

**THÀNH PHẦN LOÀI TẢO SILIC (BACILLARIOPHYCEAE)
CỦA VỊNH VĂN PHONG-BẾN GỎI, MIỀN TRUNG VIỆT NAM**

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TÓM TẮT Một danh mục bao gồm 125 loài Tảo Silic, trong đó 11 loài mới được ghi nhận lần đầu tiên cho khu hệ Thực vật Phù du biển Việt Nam. Các giống *Cymatnitzschia*, *Podocystis*, *Leyanella*, *Minutocellus* được bổ sung vào danh mục.

**SPECIES COMPOSITION OF DIATOMS (BACILLARIOPHYCEAE)
IN VAN PHONG-BEN GOI BAY, CENTRAL VIETNAM**

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ABSTRACT One hundred and twenty-five species of diatoms were listed, in which 11 species of diatoms are new records for the plankton flora of Vietnam. Genera such as *Cymatnitzschia*, *Podocystis*, *Leyanella*, *Minutocellus* are added to the list of species

Keywords: Van Phong-Ben Goi bay, Central Vietnam, species composition, new records, diatoms.

INTRODUCTION

Van Phong-Ben Goi bay is one of the biggest bays in the southern part of central Vietnam, with an area of 450 km², located at the latitude of 12°24' – 12°48' N and the longitude of 109°11' – 109°26' E (Fig. 1 & 2). The bay is divided into two parts: a northern part called Ben Goi creek with water depths about 20 meters and a southern part called Van Phong bay with 40 meters as maximum water depth. The bay is located about 60 km far from Nha Trang city.

Hoang (1962) and Shirota (1966) carried out some phytoplankton surveys in Nha Trang bay and in coastal waters of South Vietnam. Another work (Truong 1993), had a description of the diatom species of the coastal

waters of Vietnam. Three phytoplankton surveys (April 1982, August 1983, and February 1984), in Van Phong-Ben Goi bay were only carried out from 1982 to 1985 by the National Project in the dry season, but unfortunately this work has not been published.

A project for Van Phong-Ben Goi bay was proposed and implemented by the Institute of Oceanography, Nha Trang from 1994-1996.

A list of potentially harmful species was also recorded in the bay by Nguyen & Doan (1996). In this paper, we used data of phytoplankton from samples collected from above surveys. We try to establish a list of species with illustration of new records for Vietnamese waters. Some species that are difficult to identify are also illustrated. Synonyms of species are added in the list with references.

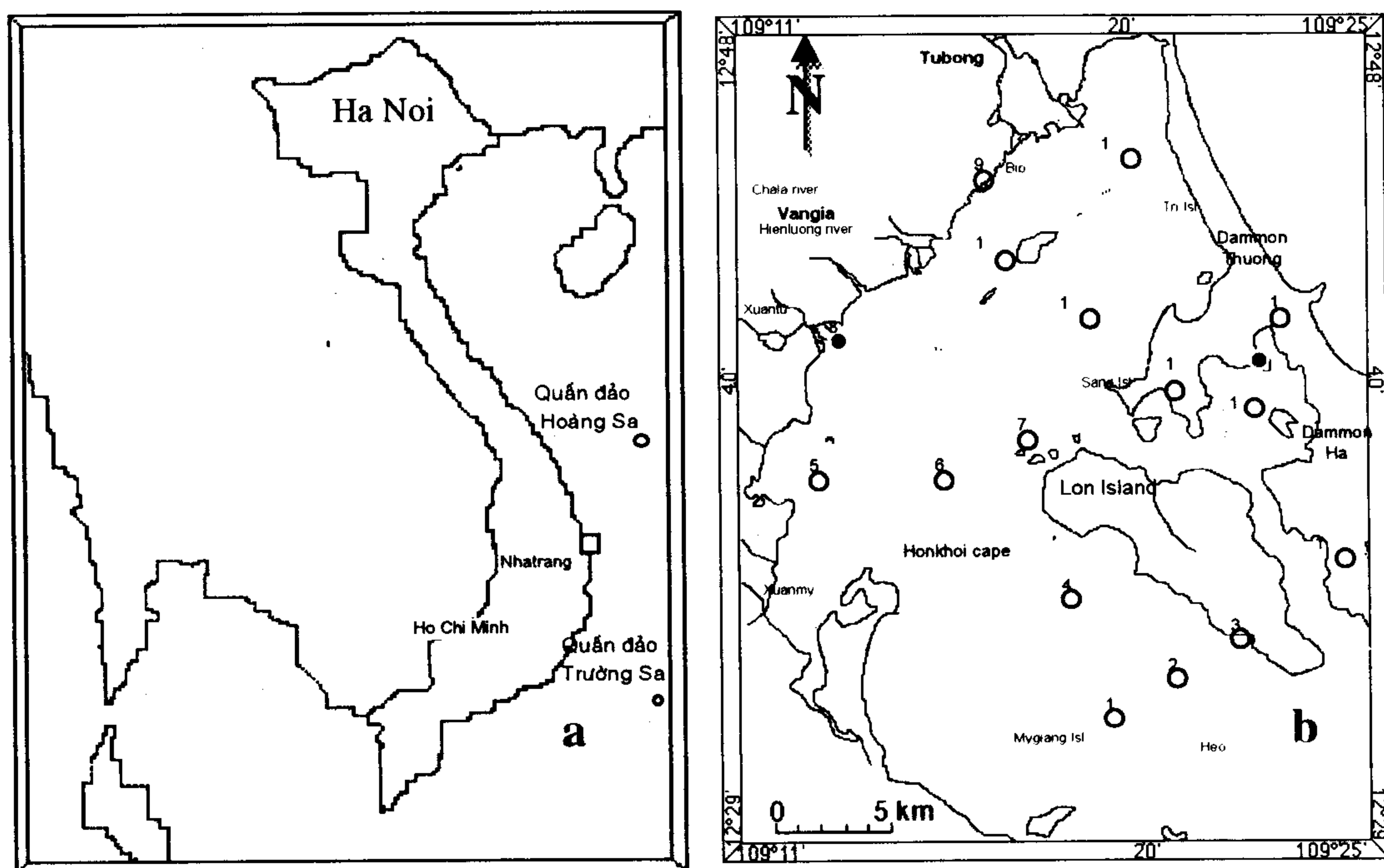


Figure 1. The map of showing studied area (a) and sampling sites in Van Phong – Ben Goi bay (b).

