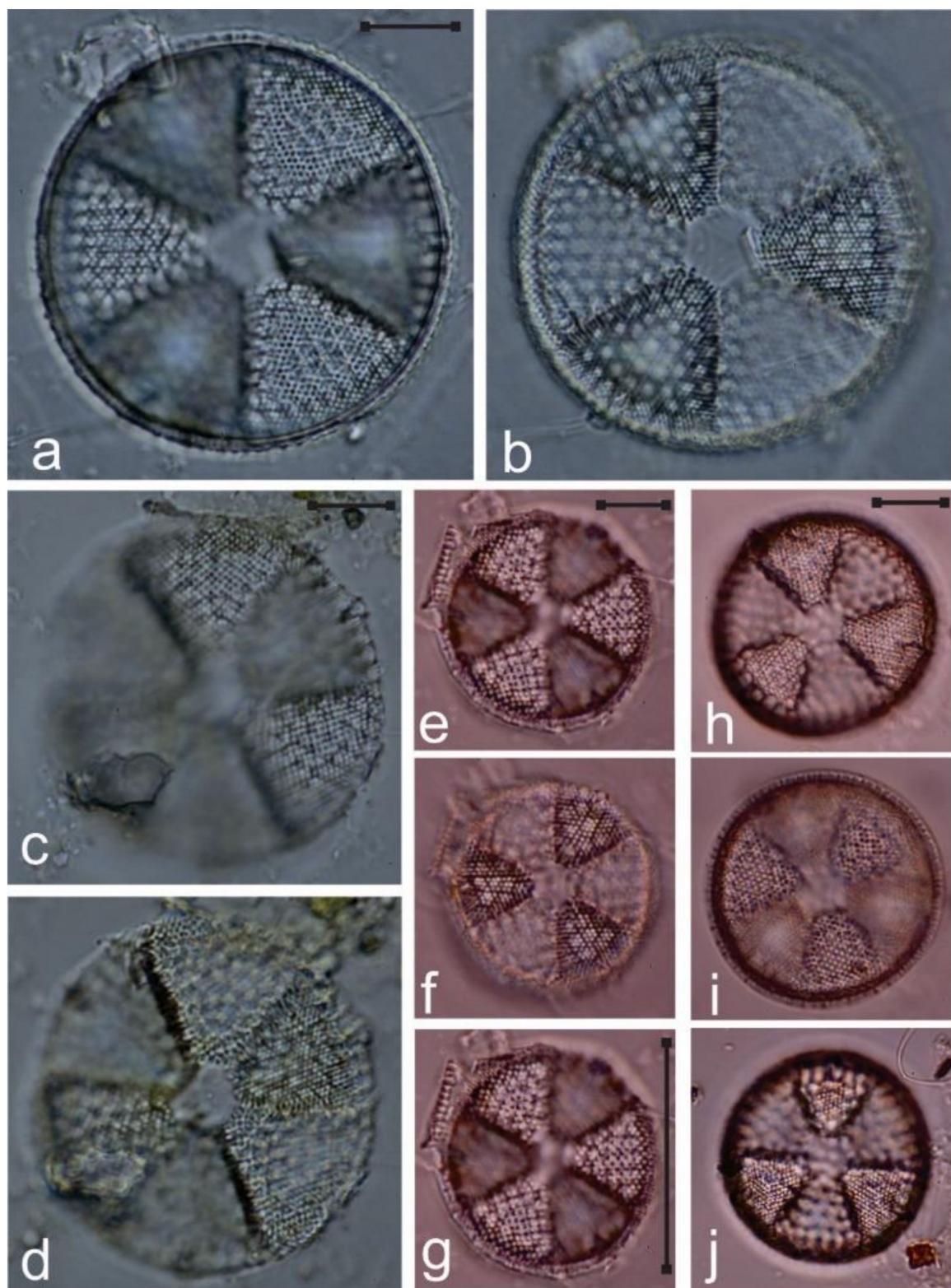


Figure 4. (a–j) *Actinoptychus senarius* in different focal planes and showing range in size. Scale bar = 10 μm .

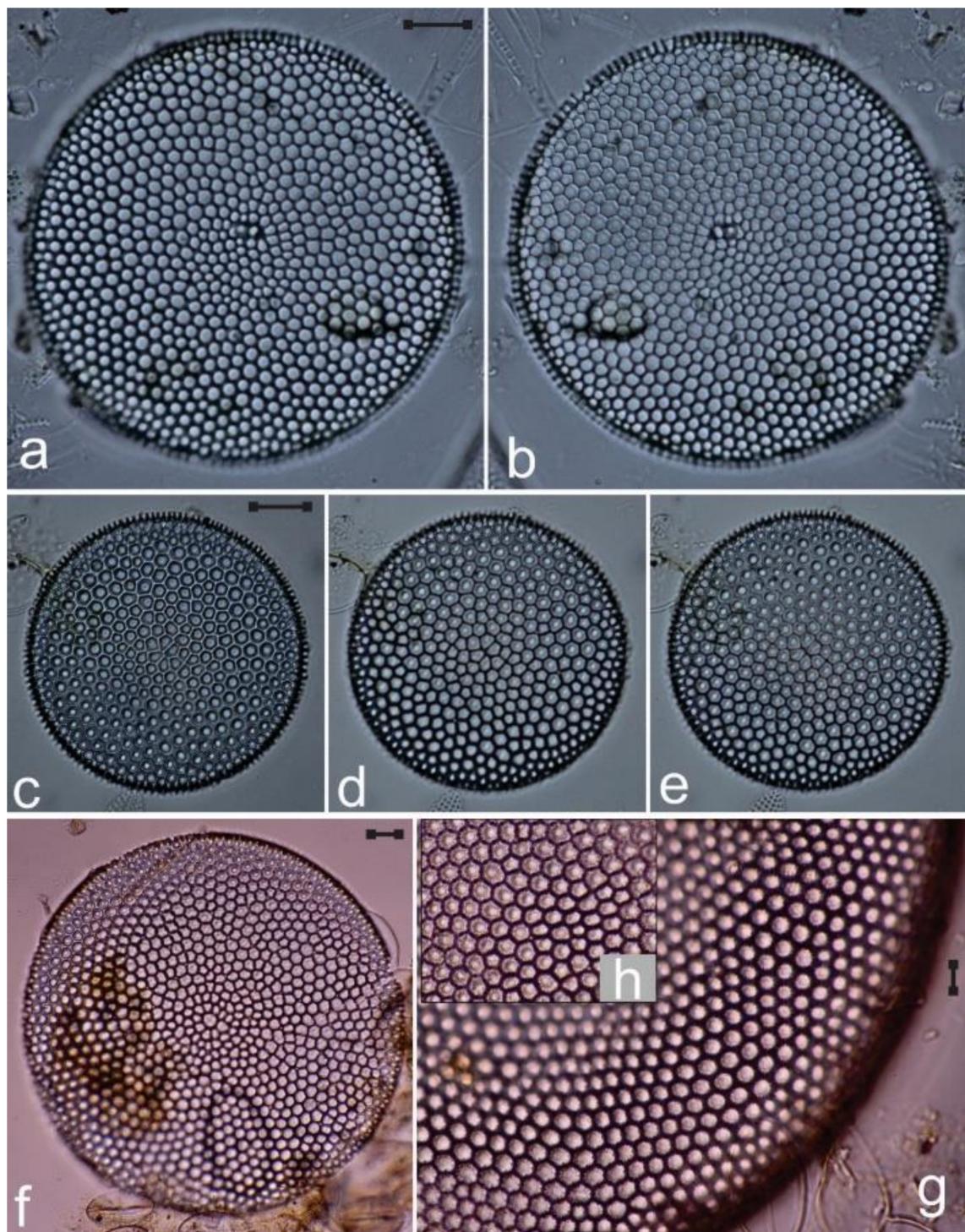


Figure 5. (a–f) *Coscinodiscus radiatus* valves in different focal views; (g,h) *C. gigas*, image h section of the valve (center) showing the arrangement of the areolae. Scale bar = 10 μm .

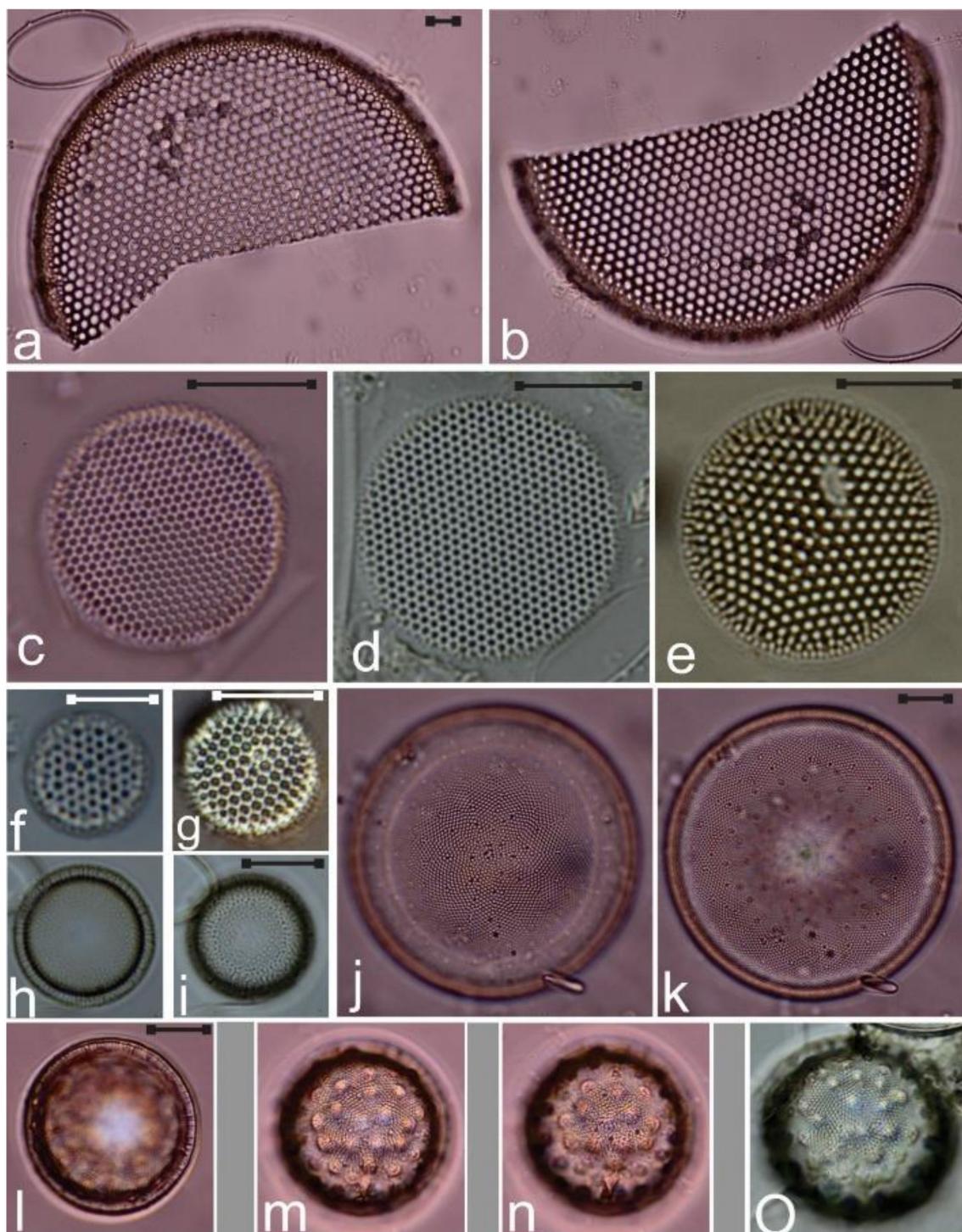


Figure 6. (a,b) *Thalassiosira leptopus* valve fragment in two focal planes; (c,d) *T. lineata* focus showing the rimoportulae; (e) *T. eccentrica*; (f,g) *T. decipiens*; (h,i) *Melosira moniliformis* var. *octogona*; (j,k) *Coscinodiscus mesoleius*; (l–o) *Margaritum terebro*, image l focus showing a side view of the rimoportulae near the margin, images m–o focus showing rimoportulae papilliformis. Scale bar: a–e, h–n = 10 μm ; f = 5 μm .

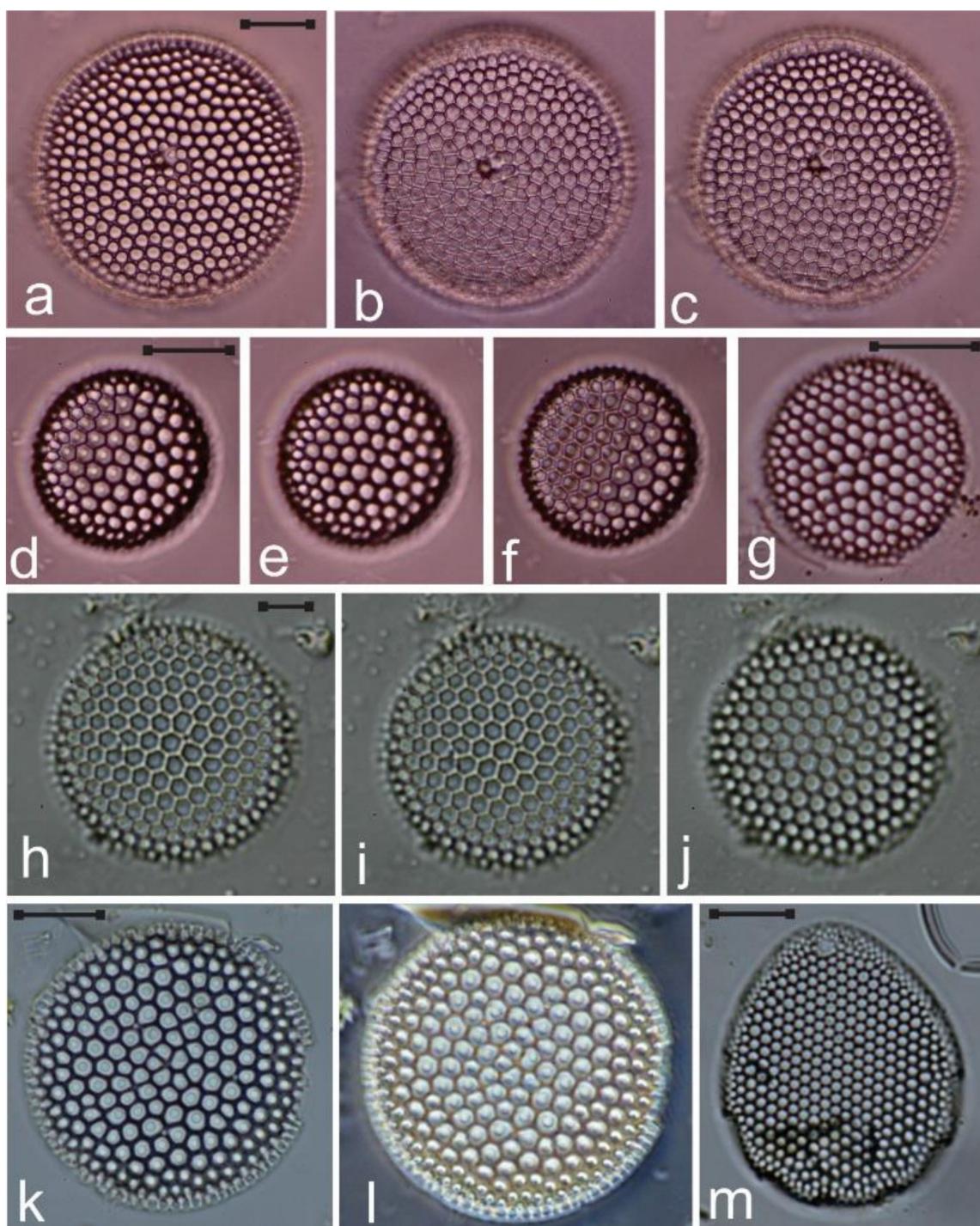


Figure 7. (a–g) *Azpeitia nodulifera* in different focal planes and showing range in size; (h–j) *Thalassiosira nanolineata*; (k,l) *Coscinodiscus radiatus* in different focal planes; (m) *Roperia tessellata*. Scale bar = 10 μm .

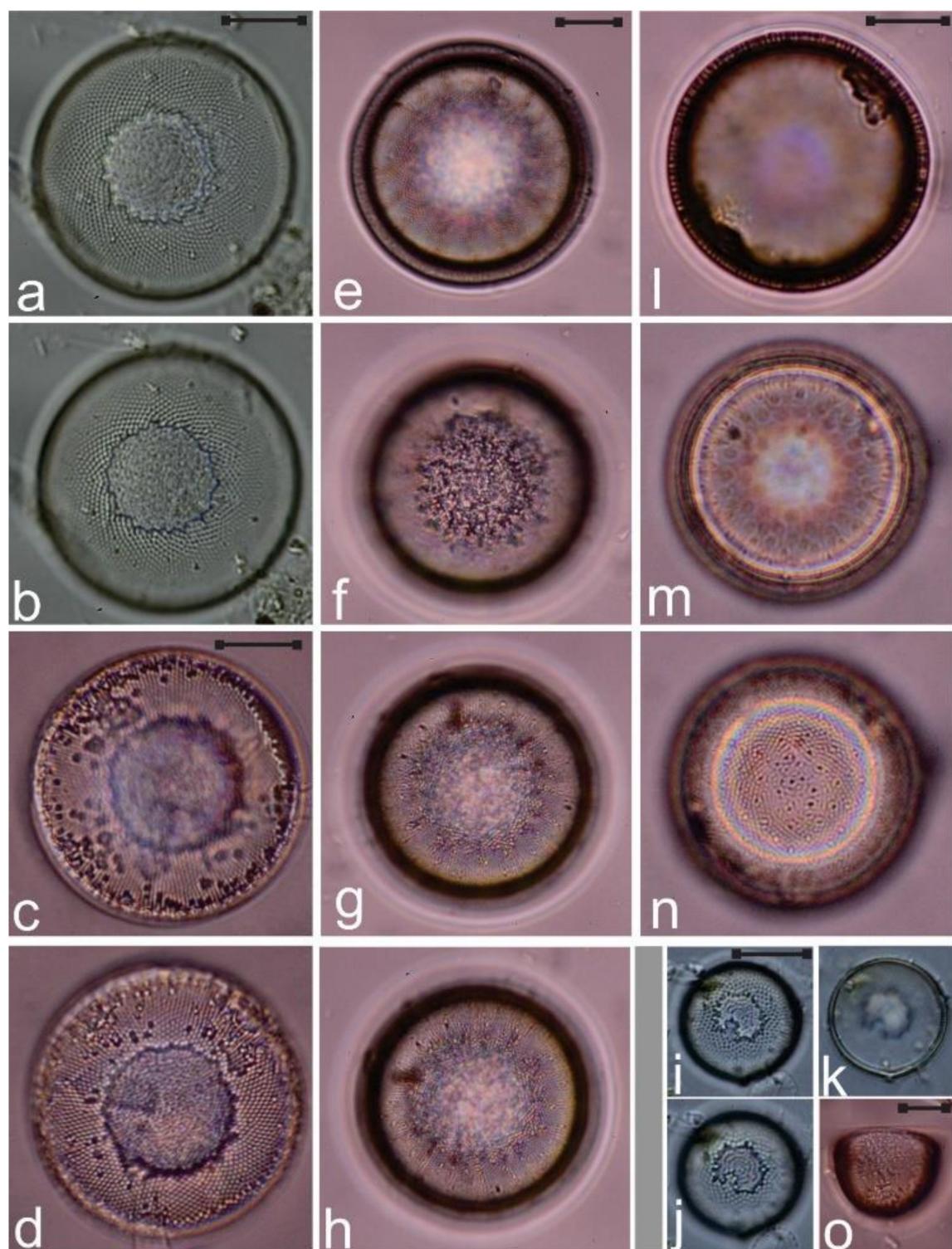


Figure 8. (a–k) *Podosira stelligera* in different focal planes and showing range in size; (l–n) *P. variegata* in different focal planes; (o) *P. montagnei* valve in girdle view. Scale bar = 10 μm .

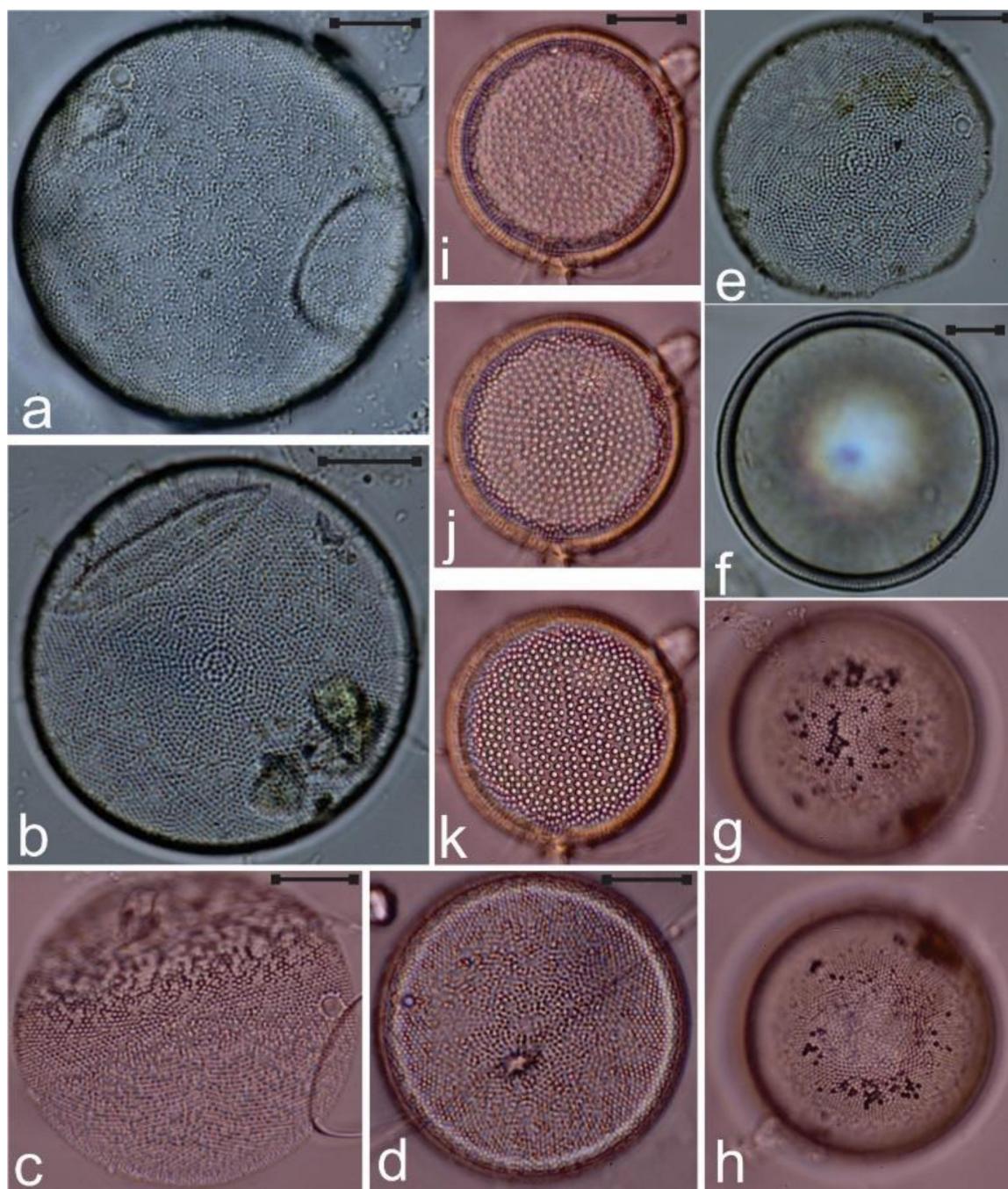


Figure 9. (a–e) *Actinocyclus subtilis* in different focal planes; (f–h) *A. tenuissimus*; (i–k) *A. ochotensis*. Scale bar = 10 μm .

