

Berkeleya sparsa sp. nov., a tube-dwelling diatom from Hokkaido, Japan*

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A new marine tube-dwelling diatom, *Berkeleya sparsa* MIZUNO sp. nov., has been collected from Point Nosappu, Nemuro City, Hokkaido, Japan and is described in detail. Colonies are found on rocks in the littoral zone and form tubular tufts, up to 2 cm in length. Valves are narrowly elliptical, being 19-37 μm in length and 5-8 μm in width. Striae are transverse in the middle part of the valve and radiating to the ends. There are 18-22 striae in 10 μm . The ratio values of the distance between the central raphe endings to the valve length are 15-21% for a valve length of 20 μm , 18-26% for 27 μm and 23-31% for 35 μm , respectively.

Key Index Words: Bacillariophyceae: *Berkeleya sparsa* sp. nov.; frustule; taxonomy; tube-dwelling diatom; valve.

The author collected a tube-dwelling diatom at the Point Nosappu, Hokkaido in April 15, 1975. After morphological observations, the author has come to the conclusion that the present diatom is a new species of the genus *Berkeleya* and has named it *Berkeleya sparsa*. A description of *B. sparsa* will be given below.

Material and Methods

Material was collected at Point Nosappu, Nemuro City, Hokkaido in April 15, 1975. It was preserved in 3% formalin seawater and formalin sample was used for observations of tube morphology. Part of the material was cleaned by concentrated nitric acid and distilled water, and was mounted in Pleurax for the observations of valve structures. The number of striae in 10 μm in the middle part of 50 valves was counted.

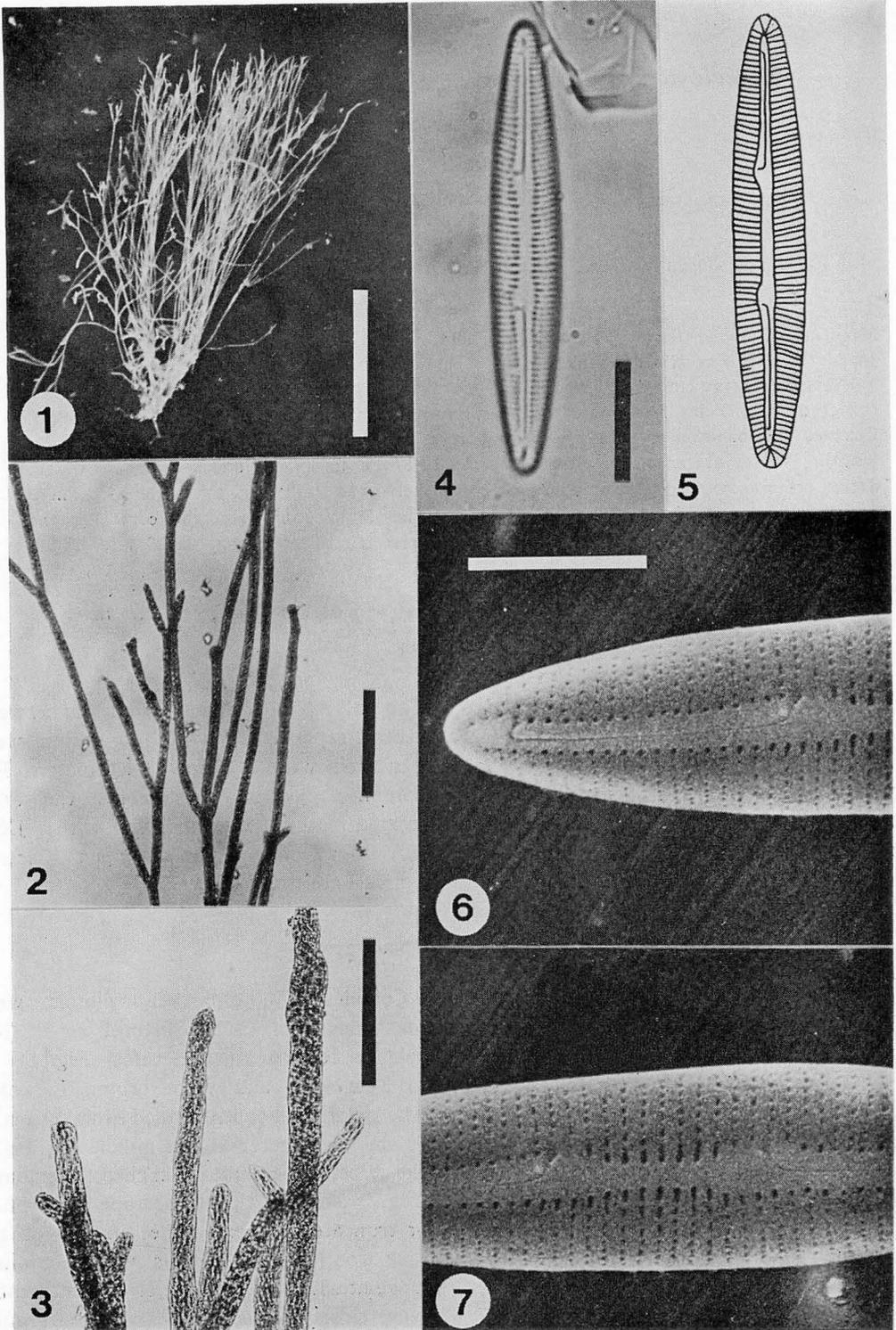
* This study was undertaken mainly at the Institute of Algological Research, Faculty of Science, Hokkaido University at Muroran, Hokkaido, Japan.