Bản đồ Việt Nam với vị trí nghiên cứu (a) và trạm thu mẫu trong vịnh Văn Phong-Bến Gò (b)

MATERIALS AND METHODS

Sampling stations and methods

The study was based on phytoplankton specimens collected in three surveys. First one was conducted in June 1994 (dry season) and October 1995 (rainy season) at 16 horizontal stations. Secondly, phytoplankton samples were collected weekly at two monitoring stations from January 1995 – January 1997. An additional survey was implemented in June 1998 at the same 16 horizontal stations. Vertical hauls were taken by using the 25 & 45 μ m phytoplankton nets. A total of 400 sample was analyzed.

Analysing methods

Identifying phytoplankton species by using main keys of Allen & Cupp (1933), Hoang (1962), Truong (1993), Hasle & Syvertsen (1997).

Before carrying out analyses, samples were treated by acid cleaning method (Hasle & Syvertsen, 1997) for identifying diatoms, and then specimens of diatoms were mounted in Naphrax solution for permanent preparations or in water for temporary preparations. All specimens were examined by phase contrast light microscopy and transmission and scanning

electron microscopy.

RESULTS & DISCUSSION

Characteristics of species composition

One hundred and twenty-five species of diatoms were recorded. As in other waters of the South China Sea, the diatoms dominated: *Chaetoceros* (19 species), *Rhizosolenia* (8 species, excluding some species that have been transferred to the other genera as *Proboscia* (= *Rhizosolenia*) *alata*, *Pseudosolenia* (= *Rhizosolenia*) *calcaravis*, *Guinardia* (= *Rhizosolenia*) *delicatula*, *Guinardia striata* (= *Rhizosolenia* *stolterfothii*), *Guinardia* (= *Rhizosolenia*) *cylindrus*).

Almost all diatom species in the Van Phong-Ben Goi bay are typical for tropical waters, and have a cosmopolitan distribution. Some species have the main distribution in warm or temperate waters. In the dry season the centric diatoms are usually abundant with many species, and individual densities of each species were also high, but in the rainy season, pennate diatom species are numerous. For explaining this, we have a hypothesis that there is a strong mixing between the two water masses, freshwater coming from inland and rivers, and seawater from the off shore. Tidal currents in

the rainy season play also an important role on the distribution of species. Under these conditions, benthic species are resuspended.

Eleven species and 4 genera of diatoms were identified as new records for the plankton flora of Vietnam. They were listed and illustrated. The nomenclature of in this paper follows Hasle & Syvertsen (1997). Based on studies of the morphology of species belonging to the family Rhizosoleniaceae, Sundström (1990) renamed some species such as *Proboscia* (*Rhizosolenia*) *alata*, *Pseudosolenia* (*Rhizosolenia*) *calcaravis*, *Guinardia striata* (*Rhizosolenia* *stolterfothii*), *Guinardia* (*Rhizosolenia*) *cylindrus*, but the species *Rhizosolenia phuketensis* Sundström was recognised as *Dactyliosolen phuketensis* by Hasle (in Hasle & Syvertsen, 1997).

Chaetoceros laevis and *C. diversus*. (Pl. 4, Figs. 2 & 3), were regarded as two separate taxa by many phytoplanktonists, but Rines & Hargraves (1988) showed that there are no differences in structure, and cell size of the two species, and the morphology of the seta did not warrant separating them into two taxa, so *C. laevis* is a synonym of *C. diversus*.

Two genera of *Minutocellus* and *Leyanella* are new records for Vietnamese waters. They have been recorded only in few taxonomic publications because their size is very small. They are a part of nanophytoplankton and they may be more common than suggested by the previous research. They can not be identified by light microscopy. Hasle *et al.* (1983) classified them as belonging to the new family Cymatosiraceae.

Species list of diatom (Bacillariophyceae) in Van Phong - Ben Goi bay

The international nomenclature in this list was different from previous list build by Hoang (1962) and Shirota (1964). These authors did not mention any synonyms and references for each species. This make some difficulties for the following research on taxonomy. In this list,

species without references were indicated that they are very common in Vietnamese waters and were clearly described in Vietnamese publications. For other species, we try to add basionyms, synonyms and cited references.

CENTRIC DIATOMS

Order Biddulphiales

Suborder Coscinodiscineae

Family Thalassiosiraceae Lebour 1930 *emend.* Hasle 1973

- ***Cyclotella striata* (Kützing) Grunow in Cleve & Grunow 1880**
Basionym: *Coscinodiscus striatus* Kützing 1844
References: Shirota, 1966; Truong, 1993
- ***Planktoniella sol* (Wallich 1860) Schütt 1892**
Basionym: *Coscinodiscus sol* Wallich 1860
References: Hustedt, 1930; Cup, 1943; Hoang, 1962; Shirota, 1966; Desichasary, 1989; Hallegraeff, 1992; Hasle & Syvertsen, 1993 & 1997; Truong, 1993.
- ***Skeletonema costatum* (Greville 1866) Cleve 1900**
Basionyms: *Melosira costata* Greville 1866
Synonym: *M. subsalsa* Cleve 1873
References: Cleve, 1873 & 1900; Hustedt, 1930; Cupp, 1943; Hendey, 1964; Hoang, 1962; Shirota, 1966; Truong, 1993; Hasle & Syvertsen, 1997
- ***Thalassiosira subtilis* (Ostenfeld 1899) Gran 1900**
Basionym: *Podosira* (?) *subtilis* Ostenfeld 1899
References: Ostenfeld, 1899 & 1903; Hasle, 1972a; Hoang, 1962; Shirota, 1966; Rivera, 1981; Truong, 1993; Hasle & Syvertsen, 1997
- ***Thalassiosira mala** Takano 1965**
Plate 1, Figures 1-3
References: Takano, 1965 & 1976; Hasle, 1976; Hallegraeff, 1984; Takano, 1990; Hasle & Syvertsen, 1997
Remarks: Warm to tropical waters.
- ***Thalassiosira oestrupii** (Ostenfeld) Hasle 1972**
Plate 1, Figure 4

Basionym: *Coscinosira oestrupii* Ostenfeld 1900

References: Hustedt, 1930; Hasle, 1972b; Fryxell & Hasle, 1980; Hasle & Syvertsen, 1997.

Remarks: Warm to tropical waters.