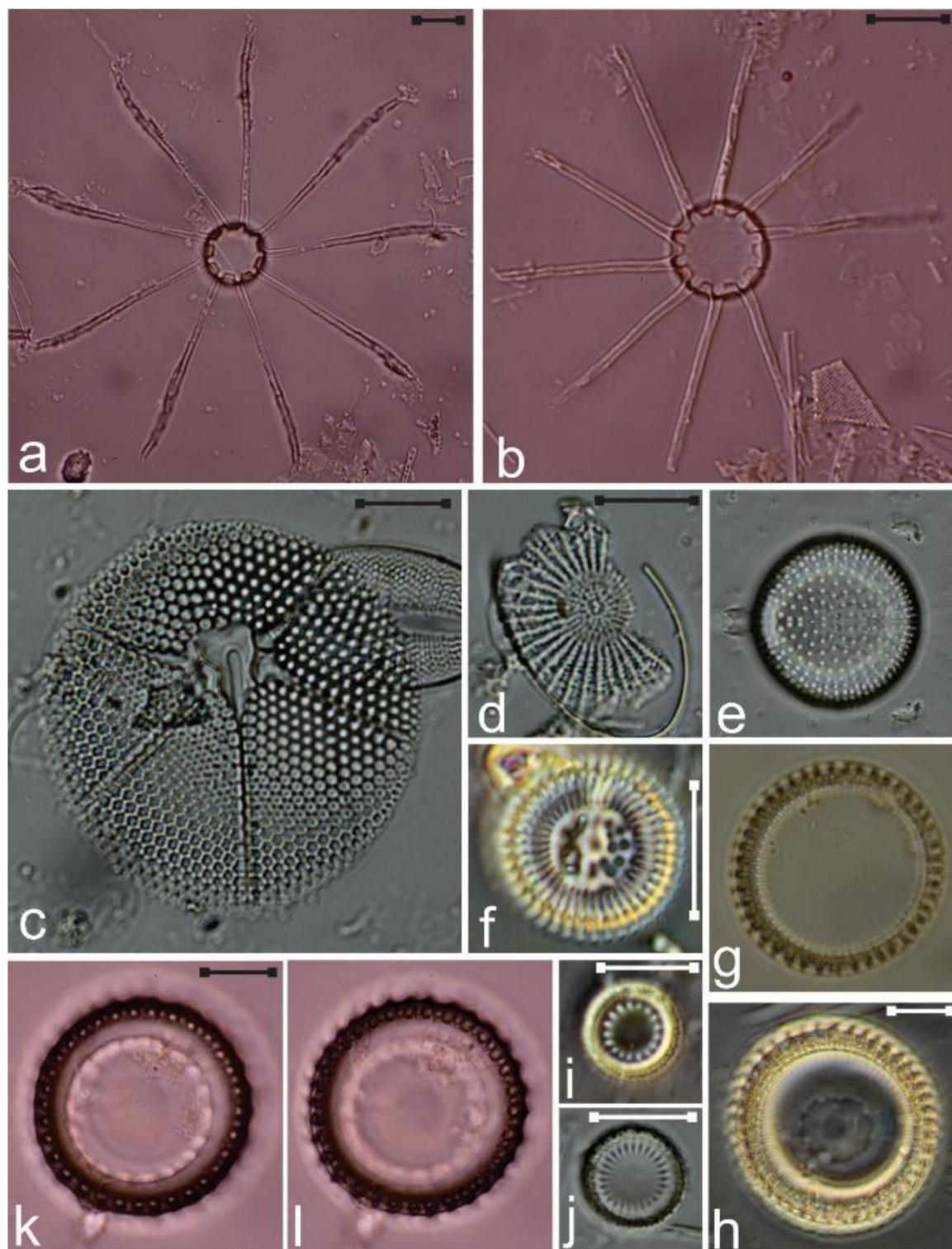


Figure 10. (a,b) *Bacteriastrum hyalinum*; (c) *Asteromphalus arachne*; (d) *Cyclostephanos* sp.; (e) *Psammodiscus nitidus*; (f) *Cyclotella striata*; (g–l) *Paralia sulcata*. Scale bar = 10 μm .

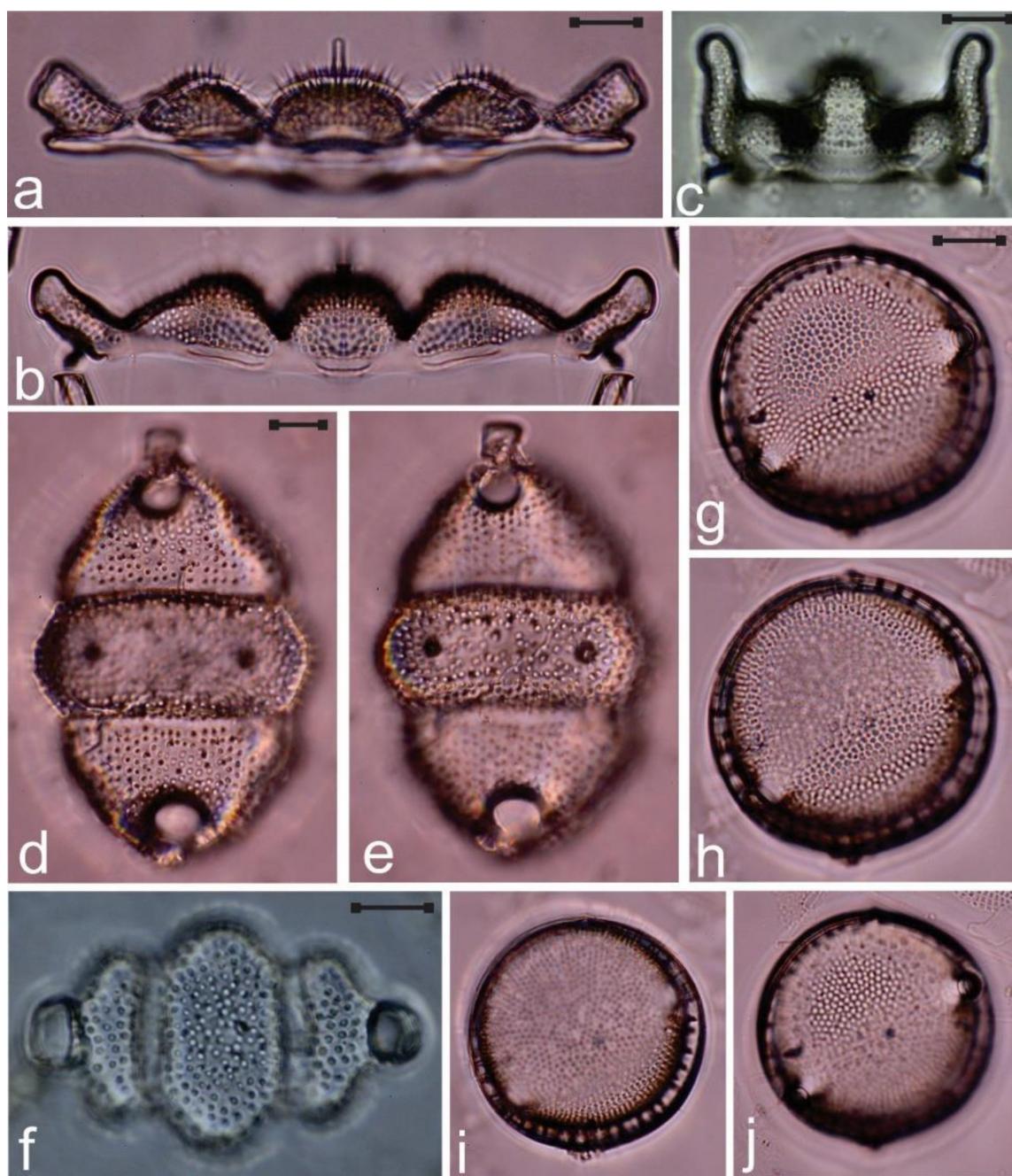


Figure 11. (a–c,f) *Biddulphia tridens*, images a–c girdle view, image f valve view; (d,e) *B. tridentata* valve at two focal planes; (g–j) *Ralfsiella smithii* showing different focal planes. Scale bar = 10 μm .

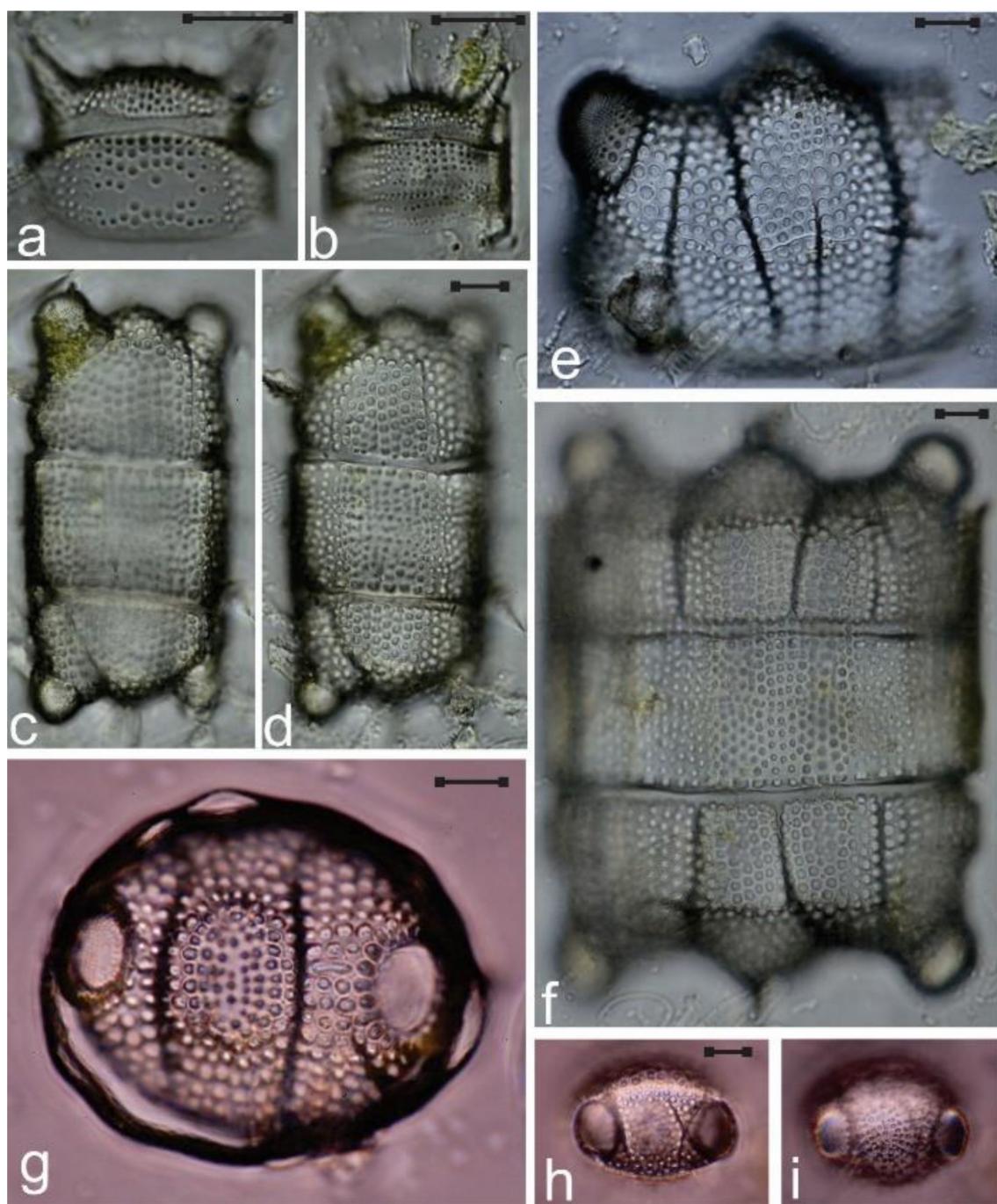


Figure 12. (a,b) *Odontella rostrata*; (c–i) *Biddulphia biddulphiana* images c,d,f frustule in girdle view showing the cingulum with full set of girdle bands. Scale bar = 10 μm .

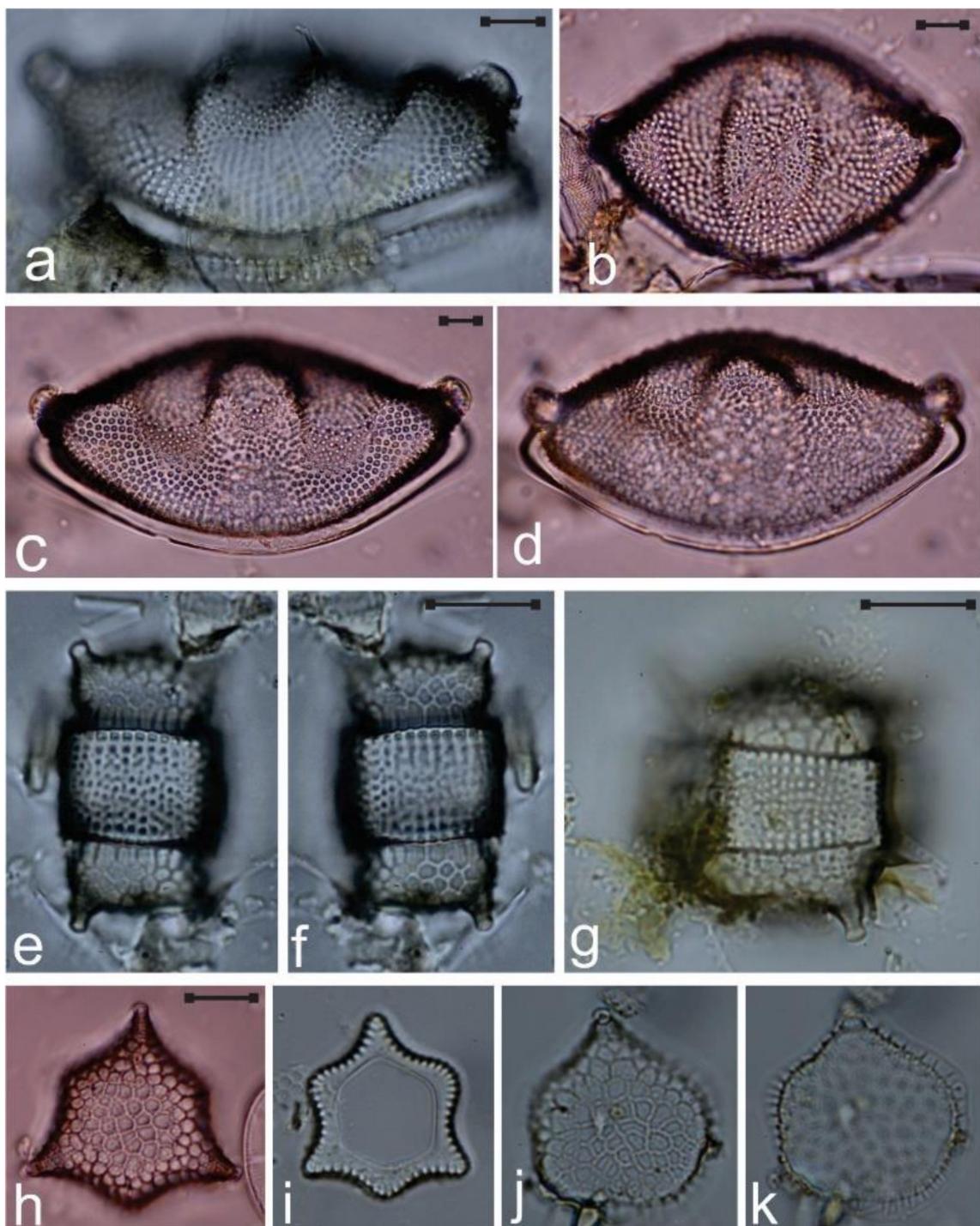


Figure 13. (a–d) *Odontella obtusa*; (e–k) *Pseudodictyota dubia*, images e–g frustule in girdle view showing the cingulum, images h–k valve view at four focal planes. Scale bar = 10 μm .

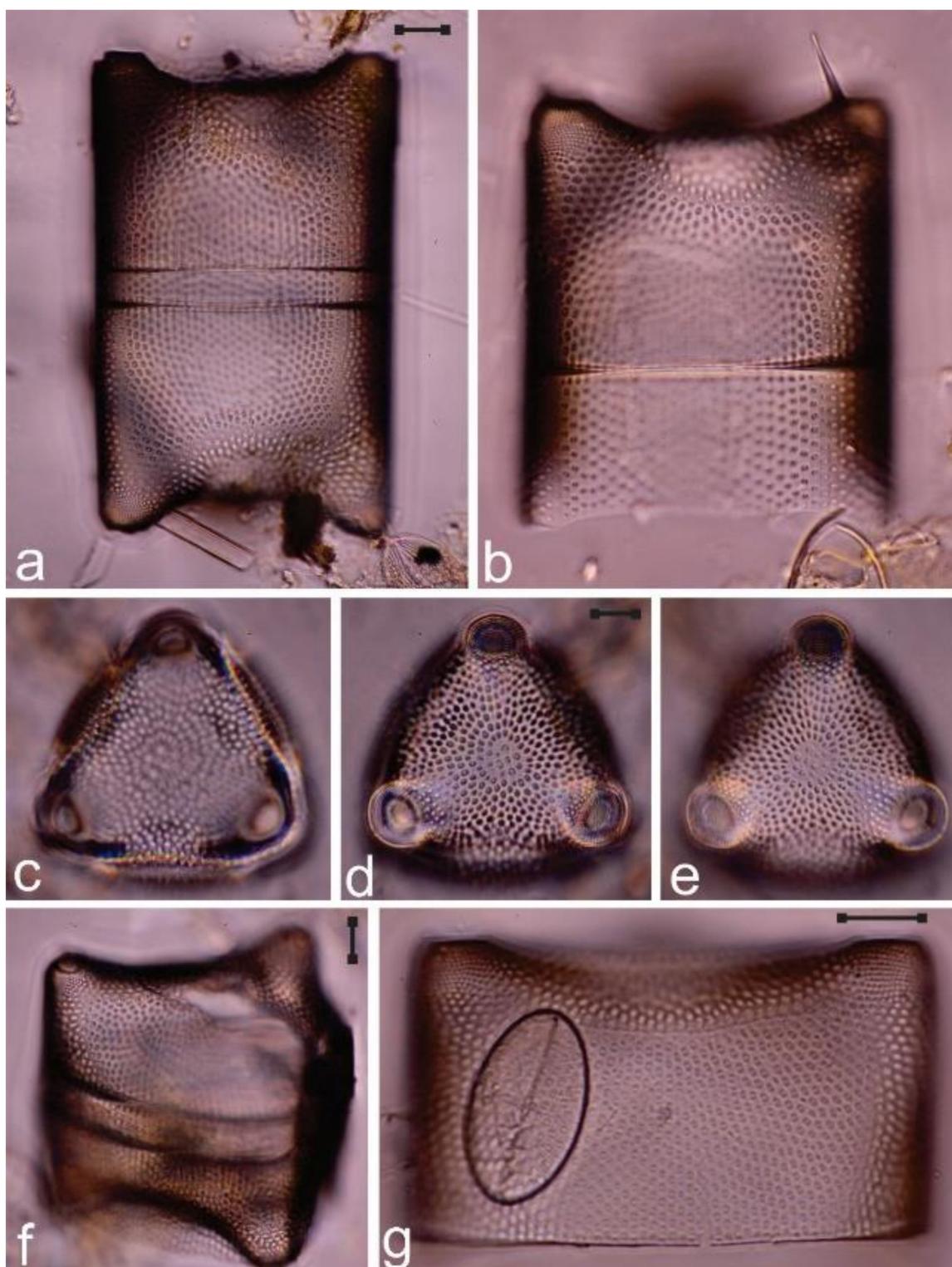


Figure 14. (a–g) *Lampriscus shadboltianum*, images a,b,f,g frustule in girdle view showing the cingulum, image b valve exterior, short elevations with ocelli at apices and submarginal spine. Scale bar = 10 μm .

