Jap. J. Phycol. (Sôrui) 27: 193-199. December 10, 1979

Fragilaria pseudogaillonii sp. nov., a freshwater pennate diatom from Japanese river

Hiromu KOBAYASI and Masahiko IDEI

KOBAYASI, H. and IDEI, M. 1979. *Fragilaria pseudogaillonii* sp. nov., a freshwater pennate diatom from Japanese river. Jap. J. Phycol. 27: 193-199.

A new diatom, *Fragilaria pseudogaillonii* is described as new to Fragilariaceae based on the specimens collected from Chikugogawa river, Fukuoka Pref., Kyushu Island. It forms band-shaped colonies composed of 8-10, up to 20 cells. Valves are long and linear, with slightly attenuate ends, being 220-410 μm in length and 8-10 μm in width. Striae are parallel throughout most of the valve but slightly radiate at the ends. Striae are 7-9 in 10 μm. Examinations with scanning electron microscope revealed that adjacent valves were united to one another by interlocking marginal spines characteristic to the genus *Fragilaria*.

Hiromu Kobayasi and Masahiko Idei, Department of Biology, Tokyo Gakugei University, Koganei-shi, Tokyo, 184 Japan.

In the materials collected on 15th October 1977 by Dr. K. OOSHIMA of the Nihon University and Mr. T. NAGUMO of the Nippon Dental University from the middle stretch of the Chikugogawa river at Komorino-Town of Kurume-City, Fukuoka Prefecture, Kyushu Island, considerable amount of band-shaped colonies composed of long and linear cells were found. When the frustule structure of this diatom was examined by using light and electron microscopes after isolation of the colonies and cleaning of them by sulfuric acid, it became apparent that the diatom was a member of *Fragilaria* and a hitherto non-described species of the genus.

Although the genus *Fragilaria* is closely related to the genus *Synedra* and as pointed by PATRICK and REIMER (1966) these two genera may be united in future, both genera have been accepted by modern diatomists (HUSTEDT 1932, HENDEY 1964, PATRICK and REIMER 1966). Under natural conditions, species of the genus *Fragilaria* form band-shaped colonies, whereas species of the genus *Synedra* may be solitary or occur in rosette-like colonies.

The diatom, for which we proposed the name *Fragilaria pseudogaillonii*, clearly forms the colonies characteristic to the genus *Fragilaria* (Figs. 4, 5). In the present paper, terminology proposed by VON STOSCH (1975) and by the working party in Kiel (ANON. 1975) was used.

Materials and Methods

Samples were collected from several localities of Chikugogawa river, Fukuoka Prefecture, 15th October 1977. Using PRINGSHEIM's pipette-washing method, solitary and colony forming diatoms were separately isolated from one of the natural scraped off materials collected from Komorino Town of Kurume City. Each of two materials was treated with sulfuric acid and potassium nitrate to remove organic matter, and then washed in distilled water. These materials were used for the light microscopical (LM) and scanning electron microscopical (SEM) observations. Likewise materials which were not treated with acid were observed with LM and SEM. The materials for LM were mounted with

pleurax. The materials for SEM were prepared by air drying on a glass coverslip and then affixed to a metal stub. They were coated with gold using Comtec CSC Sputer Coater and viewed with Nihondenshi JSM-U 3 at 25 kV or Comtec CSM-501 at 30 kV.

Results and Discussion

Colonies and a valve which were mechanically separated from a colony by means of a needle under light microscope are shown in Figs. 1–5. Most of the colonies were composed of 8–10 cells and the longest ones were composed of about twenty or up to thirty cells. However, among these colonies, solitary cells were rarely found. Therefore, these solitary cells were isolated and cleaned for the comparative study using light and scanning electron microscopes. SEM micrographs of the solitary cells are shown in Fig. 7. We could not find any differences between the valves forming colonies and the valves of solitary cells except the existence of interlocking marginal spines of the adjacent valves (Figs. 11–13).

As emphasized by HOAGLAND and ROSOWSKI (1978) main characteristics for *Fragilaria*, e. g. interlocking marginal spines, apical pore fields on the mantles of the valve ends, and labiate processes at the valve ends, were all detected in the present specimens.