The valve length and the distance between central raphe endings of 119 valves were measured with a screw micrometer. For scanning electron microscopy, the acid-treated material was observed with a JXA-50A X-ray microanalyzer (Japan Electron Optics Lab. Co., Ltd.).

Observations

Colonies of the present diatom were found on rocks in the littoral zone. The colonies formed tubular tufts (Fig. 1), up to 2 cm long and were brown in color. The gelatinous tubes ranged from 27 μm to 66 μm in diameter at the middle portion of the tube. The tube branched irregularly (Fig. 2) and the tip of the tube was obtuse or truncate (Fig. 3). The texture of the tube was rigid. The cells were contained in gelatinous tubes in which a vast number were closely or loosely packed in irregular files (Fig. 3).

The frustules were narrowly elliptical in valve view (Figs. 4, 5, 8A-B). In girdle



Figs. 1-7. *Berkeleya sparsa* sp. nov. 1. A colony; 2. Light micrograph showing the branching of the tube; 3. Light micrograph showing the apices of the tube; 4. Light micrograph of valve view; 5. Sketch of Fig. 4; 6. Scanning electron micrograph of outer

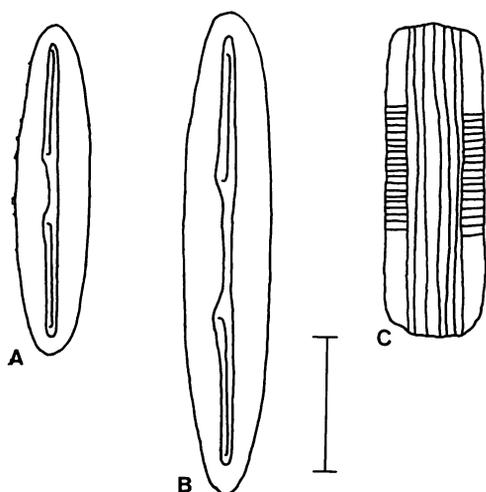


Fig. 8. *Berkeleya sparsa* sp. nov. A-B: Valve view; C: Girdle view. Scale 10 μm .