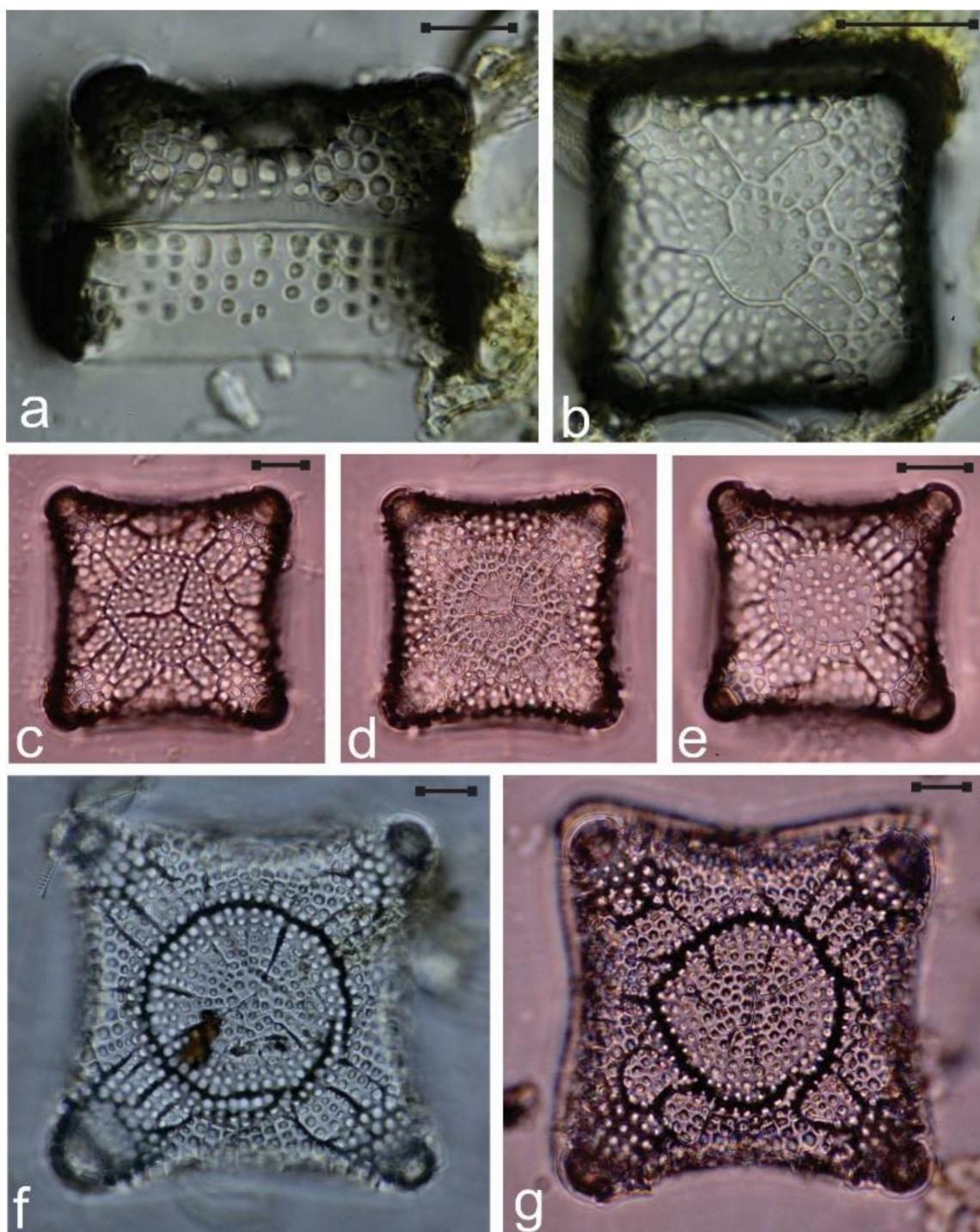


Figure 15. (a,b) *Amphitetas antediluviana* mantle view of valve with barely raised elevations; (c–g) *Triceratium balearicum* fo. *biquadratum* valve with four slightly raised elevations. Scale bar = 10 μm .

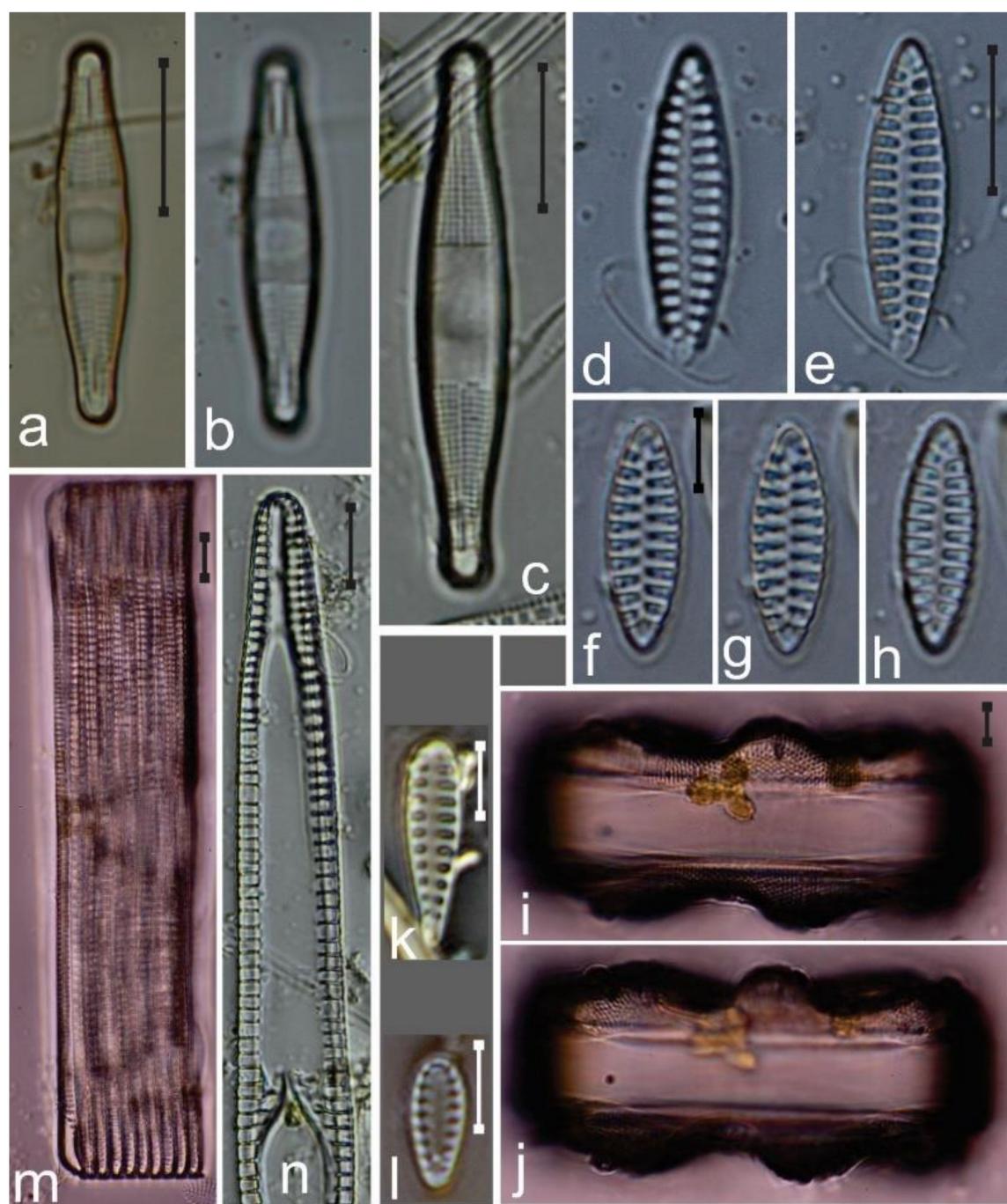


Figure 16. (a–c) *Talaroneis* sp.; (d–h) *Opephora pacifica*; (i,j) *Aulacodiscus* sp. frustule in girdle view showing the cingulum; (k) *Gedaniella mutabilis*; (l) *Staurosirella guenter-grassi*; (m,n) *Rhabdonema adriaticum*, image m girdle view showing the bands. Scale bar: a–j, m,n = 10 μm ; k,l = 5 μm .

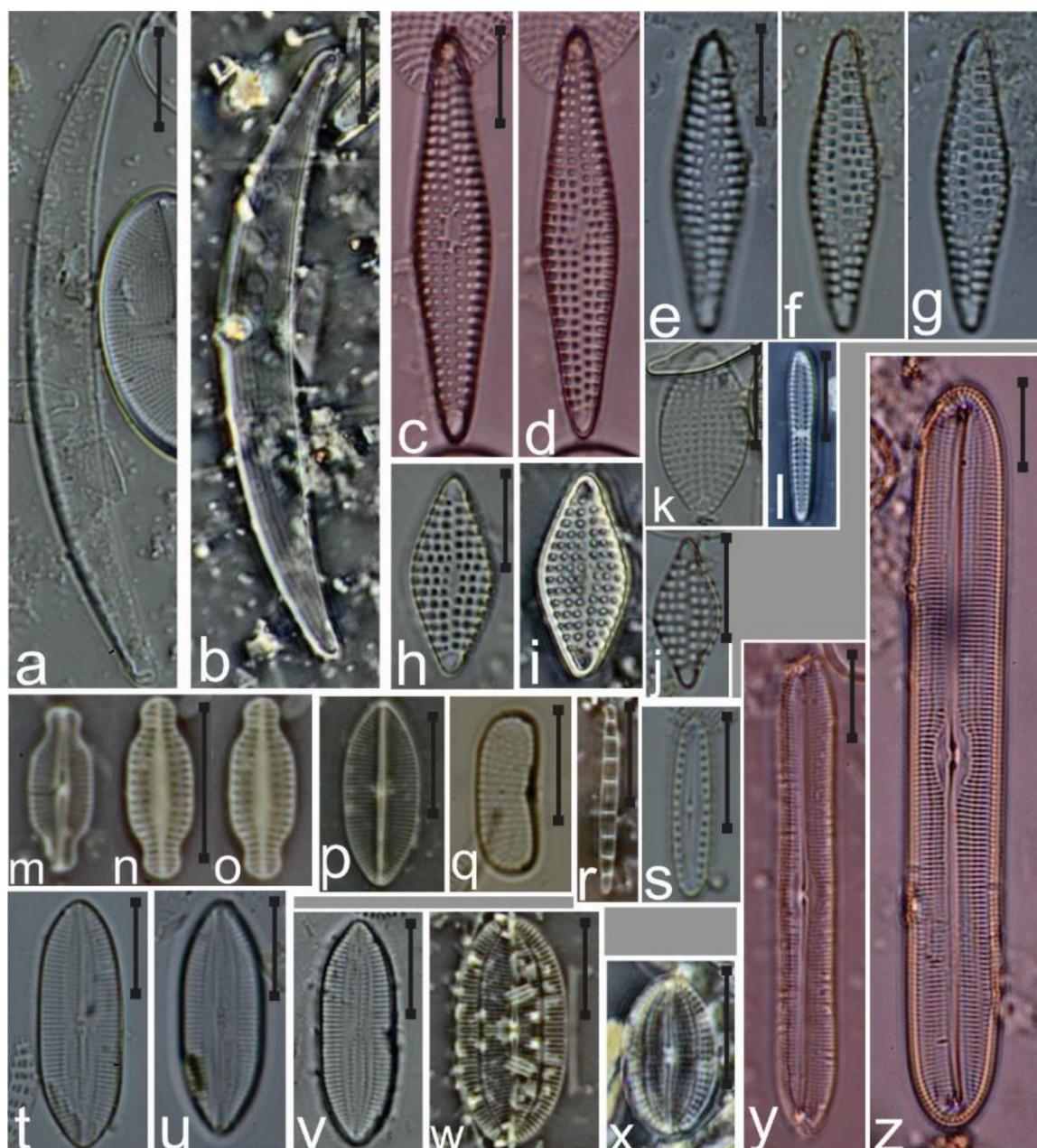


Figure 17. (a,b) *Falcula media*; (c,d) *Dimeregramma fulvum*; (e–j) *D. minor*; (k) *Delphineis minutissima*; (l) *Gomphoseptatum aestuarii*; (m–o) *Karayevia amoena*, image m raphe valve, images n and o rapheless valve; (p) *Astartiella bahusiensis*; (q) *Colliculoamphora reichardtiana*; (r) *Nagumoea vallus*; (s) *Biremis lucens*; (t–v) *Fallacia litoricola*; (w,x) *F. vittata*; (y) *Caloneis linearis*; (z) *C. elongata*. Scale bar = 10 μm .

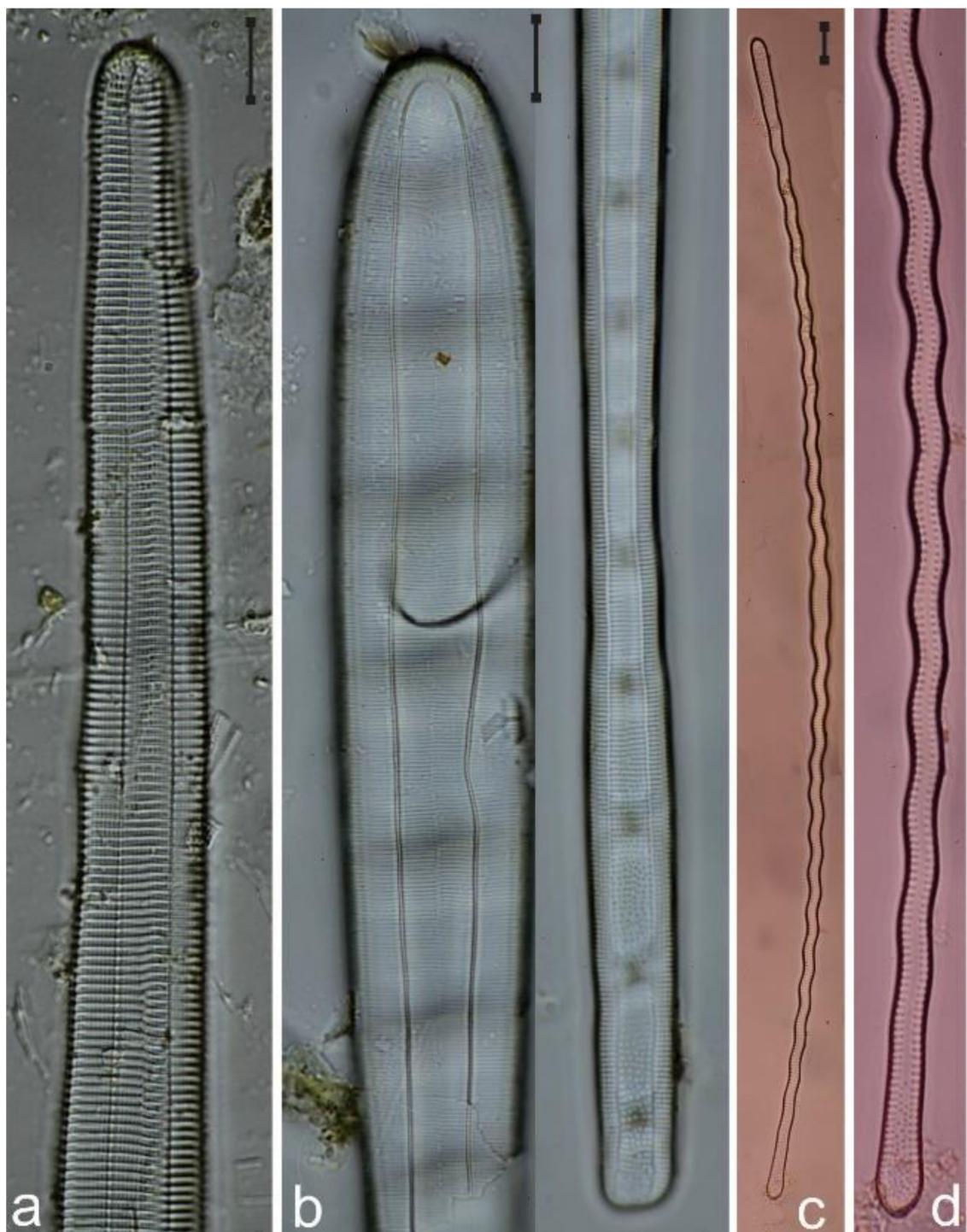


Figure 18. (a) *Ardissonaea formosa*; (b) *Climacosphenia elongata*; (c,d) *Toxarium undulatum*. Scale bar = 10 μm .

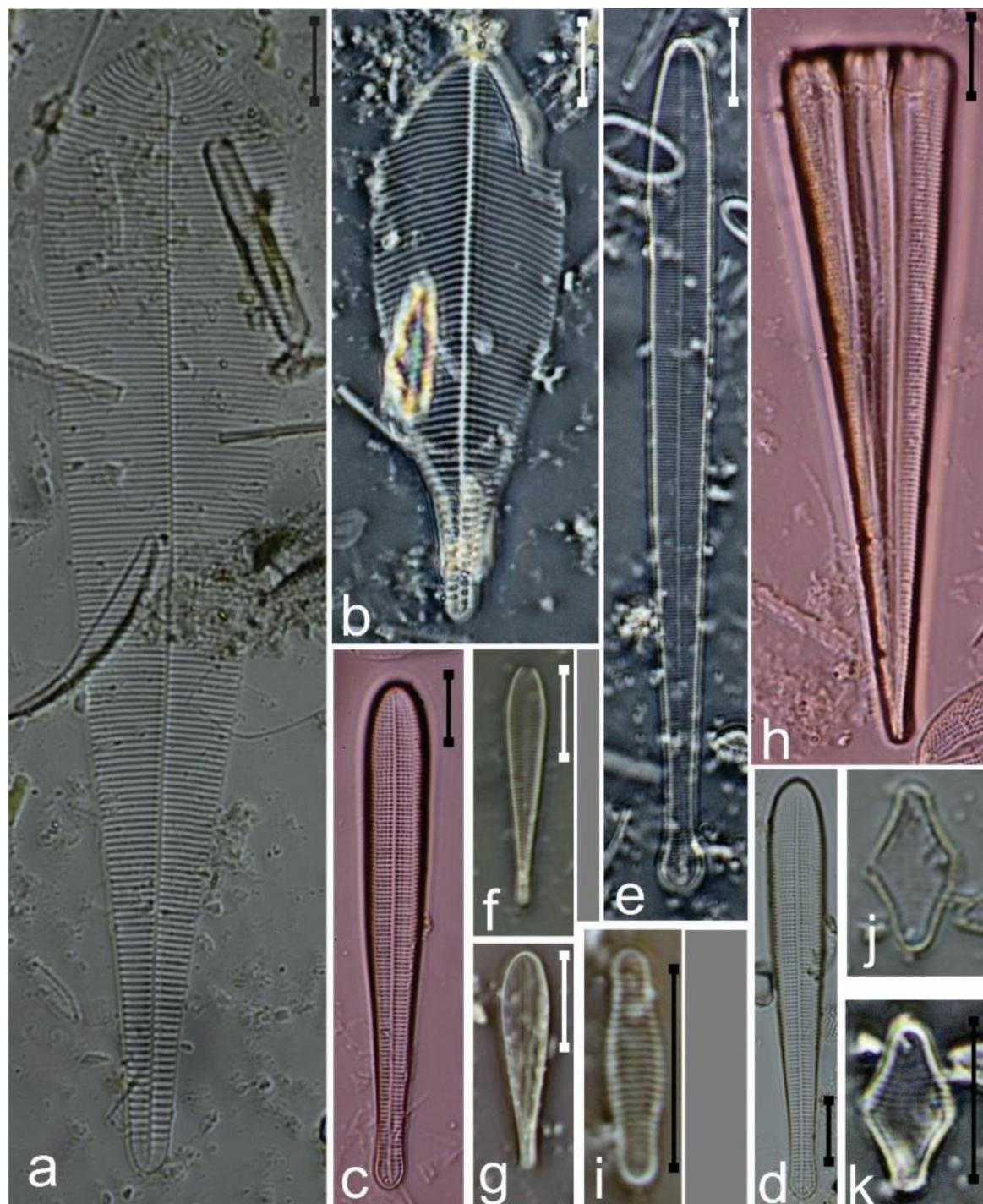


Figure 19. (a,b) *Licmophora ehrenbergii*; (c,d) *L. paradoxa*; (e) *L. pfannkuchae*; (f,g) *L. gracilis* var. *anglica*; (h) *L. abbreviata* frustule in girdle view; (i–k) *Hyalosira tropicalis*. Scale bar = 10 μm .

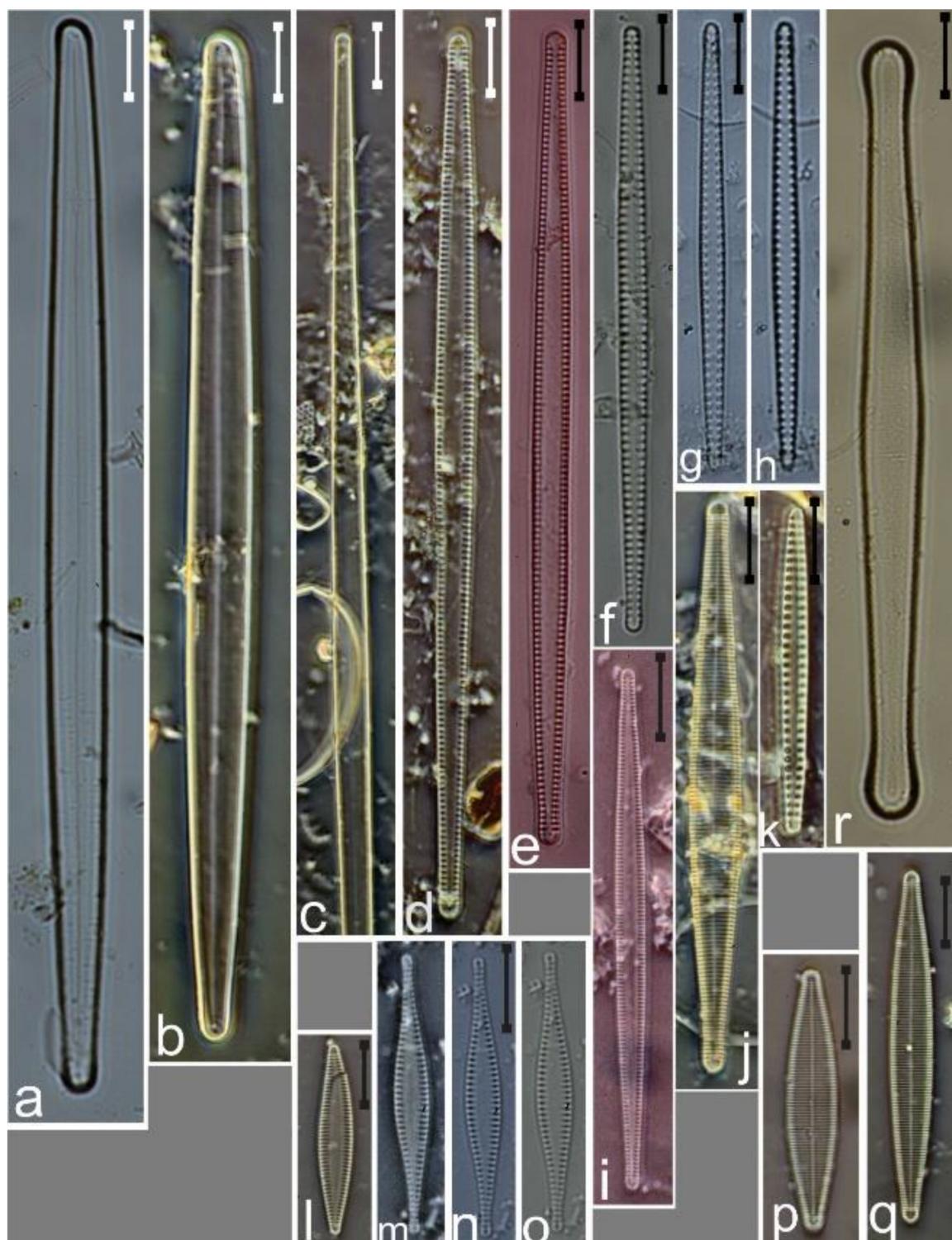


Figure 20. (a,b) *Synedra gaillonii* var. *macilenta* cf.; (c) *Hyalosynedra laevigata*; (d–f) *Tabularia tabulata*; (g,h,k) *T. investiens*; (i) *T. parva*; (j,p,q) *Fragilaria barbatula*; (l) *Tabularia fasciculata*; (m–o) *Synedra tabulata* var. *rostrata*; (r) *Grammatophora macilenta*. Scale bar = 10 μm .