- ***Paralia sulcata* (Ehrenberg 1838) Cleve 1873**

Basionym: *Gaillonella sulcata* Ehrenberg 1838

Synonym: *Melosira sulcata* Ehrenberg 1841

References: Cleve, 1873; Hustedt, 1930; Cupp, 1943; Hoang, 1962; Hendey, 1964; Shirota, 1966; Crawford, 1979; Truong, 1993; Hasle & Syvertsen, 1997

- ***Stephanopyxis palmeriana* (Greville) Grunow 1884**

Basionym: *Creswellia palmeriana* Greville, in Gregory 1857

References: Gregory, 1857; Hustedt, 1930; Cupp, 1943; Hendey, 1964; Shirota, 1966; Truong, 1993; Hasle & Syvertsen, 1997.

- ***Leptocylindrus danicus* Cleve 1889**

Synonym: *Dactyliosolen mediterraneus* (H. Peragallo) H. Peragallo 1888, in Hasle 1975

References: Hustedt, 1930; Cupp, 1943; Shirota, 1966; Hasle, 1975; French & Hargraves, 1986; Takano, 1990; Truong, 1993; Hasle & Syvertsen, 1997.

- ***Corethron criophylum* Castracane 1886**

References: Hendey, 1964; Thomas & Bonham, 1990; Hoang, 1962; Shirota, 1966; Truong, 1993; Hasle & Syvertsen, 1997.

Family Coscinodiscaceae Kützing 1844

- ***Coscinodiscus radiatus* Ehrenberg 1841**

References: Hustedt, 1930; Hoang, 1962; Hendey, 1964; Shirota, 1966; Hasle & Sims, 1986; Sancetta, 1987; Fryxell & Asworth, 1988; Truong, 1993; Hasle & Syvertsen, 1997.

- ***Coscinodiscus asteromphalus* Ehrenberg 1844**

References: Hustedt, 1930; Hoang, 1962; Hendey, 1964; Shirota, 1966; Hasle & Lange, 1992; Truong, 1993; Hasle & Syvertsen, 1997.

- ***Coscinodiscus centralis* Ehrenberg 1844**

- ***Coscinodiscus wailesii* Gran & Angst 1931**

References: Schmid, 1990.

- ***Coscinodiscus jonesianus* (Greville 1862) Ostenfeld 1915**

Basionym: *Eupodiscus jonesianus* Greville 1862

References: Greville, 1862; Hustedt, 1930; Cupp, 1943; Hendey, 1964; Hoang, 1962; Shirota, 1966; Takano, 1990; Truong, 1993; Hasle & Syvertsen, 1997.

- ***Coscinodiscus marginatus* Ehrenberg 1844**

- ***Coscinodiscus granii* Gough 1905**

- ***Coscinodiscus gigas* var. *praetexta* (Janisch) Hustedt**

Synonym: *Coscinodiscus praetextus* Janisch

References: Hustedt, 1930; Shirota, 1966; Truong, 1993

- ***Coscinodiscus perforatus* (Ehr.) var. *pavillardii* (Forti) Hustedt 1930**

- ***Palmeria hardmaniana* Greville 1865**

Synonym: *Hemidiscus hardmannianus* (Greville 1865) Mann 1907

References: Greville, 1865b; Mann, 1907; Allen & Cupp, 1933; Shirota, 1966; Simonsen, 1972; Von Stosch, 1987; Truong, 1993; Hasle & Syvertsen, 1997

Family Stellarimaceae Nikolaev ex Sim & Hasle 1990

- ***Gossleriella tropica* Schütt 1892**

- ***Actinocyclus octonarius* Ehrenberg 1838**

Synonym: *Actinocyclus ehrenbergii* Ralfs in Pritchard

References: Hustedt, 1930; Hendey, 1964; Shirota, 1966; Villareal & Fryxell, 1983; Truong, 1993; Hasle & Syvertsen, 1997.

- ***Actinocyclus* sp.**

- ***Hemidiscus cuneiformis* Wallich 1860**

Family Asterolampraceae H.L. Smith 1872 *emend.* Gombos 1980

- ***Asterolampra marylandica* Ehrenberg 1844**

Basionym: *Asterlampra vanheurckii* Brun 1891

References: Greville, 1860; Hustedt, 1930; Cupp, 1943; Shirota, 1966; Truong, 1993; Hasle & Syvertsen, 1997.

- ***Asteromphalus flabellatus* (Brébisson 1857) Greville 1859**
Basionym: *Spatangidium flabellatum* Brébisson 1857
References: Brébisson, 1857; Hustedt, 1930; Shiota, 1966; Simonsen, 1974; Hernandez-Becceril, 1991a; Truong, 1993; Hasle & Syvertsen, 1997
- ***Asteromphalus cleveanus* Grunow**
- ***Asteromphalus elegans* Greville 1859**
- ***Asteromphalus heptactis* (Brébisson 1857) Ralfs in Pritchard 1861**

Family Heliopeltaceae H.L. Smith 1872

- ***Actinoptychus senarius* (Ehrenberg 1838) Ehrenberg 1843**
Basionym: *Actinocyclus senarius* Ehrenberg 1838
Synonym: *Actinoptychus undulatus* (Bailey) Ralfs in Pritchard
References: Hustedt, 1930; Cupp, 1943; Hendey, 1964; Shiota, 1966; Takano, 1990; Truong, 1993; Hasle & Syvertsen, 1997.

