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# Studies on the Genera *Gyrosigma* and *Pleurosigma* (Bacillariophyceae): *Pleurosigma* species in the plankton from the Pacific coast of Mexico, with the description of *P. gracilitatis* sp. nov.

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**Abstract** — Plankton samples from the Pacific coast of Mexico included some *Pleurosigma* species, of which three are particularly interesting: *Pleurosigma ibericum* Peragallo (typified here), *P. distinguendum* Hustedt, and a species fully matching all available data for *Pleurosigma elongatum* var. *gracile* Grunow. The latter diatom, here described as *Pleurosigma gracilitatis* sp. nov., cannot taxonomically be placed as a variety of *P. elongatum* W. Smith, as verified by a study of the type of the latter species. Its specimens were seen in various stages of valve morphogenesis. Type slide numbers are designated for *Pleurosigma normanii* Ralfs *in* Pritchard and *P. rhombeum* (Grunow *in* Cleve *et* Grunow) H. Peragallo.

**diatoms / marine / microalgae / *Pleurosigma elongatum* / *Pleurosigma gracilitatis* sp. nov. / *Pleurosigma ibericum* / species diversity**

**Résumé — Étude des genres *Gyrosigma* et *Pleurosigma* (Bacillariophyceae) : espèces de *Pleurosigma* dans le plancton de la côte Pacifique du Mexique, avec la description de *P. gracilitatis* sp. nov.** Des échantillons planctoniques de la côte Pacifique du Mexique contenaient quelques espèces de *Pleurosigma*, dont trois sont d'un intérêt particulier : *Pleurosigma ibericum* Peragallo (typifié ici), *P. distinguendum* Hustedt et une espèce se conformant à tous les critères disponibles pour *Pleurosigma elongatum* var. *gracile* Grunow. Celle-ci, décrite ici comme *Pleurosigma gracilitatis* sp. nov., ne peut pas être considérée, après vérification du type, comme une variété de *P. elongatum* W. Smith. Une série de stades morphogénétiques dans l'ontogénèse des frustules est décrite. Pour *Pleurosigma normanii* Ralfs *in* Pritchard et *P. rhombeum* (Grunow *in* Cleve *et* Grunow) H. Peragallo, les numéros des lames types sont spécifiés.

**Diatomées / diversité spécifique / microalgues marines / *Pleurosigma elongatum* / *Pleurosigma gracilitatis* sp. nov. / *Pleurosigma ibericum***

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## INTRODUCTION

This paper is a result of the project "Biodiversity of Phytoplankton on the Tropical Mexican Pacific Coasts" by the research team led by Meave del Castillo. The principal aim of this project is to catalog and characterize the diatom flora of the marine littoral of Mexico's western (Pacific) coast, from 21° N. (San Blas, Nayarit State) to 15° N. (Huatulco Bays, Oaxaca State) – see map 1 – and to create a collection of liquid samples and permanent slides of cleaned specimens mounted in resin.

Several papers have been published as a result of this research, including Hernández-Becerril (1987), Hernández-Becerril *et al*. (1993), Aké-Castillo (1997), Aké-Castillo *et al*. (1999, 2001), Meave & Hernández-Becerril (1998) and Meave *et al*. (2001).

In several samples, *Pleurosigma* species were observed for which only a cursory description and minimal number of records are available, and which obviously are in need of up-to-date documentation and typification. Furthermore, our study shows that available biodiversity records may need careful taxonomic scrutiny to trace possible misidentifications.

## STUDY AREA

On the Mexican Tropical Pacific (MTP) coast, the ocean has a superficial layer where the annual temperature is constant at 26-28 °C (Weare *et al*., 1981). The annual variation is greater on the periphery of the region: 2 °C in the central part, 3-4 °C in the east (Gulf of Tehuantepec, Oaxaca State) and 5 °C in the northwest near Cabo Corrientes (Jalisco State). These variations are due to the influence of upwelling during the winter caused by the "Tehuantepecanos" winds and by the California Current in the spring. Just underneath this layer a shallow (20-30 m deep) thermocline exists, showing an abrupt change of temperature. Lower down, the subsuperficial layer shows a continuous but gradual decrease in temperature (Tschernia *in* Pacheco 1991).

The salinity of the materials discussed here, which were all collected near the coast, ranged from 30 to 34 psu; temperatures ranged from 25 to 30 °C.

## MATERIALS AND METHODS

Samples were collected from 17 localities along the coast. At each locality, phytoplankton was collected at 4 sites located at a distance of 2, 4, 6 and 8-10 nautical miles from the coast. Collections were made with a standard phytoplankton net of 54 µm mesh, with vertical (from either 60 m or the maximum depth possible) and horizontal hauls of 3 to 5 minutes duration. The material was fixed with formalin at a final concentration of 4 %. Other samples were collected with a van Dorn bottle at depths of 10, 20, 30 and 50 m and fixed with Lugol's solution. Bottle samples were centrifuged (1500 rpm, 5 minutes). For permanent slides, material was washed several times with bidistilled water and oxidized with