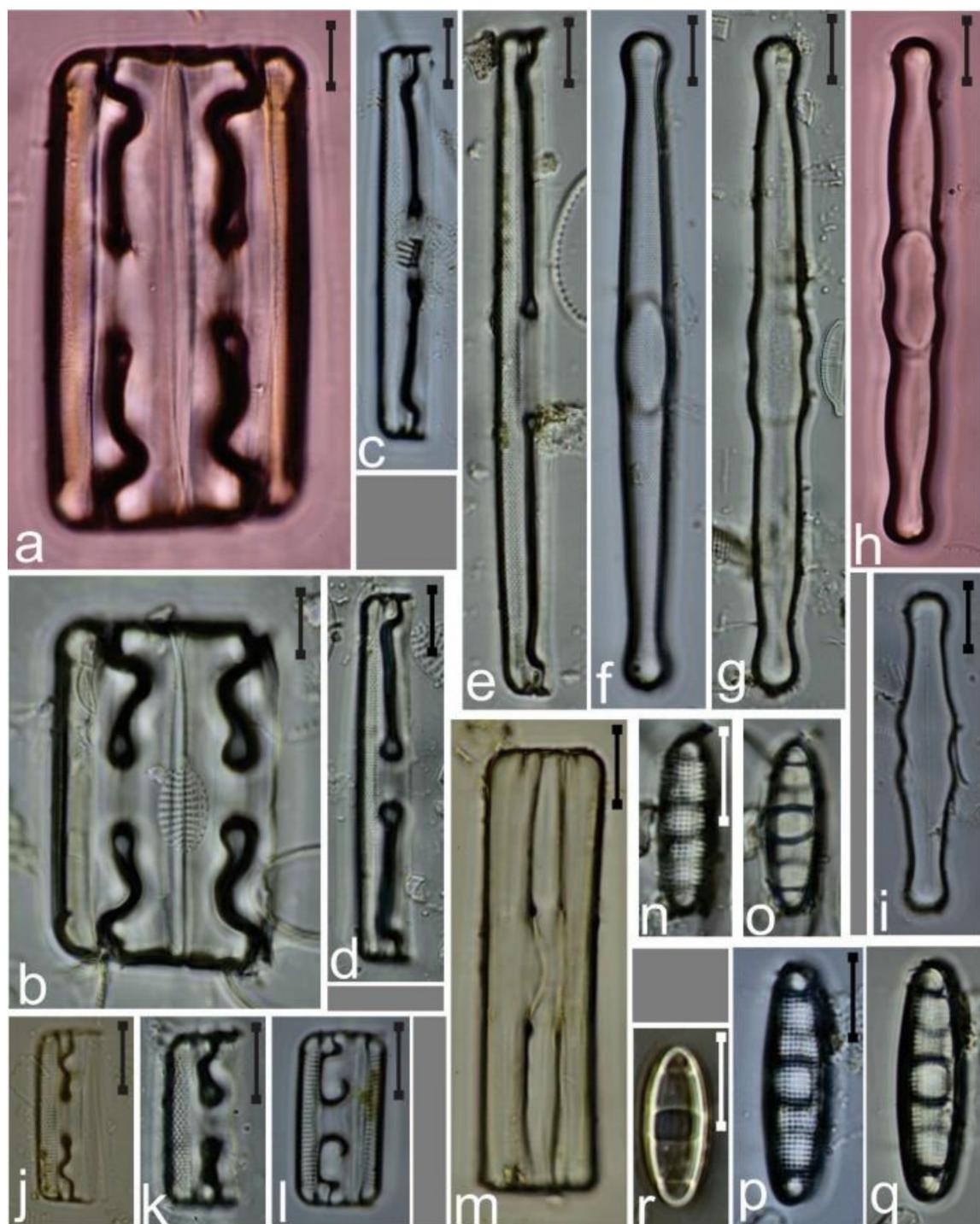


Figure 21. (a,b) *Grammatophora macilenta*; (c–f,j) *G. oceanica*; (k) *G. marina*; (g–i,m) *G. undulata* var. *gallopagensis*; (l,n–r) *G. hamulifera*. Scale bar = 10 μm .

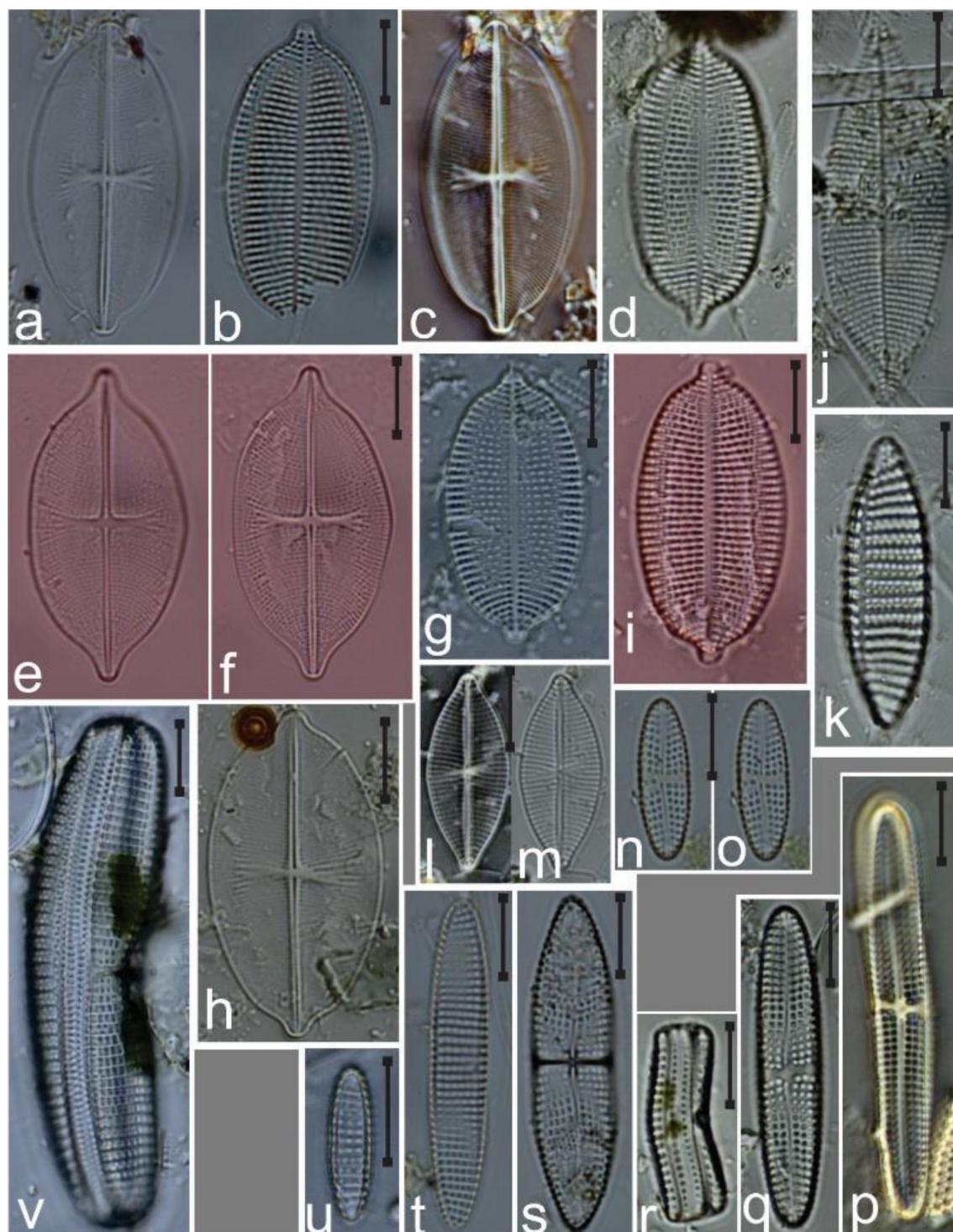


Figure 22. (a–i) *Achnanthes citronella*; (j,l,m) *A. cf. fimbriata*; (k,v) *A. subconstricta*; (n,o,u) *A. parvula*; (p,q) *A. groenlandica* var. *phinneyi*; (r,t) *A. pseudogroenlandica*; (s) *A. yaquinensis*. Scale bar = 10 μm .

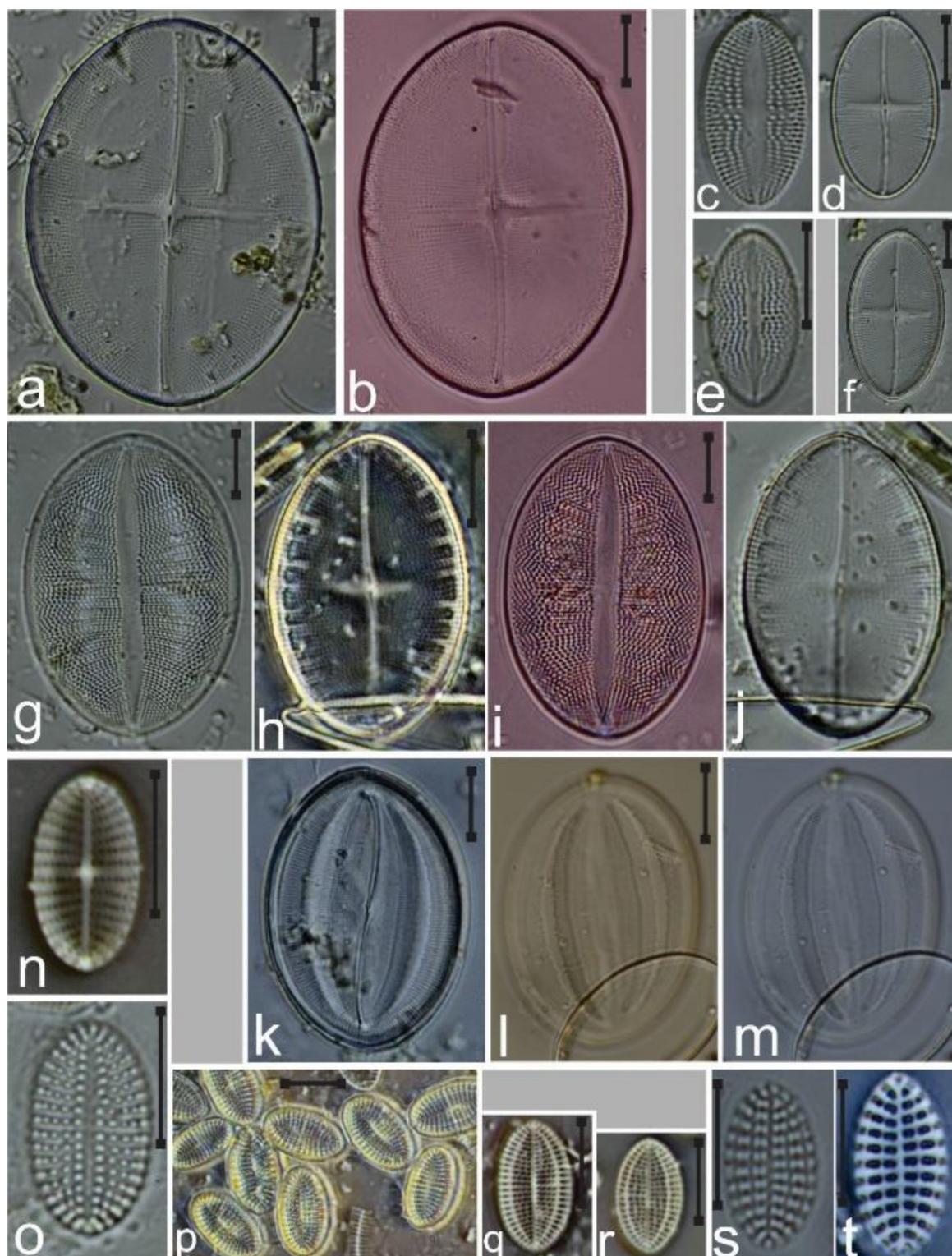


Figure 23. (a–j) *Cocconeis dirupta* raphe and sternum valves at different focal planes and showing range in size; (k–m) *C. heteroidea*; (n–p) *C. scutellum* var. *parva*, images n and o, raphe and sternum valves, respectively; (q,r) *C. californica*; (s,t) *Amphicocconeis disculoides*. Images q–t sternum valves. Scale bar = 10 μm .

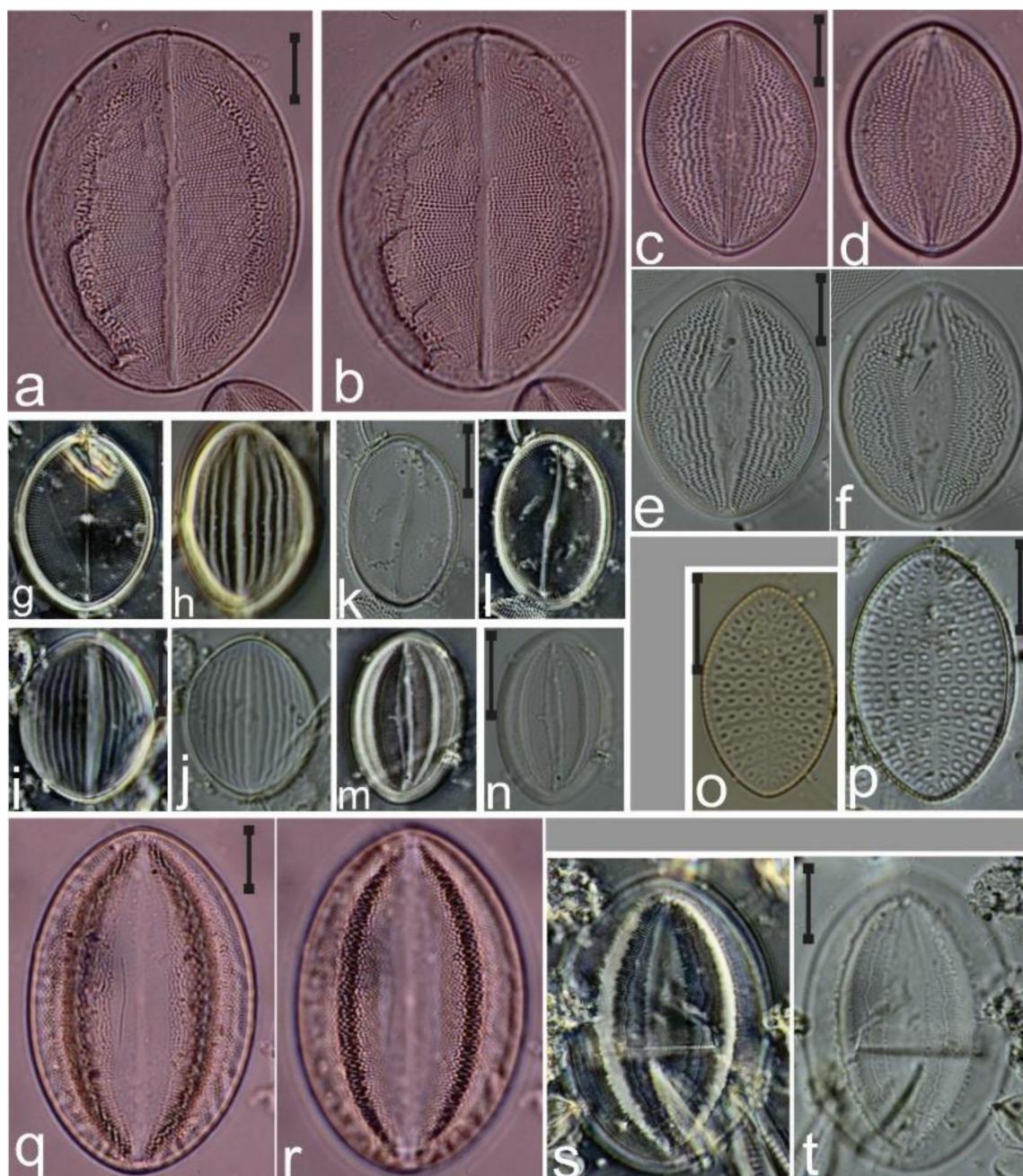


Figure 24. (a,b) *Cocconeis lineata*; (c–f) *C. contermina* raphe valves at different focal planes; (g–j) *C. convexa*, image g raphe valve, images h–j sternum valves; (k–n) *C. krammeri*, images k and l raphe, images m and sternum valves; (o,p) *C. guttata*; (q–t) *C. pseudomarginata*. Scale bar = 10 μm .

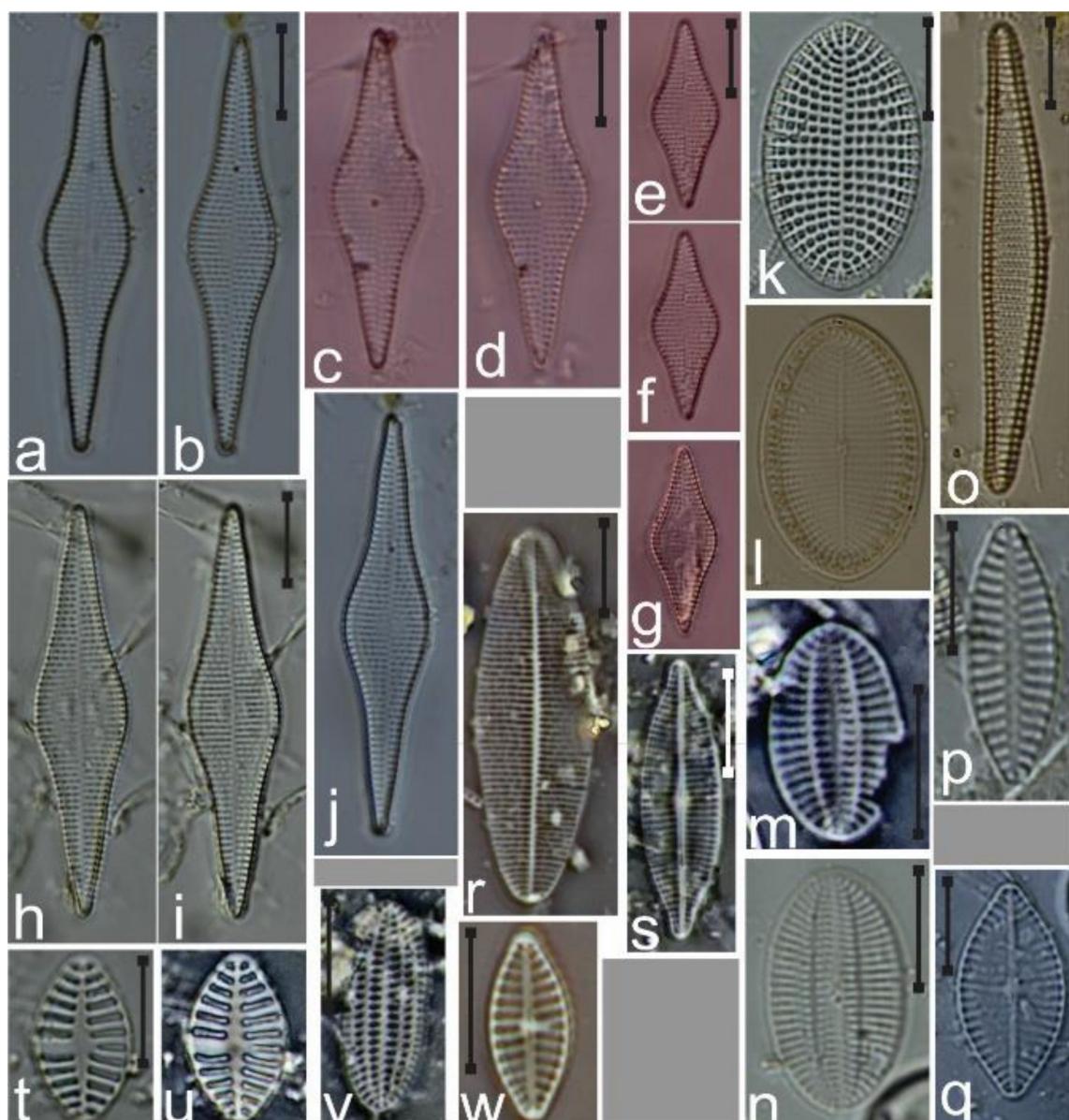


Figure 25. (a–j) *Glyphodesmis rhombica* valves at different focal planes and showing range in size; (k,l) *Cocconeis scutellum* sternum and raphe valves, respectively; (m,n) *C. peltoides*; (o) *Fragilariopsis doliolus*; (p) *Planothidium lilljeborgei* sternum valve; (q,t,u) *P. delicatulum* raphe and sternum valves; (r) *P. polare* sternum valve; (s) *P. campechianum* raphe valve; (v) *Amphicocconeis discrepans* sternum valve; (w) *Planothidium hauckianum* raphe valve. Scale bar = 10 μm .