Suborder Rhizosoleniineae

Family Rhizosoleniaceae De Toni 1890

- ***Rhizosolenia styliformis* Brightwell 1858**
Synonym: *Rhizosolenia styliformis* var. *longispina* Hustedt
References: Brightwell, 1858; Hustedt, 1930; Hoang, 1962; Shiota, 1966; Sundström, 1990; Truong, 1993; Hasle & Syvertsen, 1997.
- ***Rhizosolenia hebetata* Bailey 1856 f. *semispina* (Hensen 1887) Gran 1904**
Synonym: *Rhizosolenia hebetata* forma *hiemalis* Gran 1904
References: Gran, 1904; Hustedt, 1930; Cupp, 1943; Drebes, 1974; Sundström, 1990; Hasle & Syvertsen, 1997.
- ***Rhizosolenia acuminata* (H. Per. 1892) H. Per. in H.&M. Perag. 1897-1908**
Basionym: *Rhizosolenia temperei* var. *acuminata* H. Peragallo
References: Peragallo & Peragallo, 1897-1908; Hustedt, 1930; Cupp, 1943; Shiota, 1966; Sundström, 1990; Truong, 1993; Hasle & Syvertsen, 1997.
- ***Rhizosolenia bergonii* H. Peragallo 1892**
- ***Rhizosolenia imbricata* Brightwell 1858**
Synonym: *Rh. shrubsolei* Cleve; *Rh. imbricata* var. *shrubsölei* (Cleve) Schröder
References: Brightwell, 1858; Cleve, 1881; Hoang, 1962; Shiota, 1966; Sundström, 1990; Truong, 1993; Hasle & Syvertsen, 1997.
- ***Rhizosolenia setigera* Brightwell 1858**
- ***Rhizosolenia robusta* Norman in Husted 1930**
- ***Proboscia alata* (Brightwell 1858) Sundström 1986**
Basionym: *Rhizosolenia alata* Brightwell 1858
Synonym: *Rh. alata* f. *gracillima* (Cleve) Grunow; *Rh. alata* f. *indica* (Per.) Ostenfeld
- ***Rhizosolenia formosa* H. Peragallo 1888**
Synonym: *Rh. styliformis* var. *latissima* Brightwell in H. Peragallo 1888, and in Truong 1993.
References: Shiota, 1966; Sundström, 1990; Truong, 1993; Hasle & Syvertsen, 1997.
- ***Pseudosolenia calcar-avis* (Schultze 1858) Sundström 1986**
Basionym: *Rhizosolenia calcaravis* (Schultze)
References: Hustedt, 1930; Cupp, 1943; Hoang, 1962; Shiota, 1966; Sundström, 1990; Truong, 1993; Hasle & Syvertsen, 1997.
- ***Guinardia flaccida* (Castracane 1886) H. Peragallo 1892**
Basionym: *Rhizosolenia flaccida* Castracane
References: Hustedt, 1930; Cupp, 1943; Hoang, 1962; Hendey, 1964; Shiota, 1966; Drebes, 1974; Hasle, 1975; Truong, 1993; Hasle & Syvertsen, 1997.
- ***Guinardia delicatula* (Cleve 1897) Hasle comb. nov. 1996**
Basionym: *Rhizosolenia delicatula* Cleve
References: Cleve, 1900; Hustedt, 1930; Cupp, 1943; Hendey, 1964; Shiota, 1966; Drebes, 1974; Sundström, 1990; Truong, 1993; Hasle & Syvertsen, 1997.
- ***Guinardia striata* (Stolterfoth 1879) Hasle comb. nov. 1996**
Basionym: *Eucampia striata* Stolterfoth 1879
Synonym: *Rhizosolenia stolterfothii* H. Peragallo
References: Hustedt, 1930; Cupp, 1943; Hendey, 1964; Shiota, 1966; Hasle, 1975; Von Stosch, 1986; Sundström, 1980 & 1990; Truong, 1993; Hasle & Syvertsen, 1997.
- ***Guinardia cylindrus* (Cleve 1897) Hasle comb. nov. 1996**

Basionym: *Rhizosolenia cylindrus* Cleve

References: Hoang, 1962; Hendey, 1964; Shirota, 1966; Sundström, 1990; Truong, 1993; Hasle & Syvertsen, 1997.

- ***Dactyliosolen antarcticus* Castracane 1886**

- ***Dactyliosolen phuketensis** (Sundström 1986) Hasle comb. nov 1996**

Basionym: *Rhizosolenia phuketensis* Sundström 1986

References: Sundström, 1990; Von Stosch, 1986; Hasle & Syvertsen, 1997.

Suborder Biddulphiineae

Family Hemiaulaceae Heiberg 1860

- ***Cerataulina pelagica* (Cleve) Hendey 1937**

Basionym: *Cerataulus bergonii* H. Peragallo 1892

Synonym: *Cerataulina bergonii* (H. Peragallo 1892) Schütt 1896

References: Peragallo, 1892; Ostenfeld & Schmidt, 1901; Hustedt, 1930; Hendey, 1937; Cupp, 1943; Hendey, 1964; Shirota, 1966; Hasle & Syvertsen, 1980; Hasle, 1983; Hasle & Sim, 1985; Takano, 1990; Truong, 1993; Hasle & Syvertsen, 1997.

- ***Climacodium frauenfeldianum* Grunow 1868**

- ***Eucampia zodiacus* Ehrenberg 1841**

- ***Eucampia cornuta* (Cleve) Grunow in Van Heurck 1882**

- ***Hemiaulus sinensis* Greville 1865**

Synonym: *H. heibergii* Cleve 1873

References: Greville, 1865a; Hustedt, 1930; Cupp, 1943; Hoang, 1962; Shirota, 1966; Truong, 1993; Moreno *et al.* 1996; Hasle & Syvertsen, 1997.

- ***Hemiaulus indicus* Karsten 1907**

- ***Hemiaulus membranaceus* Cleve 1873**

- ***Hemiaulus hauckii* Grunow in Van Heurck 1882**

Family Cymatosiraceae Hasle, Von Stosch, & Syvertsen 1983

- ***Minutocellus polymorphus*** (Harg. & Guillard 1974) Hasle *et al.* 1983**

Plate 1, Figure 5

Basionym: *Bellerochea polymorpha* Hargraves & Guillard 1974

References: Hargraves & Guillard, 1974; Hasle *et al.*, 1983; Ricard, 1987; Takano, 1990; Hasle & Syvertsen, 1997.

Remarks: Cosmopolitan, from brackish to marine (Takano, 1990). Cells are very small size as nanophytoplankton.

- **cf. *Leyanella arenaria*** Hasle, Von Stosch, & Syvertsen 1983**

Plate 1, Figure 6

References: Hasle *et al.*, 1983; Ricard, 1987.

Remarks: Geographical distribution is unknown. Cells are very small size as nanophytoplankton.

Family Chaetocerotaceae Ralfs in Pritchard 1861

- ***Bacteriastrum elongatum* Cleve 1897**

- ***Bacteriastrum comosum* Pavillard 1924**

- ***Bacteriastrum furcatum* Shadbolt 1854**

Synonym: *Bateriastrum varians* Lauder 1864

References: Lauder, 1864; Cupp, 1943; Shirota, 1966; Ricard, 1987; Truong, 1993; Hasle & Syvertsen, 1997.

- ***Bacteriastrum minus* Karsten 1907**

- ***Bacteriastrum delicatulum* Cleve 1897**

Subgenus *Phaeoceros* Gran 1897

- ***Chaetoceros aequatorialis* Cleve 1873**

Synonym: *Chaetoceros pendulus* Karsten 1905

References: Karsten, 1907; Hendey, 1937; Cupp, 1943; Hoang, 1962; Shirota, 1966; Ricard, 1987; Truong, 1993; Hasle & Syvertsen, 1997.