view, frustules with girdle bands were rectangular (Fig. 8C). The valves measured 19–37 μm in length, 5–8 μm in width. By light microscopy, two parts of the axial area expanded in the same direction as the bending direction of raphe endings and resulted in asymmetry (Figs. 4, 5, 8A-B). Scanning electron micrographs of the outer surface clearly showed that the central raphe endings bent to the expanded axial area and also the polar raphe endings bent to the same side (Figs. 6, 7). The valve surface was sparsely covered with striate (Figs. 4, 5). The striae were transverse in the middle part of the valve and radiated over the end (Figs. 4, 5). The striation density was 18–22 in 10 μm in the middle of the valve and 20 striae in 10 μm were frequently observed. By scanning electron microscopy, each stria consisted of a single row of pores and the pores next to the central area were transversely elongated (Fig. 7). Central raphe endings were widely separated (Figs. 4, 5, 7). The ratio value of “the distance between central raphe endings to the valve length” was shown in Fig. 9. The ratio values (percentage) in each class of the valve length were

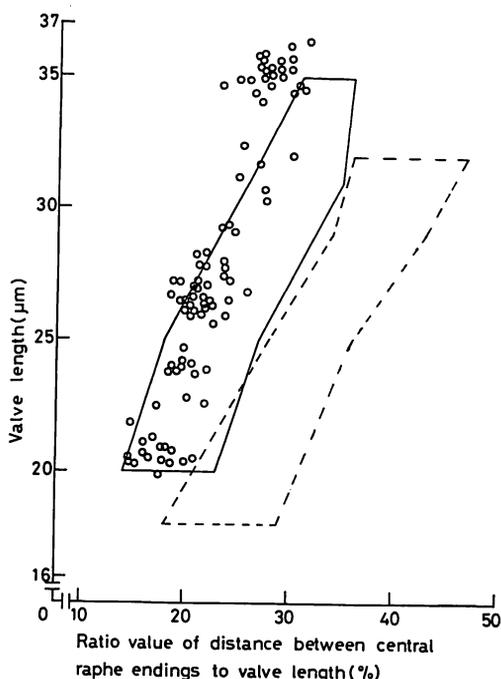


Fig. 9. Correlation between the valve length and the ratio value of the distance between central raphe endings to the valve length of *Berkeleya sparsa* sp. nov. (○). The area surrounded by broken line shows that of *B. rutilans* (MIZUNO 1977) and the area surrounded by solid line shows that of *B. obtusa* (MIZUNO 1979).

as follows; 15–21% for a valve length of 20 μm , 18–26% for 27 μm and 23–31% for 35 μm . The ratio value increased in proportion to the valve length.

Discussion

Recently COX (1975a) showed that the genus *Amphipleura* sensu CLEVE was comprised of a heterogenous group of species on the basis of a detailed study using light and electron microscopes and she transferred the marine tube-dwelling species of the genus *Amphipleura* to the genus *Berkeleya* GREV. emend. COX. The characteristics of the genus *Berkeleya* emended by her are as follows; (1) plants live in brackish or marine conditions, (2) cells are usually

← surface of the valve apex; 7. Scanning electron micrograph of outer surface of the middle of the valve. Scale in 1 represents 3 mm; scale in 2 represents 300 μm ; scale in 3 represents 200 μm ; scale in 4 for 4–5 represents 10 μm ; scale in 6 for 6–7 represents 5 μm .

enclosed in gelatinous tubes, (3) the frustule has many girdle bands, and (4) central raphe endings are distant.