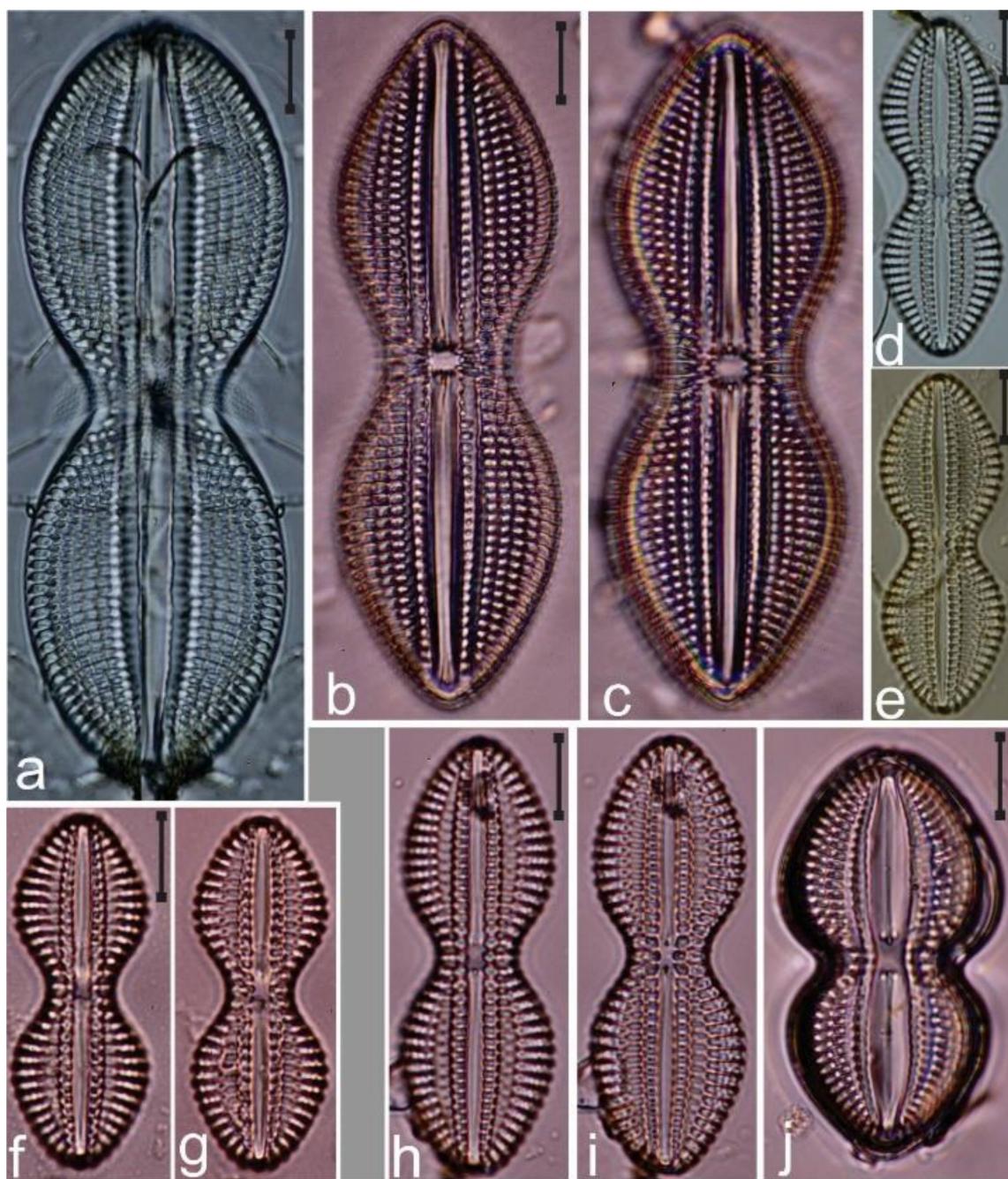


Figure 26. (a) *Diploneis bombus*; (b,c) *D. chersonensis*; (d–i) *D. crabro* valves at different focal planes and showing range in size; (j) *D. gruendleri*. Scale bar = 10 μ m.

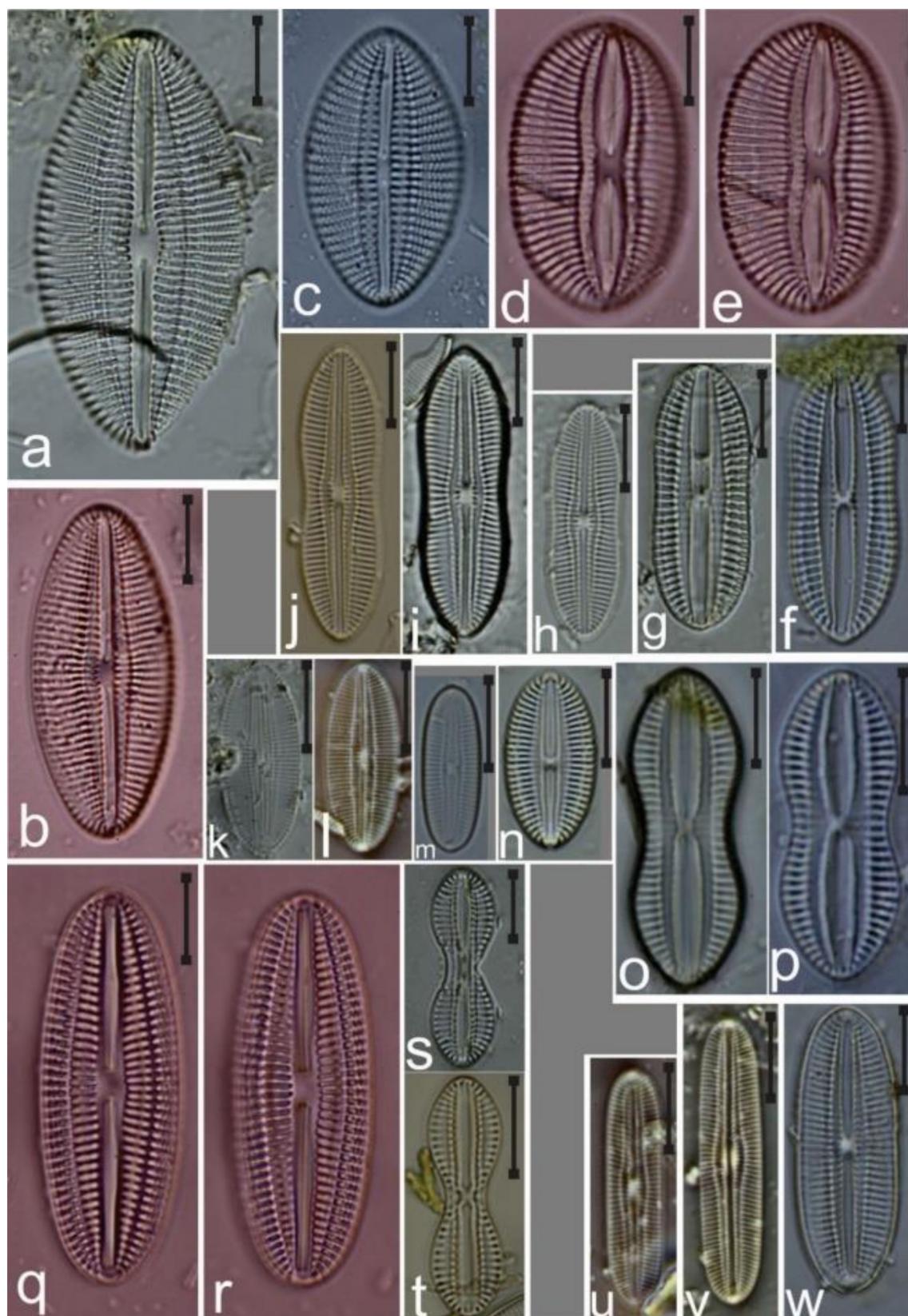


Figure 27. (a–c) *Diploneis smithii*; (d,e) *D. suborbicularis*; (f–j) *D. vacillans* var. *renitens*; (k,l) *D. littoralis* var. *clathrata*; (m,u,v) *D. vacillans* var. *vacillans*; (n) *D. papula*; (o,p) *D. incurvata*; (q,r) *D. nitescens*; (s) *D. novaeseelandiae*; (t) *D. suspecta*; (w) *D. littoralis*. Scale bar = 10 μ m.

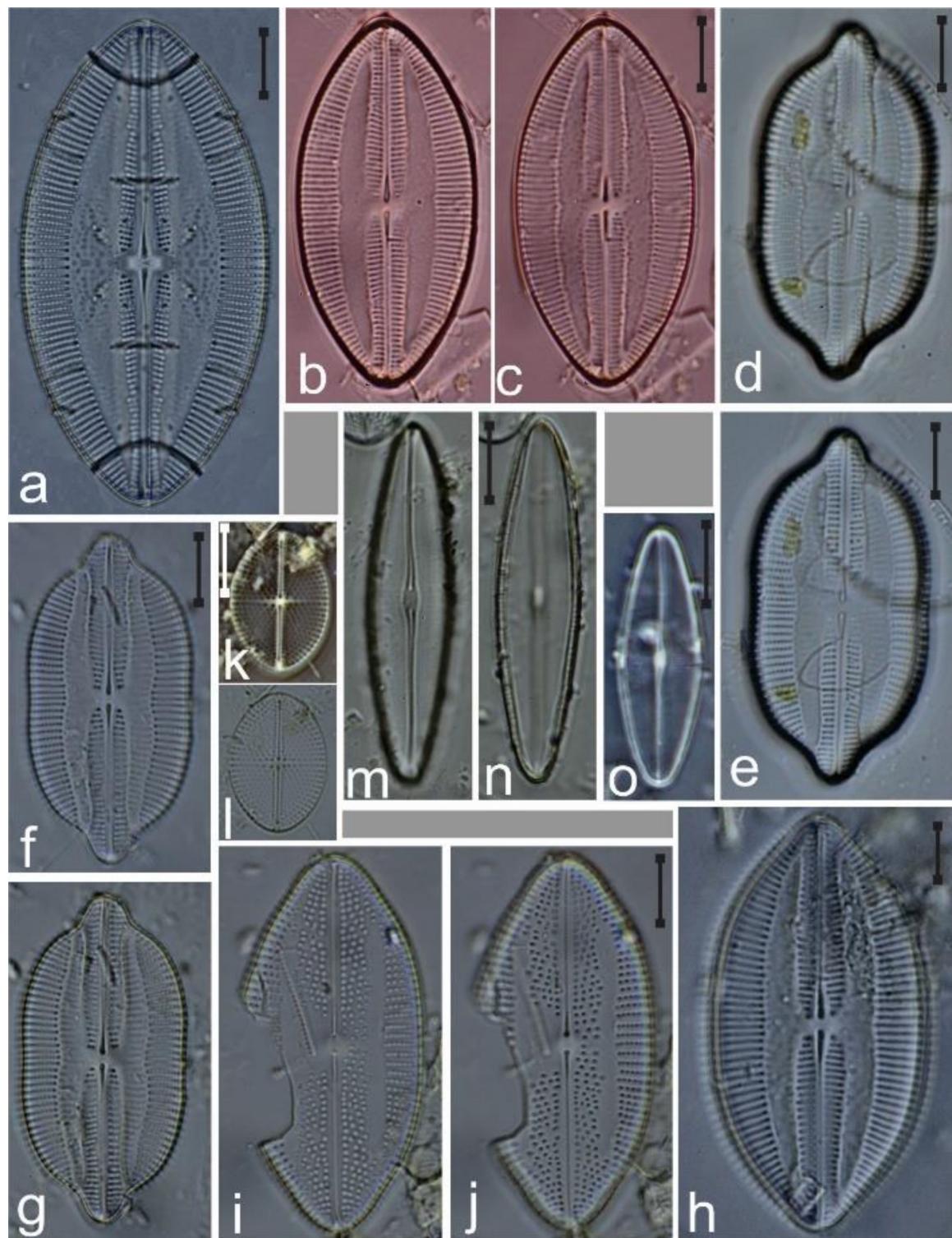


Figure 28. (a–c) *Lyrella hennedyi*; (d–g) *L. clavata* var. *caribaea*; (h) *L. atlantica*; (i,j) *L. approximatoides*; (k,l) *Mastogloia binotata*; (m,n) *M. ciskeiensis*; (o) *M. chersonensis*. Scale bar = 10 μm .

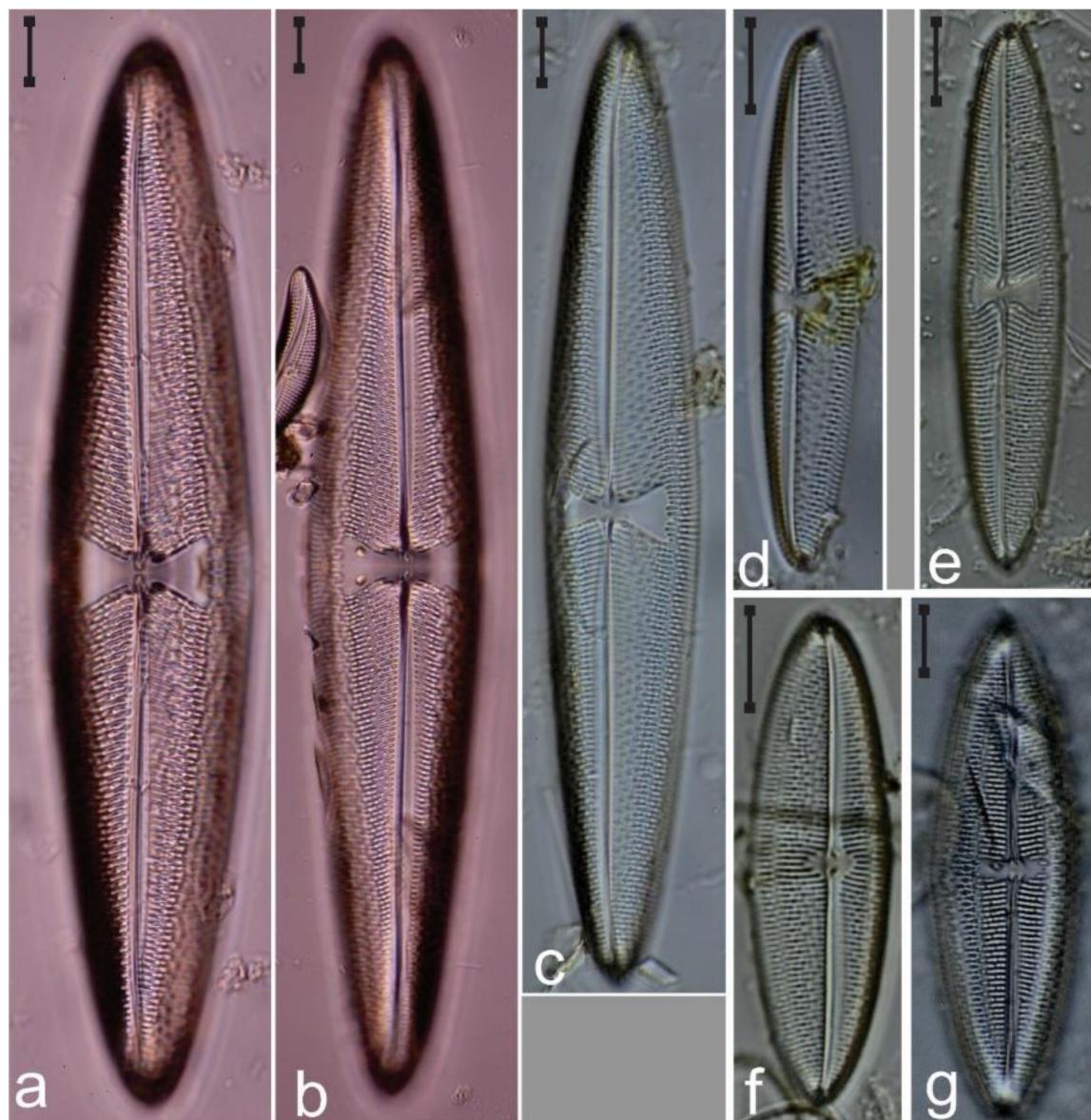


Figure 29. (a–e) *Trachyneis aspera* valves at different focal planes and showing range in size; (f,g) *T. velata*. Scale bar = 10 μm .

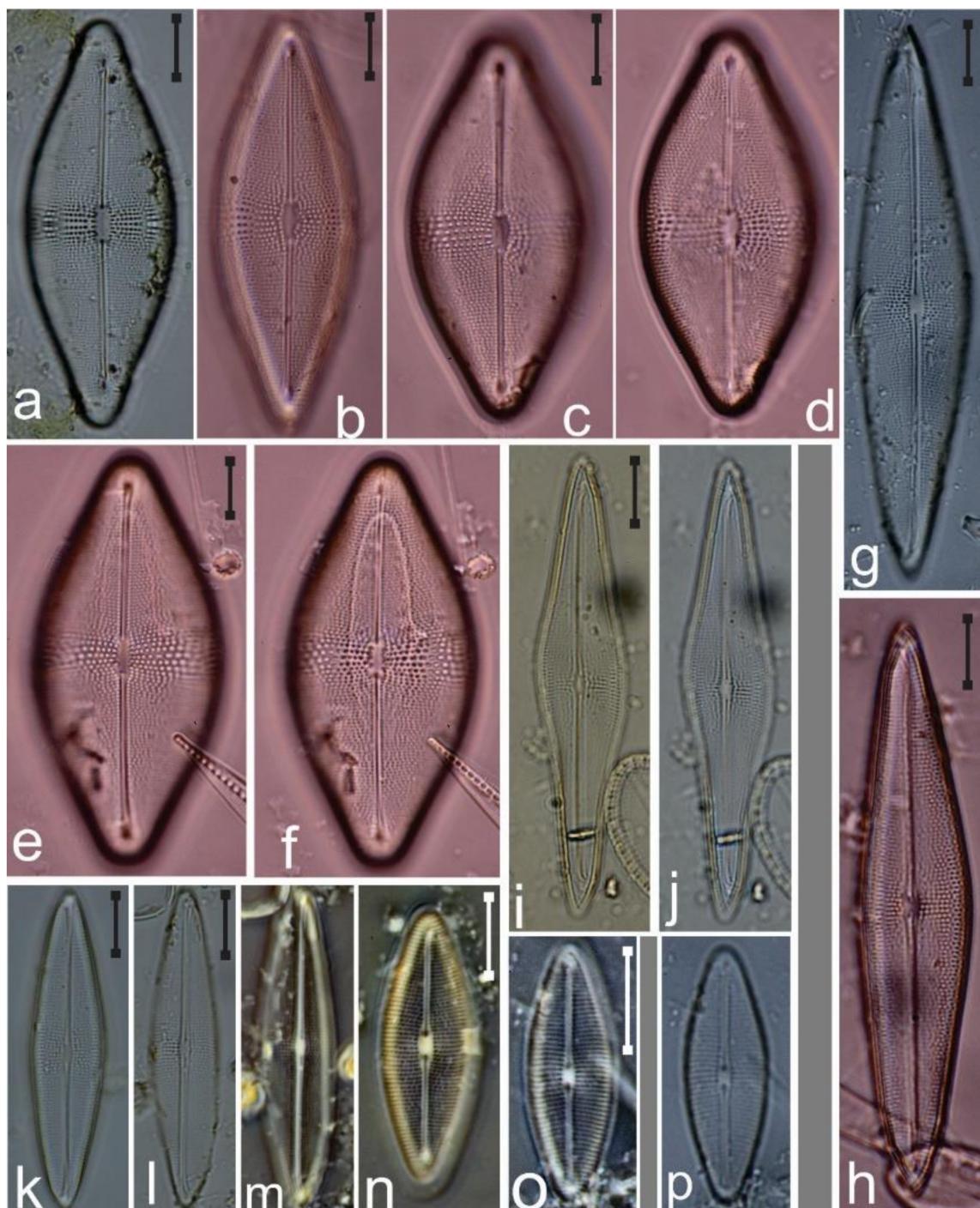


Figure 30. (a–f) *Parlibellus weissflogii*; (g,h,k–m) *P. rhombicula*; (i,j) *P. rhombicus*; (n–p) *P. delognei*. Scale bar = 10 μm .

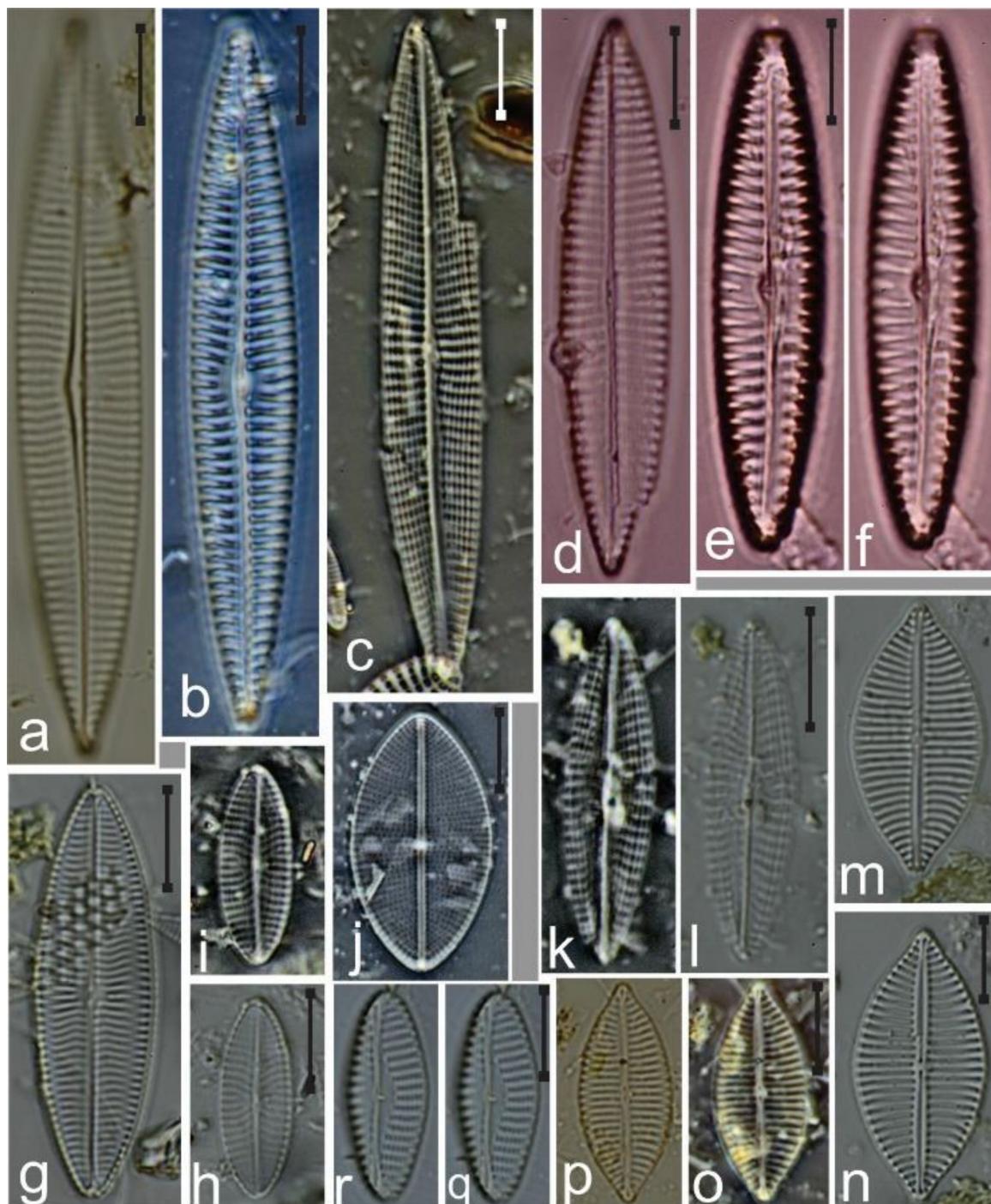


Figure 31. (a) *Navicula transitans*; (b) *N. pennata*; (c,k,l) *N. pavillardii*; (d) *N. arenaria* var. *rostellata*; (e,f) *N. cancellata*; (g) *N. johannrossii*; (h,i) *N. lusoria*; (j) *N. cluthensis*; (m–p) *N. diversistriata*; (q,r) *N. valida* var. *minuta*. Scale bar = 10 μ m.