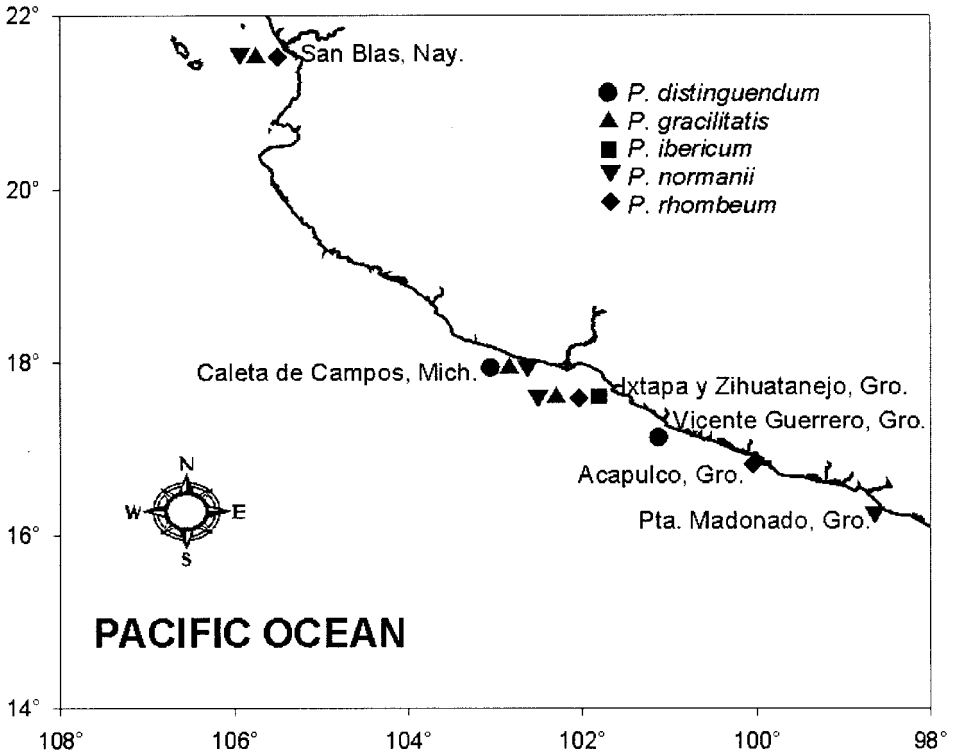
Hasle's (1978) method. For SEM, valves were selected in LM with a micropipette, dried on cover slips and sputter coated with Au-Pd.

This study presents findings from the most representative samples: FpM 456 (Ixtapa, Guerrero, 07-11-98); FpM 505 (San Blas, Nayarit, 16-07-99); FpM 509 (San Blas, Nayarit, 16-07-99); FpM 548 (Zihuatanejo, Guerrero, 06-11-99); FpM 630 (Caleta de Campos, Michoacán, 19-10-99, 10 nm offshore) and FpM 637 (Caleta de Campos, Michoacán, 19-10-99, 2 nm offshore). All these specimens are kept in the collection of the second author, with duplicates in the collection of the first author. W. Smith type material was used for the study of *P. elongatum*; *P. ibericum* is here typified in the material of its protologue. Designated type slides are specified under the species descriptions, where additional materials studied to verify and extend the morphological range are also specified.

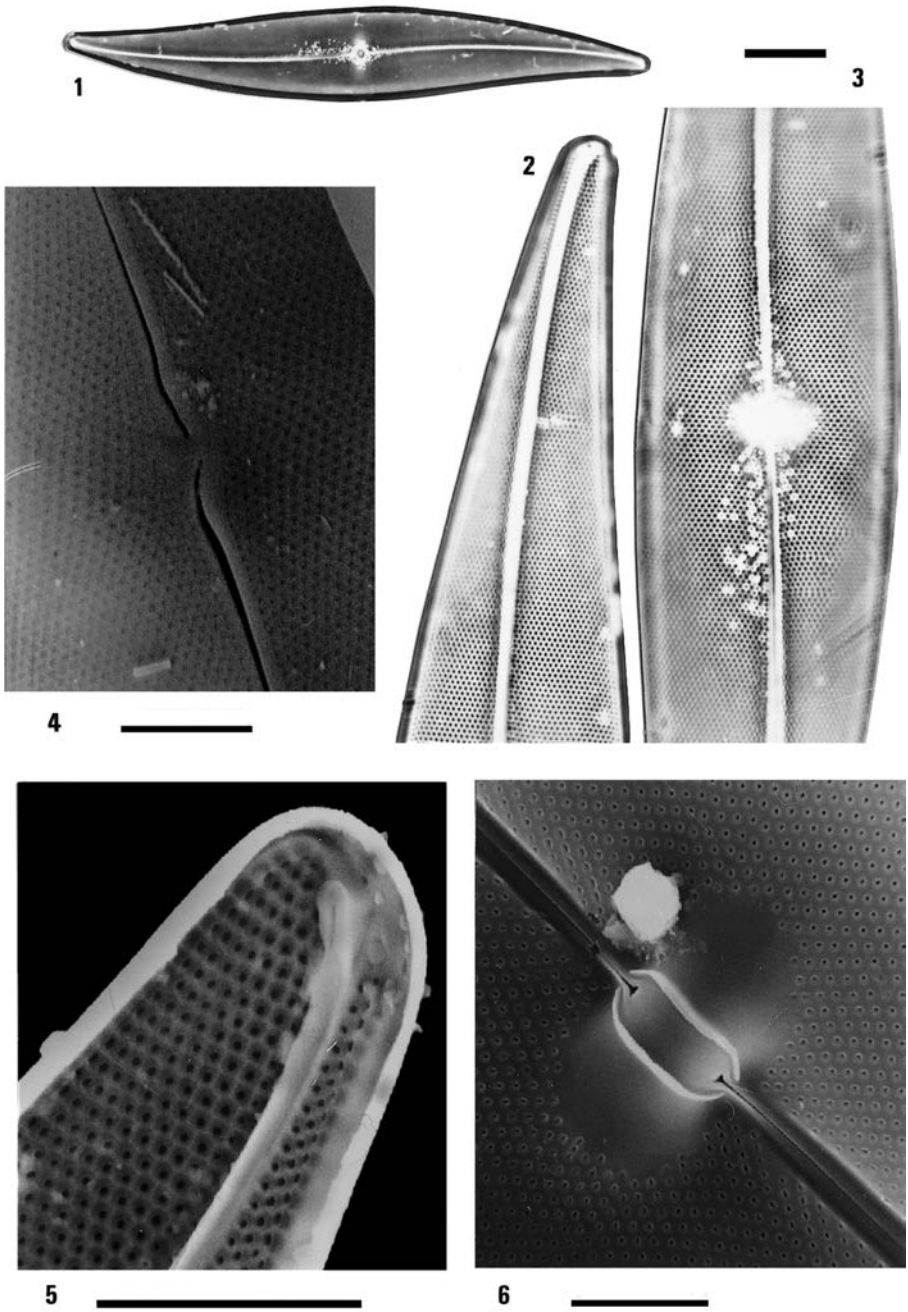
For definitions of the terms used in the species descriptions and other methods see Sterrenburg (1991a).

