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Peat soils in the Bellsund region, Spitsbergen

ABSTRACT: Peat soils (FAO — *Gelic Histosols*) in the southern Bellsund coast area occur on slopes and terraces. They are formed in places favourable for plant growth, *i.e.* adequately moistened and fertilized largely with bird excrements. These formations belong to moss peats which, are generally decomposed weakly and moderately to about 0.5 m depth. Their content of organic matter is equal to about 30–90%, but it is higher in terrace peats. The latter are more acidified than slope peats. The reaction both of slope and terrace peat soils is as a rule, slightly acid or neutral, and $CaCO_3$ content does not exceed 10%. As regards the content of macroelements, that of Al is the highest followed by Ca, Fe, Mg and P. Little K and Ti, and only traces of Na are found. Microelements occur in the following sequence: Mn, Zn, Cu, Cr, Ni, Pb, Co, Cd. Particularly Mn, Zn as well as Cu and Cd were found in a higher concentration. Slope peat soils are richer in macro- and microelements than terrace ones, *e.g.* 4 times in the case of Mg. Peat soils poor in ash parts (up to 25% ash), contain the fewest elements. Some regularities concern also a vertical distribution of the particular profiles but only with regard to terrace peat soils.

Key words: Arctic, Spitsbergen, peat soils, chemical properties.

Introduction

The opinion that unfavourable formation conditions of peats exist in Svalbard has been valid for a long time in literature (Lag 1988). In the most recent handbooks concerning the geography of soils, the peats dealt with are omitted in relation to arctic tundra, and their wider distribution is connected with a southern tundra. However, peats in Svalbard were reported for the first time at the beginning of the last century (Nathorst 1910, after Lag 1988). More papers about the peat soils (FAO — *Gelic Histosols*) were published in the seventies and later *e.g.* Zelikson (1971), Fabiszewski (1976), Klementowski (1977), Lag (1980, 1988), Göttlich and

Hornburg (1982), and Serebryannyi *et al.* (1985). Also Żurek (1987) made a brief account of arctic tundra peats. Relatively common occurrence of organic-mineral formations and a peat-like cover (organic layer up to 30 cm thick) were found in Spitsbergen by Eurola (1971), Plichta (1977) and Dobrovolsky (1990). Peats in the Bellsund region were mentioned by Klimowicz and Uziak (1988), Melke *et al.* (1990), Uziak (1992) and Klimowicz *et al.* (1993). This paper presents the conditions which are favourable for development of organic soils in the arctic tundra, and describes their selected properties.

The studies were carried out and the material was collected during the geographical expeditions to Spitsbergen, organized by the Maria Curie-Skłodowska University in Lublin (Poland).

Study area and methods

In the southern Bellsund region the coast peatlands occur on mountain slopes and marine terraces. Two areas of slope peat soils are discussed. One is located in the southern and southwestern part of the Dundrabeisen slopes (Dunderbukta region) and passes directly into a terrace peat. The other is on the northeastern slope of the Observatoriefjellet (Recherchefjorden region). Moreover, a terrace peatland was located on a narrow isthmus between Lognedalsflya and Dyrstadflya — at bottom of the Klokkefjellet (Fig. 1).

An outline of geological structure, including description of the youngest formations on which largely terrace peatland have been formed, is presented by the map (Dallmann *et al.* 1990). The landscape was partially presented by Pękala and Reder (1989). Climatic conditions of this part of Svalbard were described by Rodzik and Stepko (1985). Results of floristic studies are also in papers of Rønning (1964), Karczmarz and Święs (1988, 1989), and Święs (1988).

Morphology of peat soils on slopes was examined at various altitudes. On terraces, however, the method of the crossing soil-topography section was applied for a detailed study of spatial differentiation of a peat cover. At the same time, a type of vegetation was determined. Samples for laboratory studies were collected from selected profiles. Because of approximate morphology of the organic formation as well as homogenous composition of plant species (predominance of mosses), mainly the chemical properties of peat soils were determined (Lityński *et al.* 1976), including contents of $CaCO_3$ (with use of the Scheibler's apparatus), pH (electrometrically), organic matter (by loss of ignition) and organic C in some samples only (by the Tiurin's method), total N (by the Kjeldahl method). The total chemical composition, *i.e.* macro- and microelements were determined after burning and dissolving the samples with a mixture of HF acid and $HClO_4$. The analysed elements were determined by AAS technique in Perkin-Elmer 3300 apparatus (Page *et al.* 1982).