Because of its tube-dwelling habit, frustule morphology and marine habitat, the present diatom apparently belongs to the genus *Berkeleya* GREV. emend. COX. Of the previously described species of the genera *Berkeleya* and *Amphipleura*, *B. capensis* GIFFEN, *B. hyalina* (ROUND et BROOKS) COX, *B. obtusa* (GREV.) GRUN., *B. rutilans* (TRENT.) GRUN., *A. arctica* PATRICK et FREESE, and *A. pumila** SCHUMANN are similar to the present diatom in valve size. GIFFEN (1970) described *B. capensis* as having following characteristics: transapical striae were 15 in 10 μm in the middle and about 20 in 10 μm towards the ends, in girdle view short pseudosepta were seen at the ends of the valve, girdle segments (girdle bands) were 2-3 and punctate along the margin. Such structures as the presence of pseudosepta and punctae of girdle band are not seen in the present diatom. The striation density of *B. hyalina* is more than 40 in 10 μm (ROUND and BROOKS 1973, COX 1975b), which is twice the density of the present diatom. The striation density of *A. arctica* is 24-32 in 10 μm and the ratio value of "the distance between central raphe endings to the valve length" is 53% in 34 μm of valve length, measuring from the figure given by PATRICK and FREESE (1960, Pl. I, Fig. 14). *A. arctica* is distinguished from the present diatom by these two characteristics. The valve of *Amphipleura pumila**, collected at Königsberg (present name Kaliningrad) facing the Baltic Sea, is $7-9 \times 10^{-3}$ "pariser Linie" (15.8-20.3 μm **) in length and striation density is 42 in 10^{-2} "pariser Linie" (18.6 in 10 μm) (SCHUMANN 1869). These characteristics of valve of *A. pumila** are similar to those of the present diatom. However, SCHUMANN (1869) doubted whether *A. pumila** would belong to the genus *Amphipleura* or not and he added

an question mark after the genus name. Examination of SCHUMANN's figure (SCHUMANN 1869, Taf. II, Fig. 7) does not clearly reveal the genus of *A. pumila**. DE-TONI (1891) suggested that *A. pumila** SCHUMANN belongs to the genus *Navicula*. Further, in the reports on the diatoms of Europe, especially of the Baltic Sea (HUSTEDT 1937, CLEVE-EULER 1952), a species having such features as those of *A. pumila** is not found in the genus *Amphipleura* or *Berkeleya*. From these, *A. pumila** seems to belong to neither the genus *Amphipleura* nor to *Berkeleya*. The curvature of raphe endings and the shape of pores adjacent to the central area of the present diatom are morphologically similar to those of *B. obtusa* and *B. rutilans* (COX 1975b, MIZUNO 1979). However, the striation densities of *B. obtusa* and *B. rutilans* were 24-32 and 24-36 in 10 μm , respectively (MIZUNO 1977, 1979). Furthermore, as shown in Fig. 9, *B. obtusa* and *B. rutilans* differed from the present diatom in the ratio value of "the distance between central raphe endings to the valve length" in the range of the large valve and in the whole range of valve length, respectively.

From the above mentioned characters, it is concluded that the present diatom is a new species of the genus *Berkeleya* GREV. emend. COX and it is named *B. sparsa* by sparse striation density.

Description

Berkeleya sparsa MIZUNO sp. nov.

Colonies tubular, gelatinous, branched irregularly, with obtuse or truncate apices, up to 2 cm long, 27-66 μm diameter, consisting of many cells. Valves narrowly elliptical, 19-37 μm long 5-8 μm wide; two parts of axial area expanded in one direction, resulting in asymmetrical axial area; central and polar raphe endings bent to same expanded direction of axial area;

* *Amphipleura?* *pumila*, according to SCHUMANN (1869)

** One "pariser Linie" was turned 2.256 mm (Brockhaus Enzyklopädie 1970).

ratios of distance between central raphe endings to valve length 15-21% for a valve length of 20 μm 18-26% for 27 μm and 23-31% for 35 μm ; transapical striae parallel in middle portion, radiating over end, sparsely, 18-22 in 10 μm , consisting of single row of pores; adjoining pores to central area elongate in transapical direction. Girdle bands numerous.

Habitat: In the littoral zone.