## OBSERVATIONS

Five species of *Pleurosigma* were observed and their local distribution is shown in Map 1. The most frequent of these species was *P. normanii* Ralfs *in*




Map 1. Tropical Mexican Pacific localities where *Pleurosigma* species were found.




Figs 1-3. *Pleurosigma normanii*, sample FpM 630, LM, bar equals 10 µm. Note difference in central and apical striation.
Figs 4-6. *Pleurosigma rhombeum*, sample FpM 548, SEM, bars equal 5 µm. Fig. 4: central raphe fissures, external view; Fig. 5: apex, internal view; Fig. 6: elevated central raphe node, internal view.

Pritchard. This species was discussed and illustrated in LM and SEM by Sterrenburg (1990), where reference was made to the original material, but no numbered type slide was formally designated. The slide BM 1376 (Natural History Museum, London) is here designated as the lectotype. A representative specimen showing the coarser central than apical striation (section Affines *sensu* Peragallo) is illustrated in LM in our Figs 1-3. *Pleurosigma normanii* is probably cosmopolitan and is quite frequent in benthic as well as plankton samples from many regions, e.g. the North Sea, Caribbean, and New Zealand (FASS).

Another species present in our samples is *Pleurosigma rhombeum* (Grunow *in* Cleve *et* Grunow, 1880) H. Peragallo. This species was previously described and illustrated in LM and SEM by Sterrenburg (1991b), but again no numbered type slide was formally designated. Herein slide BM 55261 (Natural History Museum, London) is formally designated as the lectotype. *Pleurosigma rhombeum* appears to favour warmer waters, as thus far it has only been verified (FASS) to occur in (sub)tropical samples, e.g. from the Pacific and Caribbean - in benthic and in plankton material. Figs 4-6 show the morphology of our specimens in SEM, which fully agrees with the earlier findings referred to above.

Three other species observed require a more detailed description here.

***Pleurosigma ibericum*** Peragallo 1891, p. 8, pl. III/12. Figs 7-13

*Lectotype (designated here):* Marked slide Cleve & Moeller #154, "Baleares", collector F. Söderlund, in Naturhistoriska Riksmuseet, Cryptogamy Dept. Stockholm (S), designated here in agreement with the data in Peragallo (1891).

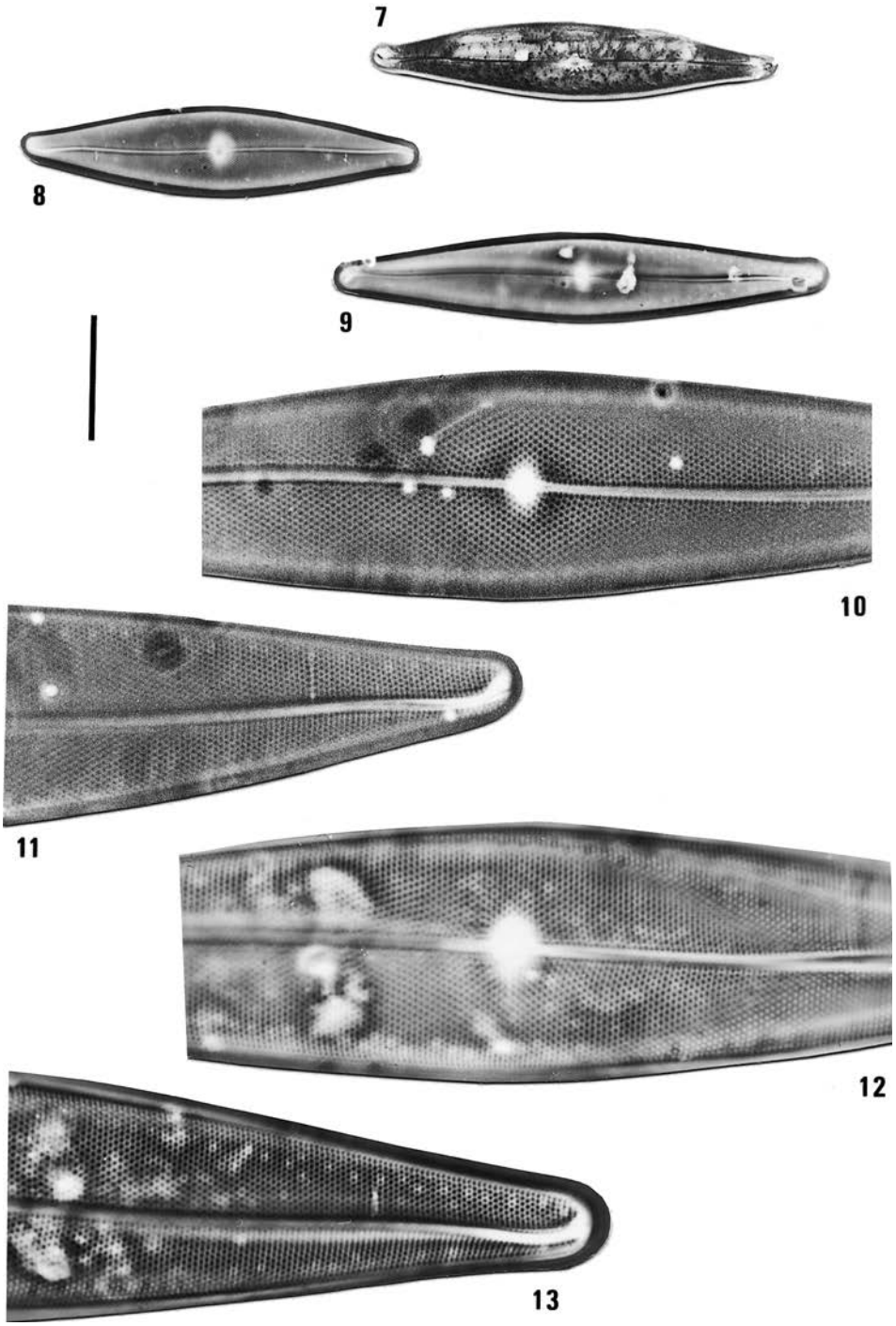
*Other materials examined:* Slides made from residual type material (kept in Sterrenburg collection); FpM 456; materials from Curaçao, Caribbean, Sterrenburg collection #258.

