

Fine structure and taxonomy of the small and tiny *Stephanodiscus* (Bacillariophyceae) species in Japan

4. *Stephanodiscus costatilimbus* sp. nov.

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Stephanodiscus costatilimbus is described as a new species. It has only been found in a plankton sample collected from a brackish lagoon, Hachirogata Regulation Pond, Akita Prefecture, northern Japan. Valves are small, less than 15 μm in diameter, with a flat face and are strongly characterized by the costate mantle from which the specific epithet is derived.

Key Index Words: Centric diatom; fine structure; new diatom species; plankton; *Stephanodiscus costatilimbus*.

In a bottle of plankton sample collected from Hachirogata Regulation Pond, a considerable amount of small discoid centric diatoms were found. These are *Stephanodiscus invisitatus* HOHN and HELL. (KOBAYASI and INOUE 1985); *S. hantzchii* GRUN. form. *tenuis* (HUST.) HÅK. & STOERM. (KOBAYASI *et al.* 1985a); *S. minutulus* (KÜTZ.) ROUND (KOBAYASI *et al.* 1985b); *Cyclotella atomus* HUST. *C. caspia* GRUN. and *C. meduanae* GERM. (NAGUMO and KOBAYASI 1985); *C. comta* (EHR.) KÜTZ., *Thalassiosira pseudonana* HASLE & HEIMD., *T. weissflogii* (GRUN.) FRYX. & HASLE and a new taxon, *Stephanodiscus costatilimbus*. These species are often less than 15 μm in diameter and are considered nanoplankton thought to be extremely productive.

Materials and Methods

The sample for this study was collected from the offshore of Imado of the Hachirogata Regulation Pond which was reduced to 2,797 ha in surface area by land reclamation by drainage, Akita Prefecture, northern Japan on 4th October 1983 by Mr. Noboru KATANO of the Akita Prefectural Office (sample no. N-1005, pH. 7.5, wt. 12.8°C, salinity 17.2‰). Methods of cleaning, washing, preparing object for light and electron microscopy are in KOBAYASI *et al.* 1985b).

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Description of the new species

Stephanodiscus costatilimbus sp. nov.

Figs. 1-14.

Valvae circulares, superficiei plana, diametro 7-11 μm . Fasciculi compositi poris duplicato vel triplicato seriatis in margine et poris uni-seriato in centro, circa 14 in 10 μm . Spinae marginales praesentes in quoque interfasciculo. Fultoportula centralis, tigillis duobus, singularis prope ordinato-centrum valvae. Fultoportulae marginales, tigillis tribus, in omni tertio ad octavo interfasciculo, infra spinas marginales. Inter-

fasciculi elongati per limbum ad marginem valvae. Costae limbi lineares. Rimoportula marginalis in costa limbi singularis, exterior-apertura parva et elliptica infra spinam.

Valves circular with flat face, 7-11 μm in diameter. Fascicles composed of double or triple row of pores at the marginal zone and single row of pores near the center, about 14 in 10 μm . Marginal spine occurring on the end of each interfascicle. One central strutted process with two struts near the pattern center of the valve. Marginal strutted processes each with three struts occurring in every 3rd to 8th interfascicle, beneath marginal spines. Interfascicles continue onto the mantle and terminate at the flange. Mantle costae linear. Single labiate process on a mantle costa with small and elliptic outer opening beneath a spine.

Holotype: H. K. T-79 in coll. H. KOBAYASI
Iconotype: Figs. 1, 2., photomicrographs in different focus of the holotype specimens.

Type locality: Hachirogata Regulation Pond, Akita Prefecture, northern Japan.

Observations

The morphological detail of this species is indiscernible under light microscopy. However, as seen in Figs. 1 and 2, linear costae on the mantle can be noticed when the valve edge runs on the other object (Fig. 1, arrow). This species is quite similar to *Stephanodiscus invisitatus* in valve view when observed with a light microscope (KOBAYASI and INOUE 1985).

The diagrammatic representation of the features in SEM level is shown in Fig. 3. The valve face is almost flat and the marginal spines occur at the end of each interfascicle. The interfascicles are raised externally and flat internally (Figs. 4-6). The mantle is a little deeper than that of *Stephanodiscus invisitatus* and is almost perpendicular to the valve surface (Figs. 4, 5, 13, 14). The peculiar feature of this species is the linear costae on the mantle as an extension of each interfascicular costa.

