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MOSS COMMUNITIES IN SOME ICE-FREE AREAS ALONG THE SÔYA COAST, EAST ANTARCTICA

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Abstract: The moss vegetation in three ice-free areas, Einstöingen, Rundvågshetta and Strandnibba along the Sôya Coast, Antarctica, was investigated phytosociologically and the vegetation was classified into the following nine communities: *Bryum pseudotriquetrum* Sociation, *Ceratodon purpureus* Sociation, *C. purpureus–B. pseudotriquetrum* Sociation, *B. argenteum* Sociation, *B. argenteum–B. pseudotriquetrum* Sociation, *Pottia heimii* Sociation, *P. heimii–B. pseudotriquetrum* Sociation, *Grimmia lawiana* Sociation, and *G. lawiana–C. purpureus* Sociation. The *B. argenteum* Sociation and the *P. heimii* Sociation were newly recorded in this study.

The moss vegetation on the small island, Einstöingen, consists of five sociations, and it is characterized by the *P. heimii–B. pseudotriquetrum* Sociation and the *B. argenteum* Sociation. Rundvågshetta is characterized by pure communities of the *P. heimii* Sociation and the *G. lawiana* Sociation. The moss vegetation of Rundvågshetta, where seven sociations were recognized, may be one of the most prominent in both of the Sôya Coast and the Prince Olav Coast.

1. Introduction

The ecology and distribution of mosses in ice-free areas along the Sôya Coast and the Prince Olav Coast have been investigated by NAKANISHI (1977) and KANDA (1981). KANDA (1981) reported that *Bryum pseudotriquetrum* and *Ceratodon purpureus* were distributed along both coasts, *Pottia austro-georgica* was found only on the Sôya Coast, *B. argenteum* and *P. heimii* occurred most frequently on the Sôya Coast, and *Grimmia lawiana* was more abundant on the Prince Olav Coast. This distribution pattern suggests that the topography and geography such as the sea or the continental glacier along both coasts may directly or indirectly affect the occurrence of the moss vegetation.

As a member of the 24th Japanese Antarctic Research Expedition (JARE-24) during January and February 1983, the author carried out an ecological study on the moss vegetation of three areas along the Sôya Coast; Einstöingen, Rundvågshetta and Strandnibba. In this article, the author classified and described the moss vegetation phytosociologically at these sites which had previously never been studied biologically.

2. Areas Studied and Methods

The ice-free areas along the Sôya Coast grasp the land on the eastern part of Lützow-Holm Bay and the coastal areas are strongly affected by maritime factors, namely, rookeries of sea birds with rich nutrient input and air-borne salt spray carried inland by