Valves of *F. pseudogaillonii* were long and linear, with slightly attenuate and rounded ends, and were 220–410 μm long and 8–10 μm wide. A jelly pore was found at each end of the valves. Axial area was narrow, linear and central area was not present.

Most species of the genus *Fragilaria* have short valves. However, *F. ungeriana* GRUN. and *F. longissima* HUST. have long valves, being 62–120 μm in length and 8–9 μm in width in the former (DE TONI 1892), and 187–203 μm in length and 5.5 μm in width in the latter (mesuring HUSTEDT's Figures 1913). SCHOEMAN (1973) also gives the valve dimensions of 65–135 μm in length and 6.5–7.5 μm in width to the South-African specimens of *F. ungeriana*. It is obvious from these descriptions that the valves of *F. ungeriana* are shorter than that of *F. pseudogaillonii* and are clearly distinguishable by its wedge-shaped valve apices and presence of the central area. On the other hand, *F. longissima* which was described from Victoria Lake by HUSTEDT (1913) is also clearly distinguished by its broad pseudoraphe (axial area), strongly attenuated valve ends, shorter valve length and denser striae.

In addition to the two *Fragilaria* species mentioned above, *Synedra gaillonii* (BORY) EHR. and *S. ulna* var. *obtusa* V. H. are quite akin to *F. pseudogaillonii* especially in their valve shapes. However, *S. gaillonii* is distinguished by its nature of living in brackish to marine water and *S. ulna* var. *obtusa* is also distinguished by its broader ends and presence of the central area.

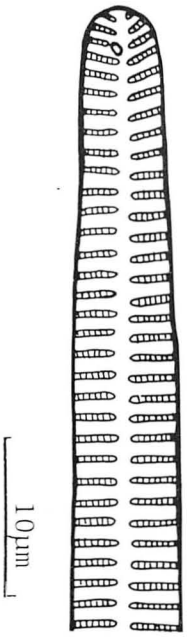
Each stria consisted of a single row of poroid areolae and continued across the valve face and down the valve mantle (Figs. 6, 7, 13). Striae were parallel throughout most of the valve, however, they were slightly radiate near the ends (Figs. 6, 8) and the striae on both sides of the axial

Figs. 1–7. *Fragilaria pseudogaillonii* sp. nov.

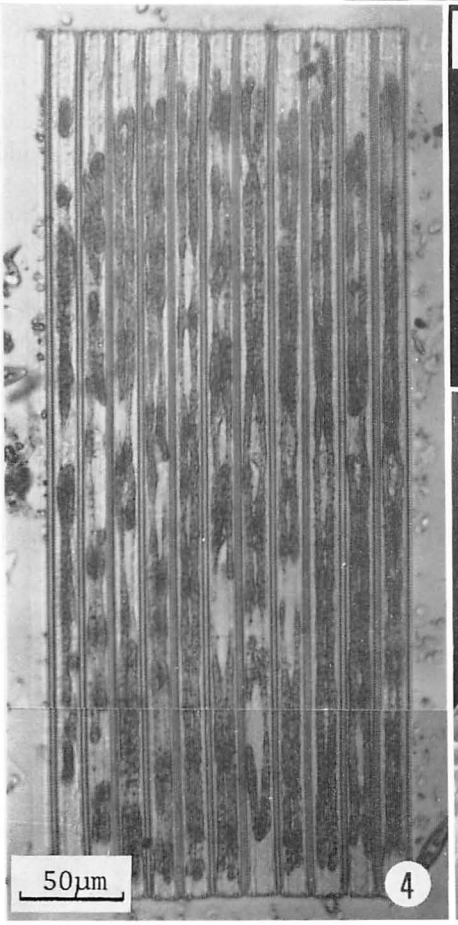
1. Photomicrograph of holotype specimen. LM ×600. 2. Figure of holotype specimen. ×600. 3. Detail of valve end. ×2000. 4. Band-shape colony showing two plate-like chloroplasts in a cell. LM ×270. 5. Detail of chain showing striation and interlocking portion of girdle side. LM ×1000. 6. Valve end in oblique view showing two terminal spines, external opening of labiate process, eroded marginal spines, striae and apical pore field on valve mantle. SEM ×5600. 7. Valve surface showing opposite (white arrow) and alternate (black arrow) arrangement of striae. Uncleaned frustule. SEM ×4200.