- ***Chaetoceros peruvianus* Brightwell 1856**

Basionym: *Chaetoceros chilensis* Krasske

References: Gran, 1908; Hustedt, 1930; Hendey, 1937; Cupp, 1943; Hoang, 1962; Shirota, 1966; Ricard, 1987; Truong, 1993; Hasle & Syvertsen, 1997.

- ***Chaetoceros atlanticus* Cleve 1873**

· ***Chaetoceros coartatus* Lauder 1864**

· ***Chaetoceros densus* (Cleve 1897) Cleve 1901**

Basionym: *Chaetoceros borealis* var. *densus* Cleve

References: Cleve, 1901; Hustedt, 1930; Shirota, 1966; Drebes, 1974; Rines & Hargraves, 1988; Truong, 1993.

· ***Chaetoceros eibenii* Grunow in Van Heurck 1880-1885**

Subgenus *Hyalochaetae* Gran 1897

· ***Chaetoceros decipiens* Cleve 1873**

· ***Chaetoceros lorenzianus* Grunow 1863**

· ***Chaetoceros compressus* Lauder 1864**

· ***Chaetoceros lauderi* Ralfs in Lauder 1864**

· ***Chaetoceros didymus* (Ehrenberg) var. *anglicus* (Grunow) Gran 1908**

· ***Chaetoceros didymus* (Ehrenberg) var. *didymus***

· ***Chaetoceros didymus* (Ehr.) var. *protuberans* (Laud.) Gran & Yendo 1914**

Basionym: *Chaetoceros protuberans* Lauder 1864

References: Gran & Yendo, 1914; Cupp, 1943; Hoang, 1962; Hendey, 1964; Shirota, 1966; Ricard, 1987; Rines & Hargraves, 1988; Hernández-Becceril, 1991; Truong, 1993; Hasle & Syvertsen, 1997; Jensen & Moestrup, 1998.

· ***Chaetoceros laciniosus* Schütt 1895**

· ***Chaetoceros curvisetus* Cleve 1889**

· ***Chaetoceros pseudocurvisetus* Mangin 1910**

· ***Chaetoceros tortissimus* Gran 1900**

· ***Chaetoceros diversus* Cleve 1873**

Plate 2, Figures 1 a-b

Synonyms: *Chaetoceros laevis* Leuduger-Fortmorel 1892

References: Cleve, 1873; Hustedt, 1930; Cupp, 1943; Hoang, 1962; Hendey, 1964; Shirota, 1966; Ricard, 1987; Rines & Hargraves, 1988; Truong, 1993; Hasle & Syvertsen, 1997.

· ***Chaetoceros messanensis* Castracane 1875**

· ***Chaetoceros affinis* Lauder 1864**

· ***Chaetoceros diadema* (Ehrenberg 1854) Gran 1897**

Basionym: *Syndendrium diadema* Ehrenberg

Synonym: *Chaetoceros distans* var. *subsecunda* Grunow in Van Heurck, *Chaetoceros subsecundus* (Grunow) Hustedt.

References: Van Heurck, 1880-1885; Hustedt, 1930; Cupp, 1943; Hendey, 1964; Shirota, 1966; Drebes, 1974; Fryxell, 1978; Ricard, 1987; Rines & Hargraves, 1988; Truong, 1993; Hasle & Syvertsen, 1997; Jensen & Moestrup, 1998.

Family Lithodesmiaceae Peragallo & Peragallo 1897-1908 *emend.* Simonsen 1979

· ***Bellerrochea malleus* (Brightwell 1858) Van Heurck 1880-1885**

· ***Ditylum sol* Grunow in Van Heurck 1880-1885**

· ***Ditylum brightwell* (West 1860) Grunow (*vide* Van Heurck 1880-1885)**

· ***Lithodesmium undulatum* Ehrenberg 1841**

· ***Helicopthea tamesis* (Shrubsole 1890) Ricard 1987**

Synonym: *Streptothea tamesis* Shrubsole

References: Hustedt, 1930; Cupp, 1943; Hoang, 1962; Hendey, 1964; Shirota, 1966; Drebes, 1974; Hasle, 1975; Ricard, 1987; Truong, 1993; Hasle & Syvertsen, 1997.

Family Eupodiscaceae 1849

· ***Triceratium favus* Ehrenberg (1839) 1941**

Synonym: *Triceratium comtum* Ehrenberg 1844, *T. muricatum* Brightwell 1853, *T. fimbriatum* Wallich 1858, *T. sarcophagus* Castracane 1886, *T. ferox* Castracane 1886.

References: Peragallo & Peragallo, 1897-1908; Cupp, 1943; Hoang, 1962; Hendey, 1964; Shirota, 1966; Ricard, 1987; Truong, 1993.

· ***Odontella mobiliensis* (Bailey) Grunow 1884**

Synonym: *Biddulphia mobiliensis* Bailey

References: Van Heurck, 1880-1885; Karsten, 1905; Hustedt, 1930; Cupp, 1943; Hendey, 1964; Shirota, 1966; Drebes, 1974; Simonsen, 1974; Ricard, 1987; Takano, 1990; Truong, 1993; Hasle & Syvertsen, 1997.

· ***Odontella sinensis* (Greville) Grunow 1884**

Synonym: *Biddulphia sinensis* Greville

References: Van Heurck, 1880-1885; Karsten, 1905; Hustedt, 1930; Cupp, 1943; Hendey, 1964; Shirota, 1966; Drebes, 1974; Simonsen, 1974; Ricard, 1987; Takano, 1990; Truong, 1993; Hasle & Syvertsen, 1997.

- ***Odontella aurita* (Lyngbye) C.A. Agardh 1832**

Basionym: *Diatoma aurita* Lyngbye 1819

Synonym: *Biddulphia aurita* (Lyngbye) Brébisson

References: Van Heurck, 1880-1885; Karsten, 1905; Hustedt, 1930; Cupp, 1943; Hendey, 1964; Shirota, 1966; Drebes, 1974; Simonsen, 1974; Ricard, 1987; Takano, 1990; Truong, 1993; Hasle & Syvertsen, 1997.

