

# ISOLATION AND CULTURE OF ANTARCTIC DIATOMS FROM THE SALINE LAKES IN THE SŌYA COAST, EAST ANTARCTICA

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**Abstract:** Five taxa of diatoms, *Achnanthes brevipes* v. *intermedia*, *Navicula muticopsis*, *Nitzschia palea*, *Pinnularia borealis* and *Tropidoneis laevis*, were isolated from the samples collected from five saline lakes, Lake Zakuro, Lake Akebi, Lake Nurume of Langhovde and Lake Suribati and Lake Hunazoko of Skarvsnes.

From the successive cultures of the isolated diatoms with agar containing various concentrations of NaCl, it is clarified that *Tropidoneis laevis* is halophilic. *Achnanthes brevipes* v. *intermedia* showed a wide range of tolerance to NaCl concentration (0–25%) in agar. *Navicula muticopsis* had a narrow range (0–5%) of halotolerance. The range of halotolerance of the others was intermediate between *Achnanthes* and *Navicula*.

## 1. Introduction

In the Syowa Station area there are various kinds of lakes in the concentration of salts dissolved in lake water. It was already reported that there are several high saline lakes in Langhovde and Skarvsnes and the chemical analysis of lake water was carried out from the geochemical point of view (TORII and YAMAGATA, 1973; TORII *et al.*, 1977; MURAYAMA, 1977; HIRABAYASHI and OSSAKA, 1977).

Many taxonomical and ecological works on the algal flora in the freshwater lakes were published (FUKUSHIMA, 1959a, b, 1961, 1967; HIRANO, 1959, 1965; NEGORO, 1971; FUKUSHIMA *et al.*, 1973, 1975a, b; KARASAWA and FUKUSHIMA, 1977). However, few investigations were made on the saline lake algae (AKIYAMA, 1974; AKIYAMA and OHNO, 1975).

In this paper, the results of culture of five diatoms isolated from three saline lakes, Lake Zakuro, Lake Akebi and Lake Nurume of Langhovde and from two lakes, Lake Hunazoko and Lake Suribati of Skarvsnes are described relating to the distribution of algae in the saline lakes. Parts of the results were previously reported in WATANUKI and KARASAWA (1975) and WATANUKI and OHNO (1975, 1976).

## 2. Materials and Method

Some of the samples used for the isolation of diatoms were collected from the lakes of Langhovde by the present author between 29 January and 3 February 1971. The other samples were obtained from the lakes of Skarvsnes by Dr. M. OHNO between 27 January and 2 February 1975.

For the sampling of algae 250 ml culture bottles were used. Two kinds of culture media were prepared (Table 1). 50 ml of culture medium was poured into a bottle prior to the field works. In the field, 50 ml of the mixture of bottom sand and lake water was added to the medium contained in the bottle.

The algae being kept in the bottles were preparatively cultured at 2–4°C in the refrigerator on board icebreaker FUJI on her way to Japan. The diatoms preparatively cultured were inoculated on agar plates and cultured under the condition of 10°C and 2000 lx.

Table 1. Composition of culture media.

Constituents	A	B
KNO <sub>3</sub>	0.25 g	—
Ca(NO <sub>3</sub> ) <sub>2</sub> ·4H <sub>2</sub> O	—	40 mg
KH <sub>2</sub> PO <sub>4</sub>	0.175 g	—
MgSO <sub>4</sub> ·7H <sub>2</sub> O	75 mg	25 mg
K <sub>2</sub> HPO <sub>4</sub>	75 mg	10 mg
NaCl	25 mg	—
CaCl <sub>2</sub> ·2H <sub>2</sub> O	10 mg	—
FeSO <sub>4</sub> ·7H <sub>2</sub> O	20 mg	—
Na <sub>2</sub> SiO <sub>3</sub>	—	20 mg
Na <sub>2</sub> CO <sub>3</sub>	—	20 mg
Fe-Citrate	—	3 mg
Distilled water	to 1000 ml	to 1000ml
pH	6.0	7.0

## 3. Results and Discussion

The location of five lakes studied is shown in Fig. 1 and the limnological data of the five lakes are given in Table 2. 81 taxa of diatoms were distinguished by the microscopic examination of the samples obtained from the five high-saline lakes during the winter season of 1971–72. Diversity in the taxa of diatoms was highest in Lake Zakuro, where 59 taxa out of 81 were found (Table 3). The number of taxa of diatoms in the other lakes is also given in the same table.