1

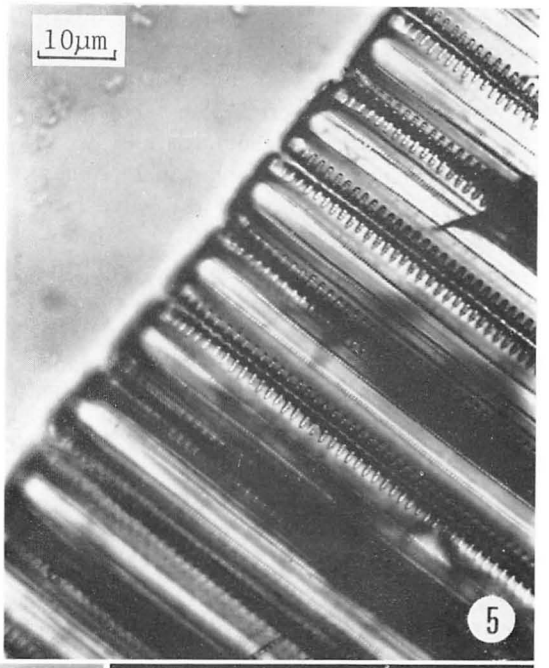
2



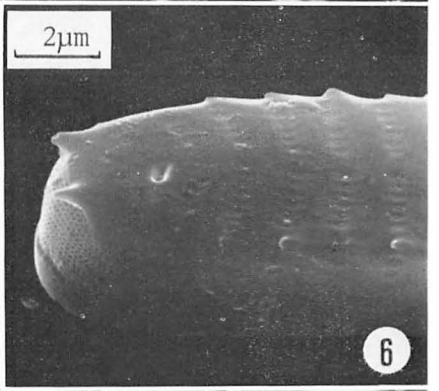
3



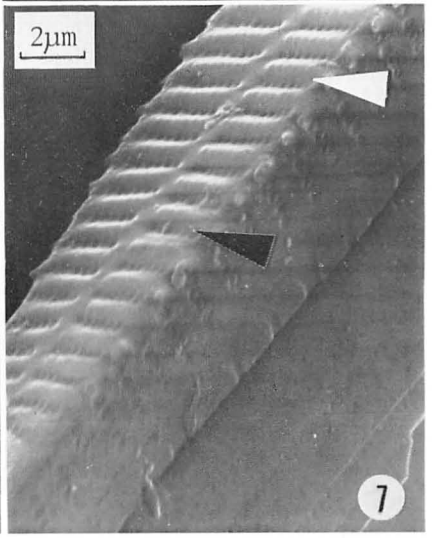
4



5



6



7

area were arranged oppositely or alternately with each other (Fig. 7).

Although the marginal spines of the end-valves were usually eroded as shown in Figs. 6, 8 and 10, adjacent frustules were united by interlocking marginal spines arising from the junction of the valve face and valve mantle (Figs. 10–13). Interlocking marginal spines similar to this diatom have been reported for *F. construens* (EHR.) GRUN. (HELMCKE & KRIEGER 1962), for *F. construens*, *F. virescens* RALFS and *F. pinnata* EHR. (GASSE 1970) and for *F. capucina* var. *mesolepta* RABH. (HOAGLAND & ROSOWSKI 1978).

Frustules forming colonies usually came apart at their girdle regions by the acid treatment (Figs. 10, 11). When mechanically separated by a needle under microscope, however, interlocking marginal spines were completely destroyed at their stalks leaving their bases (Figs. 12, 13). In nature, similar mechanical separation caused by the current action of the running water may have been easily occurred. In the case of this diatom, mechanical separation is likely the reason of the erosion of marginal spines of both end-valves of the colonies and the valves of the solitary cells. We could neither find separating cells as seen in the colony of *Melosira* nor valves without spines in the colonies of *F. pseudogaillonii* so far as observed.