These mantle costa are raised externally, flat internally and reaching the mantle edge (Figs. 3d, 4, 5, 7). The marginal spines are slender and with an upward curved tip (Fig. 1).

Each stria, a row of pores, on the mantle is composed of five to six pores and three to four pores beneath the marginal strutted process. Between pairs of mantle costae, two to four striae are packed as an extension of each fascicle. The fascicle consists of two to three rows of puncta near the margin of the valve, narrowing to a single row near the valve center. The fascicles and interfascicular costae become sinuous towards the valve center (Figs. 3i, j, 4-13).

The marginal strutted process with two struts occurs every 3rd to 8th marginal costa just below and close to the spines. Both outer and inner tubes of a marginal strutted process are well developed (Figs. 5, 7, 11). A single strutted process with two struts is generally seen towards the center of the valve (Figs. 3g, 4, 6, 10, 12, 13).

The valves observed were all weakly silicified, though the specimens were very scarce in the material. The exterior opening of each pore is more or less broad and the pores are occluded by a flat cribrum internally (Fig. 11). In the case of extremely thin valves, the lateral wall of each pore has disappeared, leaving a broad fascicular occlusion with regularly scattered perforations (Figs. 8, 9). In the case of somewhat heavily silicified valves, only the central region is thickened, and the pores of the region are reduced in size and the pore occlusions are slightly raised internally (Figs. 12, 13).

A single marginal labiate process occurs on a mantle costa in the nearly opposite direction to the central strutted process. The exterior opening of the labiate process is small and elliptic. It opens just beneath the marginal spine, higher than the level of the marginal ring of strutted processes (Figs. 4, 13, arrow). In the case of *S. invisitatus*, it opens lower than the level of the ring of marginal strutted processes (Fig. 14, arrow).