Diatoms of five lakes consisted of both marine and freshwater diatoms. Numbers of marine diatoms and freshwater ones are shown in Table 3. Number

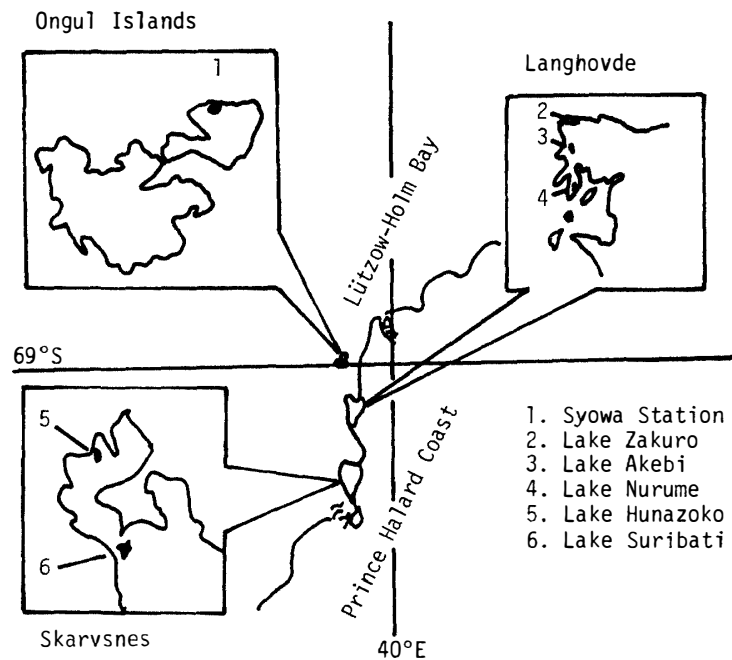


Fig. 1. Location of the five lakes investigated.

Table 2. Limnological data on the five saline lakes in Langhovde and Skarvsnes, East Antarctica.

Lake	Langhovde			Skarvsnes	
	Akebi	Nurume	Zakuro	Suribati	Hunazoko
Location	69°12'S 39°39'E	69°14'S 39°40'S	69°01'S 39°39'E	69°29'S 39°39'E	69°26'S 39°33'E
Above sea level (m)	-4	±0	-6	-33	-23
Length (m)	420	305	455	1070	675
Max. breadth (m)	125	155	215	780	250
Area (m <sup>2</sup> × 10 <sup>4</sup> )	3.9	3.1	7.5	40.6	14.2
Depth (m)	5.0	16.6	4.6	31.2	9.2
Sampling date	Jan. 29, 1971	Jan. 30, 1971	Feb. 1, 1971	Feb. 1, 1971	Feb. 1, 1971
Air temp. (°C)	2.9	1.7	3.8	5.3	5.5
Water temp. (°C)	7.8	8.6	11.7	10.7	8.8
pH	7.6	7.6	8.0	7.6	8.0
Cl (mg/l)	151.3	124.8	217.6	25500	73120
NO <sub>2</sub> -N (μg-at/l)	0.01	0.01	0.02	0.04	0.13
NO <sub>3</sub> -N (μg-at/l)	0.51	0.64	1.10	0.48	3.57
Urea-N (μg-at/l)	0.40	0.59	0.18	0.22	15.0
NH <sub>4</sub> -N (μg-at/l)	0.88	1.20	0.51	0.86	17.0
SiO <sub>2</sub> -Si (mg/l)	0.60	0.57	0.75	1.87	1.78
PO <sub>4</sub> -P (μg-at/l)	0.010	0.190	0.020	0.140	0.090
Total-N (μg-at/l)	10.7	12.0	18.8	29.1	44.3
Total-C (μg-at/l)	1.2	1.6	8.2	7.6	37.2
Total-P (μg-at/l)	0.05	0.45	0.07	0.82	1.89

Table 3. Number of diatom taxa and dominant organisms of the five saline lakes in Langhovde and Skarvsnes.