On the contrary to the interlocking marginal spines of *Fragilaria*, there were no spines on the adjacent valves of *Synedra ulna* (NITZ.) EHR. observed (Fig. 14) as well as on the valves of *S. tabulata* (AG.) KUETZ. (HASLE 1974) and for *S. ulna* (HELMCKE *et al.* 1977, OKUNO 1964).

Each apex had an apical pore field (HASLE 1974) and two spines (Fig. 6). The apical pore field was located on the valve mantle and its porelli were regularly arranged in longitudinal rows.

A single well developed labiate process appeared at both internal valve ends (Fig. 9). It had short stalk and its two lips were slightly apart. Its external opening was looked like a deep hole (Fig. 8). The labiate process is a common feature of the Fragilariaceae and as listed by HOAGLAND & ROSOWSKI (1978), it has been found in every genus examined to date. On the other hand, the genus *Semiorbis* of which transference from Fragilariaceae to Eunotiaceae was proposed by Moss *et al.* (1978) and KOBAYASI & NAGUMO (1978) bears neither labiate process nor apical pore field.

The girdle region is shown in Fig. 10. The cingulum was composed of three bands. The first band, the valvocopula, underlapped the mantle edge. The second and third bands also underlapped successively the bands proximal to them. The girdle region of *F. pseudogaillonii* is quite similar to that of *Gomphonema parvulum* (KUETZ.) GRUN. reported by DAWSON (1972) and *F. capucina* var. *mesolepta* examined by HOAGLAND & ROSOWSKI (1978).

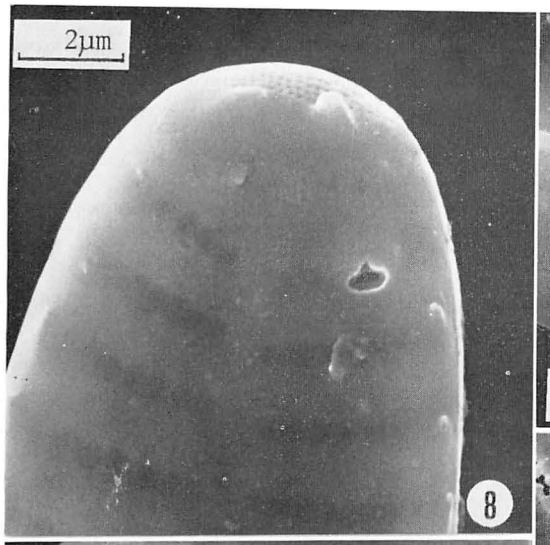
Fragilaria pseudogaillonii sp. nov.

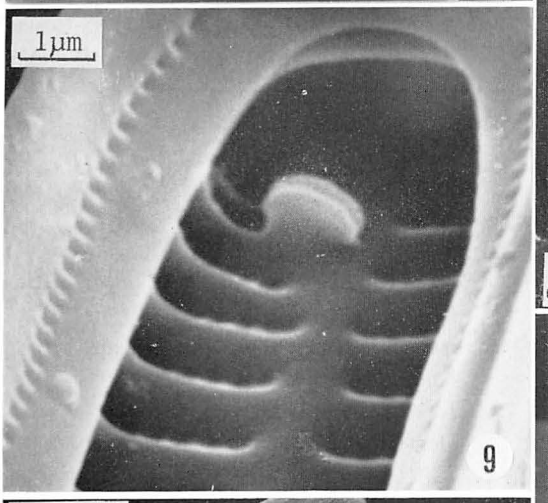
Cellulae duobus chloroplastis laminiformibus et in catenas 8–10, raro 20 cellularum conjuncta vel rarissime solitariae. Valvae

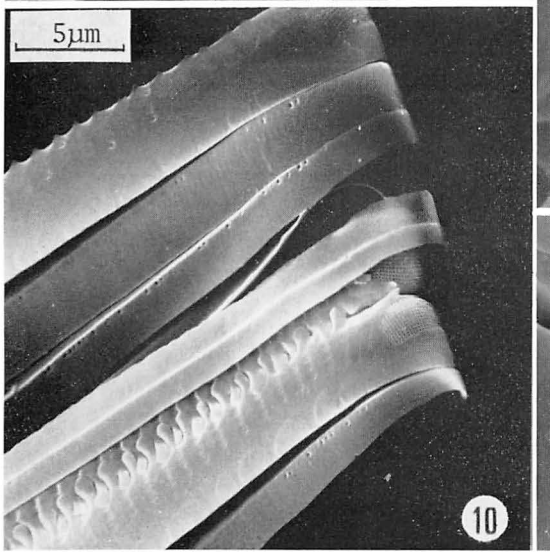
Figs. 8–13. *Fragilaria pseudogaillonii* sp. nov.