*Synonym: Pleurosigma* (*marinum* var.?) *ibericum* Peragallo 1891

*Species description:* Valve practically non-sigmoid, lanceolate with somewhat capitate apices, 60-105 µm long, 15-18 µm wide. Low contrast in brightfield because of delicate valve. Colour in resin in standardised dark field: faint peacock. Raphe sternum slightly undulate to almost straight and median, except at the apices where it becomes eccentric and ends in distinct oppositely deflected apical 'hooks'; raphe angle circa + 2°. The central external raphe fissures extend far into the central area, their deflection pattern is variable. Central area small, round. Terminal areas minute, undilated, in semilateral position. Striation of the Affines type: transverse 22-24 in 10 µm, oblique typically circa 22 in 10 µm centrally, somewhat finer (typically circa 24 in 10 µm) near the apices, with a corresponding change in stria angle.

Littoral-marine species, abundant in the type material, rare in FpM 456 and Sterrenburg #258.

*Taxonomic notes:* This species is characterized by its practically symmetric, lanceolate and somewhat capitate contour and non-sigmoid, slightly undulate to almost straight raphe sternum with distinct apical 'hooks'. Its identity was checked by examination of the material Peragallo specified in his protologue, which is here formally designated as the lectotype. Peragallo assigned *P. ibericum* to his section Speciosi, where the oblique striae cross at an angle > 60° but < 90°. Examination of the type material reveals that this was incorrect: the crossing angle of the oblique striae is larger in the centre than at the apices of the valve (Figs 10, 11: type material, Figs 12, 13: our specimen) so that the species belongs to the sec-




Figs 7-13. *Pleurosigma ibericum*, LM, bar equals 10 µm. Figs 7-11: type material Cleve & Moeller #154, Figs 12, 13: sample FpM 456.

tion Affines *sensu* Peragallo. A varietal relationship to *P. marinum* Donkin (section Speciosi) – as tentatively suggested by Peragallo (1891) in the legends for Plate III, fig. 12 and mentioned in Van Landingham (1978) – is, therefore, rejected. It should be noted, however, that the difference in striation for the apical and central portions of the valve may be small in this species, requiring careful verification.

*Pleurosigma ibericum* requires a detailed examination to differentiate it from the following very similar species, which also happened to be present in some of our samples:

***Pleurosigma distinguendum*** Hustedt 1955, p. 36, pl. 11, 3-5. Figs 14-20

*Lectotype:* (Simonsen 1987): BRM Zt1/93, "Beaufort, N.C., U.S.A., Strand.b.16." Marked at finder position 248,6. 'Paralectotype' (Simonsen 1987): BRM W5/88b, "Beaufort, N.C., U.S.A., Hafen. 32." Marked at finder position 260,2.

*Materials examined:* FpM 548 and 637 (half a dozen specimens seen) and benthic material from Mission Bay, California, USA (leg. Tiffany, Sterrenburg collection #657), in which it is more abundant.

*Species description:* Valve practically non-sigmoid, lanceolate with somewhat obtuse apices, 50-100 µm long, 1-16 µm wide. Colour in resin in standardised darkfield: faint peacock. Raphe sternum slightly undulate, ending in eccentric and oppositely deflected apical 'hooks'. The central external raphe fissures extend far into the central area, their deflection pattern is variable. Central area small, round. Terminal areas minute, undilated, in semilateral position. Transverse and oblique striae 22-24 in 10 µm, stria angle circa 60° (Angulati *sensu* Peragallo).

*Taxonomic notes:* This species is very similar to *P. ibericum* except for the fact that the latter belongs to the Affines *sensu* Peragallo, whereas in *P. distinguendum* both the apical and the central oblique striae intersect at an angle of circa 60° (Figs 17-20). The Affines-type striation has been verified as stable in about a dozen such species examined (FASS), so that this difference separates the two species. Our specimens fully match Hustedt's description and often show (e.g. Figs 18, 20) the small apical "patch" of irregular striation illustrated in Hustedt (1955, pl. 11, fig. 4a), further supporting the identification.

The third *Pleurosigma* species discussed here was fairly abundant in several samples:

***Pleurosigma gracilitatis*** Sterrenburg, Meave *et* Tiffany, **sp. nov.** Figs 21-29

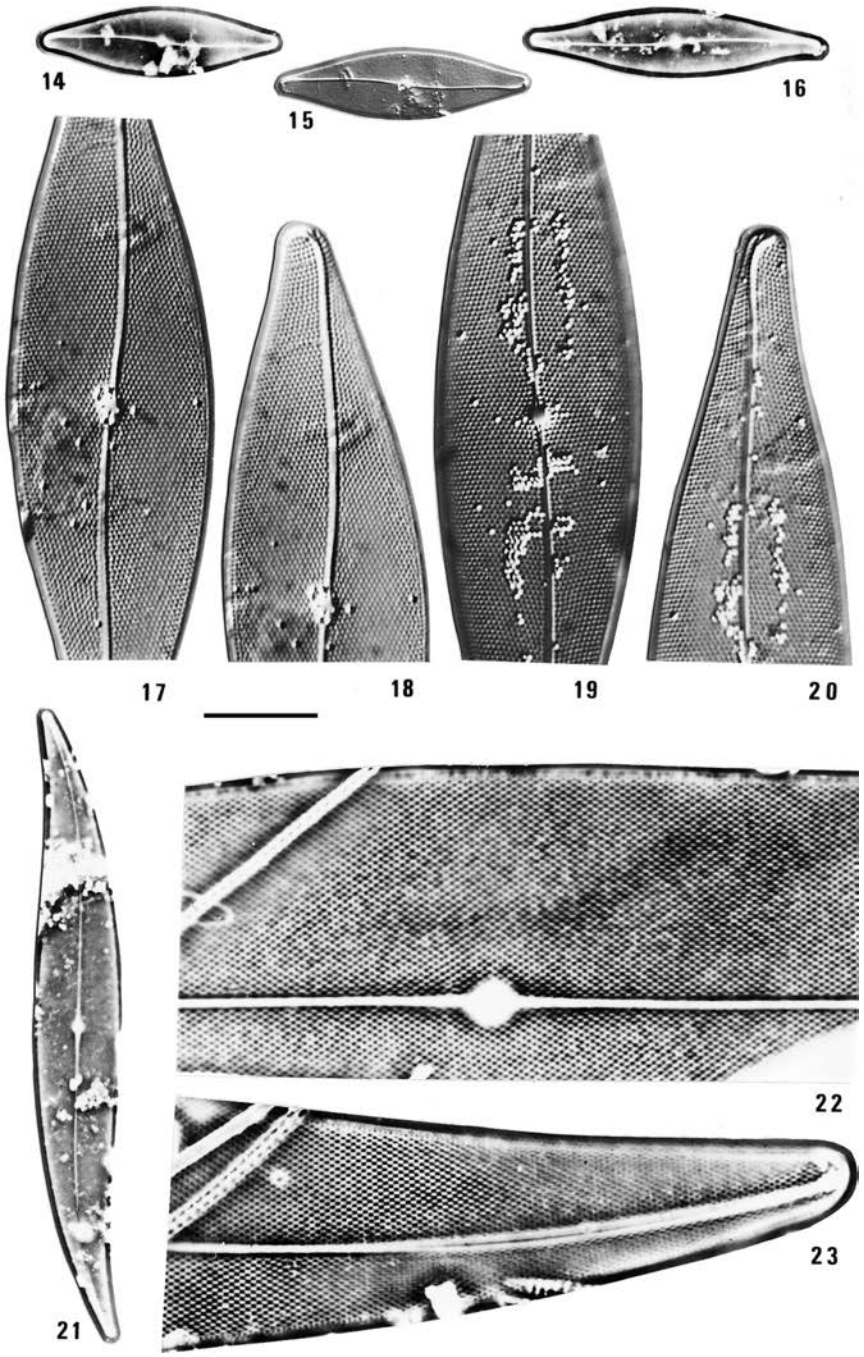
*Holotype:* « San Blas », Nayarit, W. coast of Mexico, 16-7-1999, plankton sample FpM 509, in Hustedt Arbeitsplatz, Bremerhaven, BRM ZU 5/50.

*Isotypes*: UAMI-D1483 in MEXU and Sterrenburg collection #661.

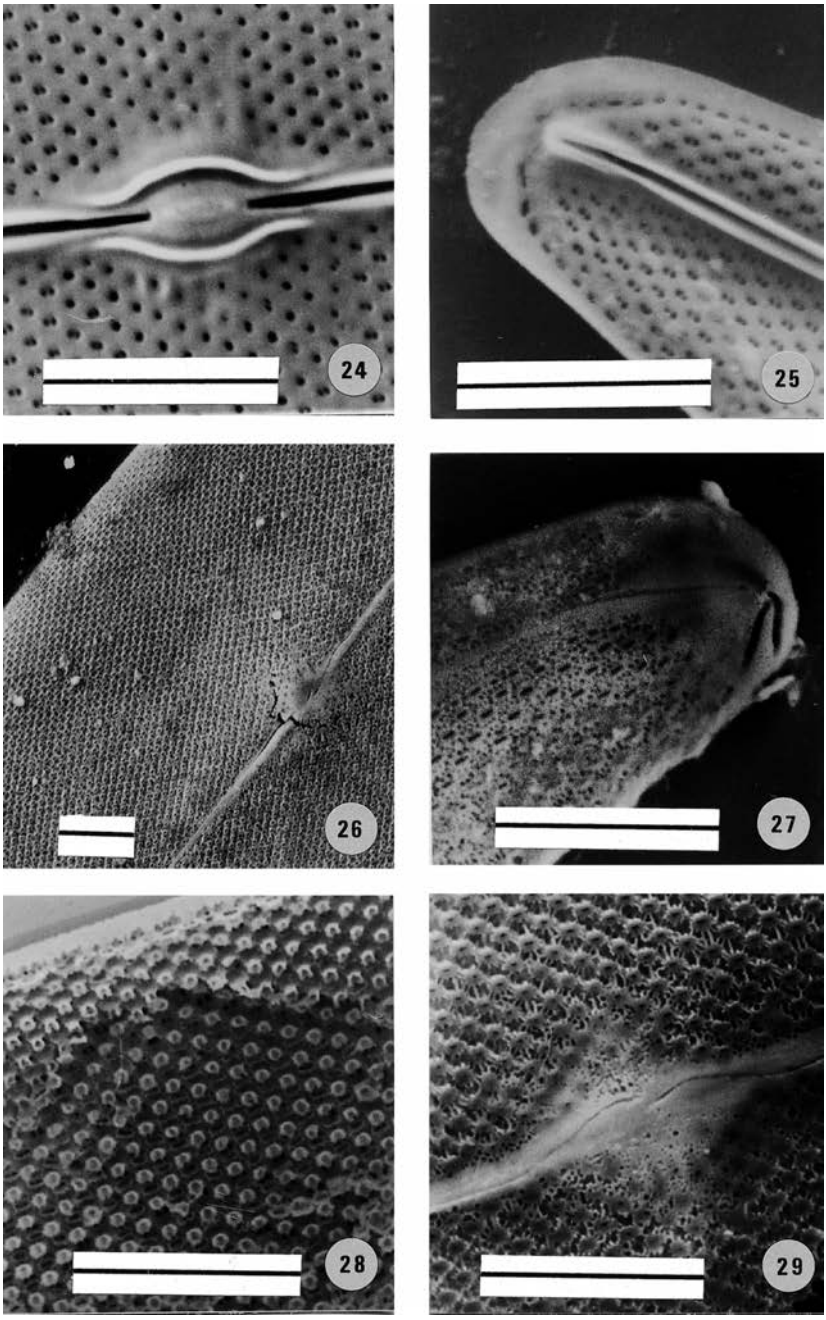
*Other materials examined:* Samples from the Caribbean, Sterrenburg collection. Also present in FpM 505, 548 and 630.