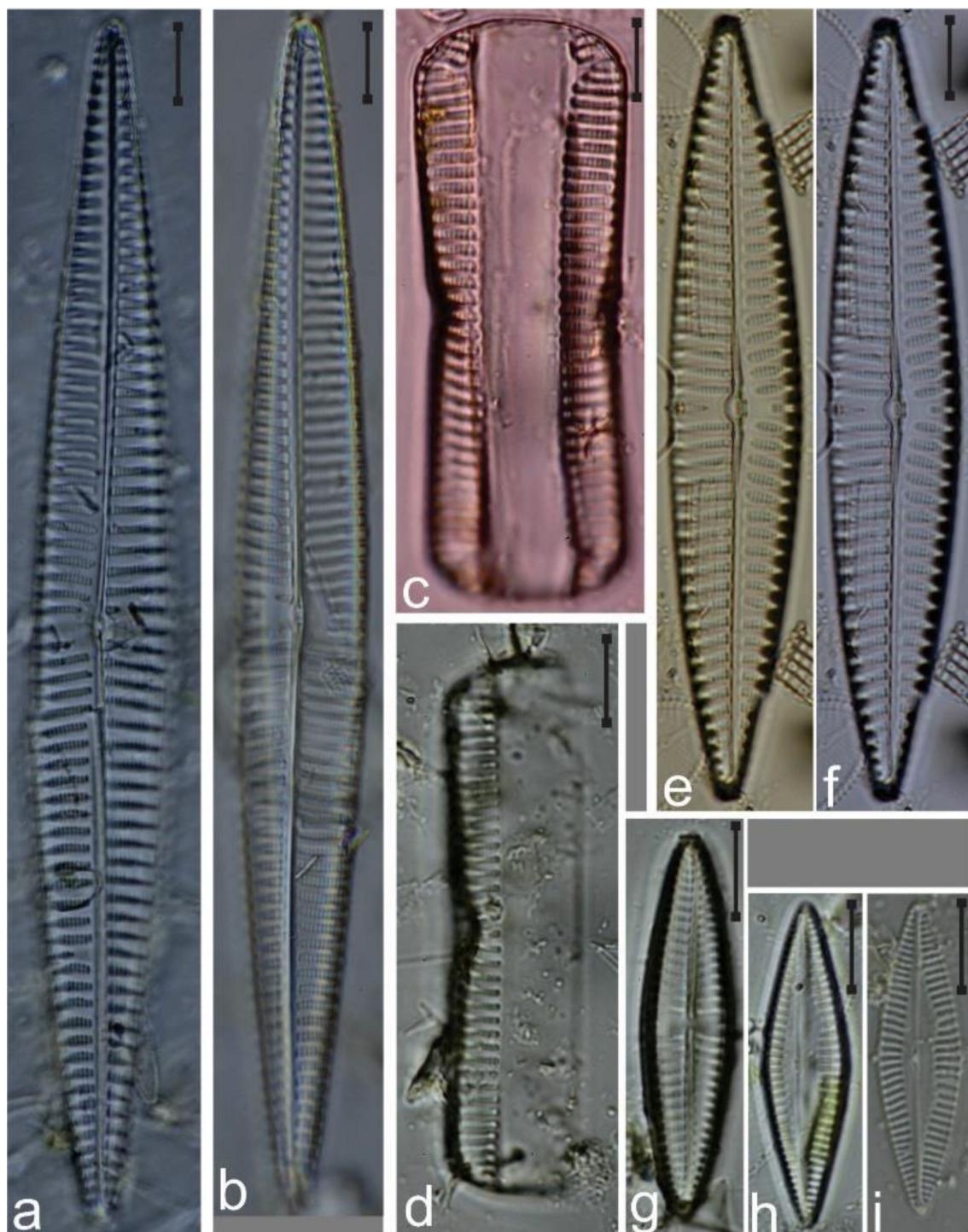


Figure 32. (a,b) *Navicula longa* var. *irregularis*; (c,g) *N. cancellata*, images c and g whole frustule and valve view, respectively; (d) *N. pennata* valve in girdle view; (e,f) *N. longa* var. *longa*; (h,i) *N. palpebralis* var. *angulosa*. Scale bar = 10 μm .

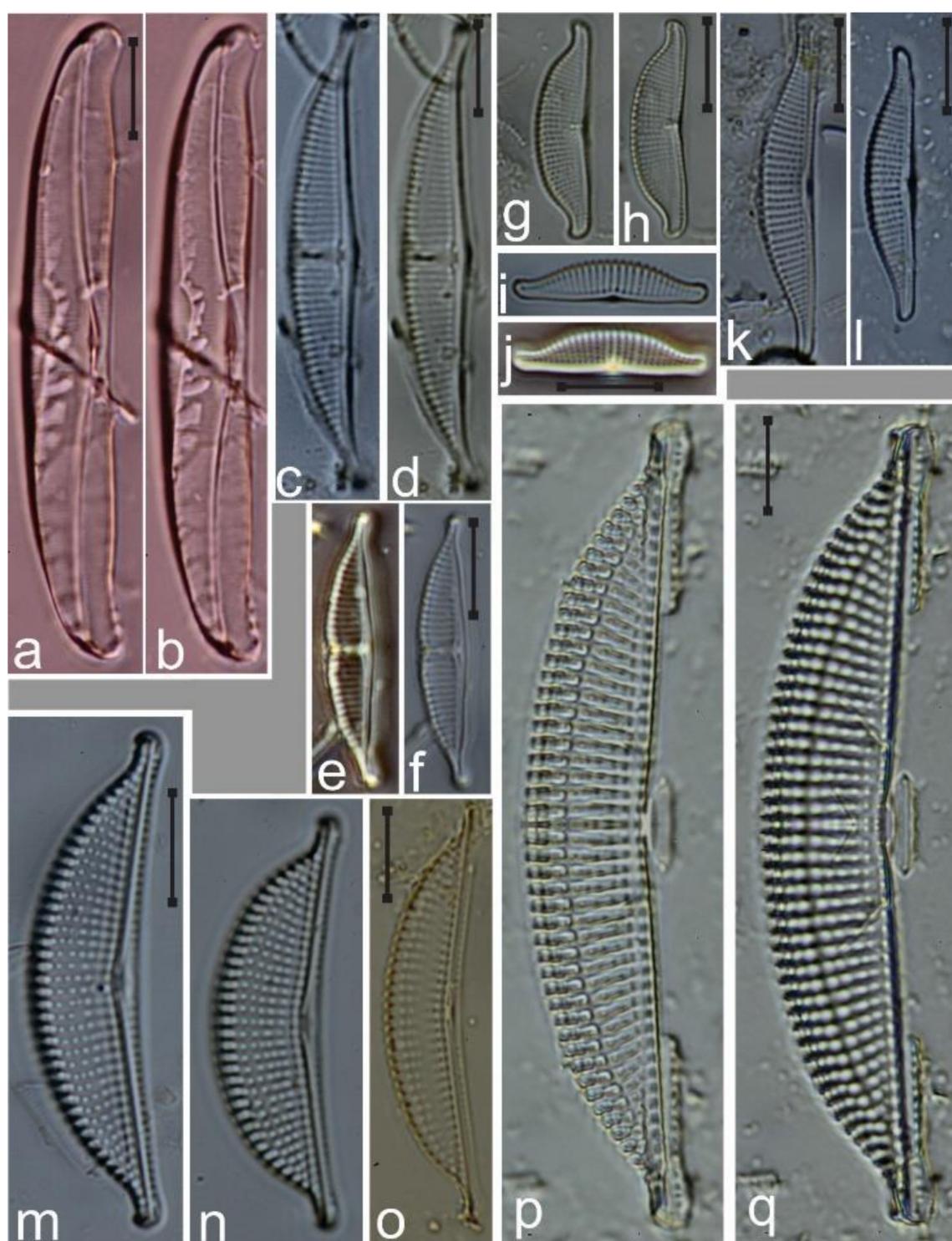


Figure 33. (a,b) *Amphora studeri*; (c–f) *Halamphora cuneata*; (g–l) *Amphora angustissima*; (m–q) *Halamphora costata*. Scale bar = 10 μ m.

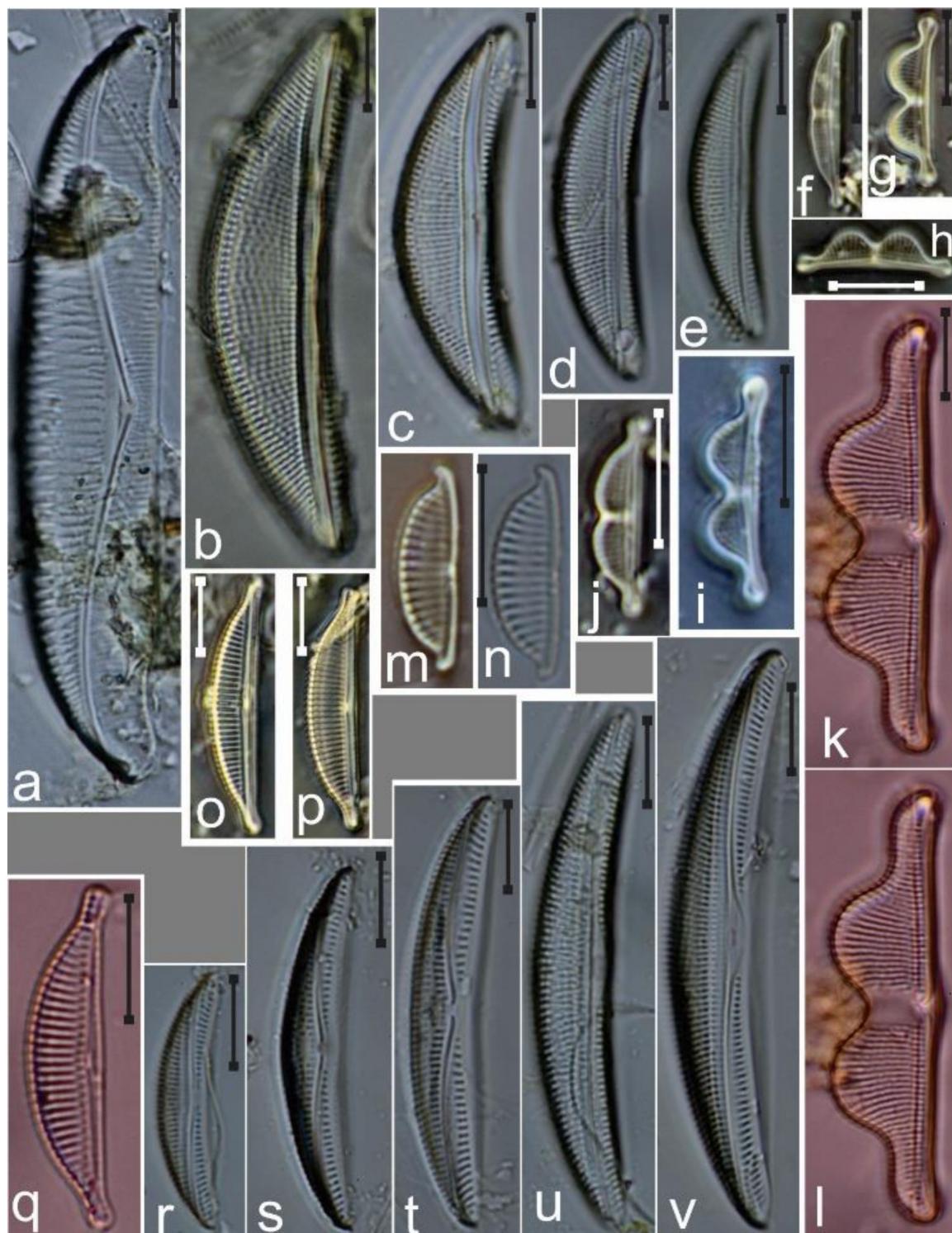


Figure 34. (a) *Amphora spectabilis*; (b–e) *A. immarginata*; (f–h,j) *A. bigibba*; (i) *Halamphora capitata*; (k,l) *Amphora bigibba* var. *interrupta*; (m,n) *Halamphora wisei*; (o,p) *H. coffeiformis*; (q) *H. acutiuscula*; (r) *Amphora proteus* var. *contigua*; (s,t) *A. marina*; (u,v) *A. proteus*. Scale bar = 10 μm .

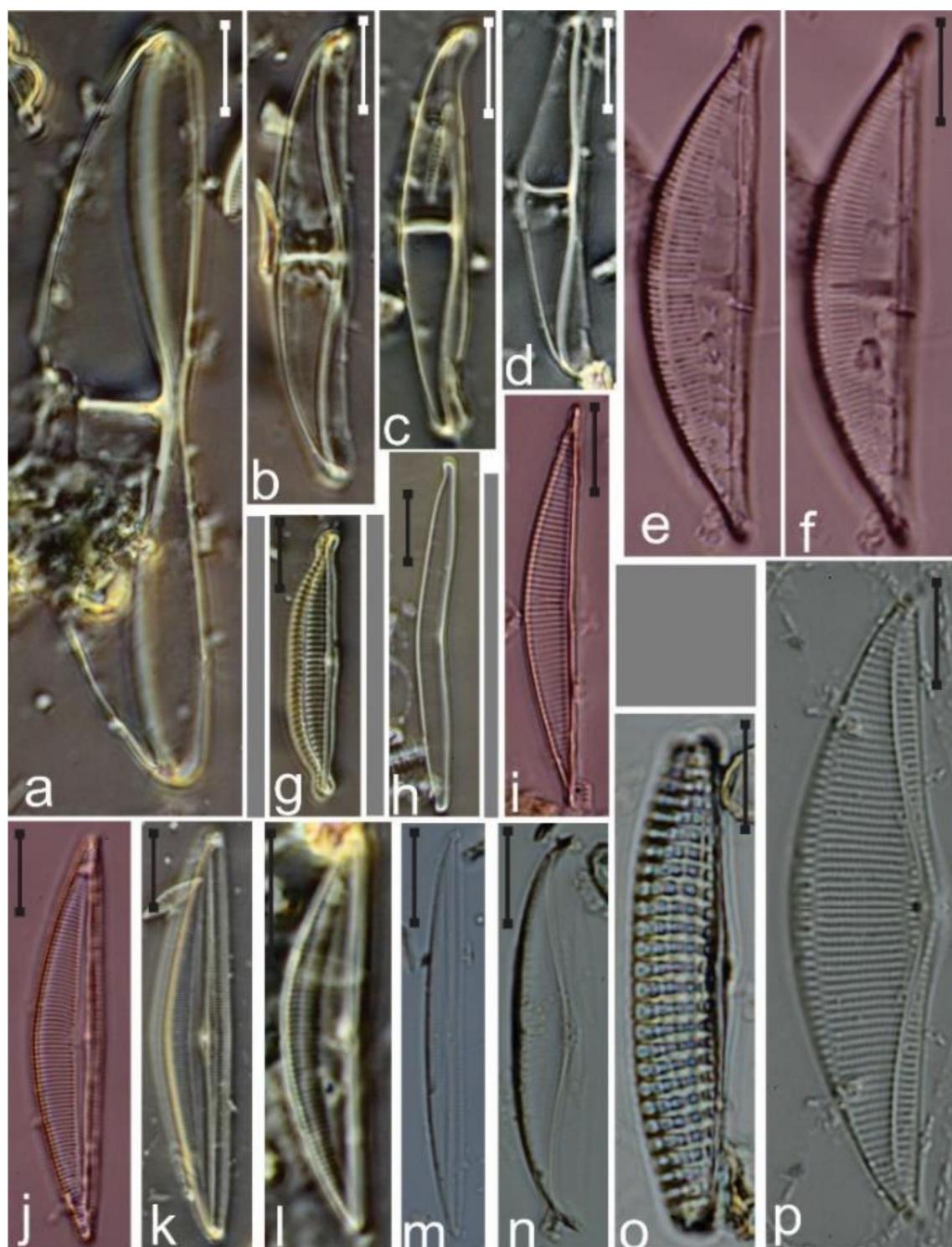


Figure 35. (a,b) *Amphora cingulata*; (c,d) *A. laevissima*; (e,f) *A. graeffeana*; (g) *Halamphora exigua*; (h) *Amphora americana*; (i) *A. cf. cymbamphora*; (j) *Seminavis robusta*; (k) *S. basilica*; (l) *Amphora beaufortiana*; (m) *Seminavis barbara*; (n) *Amphora obtusa*; (o) *A. crassa*; (p) *Tetramphora securicula*. Scale bar = 10 μm .

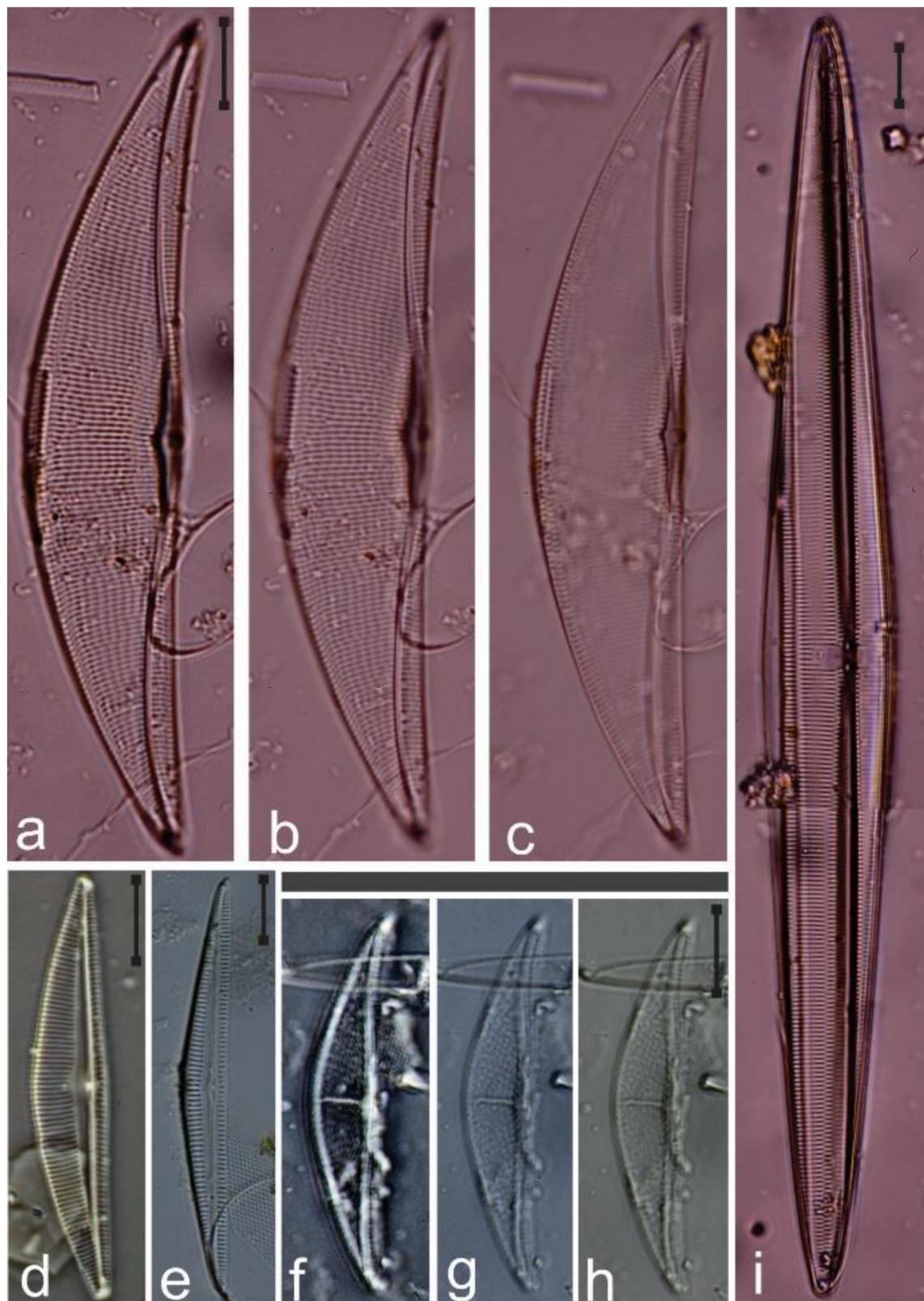


Figure 36. (a–c) *Tetramphora intermedia* in different focal planes; (d) *Seminavis robusta*; (e) *S. macilenta*; (f–h) *Tetramphora decusata*; (i) *Plagiotropis australis*. Scale bar = 10 μm .

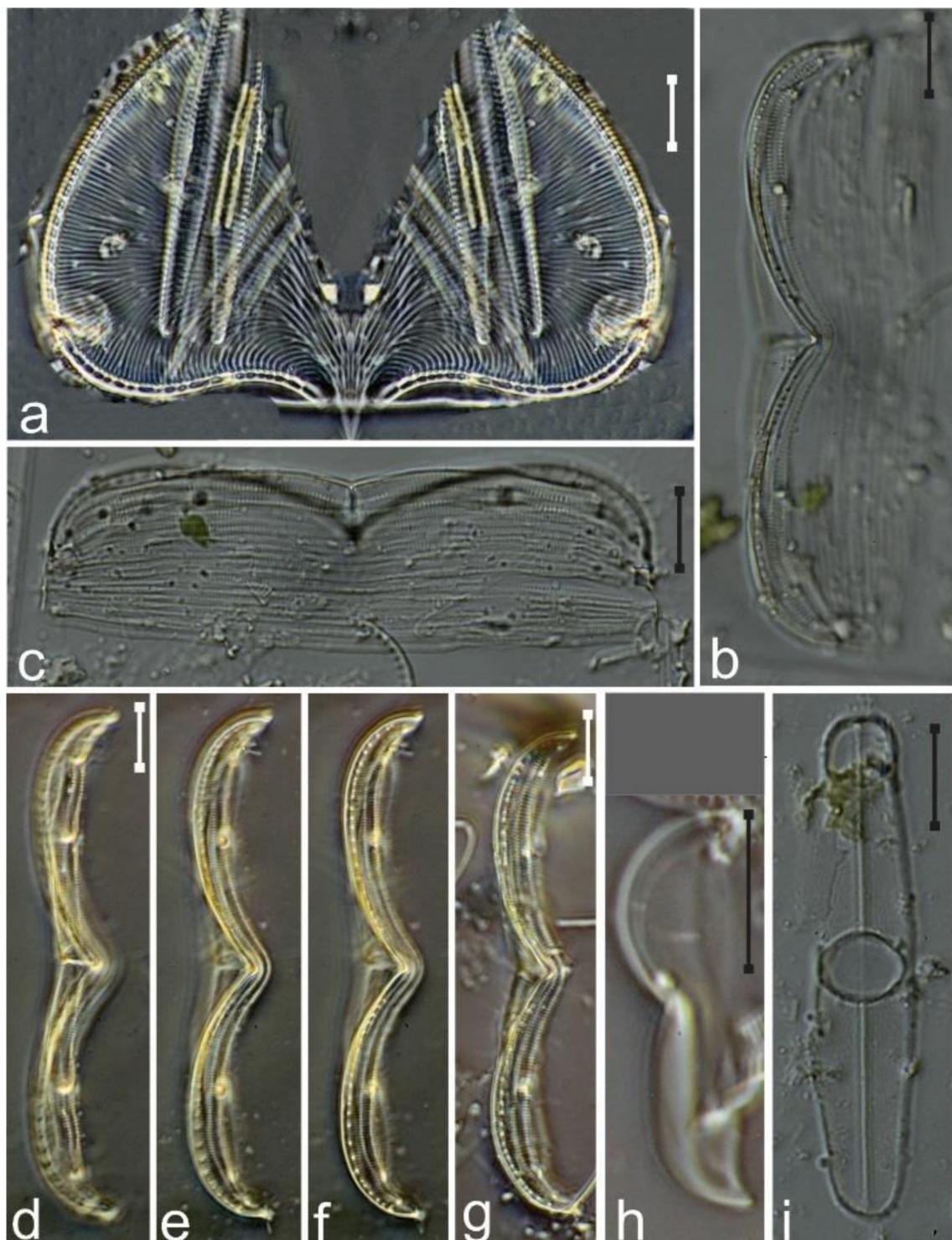


Figure 37. (a) *Auricula flabelliformis*; (b–g) *A. pulchra*; (h) *Amphiprora pseudoduplex*; (i) *Cyclophora tenuis*. Scale bar = 10 μm .