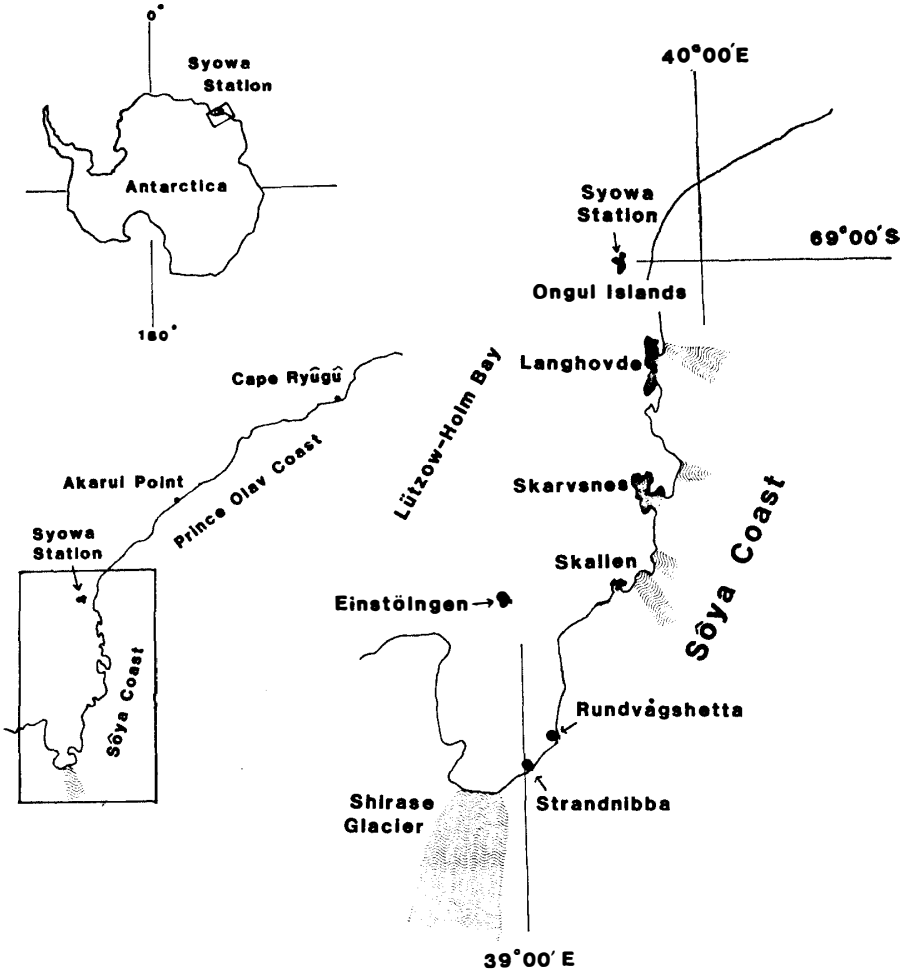

Fig. 1. Map of the ice-free areas along the Sôya Coast.

the prevailing wind from the sea. The following three ice-free areas along the Sôya Coast were studied (Figs. 1–4).

Einstöingen: Two ice-free areas, each 0.5 km in length, are exposed on this small isolated island which is located at latitude 69°39′S, longitude 38°50′E. The island is about 15 km west of Skallen (69°39′S, 39°25′E), the continental ice-free area, and is often surrounded with bergy-ice discharged from the Shirase Glacier, which is the largest glacier on the Sôya Coast. Some small ponds are scattered in the central part of the west area and traces of sea bird excrement are found around these ponds. Calcareous substrate resulting from marble and chert bedrocks is characteristic in the western part of the island.

Rundvågshetta: The ice-free area is located at latitude 69°53′S, longitude 39°00′E. It extends for about 3.5 km in a nearly N-S direction. A large lake lies in the central part of the area and some streams flow down gentle slopes on the northern coast. Fresh glacial striae are visible on the exposed rock surface. It is considered that the glacier retreated later than those of the northern part of Lützow-Holm Bay (MORIWAKI, 1976). There are long stranded moraines on the ice sheet behind the ice-free area which has

some ponds and some patches of silty substratum caused by the melt water of the continental ice sheet.

Strandnibba: The Strandnibba district consists of three major ice-free areas, Vesleknausen, Strandnibba and Ytstekleppane. The district is located at latitude 69°57′S–70°00′S and longitude 38°44′E–38°54′E, in the southern part of the Sôya Coast. The area studied at the present time was limited to Strandnibba which is the main ice-free area in the district. It extends in a nearly E-W direction which is similar to the geological structure of the basement rocks (MOTOYOSHI *et al.*, 1985). Owing to numerous steep cliffs facing the north, the topography of the area is characterized by many swift streams and waterfalls.

During the austral summer of January 10–22, 1983, the degree of dominancy of each moss species occurring within 20×20 cm quadrates was recorded on the basis of the phytosociological methods of BRAUN-BLANQUET (1964). The degrees of coverage were determined as follows; 5 (100–75%), 4 (75–50%), 3 (50–25%), 2 (25–10%), 1 (10–1%), +(less than 1%). The presence class of each species was determined and shown in the synthesis table, according to the percentage of frequency of appearance of the species in total quadrats as follows; V (80–100%), IV (60–80%), III (40–60%), II (20–30%), I (less than 20%). In each community, the exposure, altitude of the moss habitats and

Table 1. Species composition of Bryum pseudotriquetrum *Sociation. Phytosociological data within one quadrat at each locality are used as the representative for the table.*

Locality number	E1	E3	E4	E5	E6	E7	E8	E10	E12	E13	E14	E15	R1	R2	R7	R8	R10
Altitude (m)	20	38	50	50	50	38	38	50	15	5	5	7	10	10	90	10	70
Exposition	S 20 W	N 60 E	N 50 E	N	N 20 E	N 20 E	N 20 E	S 60 E	E	N 45 E	N	N	N	N	N	N	S 45 E
Bryum pseudotriquetrum	4	1	4	5	5	5	5	5	5	5	5	5	2	3	4	5	2
Rinodina olivaceobrunnea	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·
Physcia caesia	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·
Xanthoria elegans	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·
Imperfect lichen	2	·	·	2	2	+	+	·	·	·	·	·	·	+	·	·	·
Algae	4	·	2	2	3	1	2	+	+	+	+	+	+	+	+	+	+

Locality number	R11	R12	R14	R15	R20	R24	R25	R26	R27	S5	S6	S7	S11	S12	S13	S24
Altitude (m)	10	10	20	50	85	40	40	40	20	5	20	20	20	15	15	85
Exposition	N	N	N	N	N	N 40 W	N	N	N 50 W	N 10 W	S 80 E	E	N 45 E	N 45 N	W	N
Bryum pseudotriquetrum	5	4	5	3	5	5	4	3	2	+	4	5	5	5	4	4
Alectoria minuscula	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·
Rinodina olivaceobrunnea	·	·	·	·	·	2	·	·	·	·	·	·	·	·	·	·
Candelariella antarctica	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+
Imperfect lichen	·	4	·	·	·	·	·	·	·	·	·	·	1	+	3	·
Algae	2	3	4	3	3	3	·	3	·	·	3	3	4	2	2	2

E: Einstöingen; R: Rundvågshetta; S: Strandnibba.

lichens and algae associated with mosses were recorded along with some additional ecological data such as aspect of the slope, topography, snow drift and soil moisture.