PENNATE DIATOMS

Order Bacillariales

Suborder Fragilariineae

Family Fragilariaceae Greville 1883

- ***Asterionellopsis glacialis* (Castracane 1886) Round, & Round *et al.* 1990**

Basionym: *Asterionella glacialis* Castracane

Synonym: *Asterionella japonica* Cleve in Cleve & Möller

References: Cupp, 1943; Hendey, 1964; Shirota, 1966; Ricard, 1987; Round *et al.*, 1990; Truong, 1993; Hasle & Syvertsen, 1997.

- ***Striatella unipunctata* (Lyngbye) C.A. Agardh 1832**

Basionym: *Fragilaria unipunctata* Lyngbye 1819

References: Cupp, 1943; Hendey, 1964; Shirota, 1966; Ricard, 1987; Hasle & Syvertsen, 1997

Family Toxariaceae F.E. Round in Round *et al.* 1990

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

Synonym: *Synedra undulata* (J.W. Bailey) Gregory 1857

References: Gregory, 1857; Hendey, 1964; Round *et al.*, 1990; Hasle & Syvertsen, 1997

Family Thalassionemataceae F.E. Round in Round *et al.* 1990

- ***Thalassionema nitzschioides* (Grunow 1862) Mereschkowsky 1902**

Basionym: *Synedra nitzschioides* Grunow

Synonym: *Thalassiothrix nitzschioides* (Grunow) Grunow in Van Heurck

References: Van Heurck, 1880-1885; Cupp, 1943; Hoang, 1962; Hendey, 1964; Shirota, 1966; Hasle & Mendiola, 1967; Drebes, 1974; Hallegraeff, 1986; Truong, 1993; Hasle & Syvertsen, 1997

- ***Thalassionema frauenfeldii* (Grunow) Hallegraeff 1986**

Synonym: *Thalassiothrix frauenfeldii* Grunow

References: Van Heurck, 1880-1885; Cupp, 1943; Hustedt, 1959; Hoang, 1962; Hendey, 1964; Shirota, 1966; Hasle & Mendiola, 1967; Drebes, 1974; Hallegraeff, 1986; Truong, 1993; Hasle & Syvertsen, 1997.

- ***Thalassiothrix longissima* Cleve & Grunow 1880**

Synonym: *Synedra thalassiothrix* Cleve

References: Cleve, 1873; Cupp, 1943; Hoang, 1962; Hendey, 1964; Shirota, 1966; Drebes, 1974; Hallegraeff, 1986; Truong, 1993; Silva & Hasle, 1993; Hasle & Syvertsen, 1997

- ***Podocystis spathulata*** (Shadbolt) Van Heurck**

Plate 2, Figure 2

References: Van Heurck, 1880-1885; Hustedt, 1959; Ricard, 1979 & 1987

Suborder Bacillariineae

Family Achnanthaceae Kützing 1844

- ***Achnanthes brevipes* Agardh 1824**

- ***Synedra crystallina* (Agardh) Kützing 1884**

Synonym: *Ardissonia crystallina* (Agardh) Grunow in Cleve & Grunow 1880, *Synedra crystallina* var. *smithii* Grunow in Vanheurck 1881.

References: Moreno *et al.* 1996.

Family Naviculaceae Kützing 1844

- ***Meuniera membranacea* (Cleve) P.C. Silva comb. nov.**

Basionym: *Navicula* (*Stauroneis*) *membranacea* Cleve

Synonym: *Stauropsis membranacea* (Cl.) Meunier, *S. membranacea* (Cleve) Hustedt

References: Cupp, 1943; Hendey, 1964; Shirota, 1966; Hasle & Syvertsen, 1997.

- ***Navicula cancellata* Donkin**

References: Boyer, 1927; Hendey, 1964; Truong, 1993

***Lyrella lyra* (Ehrenberg) Karayeva 1978**

Synonym: *Navicula lyra* Ehrenberg 1843

References: Hendey, 1964; Ricard, 1987; Truong, 1993.

***Diploneis bombus* (Ehrenberg) Cleve 1894**

Synonyms: *Pinnularia bombus* Ehr. 1844; *Navicula bombus* (Ehrenberg) Kützinger 1849

References: Hendey, 1951; Hendey, 1964; Shirota, 1966; Truong, 1993; Morino *et al.*, 1996.

***Diploneis crabro* Ehrenberg**

References: Hendey, 1951; Hendey, 1964; Shirota, 1966; Truong, 1993; Morino *et al.*, 1996.

***Diploneis smithii* (Brébisson) Cleve**

Synonym: *Navicula elliptica* Wm. Smith, 1853; *N. smithii* Brébisson 1854.

References: Hendey, 1951; Hendey, 1964; Shirota, 1966; Truong, 1993.

***Mastogloia cf. erythraea** Grunow 1860**

Plate 2, Figure 4

Synonym: *Mastogloia bullata* Schmidt 1893 in Schmidt *et al.* 1874-1959, *M. interrupta* Hantzsch in Rabenhorst 1863.

References: Licea-Durán, 1974; Moreno *et al.*, 1996.

Remarks: Temperate waters.

***Pleurosigma angulatum* (Quekett) Wm. Smith 1853**

Basionym: *Navicula angulata* Quekett 1848

References: Boyer, 1927; Cupp, 1943; Hendey, 1951; Cleve-Euler, 1952; Hendey, 1964; Shirota, 1966; Truong, 1993; Hasle & Syvertsen, 1997.

***Pleurosigma normanii* Ralfs in Pritchard**

***Pleurosigma naviculaceum* Brébisson 1854**

***Gyrosigma balticum* (Ehrenberg) Cleve 1894**

Basionym: *Navicula baltica* Ehrenberg 1838

Synonym: *Pleurosigma balticum* (Ehrenberg) Wm. Smith 1852

References: Cupp, 1943; Hoang, 1962; Hendey, 1964; Shirota, 1966; Truong, 1993; Moreno *et al.*, 1996.

***Trachyneis aspera* (Ehrenberg) Cleve 1894**

Basionym: *Navicula aspera* Ehrenberg 1840

Synonym: *Stauroneis pulchella* Wm. Smith 1853, *Trachyneis aspera* var. *pulchella* (Wm. Smith) Cleve 1894.

References: Boyer, 1927; Cupp, 1943; Hendey, 1951; Hoang, 1962; Hendey, 1964; Shirota, 1966; Truong, 1993; Moreno *et al.*, 1996.