*Diagnosis: Valvae leniter sigmoideae, lanceolatae, apicibus acutis, 298-500 µm longae, 3-52 µm latae. Sternum raphis sensim curvatum, leniter eccentricum, angulum raphis + 7 ad + 10°. Striae transversae 2-23, obliquae 1-20 in 10 µm, in angulo 68-72°. Aquis marinis.*

*Species description:* Valves slightly sigmoid, lanceolate with acute apices, 298-500 µm long (commonly ca. 350 µm), 35-52 µm wide (commonly ca. 40 µm). Colour in resin with standardized darkfield illumination: bright blue. Low contrast in brightfield as the valve is often delicate. Raphe sternum gently curved, slightly eccentric (displaced to its convexity) near the apices, raphe angle + 7 to + 10°.




Figs 14-20. *Pleurosigma distinguendum*, sample FpM 548, LM, bar equals 10 µm. Note irregular apical stria pattern in Figs 18 and 20.
Figs 21-23. *Pleurosigma gracilitatis* sp. nov., sample FpM 509, LM, bar equals 10 µm.




Figs 24-29. *Pleurosigma gracilitatis* sp. nov., sample FpM 509, SEM, bars equal 5 µm. Fig. 24: central raphe node, internal view; Fig. 25: apex, internal view; Fig. 26: external valve surface showing unusual "granular" aspect; Fig. 27: at higher magnification, the external areolar fissures are seen to be surrounded by minute foramina; Fig. 28: other valves present a verrucose external aspect; Fig. 29: or a network of minute bridges in stellate arrangement.

Central raphe fissures not reliably visible in LM; long, approximate and deflected to the same side in specimens seen in SEM (Fig. 29) but possibly not stable. Central area small, round. Terminal areas very small, not dilated, in apical position. Apical structure: no 'calcar' (a spur-like feature) present. Oblique striae crossing at an angle of 68-72° (section Speciosi *sensu* Peragallo), transverse striae 20-23 in 10 µm, oblique 17-20 in 10 µm.

Littoral-marine species, rather common in our samples.

*SEM findings:* The specimens seen in SEM presented an extraordinary external valve structure as shown in Figs 26-29. The valve surface looks verrucose, or shows a network of small bridges in a more or less stellate arrangement. At first this was tentatively interpreted as a result of erosion, but an independent series of observations (MAT) on a different *Pleurosigma* species made it clear that these are valves in various stages of development. Valve morphogenesis in *Pleurosigma* will be discussed in a future publication, where additional SEM illustrations of *P. gracilitatis* will be shown and commented on.

*Taxonomic notes, nomenclature:* The only taxon in the literature that matches our diatom in LM is *Pleurosigma elongatum* var. *gracile* Grunow. A study on the type material of *Pleurosigma elongatum* W. Smith (see below), however, shows several major differences in LM: in apical structure, raphe angle, visibility of the central raphe fissures and size of the central area, for example. Thus our diatom cannot be regarded as a variety of *P. elongatum*. Unfortunately, as is also the case for the vast majority of species in this genus, *P. elongatum* var. *gracile* Grunow (1878) has not been typified. Whilst it may eventually be possible to trace a corresponding slide, experience has shown that the existence of a residue of the original sample in herbaria is unlikely. Grunow's taxon is not mentioned in the catalogues of the Cleve & Moeller or the Tempère & Peragallo slides, for which some material is still available. This raises the question of whether conspecificity can be claimed solely on the basis of a match in LM, since the double areolae are only visible in SEM. Judging by recent identification manuals, this is generally considered acceptable, as SEM illustrations of specimens from type materials of long-established species are rare.