3. Results and Discussions

3.1. Species composition and distribution of the moss communities

The moss vegetation in three ice-free areas along the Sôya Coast is composed of the following five species: *Bryum argenteum*, *B. pseudotriquetrum*, *Ceratodon purpureus*, *Pottia heimii* and *Grimmia lawiana*. Each community was classified on the basis of the species composition. The nine communities were recognized in the areas studied (Tables 1–5). The term Sociation as the fundamental community unit was adopted for the moss community in this study according to NAKANISHI (1977).

All phytosociological data were summarized in the form of synthesis table (Table 6).

1) *Bryum pseudotriquetrum* Sociation (Tables 1, 6)

The community is composed of one species, *B. pseudotriquetrum*, and is abundant in three areas. It is recognized around ponds and along stream banks at lower elevation or near the sea shore. Associated algae, which indicate representative species of blue green algae, namely *Nostoc*, *Glaeocapsa* and *Lyngbya*, are usually abundant on the moss turfs in all three areas. Imperfect lichen on the moss turf in this community is scarce in comparison with the other communities.

2) *Ceratodon purpureus* Sociation (Tables 2, 6)

The community is composed of one species, *C. purpureus*, and is as common as the *B. pseudotriquetrum* Sociation in all three areas. It is recognized on the drier sandy soil near the sea shore and has more extended distribution than the *B. pseudotriquetrum* Sociation. Imperfect lichen on the moss turf is more abundant than in the other moss communities because of the dry habitat.

3) *Ceratodon purpureus–Bryum pseudotriquetrum* Sociation (Tables 3, 6)

The community is composed of *C. purpureus* and *B. pseudotriquetrum* and is common in all three areas. *Ceratodon purpureus* shows a higher degree of dominancy than *B. pseudotriquetrum.*

4) *Pottia heimii* Sociation (Tables 4, 6)

The community is newly recorded from Rundvågshetta in this study, though NAKANISHI (1977) has already indicated the presence of this community in Skarvsnes and the author (KANDA, 1981) in the Skallen area. The community occurs on the silty substratum near moraines and at the margins of the continental ice sheet (Fig. 3).

5) *Pottia heimii–Bryum pseudotriquetrum* Sociation (Tables 4, 6)

The community is composed of *P. heimii* mingled with *B. pseudotriquetrum* and is found in Einstöingen and Rundvågshetta (Figs. 2, 3). The occurrence of the community is dependent on the calcareous substratum resulting from the marble and chert bedrocks. No associated lichens including imperfect lichen are observed in the community.

6) *Bryum argenteum* Sociation (Tables 4, 6)

The community is composed of one species, *B. argenteum*, and is newly recorded from Einstöingen in this study. The community is possibly dependent on high nutrient status provided by colonies of breeding snow petrels (Fig. 2). Associated lichens such as *Physcia caesia*, *Candelariella antarctica* and *Xanthoria elegans* grow on moss turf in

Table 2. Species composition of Ceratodon purpureus *Sociation.*

Locality number	E2	E3	E5	R3	R4	R5	R6	R8	R10	R12	R13	R18	R19	R21	R29
Altitude (m)	20	38	50	90	90	90	90	10	70	10	15	90	90	80	40
Exposition	N 60 E	N 60 E	N	N	N	N	N	N	S 45 E	N	N	N 60 W	N	N	N 40 W
Ceratodon purpureus	3	5	4	5	5	5	5	4	4	3	5	5	4	5	5
Physcia caesia	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Candelariella antarctica	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Xanthoria elegans	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Imperfect lichen	4	5	+	+	.	.	+	+	2	4	5	4	4	2	2
Algae	3	1	.	.	4	.	.	.	4	1	4	.	4	4	3

Locality number	S1	S2	S4	S7	S8	S10	S11	S14	S15	S16	S18	S19	S20	S21	S22	S23	S24
Altitude (m)	10	10	2	25	25	20	20	20	20	20	30	40	40	50	20	70	80
Exposition	N 20 E	N 20 E	N E	E	E	N E	N E	W	W	S W	N W	N E	N E	N	N	N	N
Ceratodon purpureus	4	5	5	5	5	5	5	5	4	5	5	5	5	5	5	4	4
Rinodina olivaceobrunnea	4	.	.	.	.	.	.	+	.	.	.	1	.	.	2	.	4
Imperfect lichen	2	1	3	.	+	3	2	4	3	+	1	3	+	+	3	.	2
Algae	2	4	1	2	2	3	+	3	3	2	3	3	5	2	3	.	2

E: Einstöingen; R: Rundvågshetta; S: Strandnibba.