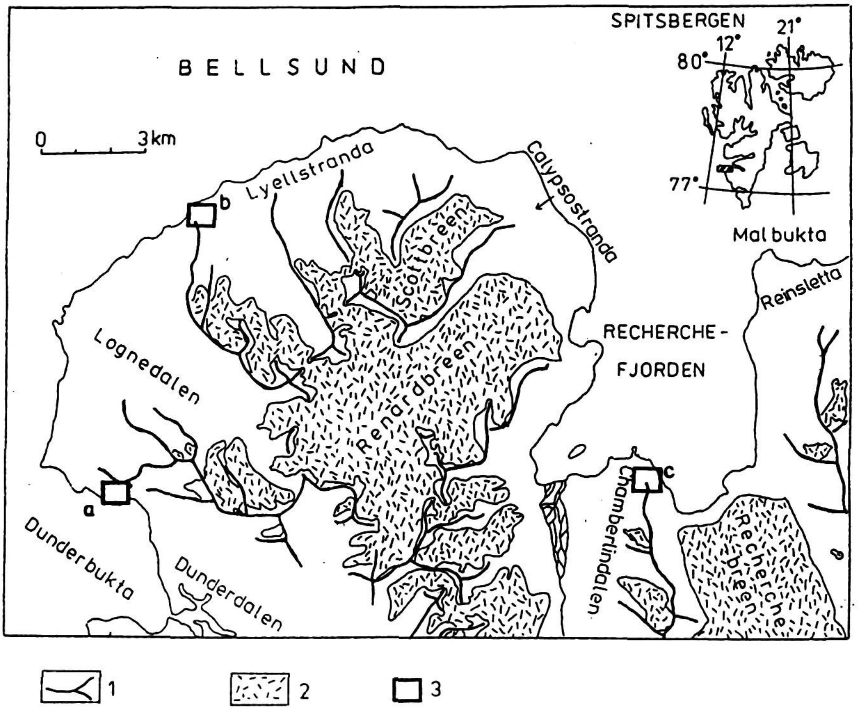

Fig. 1. Location of the study area in the Bellsund region. 1 – mountain ridges, 2 – glaciers, 3 – study sites: a – Dundrabeisen, b – Klokkefjellet, c – Observatoriefjellet.

Description of peat areas

The areas of studied slope peats are not large (considerably below 1 ha). In the case of Dundrabeisen, a relatively thick organic cover occurs at about 30 m (slope bottom) to 90 m a.s.l. and it is less than 100 m wide. The windward slope is considerably inclined (at least 30°) and generally exposed to the south. It passes from about 100 m a.s.l. to a high, almost vertical rocky wall devoid of vegetation and with hundreds of nests, largely of kittiwake (*Rissa tridactyla*). The organic layer is there of varying thickness, generally less than 0.5 m. Peat (or rather an organo-mineral formation) is distinctly shallower on the Observatoriefjellet slope, but its area is a little larger and occurs at a higher altitude than that described above. Bird colonies (different species) are less numerous than on the Dundrabeisen slope and more distant from the formations studied.

The area of terrace peat soils in the Dundrabeisen region, together with an organo-mineral formation, is over a dozen of hectares large. The peats occur on a narrow "passage" between the extensive Dunder valley and Lognedalsflya (Fig. 1). The surface is very rugged, because of numerous boulders and stone blocks from 0.5 to about 6 m in diameter (commonly 2–3 m). It indirectly acts