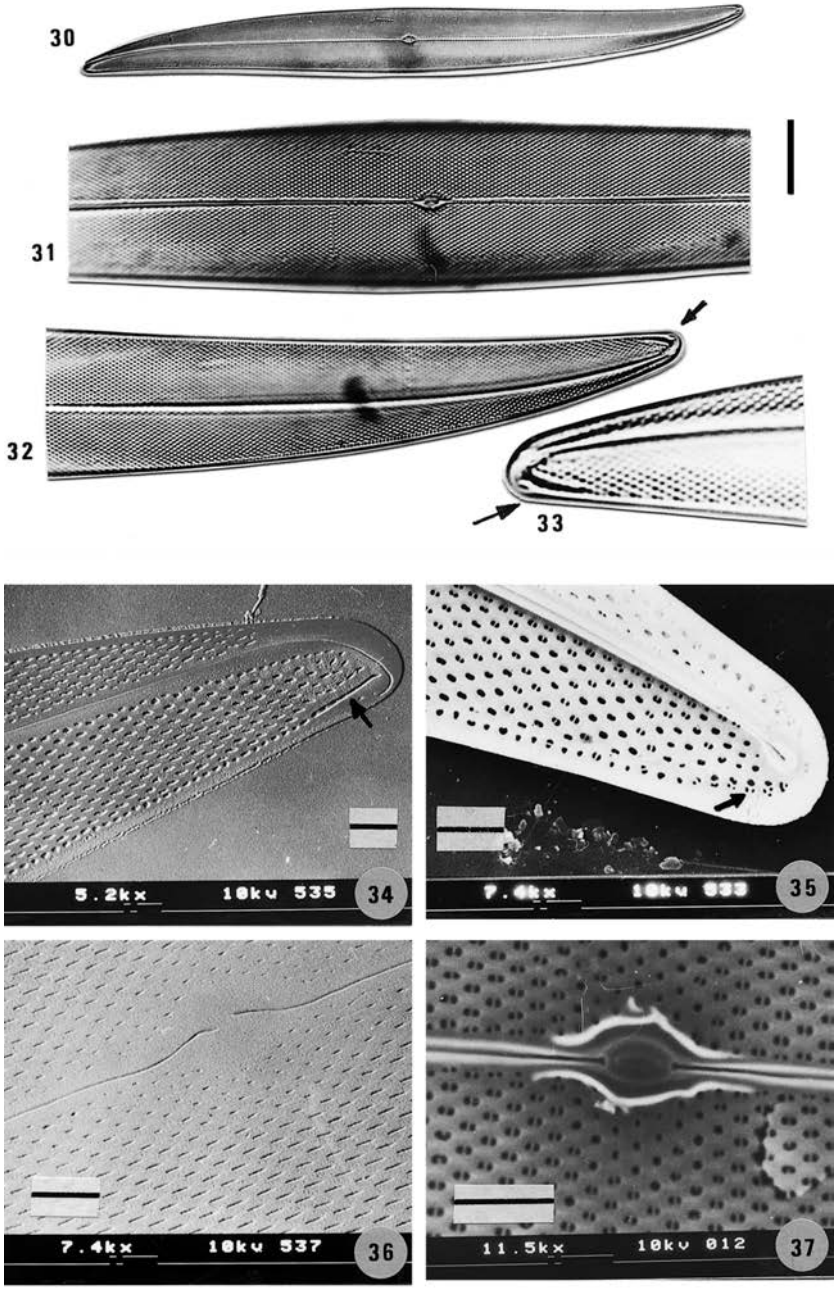
We are faced with two options, the first being: posit conspecificity of *P. elongatum* var. *gracile* Grunow and our diatom. Since our examination of the type of *P. elongatum* has shown var. *gracile* (based on our material) to be inappropriately placed, recognition at the species level is proposed. Adopting Grunow's varietal name at the species level, however, would create a later homonym of *P. gracile* Hustedt (1955), necessitating the proposal of a new name based on Grunow's material. As the whereabouts of Grunow's material is presently unknown, however, we feel doing so could be counterproductive.

Our second and preferred option is: neither posit nor reject conspecificity, but propose a new species based on our material. If the eventual tracing and examination in SEM (to verify the presence of double areolae) of Grunow's material should confirm conspecificity, *P. elongatum* var. *gracile* would become a heterotypic synonym of *P. gracilitatis* Sterrenburg, Meave & Tiffany.

For comparison, the findings of an LM and SEM study on the type material of *P. elongatum* follow here:

***Pleurosigma elongatum*** W. Smith 1852, p. 6, pl. 1/4. Figs 30 – 37

*Lectoype* (Hendey 1964): W. Smith slide « Poole Bay, June 1849 », BM 23651, Natural History Museum, London.




Figs 30-33. *Pleurosigma elongatum*, sample "Poole Bay, June 1849", LM, bar equals 25 µm (Fig. 30), 10 µm (Figs 31, 32) and 5 µm (Fig. 33). Arrows in Figs 32 and 33 mark calcar.
Figs 34-37. *Pleurosigma elongatum*, sample Sterrenburg #59, SEM, bars equal 2 µm. Figs 34, 35: apex of valve, external and internal views. Figs 36, 37: centre of valve, external and internal views. Arrows in Figs 34 and 35 mark SEM equivalent of calcar.

*Other materials examined:* W. Smith's "Poole Bay, June 1849" type material (Sterrenburg collection); marine and non-marine populations from The Netherlands (Sterrenburg #59), Spain (Sterrenburg #505, #507), Crete (Sterrenburg #267)and Caribbean (Sterrenburg #269).

*Species description:* Valve moderately sigmoid, narrow lanceolate, gradually tapering to rather acute ends, 150-350 µm long, 2-30 µm wide. Colour in resin and with standardised darkfield illumination blue, rather faint for more delicate specimens. Raphe sternum fairly wide, with single curvature, almost straight and median in the middle portion, curving gently and somewhat displaced to its convexity near the ends. Raphe angle + 4° to + 7°. Central raphe fissures distinct, extending far into the central area; their shape and deflection are extremely variable. Terminal fissures very long and recurving on the mantle (SEM, Fig. 34), but not very clear in LM. Central area fairly large, oval to rhombic. Terminal areas unilaterally dilated funnels in apical position. Striae angle 65-70°, transverse striae 20-23, oblique striae 17-20 in 10 µm. Apical structure: in the LM, a 'calcar' is seen at the apical margin of suitably oriented valves, situated on the concave side of the raphe sternum (Figs 32-35, arrows).

*SEM findings:* In most specimens examined in SEM, the external areolar openings were bisected (double), while other specimens showed single as well as double areolar foramina, with intermediate areolar foramen shape also being present, as particularly evident in Fig. 35. These differences are interpreted as phases in valve morphogenesis and will be further discussed in a future paper on valve morphogenesis in *Pleurosigma*.

The SEM equivalent of the spur-like feature in LM called 'calcar' is indicated by arrows in Figs 34 and 35: there is a long fissure on the external valvar surface and a corresponding row of compound areolar foramina on the internal surface. Refer also to Stidolph (1992) for additional SEM findings in the Dutch non-marine population and comments on the 'calcar' and central raphe fissure instability.