Table 3. Species composition of Ceratodon purpureus–Bryum pseudotriquetrum *Sociation.*

Locality number	E2	E3	E7	E8	R8	R9	R10	R12	R15	R16	R18	R21
Altitude (m)	20	38	38	38	10	70	70	10	50	55	90	80
Exposition	N	N 60 E	N 20 E	N 20 E	N	S 45 W	S 45 W	N	N	S	N 60 E	N
Ceratodon purpureus	3	4	3	+	3	1	2	1	+	3	5	4
Bryum pseudotriquetrum	1	1	1	5	3	2	2	3	3	+	2	2
Physcia caesia	.	.	+	.	.	.	.	.	.	.	.	.
Rinodina olivaceobrunnea	.	.	.	.	.	.	.	.	.	.	.	.
Imperfect lichen	+	+	+	.	.	+	+	+	1	+	3	+
Algae	+	+	+	.	.	+	2	.	.	3	3	2

Locality number	R27	R28	R29	S2	S3	S5	S7	S9	S14	S17	S21	S23
Altitude (m)	20	40	40	10	3	5	30	40	25	25	50	70
Exposition	N 50 W	N 40 W	N 40 W	N 20 E	N 45 E	N 10 E	E	N 45 W	S 45 W	S 45 W	N	N
Ceratodon purpureus	1	5	4	5	4	+	5	+	5	1	5	1
Bryum pseudotriquetrum	3	3	2	+	4	4	+	2	1	3	+	3
Physcia caesia	.	.	.	.	.	.	.	.	.	.	.	.
Rinodina olivaceobrunnea	.	.	.	.	+	.	.	.	.	.	.	.
Imperfect lichen	.	1	1	+	4	.	3	.	.	1	1	+
Algae	.	2	3	3	3	3	1	.	3	+	2	2

E: Einstöingen; R: Rundvågshetta; S: Strandnibba.

Table 4. Species composition of Pottia heimii, P. heimii–B. pseudotriquetrum, B. argenteum *and* B. argenteum–B. pseudotriquetrum *Sociations.*

Community	A			B						C		D
Locality number	R22	R23	R26	E9	E11	R22	R23	R25	R26	R12	R14	E5
Altitude (m)	70	40	40	50	50	70	40	40	40	10	20	50
Exposition	N 20 E	N 40 E	N	S 60 E	S 60 E	N	N 40 E	N	N	N	N	N
Pottia heimii	4	2	4	+	2	4	4	3	3	·	·	·
Bryum pseudotriquetrum	·	·	·	4	+	2	2	2	3	4	4	·
B. argenteum	·	·	·	·	·	·	·	·	·	3	4	2
Physcia caesia	·	·	·	·	·	·	·	·	·	·	·	+
Candelariella antarctica	·	·	1	·	·	·	·	·	·	·	·	+
Rinodina olivaceobrunnea	·	·	3	·	·	·	·	·	·	2	·	·
Xanthoria elegans	·	·	·	·	·	·	·	·	·	·	·	1
Imperfect lichen	·	·	·	·	·	·	·	·	·	·	·	1
Algae	1	·	2	+	·	+	·	3	3	2	+	·

A: *Pottia heimii* Sociation, B: *P. heimii–Bryum pseudotriquetrum* Sociation, C: *B. argenteum–B. pseudotriquetrum* Sociation, D: *B. argenteum* Sociation.
E: Einstöingen; R: Rundvågshetta; S: Strandnibba.

Table 5. Species composition of Grimmia lawiana *and* G. lawiana–Ceratodon purpureus *Sociations.*

Community	A														B	
Locality number	R30	R31	R32	R33	R34	R35	S7	S8	S9	S17	S21	S24	S25	S26	S7	S8
Altitude (m)	7	5	7	20	25	15	35	30	40	50	50	85	90	90	30	30
Exposition	N 65 W	N	N 65 W	N	N	N	E	E	N 45 E	N E	E	N 45 E	N	E	E	E
Grimmia lawiana	5	5	5	5	5	5	5	5	5	5	4	4	4	4	4	4
Ceratodon purpureus	·	·	·	·	·	·	·	·	·	·	·	·	·	·	2	3
Alectoria minuscula	·	3	1	·	·	·	·	·	·	·	·	·	·	·	·	·
Imperfect lichen	1	·	+	+	·	·	1	1	·	·	·	+	+	·	·	+
Algae	5	2	5	5	·	·	3	3	3	1	3	1	1	2	+	3

A: *Grimmia lawiana* Sociation, B: *G. lawiana–Ceratodon purpureus* Sociation.
E: Einstöingen; R: Rundvågshetta; S: Strandnibba.

the community.