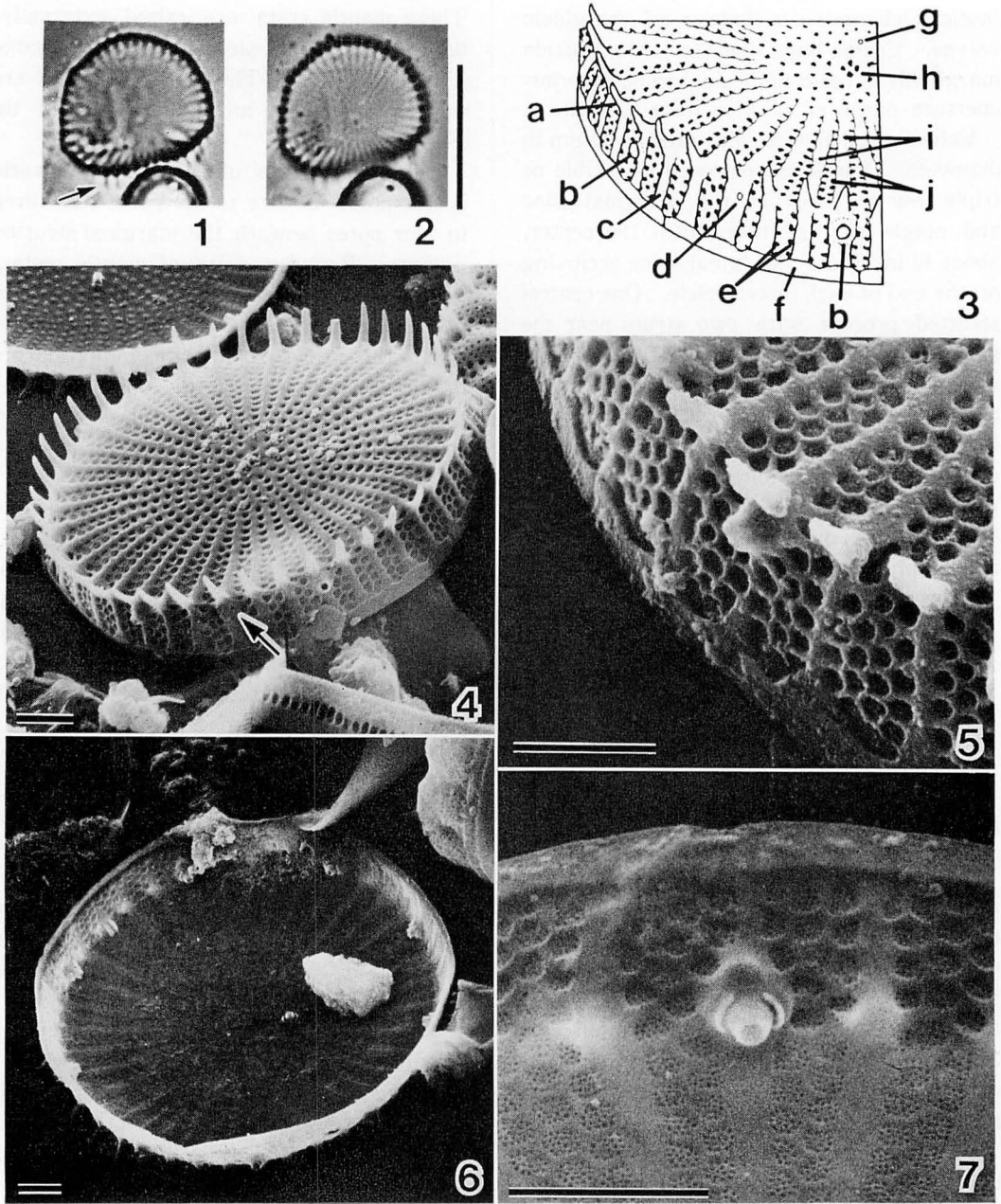


Plate 1. Figs. 1-7. *Stephanodiscus costatilibus* sp. nov. Hachirogata. Figs. 1, 2. Holotype specimen in different focuses. Note the linear costae on the mantle arrowed. LM $\times 2000$ (bar = $10 \mu\text{m}$). Fig. 3. Diagrammatic representation of the exterior valve structure. a. marginal spines, b. marginal strutted processes, c. linear costae on the mantle, d. exterior opening of the labiate process, e. areolar rows on the mantle, f. flange, g. central strutted process, h. pattern center, i. interfascicles, j. fascicles. Fig. 4. Outside view of valve. Note the exterior opening of the labiate process arrowed. SEM $\times 8000$ (bar = $1 \mu\text{m}$). Fig. 5. Enlargement of valve margin showing the costate mantle. SEM $\times 20000$ (bar = $1 \mu\text{m}$). Fig. 6. Inside view of whole valve. SEM $\times 6000$ (bar = $1 \mu\text{m}$). Fig. 7. Enlargement of inner valve margin showing the marginal strutted process with two struts and interior linear costae of the mantle. SEM $\times 28000$ (bar = $1 \mu\text{m}$).