*Ecology:* This species is widely distributed in the marine littoral of many regions and may occur worldwide. It is also seen to live in only minimally brackish inland waters, e.g. in canals in North Holland (FASS). Such a wide ecological range is unusual in the genus.

## DISCUSSION

### Taxonomic aspects

Three species, *Pleurosigma distinguendum*, *P. gracilitatis* and *P. rhombeum,* are new records for Mexican waters.

*Pleurosigma rhombeum* may have been identified as *P. angulatum* in previous papers referring to the Pacific coast of Mexico. Fifteen such records were traced in the literature between 1972 and 1998, but the illustrations do not permit positive identification. The presence of *P. angulatum* in tropical waters is not certain, however, see Sterrenburg (1991b and 2001). The materials that formed the basis of these records should, therefore, be critically re-examined.

*Pleurosigma gracilitatis* is rather common and widespread in the MTP region. After *P. normanii* it appears to be the most frequent *Pleurosigma* species

in our materials. Eleven records of '*P. elongatum*' were traced for the W. coasts of the Baja California peninsula and the Gulf of California in the literature between 1943 and 1996. The species has not been found in our samples, and, because of their superficial similarity, some of these records might be misidentifications of *P. gracilitatis*, similar to the case of '*P. angulatum*' mentioned above.

With regard to records of *P. ibericum* in the Gulf of California (Moreno *et al.*, 1996) and near its entrance (Licea-Duran, 1974), these agree with our findings, but from the data supplied the closely similar *P. distinguendum* cannot be excluded. Verification of the original materials is necessary.

**Mode of life**

All our *Pleurosigma* specimens were collected during the rainy season. Perhaps a temporary drop in salinity could be a promoting factor in their life-cycle.

In general terms, however, the question arises: what are these *Pleurosigma* species doing in the plankton at all ? The raphe of *Pleurosigma* is an organ for locomotion on solid substrata and would have no function for a planktonic diatom. Species of this genus are, therefore, typically benthic or epiphytic and all species discussed here have also been observed (FASS) in benthic or epiphytic samples. One explanation could be that these species are resuspended in the water column from the sediment. Admixture of benthic species to the plankton could certainly occur in our area of study, with its evaporative convection, changing winds and currents, but it should be noted that our plankton samples do not appear to contain other benthic pennate diatoms. An interesting comparison can be made with findings from a long-term study (MAT) on the Salton Sea, an inland, but highly saline polymictic lake in California. Cells of *Pleurosigma ambrosianum* Sterrenburg, Tiffany *et* Lange (2000) are regularly found in very large numbers (up to 575 cells $ml^{-1}$) in the plankton during winter and early spring mixing events, but are nearly or completely absent during summer when a thermocline develops. Presumably, the strong mixing of the water column allows this usually benthic species to 'float' and become abundant in the plankton. The question remains, however, whether our planktonic *Pleurosigmas* then passively wait until they sink again – or actively prolong their sojourn in the plankton. The valves of *P. rhombeum* are heavily silicified, but those of *P. gracilitatis* and *P. ambrosianum* are delicate and oil or gas bubbles could easily keep them afloat. Some *Pleurosigma* species might therefore combine different modes of life. Rich populations of several *Pleurosigma* species have been seen (FASS) to grow on *Sargassum* very far from land, for instance, and *P. normanii* has been regularly observed (FASS) in marine plankton samples. *Pleurosigma simonsenii* (Simonsen) Hasle (the corrected name for *P. planctonicum* Simonsen, whose specific epithet had already been used), is of course fully adapted to a planktonic existence by its lightweight build and its raphe would appear to have no function for its mode of life.

**Species distribution**

The available data for *Pleurosigma ibericum* first appeared to be limited to the protologue (Peragallo, 1891). Cleve (1894) does not add new information and no illustrations better than that provided by Peragallo (1891). The only location given by these authors is « Balearic Islands », Spain, obviously the Cleve & Moeller #154 material. Although the two recent records near our area of study (Licea-Duran, 1974 and Moreno *et al.*, 1996) do not permit exclusion of *P. dis-*

*tinguendum*, the Caribbean specimens mentioned above do, to some extent, bridge the gap between the Balearic Islands and Mexico's Pacific coast. The organism may be more widely distributed, however.

For *Pleurosigma gracilitatis* the situation is somewhat similar: the possibly conspecific *P. elongatum* var. *gracile* Grunow was described from the Kaspian Sea in the Caucasus, at a great distance from our collection localities. We have found one more record of this taxon: Hagelstein (1938), in the Caribbean. Unfortunately, Hagelstein's identification is not truly verifiable as no illustration was supplied, but his data match the protologue and our findings, and such a diatom certainly does occur in materials collected (FASS) from the Caribbean. Again, it is unlikely that the organism would not be present in other areas as well. For many 'rare' or even 'lost' diatom species, we conclude that the lack of records is artificial, see the example in Sterrenburg, de Souza-Mosimann & Fernandes (2002). The genera *Gyrosigma* and *Pleurosigma* have long been regarded as 'difficult' and lacking in informative species characters - witness, for instance, the remarks in Mann (1925). Detailed descriptions and especially: photomicrographs, to stimulate recognition of species have therefore been scarce. This may explain how several *Pleurosigma* and *Gyrosigma* species have almost or wholly vanished from the literature for a century despite their frequent and widespread occurrence. On the other hand, the use of mainly West-European identification manuals in investigation of tropical samples may have weighted the records in favour of a limited number of taxa common in temperate waters, but perhaps rare or wholly absent on tropical coasts. As a result, the recorded diatom species diversity in many regions may need a careful taxonomic scrutiny to eliminate misidentifications. This is especially the case for the (sub)tropical marine littoral, where the species diversity in certain diatom genera including *Pleurosigma* and *Gyrosigma* culminates.

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