7) *Bryum argenteum–B. pseudotriquetrum* Sociation (Tables 4, 6)

The community is composed of *B. argenteum* and *B. pseudotriquetrum* and is characterized by *B. argenteum* mingled with *B. pseudotriquetrum*. The community is recognized only in Rundvågshetta (Fig. 3).

8) *Grimmia lawiana* Sociation (Tables 4, 6)

The community is composed of one species, *G. lawiana*, and is found in Rundvågshetta and Strandnibba. Since the community was newly described from Cape Ryûgû, Prince Olav Coast (KANDA, 1981), this is the first record from the Sôya Coast. In

Table 6. Synthesis table of the moss communities on Einstöingen, Rundvågshetta and Strandnibba, Sôya Coast.

Community	1			2			3			4	5		6	7	8		9
Area	E	R	S	E	R	S	E	R	S	R	E	R	E	R	R	S	S
No. of quadrats	23	46	18	10	27	52	6	16	16	6	4	8	4	4	26	23	6
Mean altitude (m)	31	36	26	36	64	28	34	49	29	50	50	48	50	15	13	59	30
Bryum pseudotriquetrum	1-5 V	2-5 V	+-5 V	·	·	·	+-5 V	+-3 V	+-4 V	·	+-4 4	+-3 V	·	+-4 4	·	·	·
Ceratodon purpureus	·	·	·	3-5 V	3-5 V	3-5 V	+-4 V	+-5 V	+-5 V	·	·	·	·	·	·	·	+-3 V
Pottia heimii	·	·	·	·	·	·	·	·	·	2-4 V	+-2 4	3-4 V	·	·	·	·	·
Grimmia lawiana	·	·	·	·	·	·	·	·	·	·	·	·	·	·	4-5 V	3-4 V	3-4 V
Bryum argenteum	·	·	·	·	·	·	·	·	·	·	·	·	1-2 4	1-4 4	·	·	·
Rinodina olivaceobrunnea	+ I	+ I	·	·	·	+-4 I	·	·	+ I	+ I	1-3 2	·	·	2 1	·	·	·
Xanthoria elegans	+ I	·	·	+ I	·	·	·	·	·	·	·	·	+-1 2	·	·	·	·
Alectoria minuscula	·	·	+ I	·	·	·	·	·	·	·	·	·	·	·	1-3 I	·	·
Physcia caesia	+ I	·	·	1 I	·	·	+ III	·	·	·	·	·	+ 2	·	·	·	·
Candelariella antarctica	·	·	+ I	+ I	·	·	·	·	·	·	+-1 2	·	+ 1	·	·	·	·
Imperfect lichen	+-2 II	+-4 II	+-3 II	+-5 V	+-5 V	+-4 V	+ IV	+-3 IV	+-4 III	·	·	·	+-1 2	·	+-1 II	+-1 II	+ II
Algae	+-4 V	+-4 IV	+-4 IV	+-3 III	+-4 IV	+-5 V	+ III	+-3 IV	+-3 IV	+ III	+ 2	+-3 III	·	+-2 2	1-5 IV	+-3 V	+-3 III

E: Einstöingen; R: Rundvågshetta; S: Strandnibba.

1. *Bryum pseudotriquetrum* Sociation
2. *Ceratodon purpureus* Sociation
3. *C. purpureus–B. pseudotriquetrum* Sociation
4. *Pottia heimii* Sociation
5. *P. heimii–B. pseudotriquetrum* Sociation
6. *B. argenteum* Sociation
7. *B. argenteum–B. pseudotriquetrum* Sociation
8. *Grimmia lawiana* Sociation
9. *G. lawiana–C. purpureus* Sociation

Rundvågshetta, the community occurs on wet rock covered partially with mineral-rich sandy soil on the coastal side and is free from the continental glacier (Fig. 3). In the case of Strandnibba, the community always occurs near the margins of the continental ice sheet (Fig. 4). None of the quadrats has associated lichens except *Alectoria minuscula* and imperfect lichen.

9) *Grimmia lawiana–Ceratodon purpureus* Sociation (Tables 5, 6)

The community is composed of *G. lawiana* and *C. purpureus*. The *Grimmia* type in the *Ceratodon purpureus* Sociation, which is recognized by NAKANISHI (1977), is considered to be the same as the community. The community is found in Strandnibba (Fig. 4).

3.2. Ecological features of the moss communities in the areas studied

Figures 2 to 4 show the distribution and the frequency of occurrence of the moss communities in three areas studied.