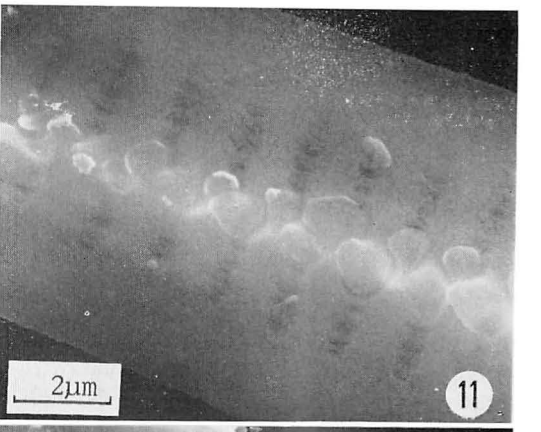
8. Valve end showing external opening of labiate process. SEM ×7000. 9. Internal valve end showing labiate process with two lips. SEM ×10000. 10. Frustule end in oblique view showing valvocopula and two pleurae. SEM ×2800. 11. Interlocking marginal spines of adjacent valves. SEM ×6300. 12. Mechanically divided interlocking portion showing disappeared spatulated spine heads. SEM ×1900. 13. Interlocking marginal spines arising from junction of valve face and mantle, connection of adjacent valves and inner furrows of striae continuing from valve face to valve mantle. SEM ×7000.

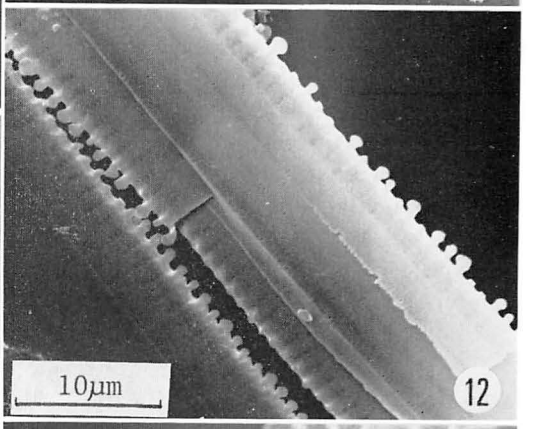
Fig. 14. *Synedra ulna* (NITZ.) EHR. Uncleaned frustules without marginal spines. SEM ×4200.

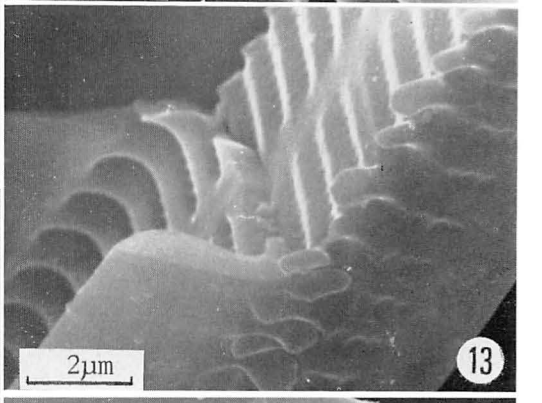

2µm
8

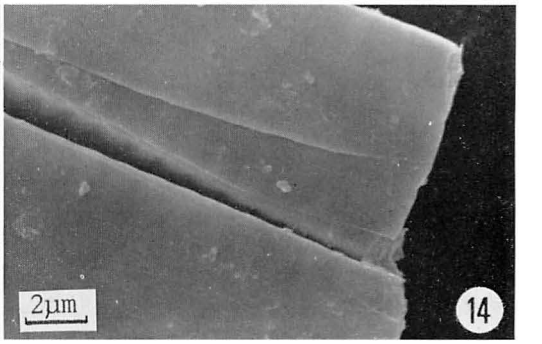

1µm
9


5µm
10


2µm
11


10µm
12


2µm
13


2µm
14

lineare, apicibus leviter attenuatis et rotundatis, 220–410 μm longae, 8–10 μm latae, poris gelatino distincto in quoque apice. Area axialis angusta et linearis sine area centrali. Striae transapicales penitus paralleles, leviter radiantes ad apices versus, 7–9 in 10 μm, distincte punctatae, 24–28 in 10 μm.