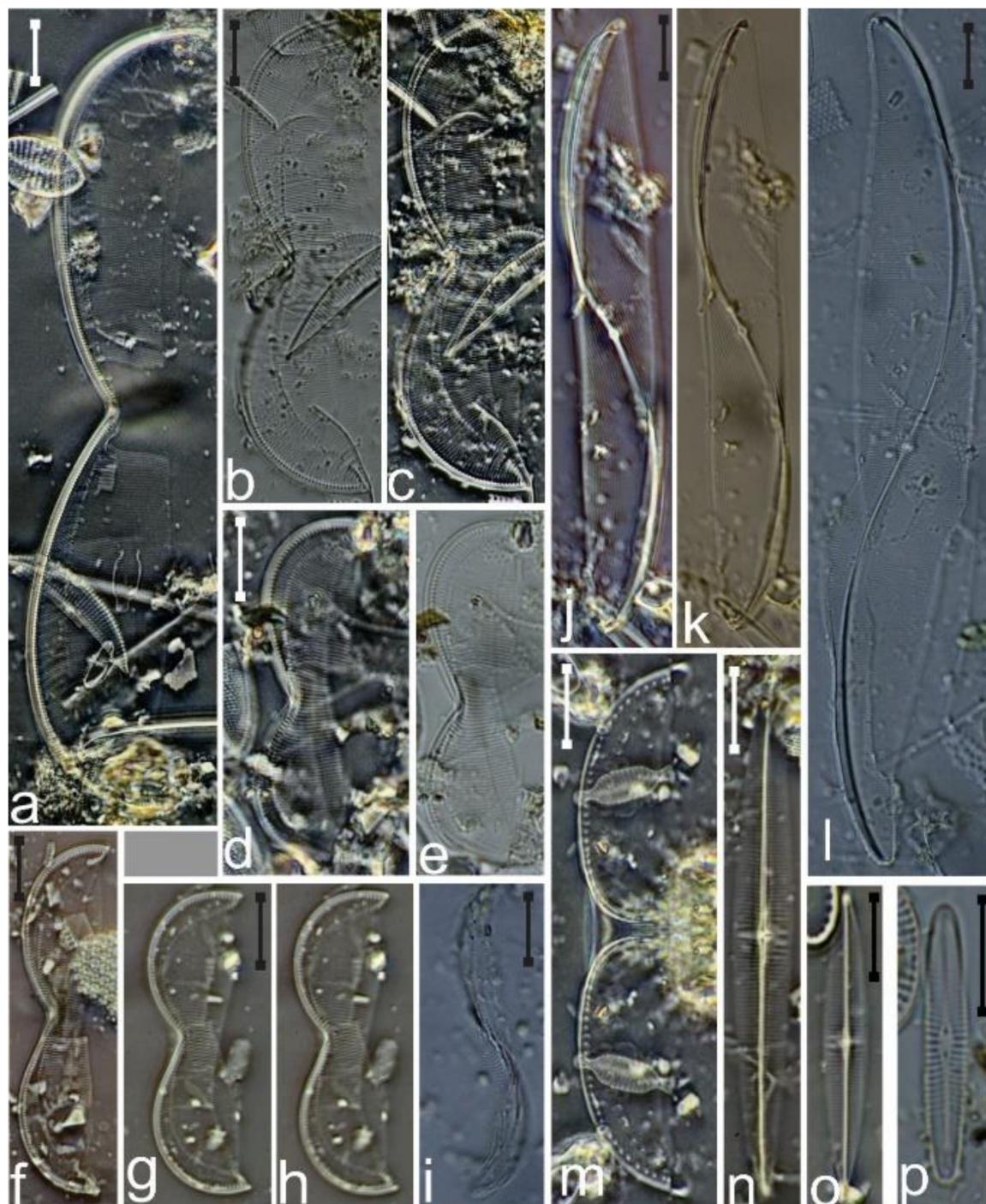


Figure 38. (a–i) *Entomoneis paludosa*; (j–l) *Donkinia carinata*; (m) *Thalassiophysa hyalina*; (n,o) *Proschkinia complanata*; (p) *Rhoicosphenia abbreviata*. Scale bar = 10 μm .

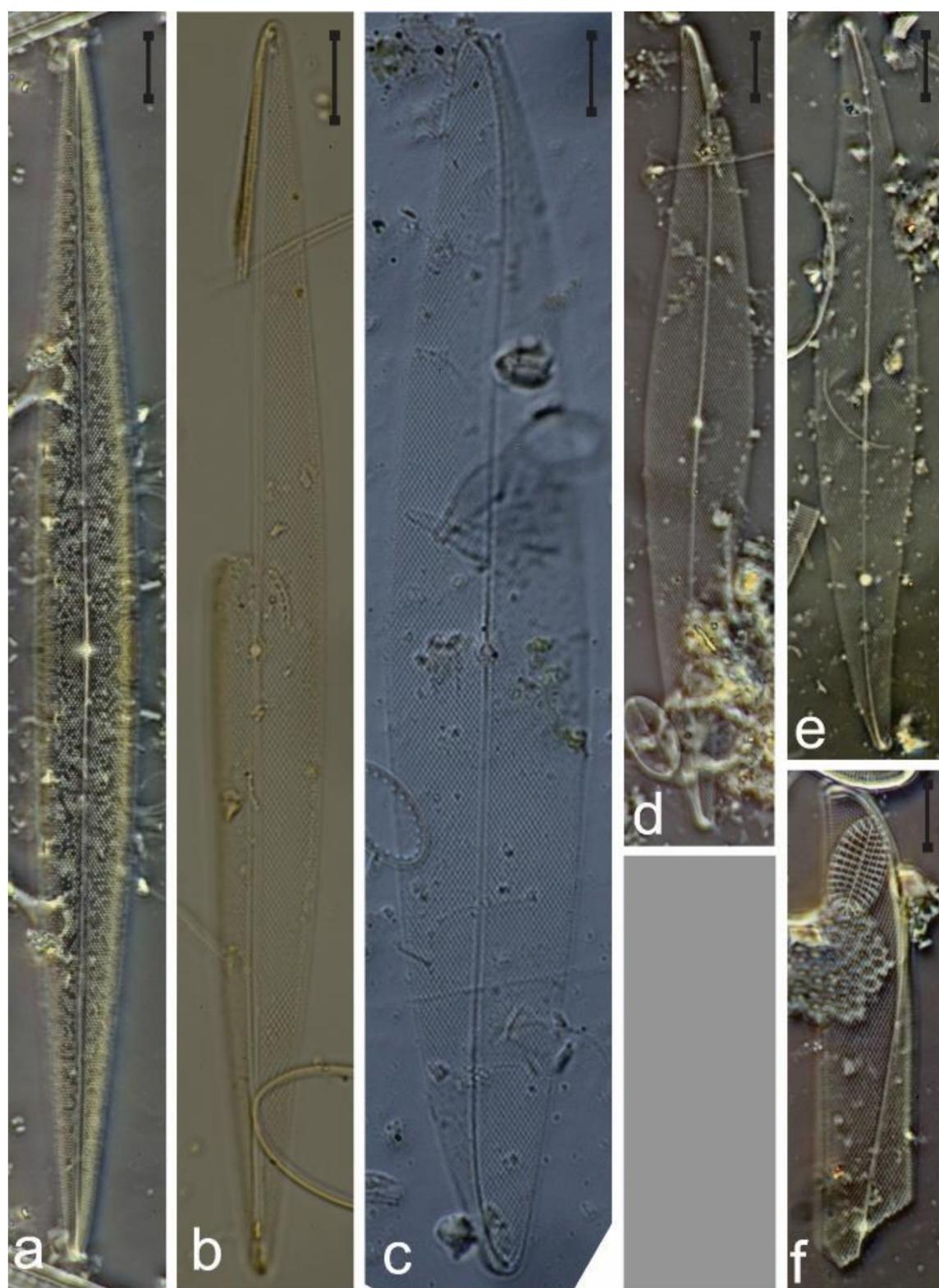


Figure 39. (a,b) *Pleurosigma patagonicum* var. *paucistriatum*; (c) *P. rigidum*; (d,e) *P. cf. gracile*; (f) *P. subsalinum*. Scale bar = 10 μm .

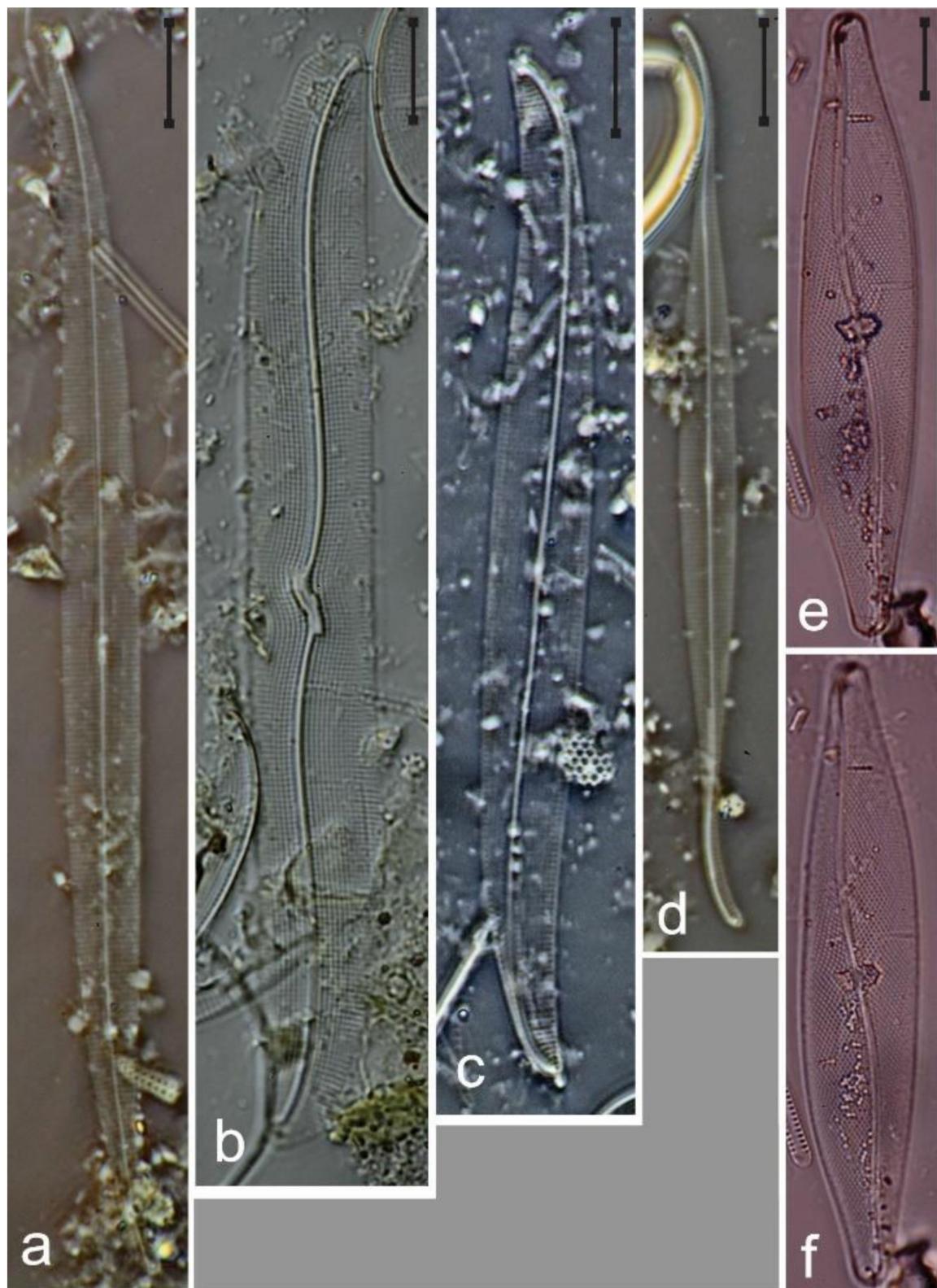


Figure 40. (a) *Gyrosigma tenuissimum* var. *hyperboreum*; (b) *G. balticum*; (c) *G. peisonis*; (d) *G. reversum*; (e,f) *Pleurosigma naviculaceum*. Scale bar = 10 μm .

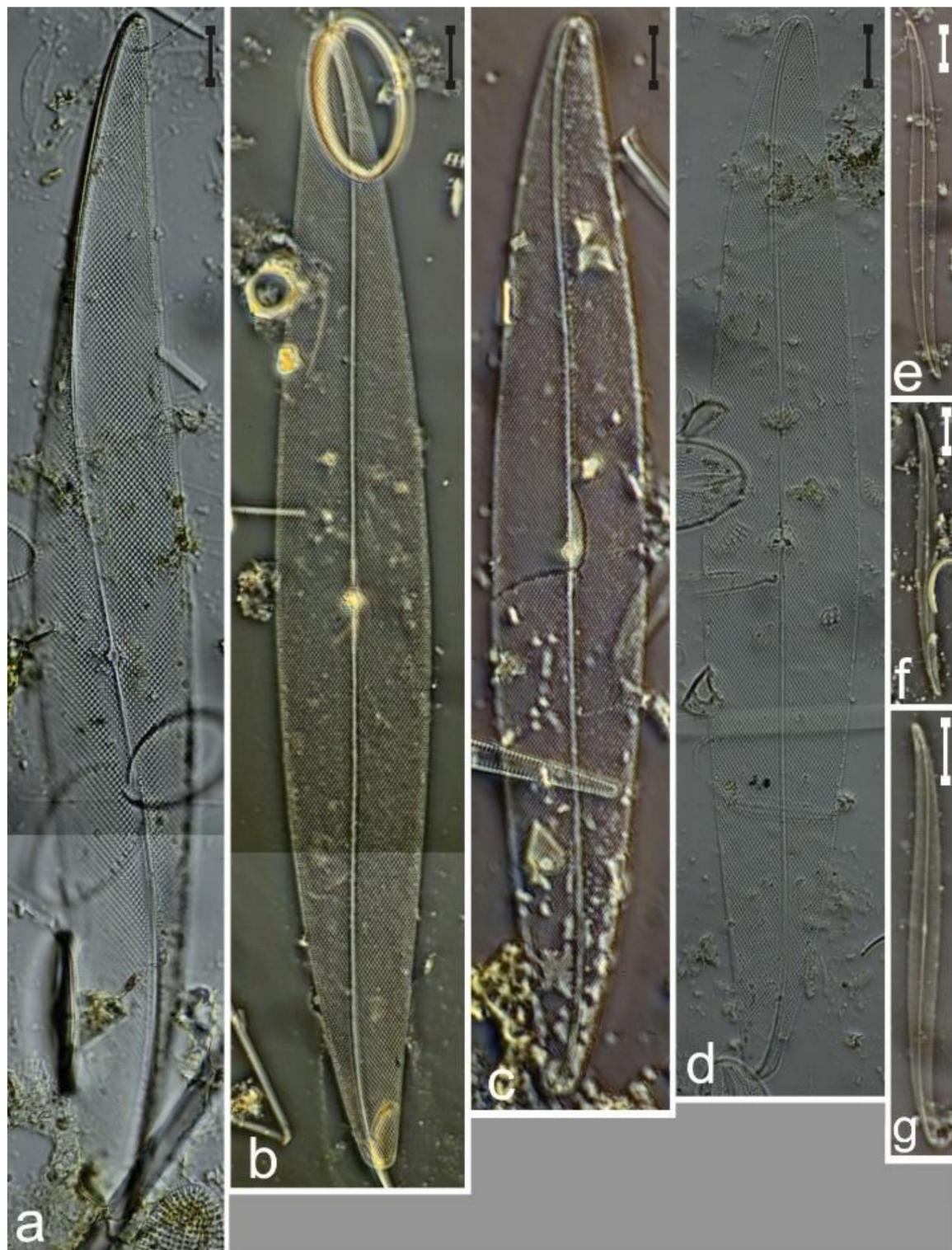


Figure 41. (a) *Pleurosigma formosum*; (b–d) *P. rigidum*; (e–g) *Gyrosigma parvulum*. Scale bar = 10 μm .

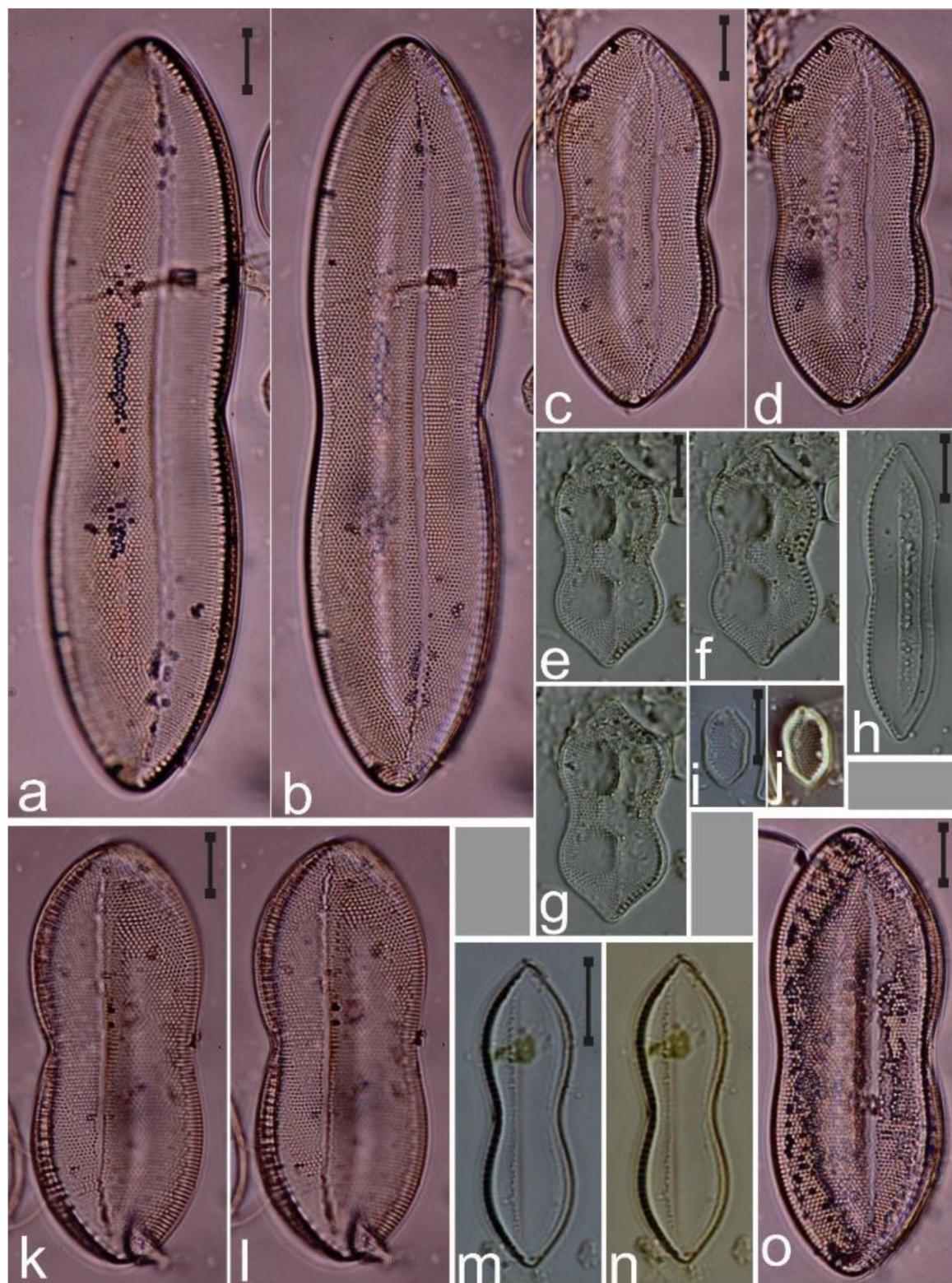


Figure 42. (a–d,k,l,o) *Psammodictyon panduriforme*; (e–g) *P. pustulatum*; (h) *P. roridum*; (i,j) *P. panduriforme* var. *continuum*; (m,n) *Nitzschia carnicobarica*. Scale bar = 10 μm .