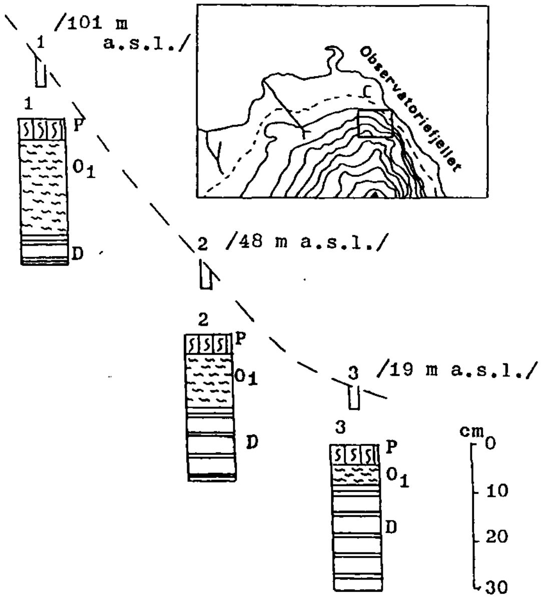

Fig. 2. Morphology of organo-mineral formations in the Observatoriefjellet region. c – study site, 1–3 – soil pits, P – non-decomposed or poorly decomposed organic horizon, O_1 – medium decomposed organic horizon, D – parent rock.

on varying thickness of the organic layer, from about a dozen centimetres on the unweathered rock fragments, to over 0.5 m between them. A thickness of peat generally decreases towards a seashore. Besides the bird faeces, the studied area is abundantly manured by numerous reindeers, grazing there.

Peat at the northern bottom of the Klokkefjellet is much limited than the described above, and its thickness does not exceed 0.5 m. The organic layer is strongly water-logged and fills a channeled landform, upholstered with clayey-loamy material. Numerous small streams come from the neighbouring slope. Many reindeers and a lot of birds, largely little auk (*Alle alle*) live there, with their nests at the top of the mountain ridge.

The properties of organic formations are basically determined by vegetation, from which they originate. This concerns above all, a fast increase and a slow decomposition of the detritus, so as it could be deposited as a peat. Particularly favourable conditions for this exist in the western and southwestern part of the Bellsund region, where climate is milder and moister. All the studied peat areas have been formed probably from moss vegetation. Karczmarz and Święs (1989) found a distinct predominance of 20 tundra and tundra-peat species of brown mosses in all types of strongly moistened peat areas.

There are also nitrophilic mosses in places where nitrogen compounds of animal origin accumulate. This takes place particularly in slope and terrace peats

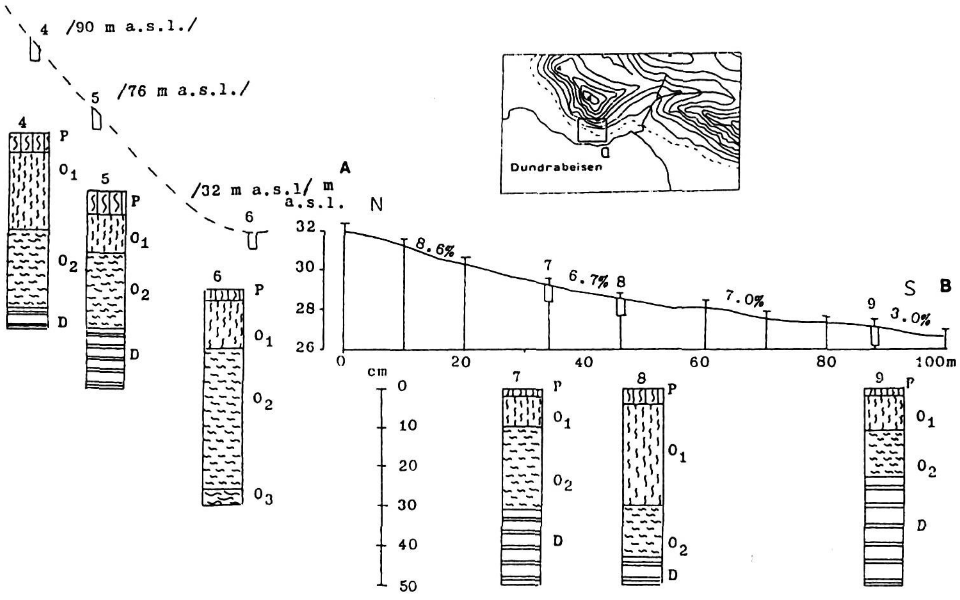

Fig. 3. Morphology of peats in the Dundrabeisen region (section A–B). a – study site, 4–9 – soil pits, T – examined sites, P – non-decomposed or poorly decomposed organic horizon, O_1 – poorly (on terrace) and medium decomposed (on slopes) organic horizon, O_2 – medium or fairly well decomposed organic horizon, O_3 – frozen peat, D – parent rock.

of the Dundrabeisen region. Richness of the moss species as well as quality of components accounts for their numerous shades: from dark-green, green to yellowish-green (Dundrabeisen region) and locally, even red (bottom of the Klokkefjellet).