Cells with two plate-like chloroplasts and connected in chains of 8–10, rarely 20 cells or very rarely solitary. Valves linear with slightly attenuated and rounded ends, 220–410 μm long, 8–10 μm wide, and with one distinct jelly pore (labiate process) at each end of the valves. Axial area narrow, linear, without central area. Transapical striae parallel throughout most of the valve, near the ends slightly radiate, 7–9 in 10 μm, distinctly punctate, 24–28 in 10 μm.

Holotype: H. K. T-71 in coll. H. KOBAYASI
Iconotype: Figs. 1–3, photomicrograph and figures of the holotype specimen.
Type locality Chikugogawa river at Komorino-Town, Kurume City, Fukuoka-Prefecture, Kyushu-Island.

Acknowledgements

We should like to express our hearty thanks to Dr. K. OOSHIMA of Nihon University and Mr. T. NAGUMO of the Nippon Dental University collected the materials from the Chikugogawa river, Kyushu Island.

References

ANONYMOUS. 1975. Proposals for a standardization of diatom terminology and diagnoses. Nova Hedwigia Beih. **53**: 323–354.

DAWSON, P. A. 1972. Observations on the structure of some forms of *Gomphonema parvulum* KUETZ. 1. Br. phycol. J. **7**: 255–271.

DE TONI, G. B. 1892. Sylloge algarum omnium hucusque cognitarum vol. 2. Bacillarieae sect. 2. Pseudoraphideae. Typis Seminarii, Patavii.

GASSE, F. 1970. Ultrastructure et organisation coloniale de la diatomée *Fragilaria construens* (EHR.) GRUN. révélée par le microscope électronique à balayage. C. R. Acad. Sc. Paris **271 D**: 1975–1977.

HASLE, G. R. 1974. The mucilage pore of pennate diatoms. Nova Hedwigia Beih. **45**: 167–194.

HELMCKE, J. -G. & KRIEGER, W. 1962. Diatomeenschalen im elektronenmikroskopischen Bild. part 2. *pl. 141*. J. Cramer, Weinheim.

HELMCKE, J.-G., KRIEGER, W. & GERLOFF, J. 1977. Diatomeenschalen im elektronenmikroskopischen Bild. part 10. *pl. 935*. J. Cramer, Vaduz.

HENDEY, N. I. 1964. An introductory account of the smaller algae of British Coastal Water. part 5. Bacillariophyceae (Diatoms). London.

HOAGLAND, K. D. & ROSOWSKI, J. R. 1978. Valve and band morphology of some freshwater diatoms. I. *Fragilaria capucina* var. *mesolepta*. J. Phycol. **14**: 479–485.

HUSTEDT, F. 1913. *In* A. SCHMIDT. Atlas der Diatomaceenkunde *pl. 298*. R. Reisland, Leipzig.

HUSTEDT, F. 1932. Die Kieselalgen Deutschlands Österreichs und der Schweiz. *In* RABENHORST [ed.], Kryptogamen-Flora von Deutschland, Österreich und der Schweiz **7** (2): 1–845. Akademische Verlagsgesellschaft, Leipzig.

KOBAYASI, H. & NAGUMO, T. 1978. On the fine structure of the pennate diatom *Semiorbis hemicyclus* (EHR.) PATR. Jap. J. Phycol. **26**: 171–175.