1) Einstöingen (Fig. 2)

Five moss species are known to be distributed on the island and the following five sociations were recognized: *Bryum pseudotriquetrum* Sociation, *C. purpureus* Sociation,

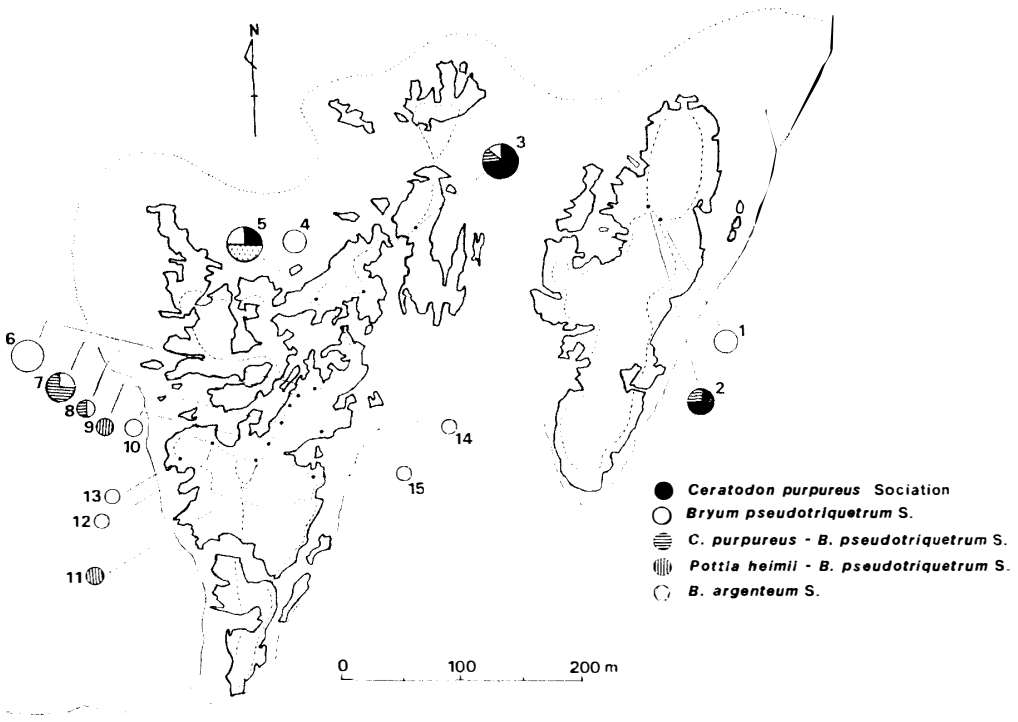

Fig. 2. Distribution and frequency of moss communities in Einstöingen. Pie diagrams indicate the frequency of occurrence of the moss community at each locality. Circle size corresponds to the number of quadrats. The number by a circle shows the locality number.

C. purpureus–B. pseudotriquetrum Sociation, *P. heimii–B. pseudotriquetrum* Sociation, and *B. argenteum* Sociation. The vegetation of the island is best characterized by the *B. heimii–P. pseudotriquetrum* Sociation and the *B. argenteum* Sociation. The Skallen area, close to this island, is known as a region with calcareous rock veins and an extensive community of *P. heimii* was found there with perfectly matured capsules (KANDA, 1981). The habitat of this community in the southern part of Einstöingen is so similar to that in the Skallen area that it seems to be related to the presence of the calcareous substratum. On the other hand, the development of the *B. argenteum* Sociation is influenced not only by calcareous bedrock, but also by nutrient input from sea birds.

Small isolated islands near Syowa Station such as Ongulkalven, Mame-zima Island, Rumpa and Ongul Islands generally have scarce moss vegetation consisting of only one or two species (MATSUDA, 1964; KOBAYASHI, 1974; SHIMIZU, 1977; NAKANISHI, 1977). According to NAKANISHI (1977), the moss vegetation in the Ongul Islands consisted of three sociations, the *C. purpureus* Sociation, the *B. inconnexum* (=*B. pseudotriquetrum*) Sociation and the *C. purpureus–B. inconnexum* Sociation. Although these islands have penguin rookeries providing an effective nutrient supply for the vegetation, there is no marked moss vegetation. As to the relationship between the penguin rookery and soil organisms, it is assumed that certain antibiotic substances in the soil at the rookery originating from penguin feces may prevent the growth of bacteria, fungi and algae (SIEBURTH, 1960; BOYD *et al.*, 1966; AKIYAMA *et al.*, 1986). In the case of the Einstöingen area without penguin rookery, the rich moss vegetation is considered to be due to snow

petrel excrement. However, the effects of nutrients, supplied by snow petrel and penguin excrements, on the moss vegetation have yet to be studied.