***Entomoneis alata* (Ehrenberg) Ehrenberg 1845**

Synonym: *Amphiprora alata* (Ehrenberg) Kützinger 1844

References: Boyer, 1927; Hendey, 1951; Hoang, 1962; Hendey, 1964; Shirota, 1966; Ricard, 1987; Truong, 1993.

***Amphora cf. obtusa** Gregory 1857**

Plate 1, Figures 6-7

References: Gregory, 1857; Peragallo & Peragallo, 1897-1908; Hendey, 1964; Moreno *et al.*, 1996.

***Suriella gemma* Ehrenberg in Hendey 1964**

***Suriella fastuosa* Ehrenberg in Hendey 1964**

Family Bacillariaceae 1831

***Nitzschia bifurcata** Kaczmarek & Licea in Kaczmarek & Fryxell 1986**

Plate 2, Figure 3

References: Kaczmarek & Fryxell, 1986; Moreno *et al.*, 1996.

***Nitzschia longissima* (Brébisson in Kützinger) Ralfs in Pritchard 1861**

Basionym: *Ceratoneis longissima* Brébisson in Kützinger.

References: Cupp, 1943; Hoang, 1962; Hendey, 1964; Hasle, 1964; Shirota, 1966; Hasle & Medlin, 1990; Truong, 1993; Hasle & Syvertsen, 1997.

***Cylindrotheca closterium* (Ehrenberg) Lewin & Reimann 1964**

Basionym: *Ceratoneis closterium* Ehrenberg

Synonym: *Nitzschia closterium* (Ehrenberg) W. Smith

References: Cupp, 1943; Hoang, 1962; Hendey, 1964; Hasle, 1964; Shirota, 1966; Truong, 1990; Hasle & Syvertsen, 1997.

***Pseudo-nitzschia pungens* (Grunow ex Cleve) Hasle**

Plate 2, Figure 8

Basionym: *Nitzschia pungens* Grunow ex Cleve

References: Cupp, 1943; Hasle, 1965; Takano, 1990; Truong, 1993; Hasle *et al.*, 1996; Hasle & Syvertsen, 1997.

- ***Bacillaria paxillifera* (O.F. Müller) Hendey 1951**
 Basionym: *Vibrio paxillifer* O.F. Müller 1783
 Synonym: *Bacillaria paradoxa* Gmelin 1791, *Nitzschia paradoxa* (Gm.) Grun. in Cleve & Grunow 1880.
 References: Cupp, 1943; Hendey, 1951; Hoang, 1962; Hendey, 1964; Shirota, 1966; Round *et al.*, 1990; Truong, 1993; Hasle & Syvertsen, 1997.
- ***Psammodictyon panduriforme* (Gregory) Mann in Round *et al.* 1990**
 Basionym: *Nitzschia panduriformis* Gregory 1857
 Synonym: *N. latestriata* var. *panduriformis* (Gregory) Pelletan 1889, *Homeocladia panduriformis* (Gregory) Kuntze 1898.
 References: Peragallo & Peragallo, 1897-1908; Moreno *et al.*, 1996.
- ***Psammodictyon constrictum* (Kützinger) Mann in Round *et al.* 1990**
 Basionym: *Synedra constricta* Kützinger 1844
 Synonym: *Tryblionella apiculata* Gregory 1857, *Nitzschia constricta* (Kützinger) Ralfs in Pritchard 1861, *N. constricta* f. *minor* Rabenhorst 1861-1879, *N. apiculata* (Gregory) Grunow 1878, *Homeocladia apiculata* (Gregory) Kuntze 1898, *N. constricta* var. *genuia* Grunow in Cleve & Grunow 1880, *N. constricta* f. *parva* Grunow in Van Heurck 1880-1885, *N. ralfsii* Wothead 1960.
 References: Peragallo & Peragallo, 1897-1908; Cleve-Eurer, 1952; Herrera-Galindo, 1996; Moreno *et al.* 1996.
- ***Cymatonitzschia marina*** (Levis) Simonsen 1974**
Plate 1, Figure X
 References: Simonsen, 1974; Ricard, 1987.

Notice: (new records of species (*) or genera (**)) of the plankton flora of Vietnam)

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ILLUSTRATIONS

Abbreviations: LM: Light Microscopy, TEM: Transmission Electron Microscopy, SEM: Scanning Electron Microscopy.

Plate 1

Figures 1-2 (LM) & 3 (TEM). *Thalassiosira mala*; Fig. 4. *T. oestrupii*, TEM; Fig. 5. *Minutocellus polymorphus*, TEM; Fig. 6. *Leyanella arenaria*, TEM; Fig. 7. *Chaetoceros diversus*, LM; Fig. 8. *C. diversus* (= *C. laevis*), LM.

Plate 2

Figure 1. *Podocystis spathulata*, LM; Fig. 2. *Nitzschia bifurcata*, LM; Fig. 3. *Mastogloia* cf. *erythraea*, LM; Fig. 4. *Cymatonitzschia marina*, LM; Figs. 5 (SEM)-6 (LM). *Amphora* cf. *obtusa*; Fig6-7. *Pseudo-nitzschia pungens*, TEM.