Coloniae tubulares, gelatinosae, irregulariter ramosae, apicibus obtusis vel truncatis, usque 2 cm altae, 27-66 μm latae, constantes ex cellulis multis. Valvae anguste ellipticae, 19-37 μm longae, 5-8 μm latae; duae partes areae axialis expansae ad unam directionem, itaque area axialis asymmetrica; fines centrales et polares raphium obstipae ad directionem expansam areae axialis; rationes distinctiarum inter fines centrales raphium pro longis valvarum 15-21% in valvam 20 μm longam, 18-26% in valvam 27 μm longam et 23-31% in valvam 35 μm longam; striae transapicales parallelae in partem mediam et radiantes in partem apicalem, sparsae, 18-22 in 10 μm , constantes ex poris seriatis singulis; pori contigui areae centrali transverse elongati. Fasciae zonarum multae.

Habitat: In saxis inter aestus accessum et recessum locatis.

Holotypus: Point Nosappu, Nemuro City, Hokkaido, Japan, M. MIZUNO No. 1008, 15 April 1975 in National Science Museum in Tokyo (TNS).

Iconotypus: Figs. 4, 5.

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References

- BROCKHAUS Enzyklopädie 1970. Band 11, 1-815. F. A. Brockhaus, Wiesbaden.
- CLEVE-EULER, A. 1952. Die Diatomeen von Schweden und Finnland. V. K. svenska Vetensk-Akad. Handl. 3: 1-153.
- COX, E. J. 1975a. A reappraisal of the diatom genus *Amphipleura* Kütz. using light and electron microscopy. Br. phycol. J. 10: 1-12.
- COX, E. J. 1975b. Further studies on the genus *Berkeleya* GREV. Br. phycol. J. 10: 205-217.
- DE-TONI, G. B. 1891. Sylloge Algarum omnium hucusque cognitarum. Vol. 2, Bacillariae, secto I, 1-490. Typis Seminarii, Patavii.
- GIFFEN, M. H. 1970. New and interesting marine and littoral diatoms from Sea Point, near Cape Town, South Africa. Bot. Mar. 13: 87-99.
- HUSTEDT, F. 1937. Die Kieselalgen. In RABENHORST's Kryptogamen Flora. Vol. VII, Teil 2, 577-736. Akademische Verlags gesellschaft, Leipzig.
- MIZUNO, M. 1977. On the tube-dwelling diatom *Berkeleya rutilans* (TRENTEPOHL) GRUN. Bull. Jap. Soc. Phycol. 25: 143-149. (in Japanese).
- MIZUNO, M. 1979. Taxonomic study on *Berkeleya obtusa* (GREV.) GRUN. (Bacillariophyceae) from Hokkaido, Japan. Jap. J. Phycol. 27: 175-181.
- PATRICK, R. and FREESE, L. R. 1960. Diatoms (Bacillariophyceae) from Northern Alaska. Proc. Acad. Nat. Sci., Phila. 112: 129-293.
- ROUND, F. E. and BROOKS, M. E. 1973. A new species of *Amphipleura* from Togo, W. Africa. Bot. Mar. 16: 77-79.
- SCHUMANN, J. 1869. Preussische Diatomeen. Schr. phys. ökon., Ges Königsb. 10: 83-88, Taf. 2.

水野 真: 海産樹枝状群体珪藻の一新種 *Berkeleya sparsa* MIZUNO

北海道根室市納沙布岬産の珪藻 *Berkeleya* 属の一種を新種 *B. sparsa* として報告する。本種は潮間帯の岩上に着生し、高さ約 2 cm の樹枝状群体を形成する。殻は狭い楕円形で、殻長 19-37 μm 、殻幅 5-8 μm である。条線は 10 μm 中に 18-22 本あり、中央部ではほぼ平行であり、殻端近くでは放射状である。殻長に対する縦溝の中心孔間の距離の比は、殻長が 20 μm の時 15-21%、殻長が 27 μm の時 18-26%、殻長が 35 μm の時 23-31% である。(094 北海道紋別市落石町 7 丁目 道都大学社会福祉学部)