2) Rundvågshetta (Fig. 3)

The moss vegetation of this area is characterized by pure communities of the *P. heimii* Sociation and the *G. lawiana* Sociation. The pure community of *G. lawiana* extends on gentle slopes facing to the north to northwest in a broad area of over 100m wide. *G. lawiana* occurs on wet rock covered partially with mineral-rich sandy soil on the coastal side of about 13m above sea level away from the continental glacier. This habitat is apparently atypical for *G. lawiana* when compared with known sites for the species elsewhere (for example in Strandnibba). It may be necessary to interpret the historical features of the habitats over geological time because the present habitats of *G. lawiana* on the coastal side are considered to have been strongly affected by the persisting continental glacier in the past. This presumption is based on the fact that the glacier in the ice-free area has retreated during relatively recent time (MORIWAKI, 1976). The moss vegetation was exposed from the glacier or was introduced by air-borne

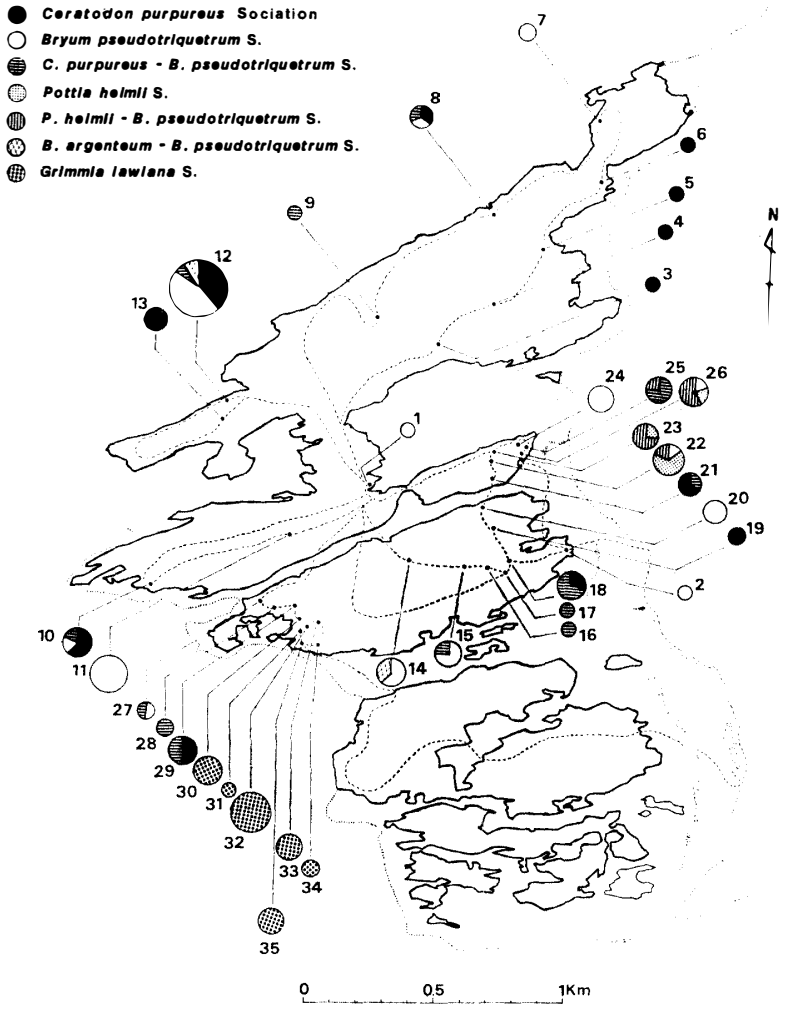

Fig. 3. Distribution and frequency of moss communities in Rundvågshetta.

spray or sea birds from other areas and settled at the preferable sites, judging from some periglacial features such as the presence of the crustose lichens of *Rhizocarpon* and the swift flowing stream or waterfalls on the rock surface. Further important evidence is that, at the coastal side where *G. lawiana* occurs in Rundvågshetta, there is no trace of *C. purpureus* and *B. pseudotriquetrum*, which appear commonly at low elevation in the Syowa Station area.

Besides the two sociations mentioned above, the moss vegetation of Rundvågshetta is composed of the following five communities: *C. purpureus* Sociation, *B. pseudotriquetrum* Sociation, *C. purpureus–B. pseudotriquetrum* Sociation, *B. argenteum–B. pseudotriquetrum* Sociation and *P. heimii–B. pseudotriquetrum* Sociation. Rundvågshetta which supports seven sociations of moss communities is one of the areas with the most prominent moss vegetation in the Syowa Station area.

3) Strandnibba (Fig. 4)

The *G. lawiana* Sociation is the most characteristic community in the area. Almost all communities of this sociation occur near the margins of the continental ice sheet and a few other colonies are distributed along stream margins or often on submerged rocks at higher elevations of about 60 m. The moss vegetation in Strandnibba is composed of the following five sociations: *B. pseudotriquetrum* Sociation, *C. purpureus* Sociation, *C. purpureus–B. pseudotriquetrum* Sociation, *G. lawiana* Sociation and *G. lawiana–C. purpureus* Sociation.