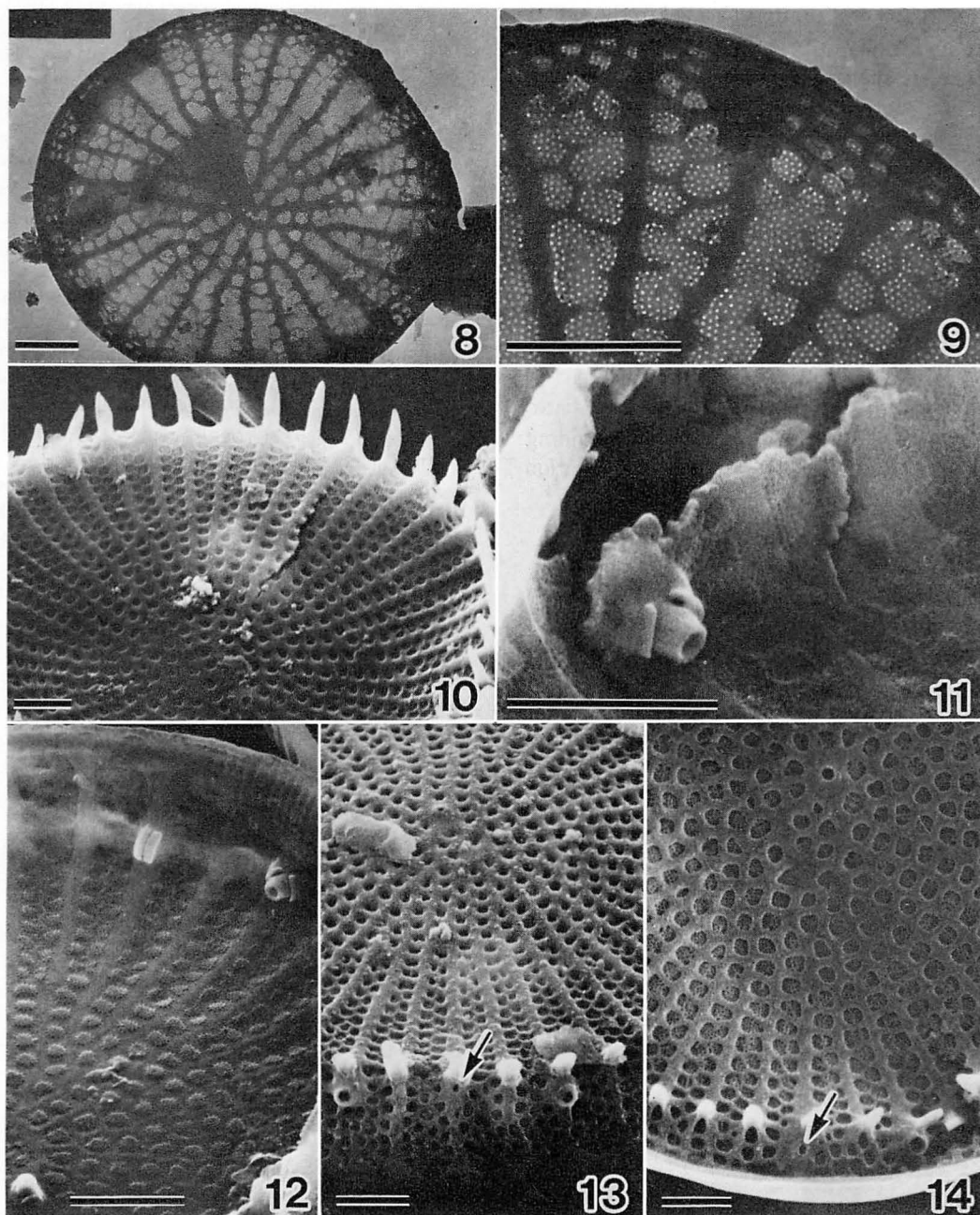


Plate 2. Figs. 8-13. *Stephanodiscus costatilibus* sp. nov. Hachirogata. Fig. 14. *S. invisitatus* HOHN & HELL. Waku-ike (Waku Pond), Nagano Pref., Central Japan. Bars are all $1\ \mu\text{m}$. Fig. 8. Valve view of extremely weakly silicified valve. TEM $\times 9000$. Fig. 9. Enlargement of valve margin showing interfascicle, linear costae on the mantle and fused pore occlusions with regularly scattered perforations. TEM $\times 25000$. Fig. 10. Outside view of valve. SEM $\times 8000$. Fig. 11. Inner view of broken valve margin showing the cross sections of the pore occlusions. SEM $\times 30000$. Fig. 12. Inner view of valve margin showing the labium. SEM $\times 16000$. Fig. 13. Outside view of valve margin showing the exterior opening of the labiate process arrowed. SEM $\times 10000$. Fig. 14. Outside view of valve margin of *S. invisitatus* showing the exterior opening of the labiate process arrowed. SEM $\times 9600$.

The labium is situating parallel to the radial axis internally (Figs. 6, 12).

The conspicuous features of this taxon in having linearly costate, somewhat deep mantle and highly situated external opening of the single labiate process were considered to be sufficient to regard this taxon as a separate species, though this taxon co-occurs with and resembles *Stephanodiscus invisitatus*.

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Thanks are due to Mr. Noboru KATANO of the Akita Prefectural office for providing the sample from Hachirogata Regulation Pond.

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小林 弘・小林秀明：日本産小形ステファノディスクス属（ケイソウ類）の微細構造と分類
4. *Stephanodiscus costatilimbus* sp. nov.

秋田県八郎潟調整池から1983年10月3日に採集されたプランクトン試料中に、顕微鏡による殻面観では、*Stephanodiscus invisitatus* とほとんど区別がつかない新種が出現した。この種類には SEM 像では、殻套部に縦に平行に走る肋線 (costa) をもつという、いままでに *Stephanodiscus* 属の他の小形種には見られなかった、目立った特徴が見られた。この特徴に基いて *costati*- (肋線をもつ) *limbus* (殻套) という種小名を与えて、新種の記載を行った。
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