Lake	Number of diatom taxa	Marine diatom taxa / Fresh-water diatom taxa	Dominant organisms
Akebi	12	5/7	<i>Tropidoneis</i> Silicoflagellata
Nurume	26	14/12	Marine centric diatom <i>Fragilariopsis</i> Silicoflagellata
Zakuro	59	20/39	Marine centric diatom Silicoflagellata
Suribati	16	11/5	<i>Tropidoneis</i> Silicoflagellata
Hunazoko	26	23/3	<i>Dunaliella</i> Marine centric diatom Silicoflagellata

Table 4. Growth on media with various concentration of NaCl after 3 weeks at 10°C.

Species	NaCl (%)	0	5	10	15	20	25
<i>Achnanthes brevipes</i> v. <i>intermedia</i> (Lake Hunazoko)		+++	+++	+++	+++	++	+
<i>Navicula muticopsis</i> (Lake Zakuro)		+++	+	±	—	—	—
<i>Nitzschia palea</i> (Lake Zakuro)		+++	+++	++	+	—	—
(Lake Nurume)		+++	+++	++	—	—	—
(Lake Suribati)		+++	+++	++	+	—	—
(Lake Hunazoko)		+++	+++	++	+	—	—
<i>Pinnularia borealis</i> (Lake Zakuro)		+++	++	+	—	—	—
<i>Tropidoneis laevissima</i> (Lake Akebi)		±	+	+++	+++	++	±
(Lake Suribati)		±	+	+++	+++	+	—

of the marine diatom taxa was extremely superior to that of the freshwater ones in Lake Hunazoko and Lake Suribati of Skarvsnes. Dominant organisms are also illustrated in Table 3. *Tropidoneis*, *Fragilariopsis* and marine centric diatoms appeared as dominant organisms. Silicoflagellates were common to five lakes. The composition of the prominent organisms indicates that these saline lakes were

closely related to the sea. YOSHIDA (1970) suggested that these lakes were relict. Lake Hunazoko was characterized by the appearance of *Dunaliella*. AKIYAMA and OHNO (1975) observed the water-bloom by *Dunaliella* in Lake Hunazoko.

Five diatoms shown in Table 4 have been isolated up to the present. *Achnanthes brevipes* v. *intermedia*, *Navicula muticopsis*, *Nitzschia palea* and *Pinnularia borealis* luxuriantly grew on agar plate without NaCl except for *Tropidoneis laevisissima*. Growth of *Navicula muticopsis* and *Pinnularia borealis* became worse with the increase of NaCl concentration in agar and they could not grow on the culture medium of more than 10% NaCl. *Nitzschia palea* was able to grow well on the agar plate in which 10% NaCl was contained but it could not grow on agar containing more than 15% NaCl. *Achnanthes brevipes* v. *intermedia* showed tolerance to a wider range of NaCl concentration in agar than *Nitzschia palea*. On the contrary, *Tropidoneis laevisissima* grew very slowly and slightly on the culture medium without NaCl and grew on agar which contained NaCl within the range of 10–15%. This species was characterized by its halophilism.

FUKUSHIMA (1959a, b, 1961, 1967) reported that *Achnanthes brevipes* v. *intermedia* was distributed from freshwater lakes to high-saline lakes in the vicinity of Syowa Station. Many authors mentioned the large halotolerance of this diatoms. The results obtained from the cultures on the media containing various concentration of NaCl coincide with the results of the above-mentioned field observations.

FUKUSHIMA (1959 a, b, 1961, 1967) found out *Tropidoneis laevisissima* in the brackish and the saline lakes, where chloride ion concentrations were 622 to 13687 mg/l. The halophilic character of this species was also recognized by this culture.

*Navicula muticopsis* appeared in the freshwater lakes in the Syowa Station area (FUKUSHIMA, 1959a, 1961, 1967). *Nitzschia palea* and *Pinnularia borealis* were distributed widely in the freshwater lakes.

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