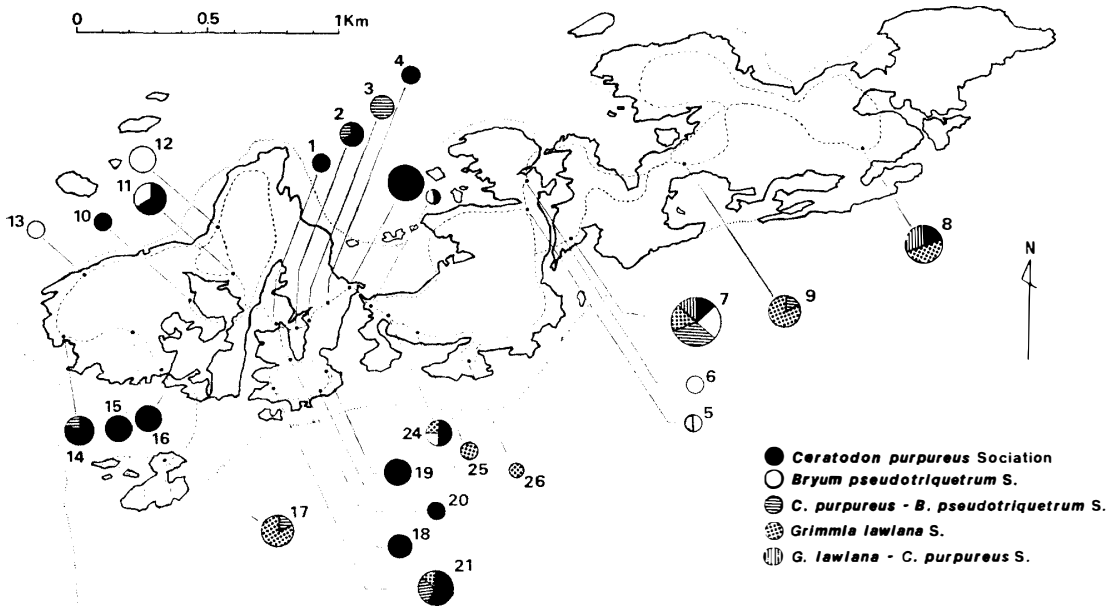

Fig. 4. Distribution and frequency of moss communities in Strandnibba.

4. Conclusion

Based on the results of NAKANISHI (1977), KANDA (1981) and the present study, the distribution pattern of moss communities in ice-free areas along the Sôya and Prince Olav Coasts is shown in Table 7. The moss vegetation on the Sôya Coast is charac-

Table 7. Distribution of the moss communities in Sôya Coast and Prince Olav Coast.

	Sôya Coast						Prince Olav Coast	
	Rundvågs-hetta	Einstö-ingen	Lang-hovde	Strand-nibba	Skarvs-ness	Ongul Islands	Cape Ryûgû	Akarui Point
1. *Ceratodon purpureus–Bryum pseudotriquetrum* Sociation	+	+	+	+	+	+	+	+
2. *B. pseudotriquetrum* Sociation	+	+	+	+	+	+	+	
3. *C. purpureus* Sociation	+	+	+	+		+	+	+
4. *Pottia heimii–B. pseudotriquetrum* Sociation	+	+	+		+			
5. *B. argenteum–B. pseudotriquetrum* Sociation	+		+		+			+
6. *Pottia austro-georgica–B. pseudotriquetrum* Sociation			+		+			
7. *Pottia heimmii* Sociation	+							
8. *B. argenteum* Sociation		+						
9. *Grimmia lawiana* Sociation	+			+			+	
10. *G. lawiana–C. purpureus* Sociation			(+)	+			+	(+)

Parentheses indicate the *Grimmia* type of *Ceratodon purpureus* Sociation (NAKANISHI, 1977).

terized by the presence of the *B. argenteum* Sociation, the *P. heimii–B. pseudotriquetrum* Sociation, the *P. austro-georgica–B. pseudotriquetrum* Sociation and the *P. heimii* Sociation. These communities are influenced not only by air-borne salt spray carried inland by prevailing wind from the sea and calcareous bedrocks, but also by nutrients introduced by sea birds. In contrast, the *G. lawiana* Sociation and the *G. lawiana–C. purpureus* Sociation are distributed on both coasts, occurring in areas which are still strongly affected by the continental glacier such as Strandnibba and Cape Ryûgû. It suggests that these moss communities may prefer topographical features conceivably affected by glaciers in the recent past.

In Einstöingen, despite of its being a small isolated island, the development of the moss vegetation in Einstöingen is prominent and the composition of the moss communities is similar to those of large-scaled ice-free areas such as Langhovde and Skallen. Such a rich development of the moss vegetation is probably influenced by nutrients derived from snow petrel excrement and by calcareous bedrock.

Rundvågshetta, where seven sociations were recognized, exhibits the most diversified moss communities in the ice-free areas of both coasts.

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