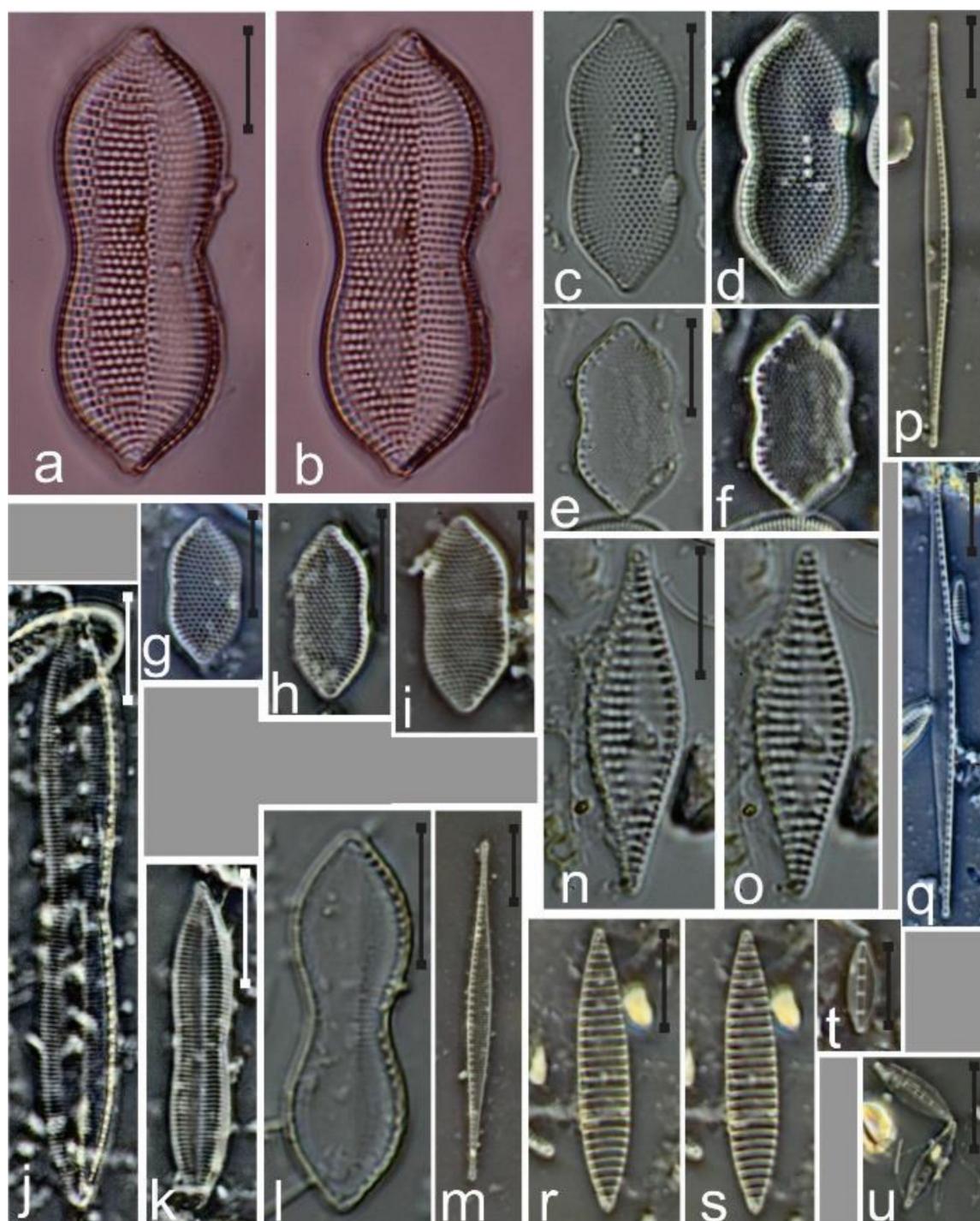


Figure 43. (a–d,g,h) *Tryblionella coarctata*; (e,f,i) *T. bathurstensis*; (j,k) *T. hungarica*; (l) *Nitzschia carnicobarica*; (m,p,q) *N. gracilis*; (n,o) *Tryblionella lanceola*; (r,s) *Nitzschia sicula*; (t,u) *N. incrustans*. Scale bar = 10 μm .

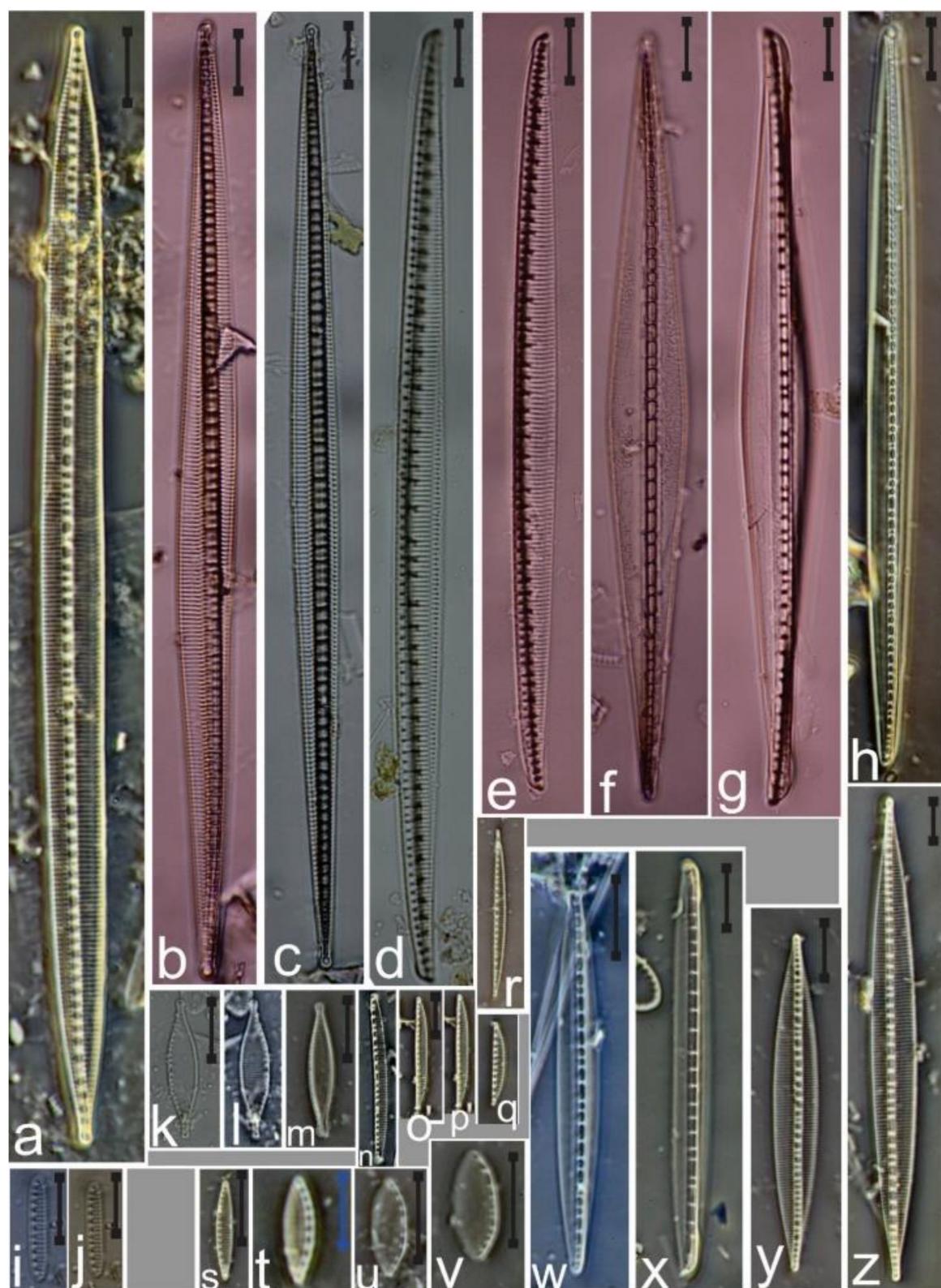


Figure 44. (a,y,z) *Bacillaria socialis*; (b,c) *Nitzschia longa*; (d,e) *N. insignis*; (f,g) *N. angularis*; (h,w) *N. spathulata*; (i,j) *N. valdestriata*; (k,l) *N. bicapitata*; (m) *N. agnita*; (n–r) *Cymbellonitzschia banzuensis*; (s,t) *Nitzschia frustulum*; (u,v) *N. amabilis*; (x) *N. distans*. Scale bar = 10 μ m.

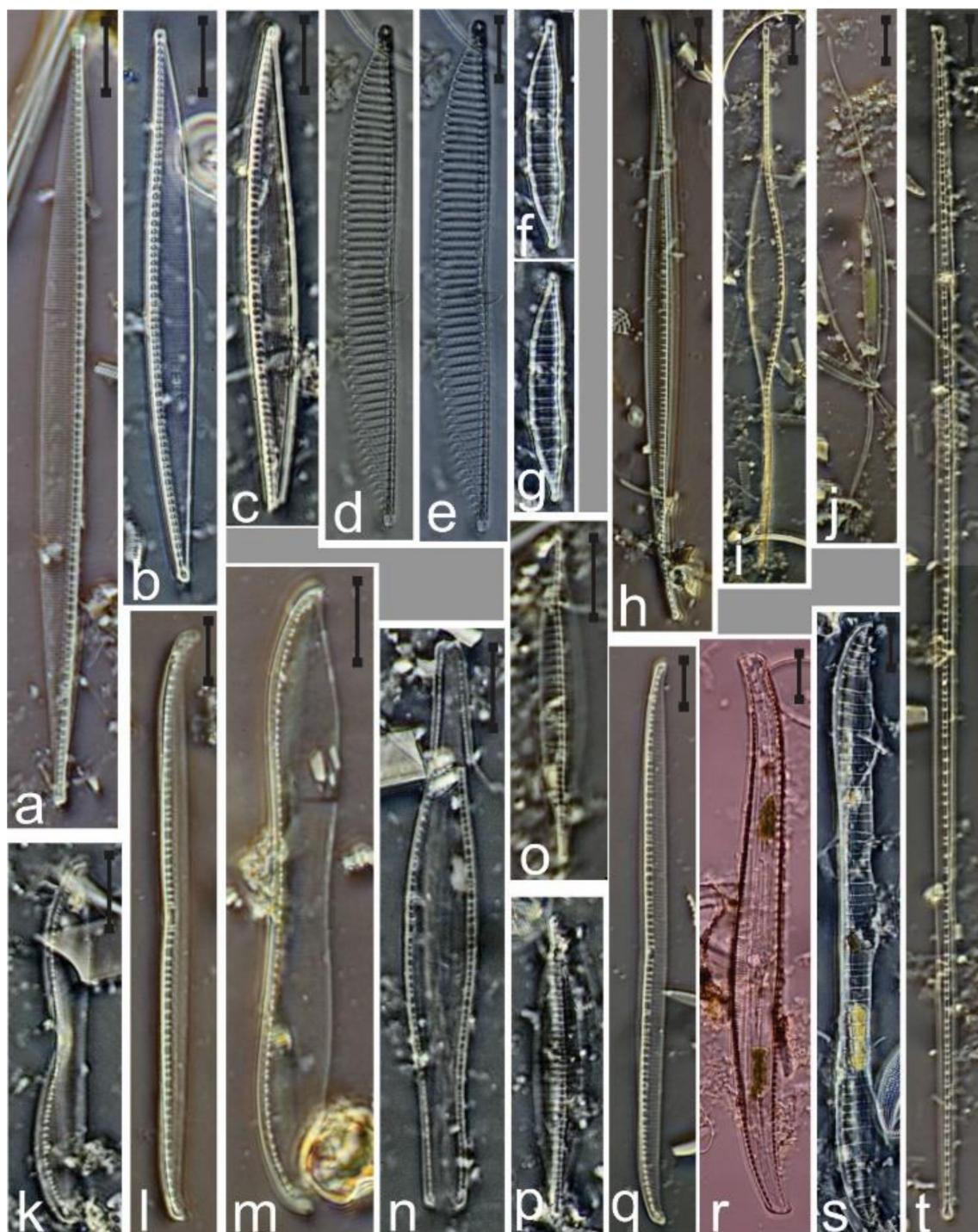


Figure 45. (a) *Nitzschia fusiformis*; (b,c) *N. sigma*; (d–g) *Hantzschia marina*; (h) *Nitzschia incurva* var. *lorenziana*; (i) *N. longissima*; (j) *Cylindrotheca closterium*; (k,m) *Nitzschia hybrida*; (l) *N. linearis*; (n) *N. lanceolata*; (o,p) *N. composita*; (q) *N. cf. spectabilis* var. *americana*; (r) *N. insignis*; (s) *N. costata*; (t) *N. martiana*. Scale bar = 10 μ m.

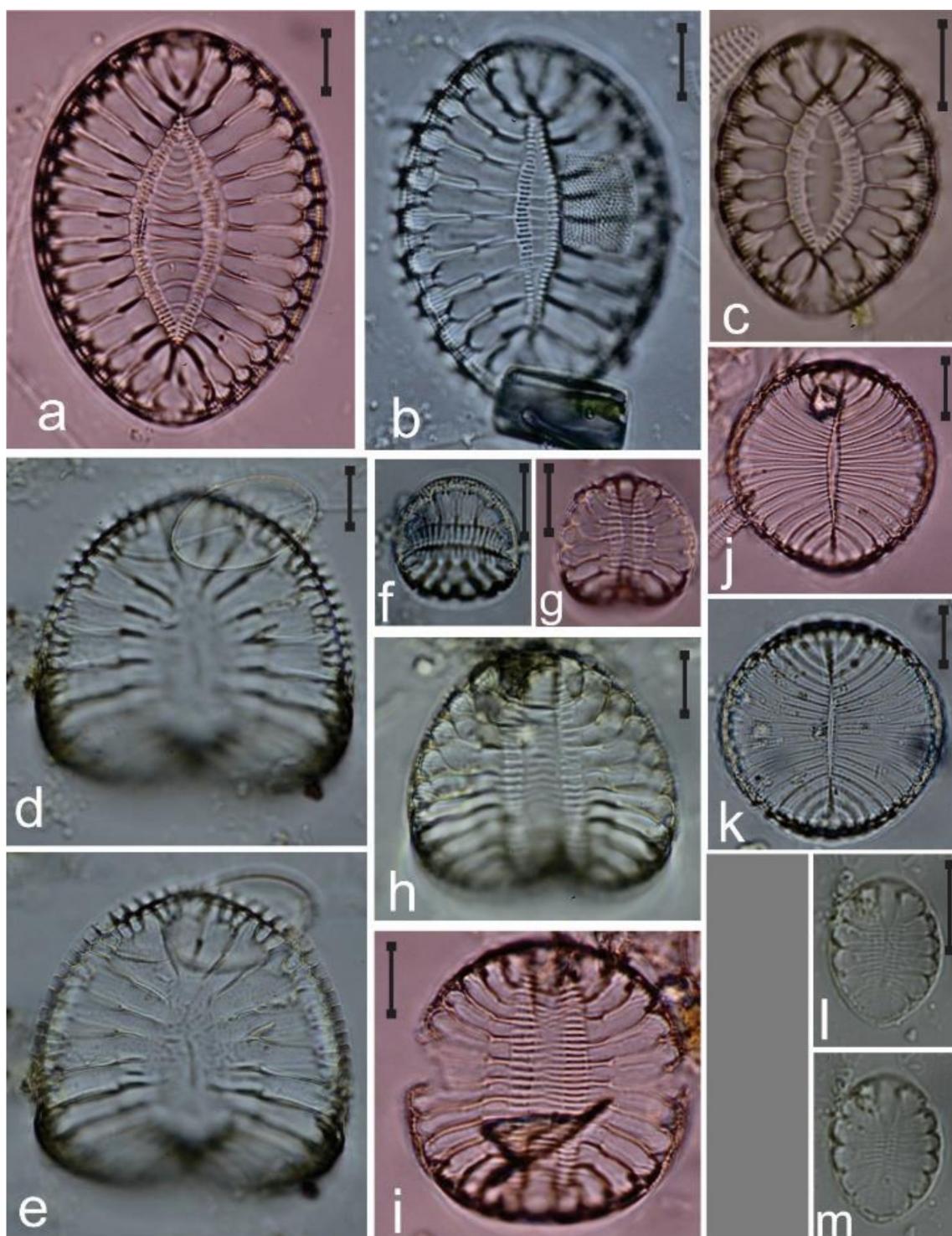


Figure 46. (a–c) *Campylodiscus neofastuosus*; (d,e) *Coronia ambigua* two focal planes; (f) *Campylodiscus bicostatus*; (g) *C. simulans*; (h,i) *C. fastuosus*; (j,k) *C. ralfsii*; (l,m) *C. scalaris*. Scale bar = 10 μm .

4. Discussion

The floristic reservoir of benthic diatoms for Mexican waters continues to be surveyed with the exploration of new areas and substrata, in an effort to update the overall species list for the region [43]. This relates to the variety of substrata that benthic diatoms occupy, mainly macroalgae that harbor a notably high species richness of epiphytic diatoms that can exceed hundreds of taxa on a single host [44]. In this regard, the species richness of diatoms living on a single specimen (3 cm^2) of *Phylloctyon pulcherrimum* from the Gulf of California yielded 244 specific and infraspecific taxa, the highest number yet recorded for any Chlorophyceae host. In contrast to the observations made during the identification of the host Chlorophyceae, the allegedly dominant genus *Cocconeis* (Figure 2) accounted for only 12 of the total species (5%). Thus, although the host surface may be paved and “dominated” by monogenetic species, many others may occur which show distinct fixing and growing strategies on the algal host surface. Although several of these taxa may be planktonic, such as *Coscinodiscus* and *Chaetoceros*, or *Thalassiosira*, they were present as epiphytes of *P. pulcherrimum* and are recorded with the epiphytic flora, but should be properly accounted for in numerical assessments, albeit solely when considering their relevance in a genus level analysis due to the scarceness of these forms. The eleven green algae taxa from the studies reviewed yielded a list of 300 taxa of epiphytic diatoms. The genera best represented were *Mastogloia* (35 species), *Nitzschia* (19), *Navicula* (19), *Cocconeis* (18), *Diploneis* (12), *Licmophora* (9), and *Amphora* (7). On *P. pulcherrimum*, *Mastogloia* and *Licmophora* were represented by only three and five species, respectively, while of the 300 diatom taxa recorded on these 11 Chlorophyceae taxa, only 68 (27.75%) were also present on the host specimen of *P. pulcherrimum*. Of the diatom genera best represented on the eleven green algae, only 25 taxa (8.3%) were also observed on *P. pulcherrimum*: *Nitzschia* (9), *Cocconeis* (7), *Diploneis* (6), *Navicula* (2), and *Amphora* (1). The species richness recorded from *P. pulcherrimum* surpasses all records in the 14 studies reviewed on other green macroalgae. Only [10] observed a similarly high species count with 115 diatom taxa as epiphytes on *Halimeda tuna* and 137 on *Caulerpa taxifolia*. Their findings are followed by [6], with 89 taxa on *Codium* spp. Other studies recorded lower numbers of epiphytic diatom taxa, such as [21] with 51 taxa on *Codium latum* subsp. *palmeri*, [18] with 63 taxa on *Chaetomorpha linum*, *Enteromorpha intestinalis*, and *Ulva lactuca*, and [9] with 52 taxa on *Halimeda* sp. Other Chlorophyceae, such as *Cladophora glomerata* and *Cladophora* sp., had only four diatom taxa that co-occurred with *P. pulcherrimum* (*Diploneis smithii*, *Halimphora coffeaeformis*, *Nitzschia gracilis* and *N. linearis*), but these are freshwater and estuarine forms.

In the case of the few fresh-water forms recorded, it has to be considered that the annual pp for the study area is around 100 mm, mainly for short periods during tropical storms [45]. The runoff is mostly sporadic, characteristic of the warm months, including July, maybe related to the San José de Magdalena oasis located around 25 km SW. In any case, the presence of said diatom forms should be assessed in terms of their permanence to determine whether these are regular residents in the marine environment or accidental inputs. The former case would lead to a review of their taxonomic status, and as with those taxa identified only as sp., further study relying on molecular and SEM would be required.

Out of the likely explanations for the high species richness of diatoms observed on *P. pulcherrimum*, we are inclined to hypothesize that the more complex thallus of this macroalgae, showing a flat surface, folds, and branching renders a microhabitat heterogeneity that promotes colonization by many more diatom taxa. However, in the same area, other substrata have also yielded many diatom taxa, as seen in [2] and in an ongoing study [46] in which close to 400 taxa were observed on several macroalgae species from a pristine control site. Thus, environmental conditions seem to promote high diatom species diversity in general. Further research will reveal how host macroalgal diversity and their epiphytic diatoms combine to define an overall floristic richness for the Gulf of California.

The identified taxon *Margaritum terebro*, with its striking morphological form, represents a new record for Mexican coasts. On the basis of previous records, [47] suggested that this taxon is restricted to tropical areas (southeast coast of Brazil, Atlantic coast of Africa, Galapagos Islands). However,

our recording of it in the middle area of the Gulf of California extends its distribution range to the subtropics. Likewise, *Glyphodesmis rhombica* had been recorded in the East Indies, Indonesia (Bali) and Byron Bay Australia [48] but not for the (eastern) Pacific Ocean. Finally, the following were all recorded for the first time on the American continent: *Auricula flabelliformis* and *A. pulchra*, *Campylodiscus scalaris*, *Coscinodiscus mesoleius*, *Dimeregramma fulvum*, *Navicula palpebralis* var. *angulosa*, *Seminavis barbareae* and *Plagiotropis australis*, while *Nitzschia fusiformis* had not been recorded previously for the Pacific Ocean.

The observations to date strongly suggest that the algal host group at the category of division determines different diatom assemblages [49]. However, many macroalgae taxa still await surveying for diatom epiphytes. Future analyses of these taxa will eventually help determine the extent of the homogeneity of diatom distribution on macroalgal hosts, as well as the potential specific relations between the host taxon and the composition of its diatom species. In addition to confirming that most diatom taxa in this region are distributed as epiphytes on macroalgal hosts, the present study of the diatom taxocoenosis living on *P. pulcherrimum* contributed many (38) new records to the floristics of the Mexican littorals, which was, to say the least, unexpected. The species richness of diatoms living on *P. pulcherrimum* is among the highest recorded for all macroalgae taxa, suggesting that the thalli of these Chlorophyceae species offer conditions that promote the settlement and growth of epiphytic diatoms unlike other macroalgae. Although it has been proposed that epiphytic diatom assemblages may be characteristic of their particular macroalgal host in terms of floristics and diversity, our findings indicate that some macroalgae taxa may offer a better substratum than others. These results allow us to confirm that surveying rare macroalgae species as hosts for epiphytic diatoms continues to offer opportunities for achieving new records of diatom taxa, or even identifying new taxa in many regions of the world.

Author Contributions: The first author (F.O.L.-F.) participated in conceptualization of the research problem, implementation of methodology for formal taxonomic analysis, overall taxa identification, and writing of the manuscript. The second author (D.A.S.B.) contributed to contextualize the scientific perspective of the taxonomic problem, reviewing species identification and new taxonomic records, plus the writing and translation of the manuscript. The third author (M.d.C.A.-C.) identified the macroalgal host, noticing and confirming the scarceness of the host taxon, and the presence of the epiphytic diatom assemblage, plus reviewed the original draft. All authors have read and agreed to the published version of the manuscript.

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