MOSS, M. O., GIBBS, G. & GRAY, V. 1978. The presence of a raphe in *Semiorbis hemicyclus* (EHRENB.) R. PATR. *In* R. SIMONSEN [ed.], Bacillaria **1**: 137–150. J. Cramer, Lehre

OKUNO, H. 1964. Fossil diatoms. *In* HELMCKE J. -G. & KRIEGER, W. [ed.] Diatomeenschalen im elektronenmikroskopischen Bild. part 5. *pl. 460, 461*. J. Cramer, Weinheim.

PATRICK, R. & REIMER, C. W. 1966. The diatoms of the United States. 1. Mongr. Acad. Nat. Sci. Philad. no. 13. Philadelphia.

SCHOEMAN, F. R. 1973. A systematical and ecological study of the diatom flora of

Lesotho with special reference to the water quality. V & R Printers, Pretoria.

VON STOSCH, H. A. 1975. An amended terminology of the diatom girdle. Nova Hedwigia Beih. **53**: 1–28.

小林　弘・出井雅彦：淡水産羽状目ケイソウの一新種 *Fragilaria pseudogaillonii*

福岡県筑後川から採集された標本に基づき Fragilaria 科の新種として，*Fragilaria pseudogaillonii* を記載した。この種は普通 8～10 細胞，多くて 20 細胞からなる帯状群体を作る。殻は長く，線形で，わずかに細くなった殻端をもち，殻長 220～410 μm，殻幅 8～10 μm である。条線は 10 μm 中に 7～9 本あり，殻端近くでわずかに放射状になるほかは，ほとんど平行である。走査電顕による観察によって，隣り合った殻は *Fragilaria* 属に特徴的な interlocking marginal spines によって互いに結合していることがわかった。(184 小金井市貫井北町 4-1-1　東京学芸大学生物学教室)

国 際 会 議 案 内

◎ 第10回国際海藻学会議 Xth International Seaweed Symposium

第10回国際海藻学会議は International Seaweed Association の主催で1980年8月11日から15日まで Sweden の Göteborg において開催されます。今回は海藻の利用に関係した藻類学，生態学，化学，工学などの分野に関する論文を中心とすることになっており，論文数が多い場合には poster form へ廻されることもあり得るということです。

論文 abstract の締切りは1980年1月31日，Registration form は4月1日となっています。2回目サーキュラー，申込用紙等は下記に連絡して下さい。

Secretariat,
Xth International Seaweed Symposium
University of Göteborg, Marine Botanical Institute
Carl Skottsbergs Gata 22, S-413 19 GÖTEBORG, SWEDEN

◎ International Phycological Society Meeting

上記の会が1980年8月19日から22日まで Scotland の University of Glasgow で開催されます。詳細は下記へ連絡して下さい。

Dr. A. D. Boney
Department of Botany, The University, Glasgow, G12 8QQ, Scotland

◎ 第13回国際植物学会議 XIII International Botanical Congress

1981年8月21日から28日までオーストラリアの Sydney で開催されるこの会議に関しては，すでに藻類 **26**(4): 184に紹介されておりますが，詳しい資料を欲しい方は下記に御連絡下さい。

Dr. W. J. Cram
13th I. B. C.
University of Sydney, N. S. W. 2006. Australia

賛助会員

社団法人北海道水産資源技術開発協会　060 札幌市中央区北4西6　毎日札幌会館内
海藻資源開発株式会社　160 東京都新宿区新宿1-29-8　財団法人公衆衛生ビル内
協和醱酵工業株式会社農水産開発室　100 東京都千代田区大手町1-6-1　大手町ビル
全国海苔貝類協同組合連合会　108 東京都港区高輪2-16-5
K.K. 白寿保健科学研究所・原　昭邦　173 東京都板橋区大山東町32-17
浜野顕微鏡商店　113 東京都文京区本郷5-25-18
株式会社ヤクルト本社研究所　186 東京都国立市谷保1796
山本海苔研究所　143 東京都大田区大森東5-2-12
弘学出版株式会社　森田悦郎　214 川崎市多摩区生田8580-61
永田克己　410-21 田方郡韮山町四日町227-1
全漁連海苔海藻類養殖研究センター　440 豊橋市吉田町69-6
神協産業株式会社　742-15 熊毛郡田布施町波野962-1
秋山　茂商店　150 東京都渋谷区神宮前1-21-9