Plate 1

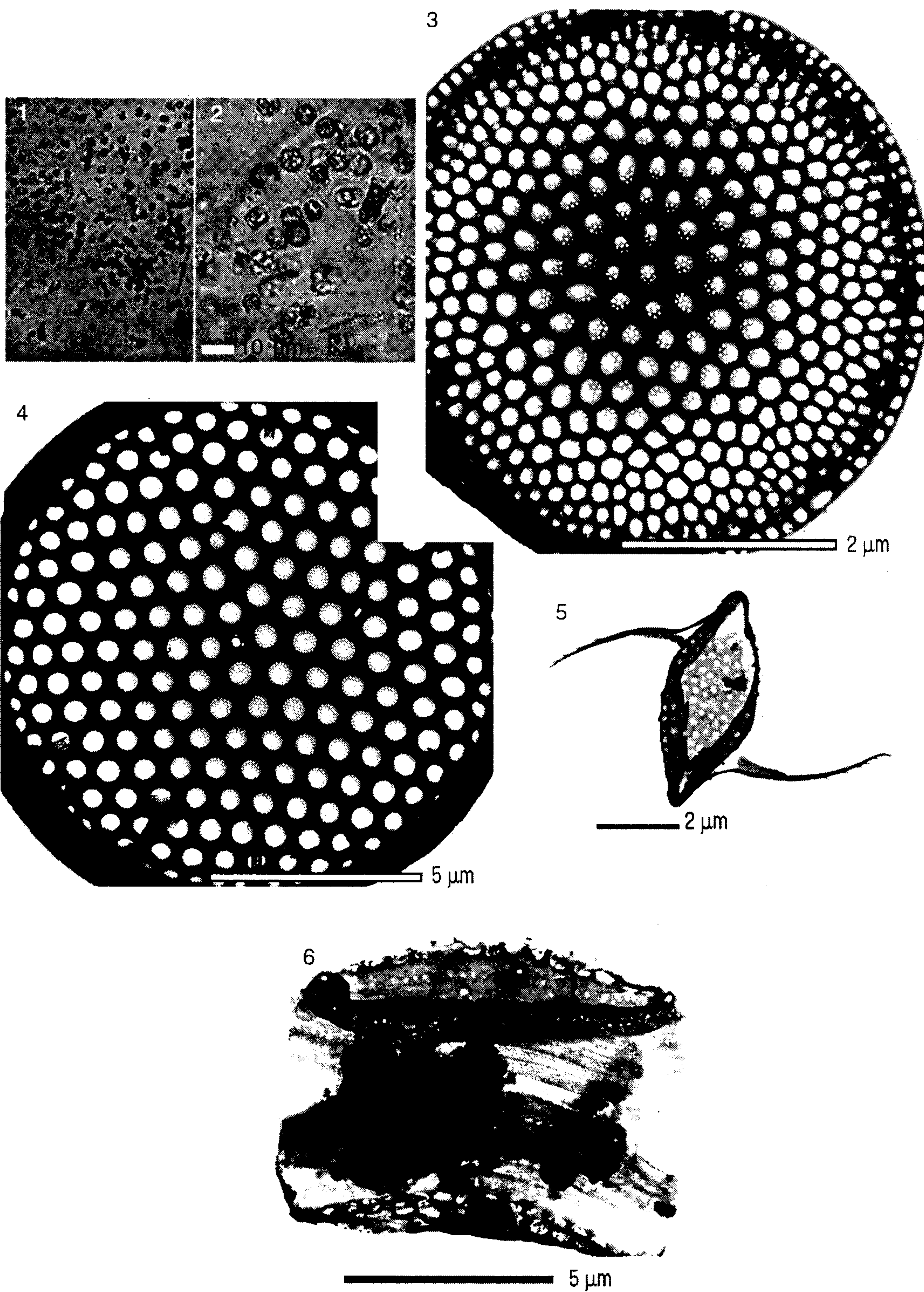
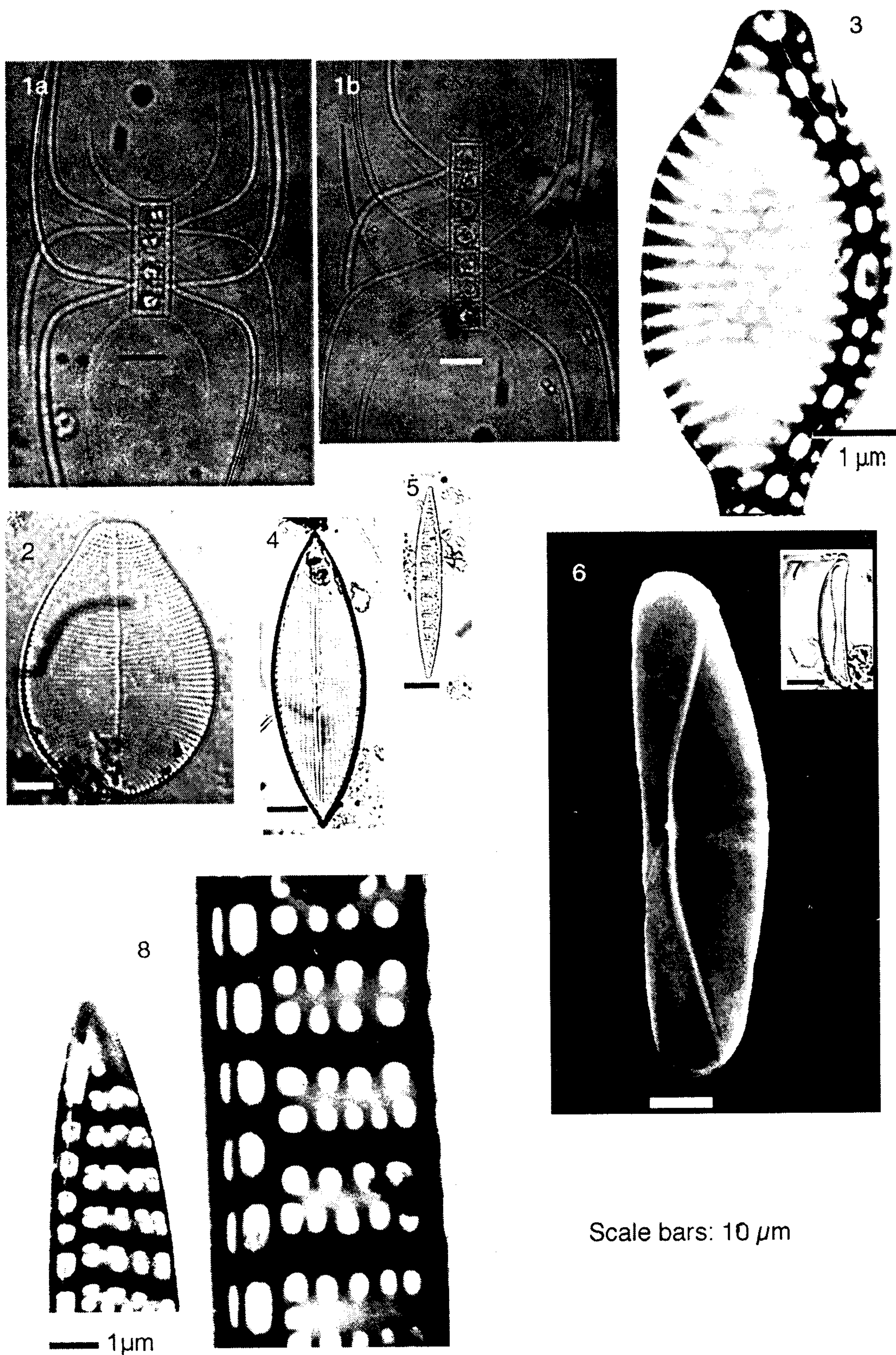


Plate 2



Scale bars: 10 μm