More or less numerous vessel plants appear also among the mosses. In the western part of the Bellsund region we could find, using Rønning's guidebook (1964), the following species: *Cardamine nymani, Cerastium arcticum, Saxifraga caespitosa, S. cernua, S. nivalis, S. svalbardensis* and also small grass tussocks. A little different and less numerous species covered the peat area on a slope of the Observatoriefjellet, largely *Saxifraga oppositifolia, S. caespitosa, Salix polaris, Cerastium arcticum,* rarely grasses.

The morphology of the studied peat areas shows a considerable differentiation. Peat on a slope of the Observatoriefjellet is characterized by the most poorly developed organic horizon (soil pits 1–3). Its thickness rarely exceeds 20 cm. Therefore, this formation should be determined (as previously indicated) as organo-mineral. A top layer which is several centimetres thick and brown, is very weakly decomposed. Beneath, a medium decomposed and dark-brown peat was found. The organic horizon is underlain largely with stony-gravel material with a small content of finer fractions (Fig. 2).

A thickness of the Dundrabeisen slope peat soils (FAO — *Gelic Histosols*) is twice as big as the described above. The top layer, partially corresponding to a root zone of the present plants, is at least 5 cm thick and green-greyish. Underneath, there is a medium decomposed brown and dark-brown peat. It is underlain with relatively well decomposed (about 20 cm thick) and almost black organic layer. At depth of about 0.5 m there is a rock debris (Fig. 3).

The terrace peat at the Dundrabeisen is the thickest of the all studied, as a strongly frozen organic formation (permafrost) was found at one of the study points (on July 27, 1990) at a depth below 0.5 m, but its average thickness is generally equal to 0.4–0.5 m. This peat is usually overgrown with exceptionally exuberant and rich vegetation, if polar conditions are concerned. It is underlain with a weakly decomposed organic formation, generally light-brown, passing into a dark-brown and highly decomposed. Loamy-silty formations or a solid rock occurs beneath (Fig. 3).

Organic formations at the Klokkefjellet slope bottom have a little smaller thickness (to about 0.4 m) than at Dundrabeisen, but a very regular system of horizons. Non-decomposed, several centimetres thick, grey-greenish moss layer occurs at the top. Underneath, there is a weakly decomposed light-brown peat passing to a more decomposed, black-brown organic horizon, several to over a dozen centimetres thick. The bed rock is constituted of blue-grey and gleyed loamy-clayey formations with a small admixture of a soil skeleton (Fig. 4).

Chemical properties

A reaction (pH) of the organic formations are equal to 5.6–7.1 on slopes and 4.1–6.6 in terrace peat soils (Table 1). Despite a relatively low pH, the mentioned formations contain occasionally some $CaCO_3$. This results from accumulation of more or less disintegrated mollusc shells, hardly to separate from the organic matter. The latter is a source of acid decomposition products. Shells occur at relatively considerable altitudes as the mentioned area has been systematically uplifted since a retreat of the Pleistocene glaciers.

A distinct differentiation is observed in content of the organic matter. The latter is evidently lower (about 30–50%) in shallow slope peat soils on the Observatoriefjellet, whereas it is much higher on slopes of the Dundrabeisen, and the highest (to about 95%) at the foot of this massif. The amount of organic matter decreases with depth in a profile. An opposite trend is observed in ash content, which is obvious in this case. Total N as a rule, correlates with content of organic matter. Hence, its average lowest amount was found in organo-mineral formations (containing smaller amounts of organic matter) on the Observatoriefjellet slopes, whilst it is the highest at foot of the Dundrabeisen (Table 1).

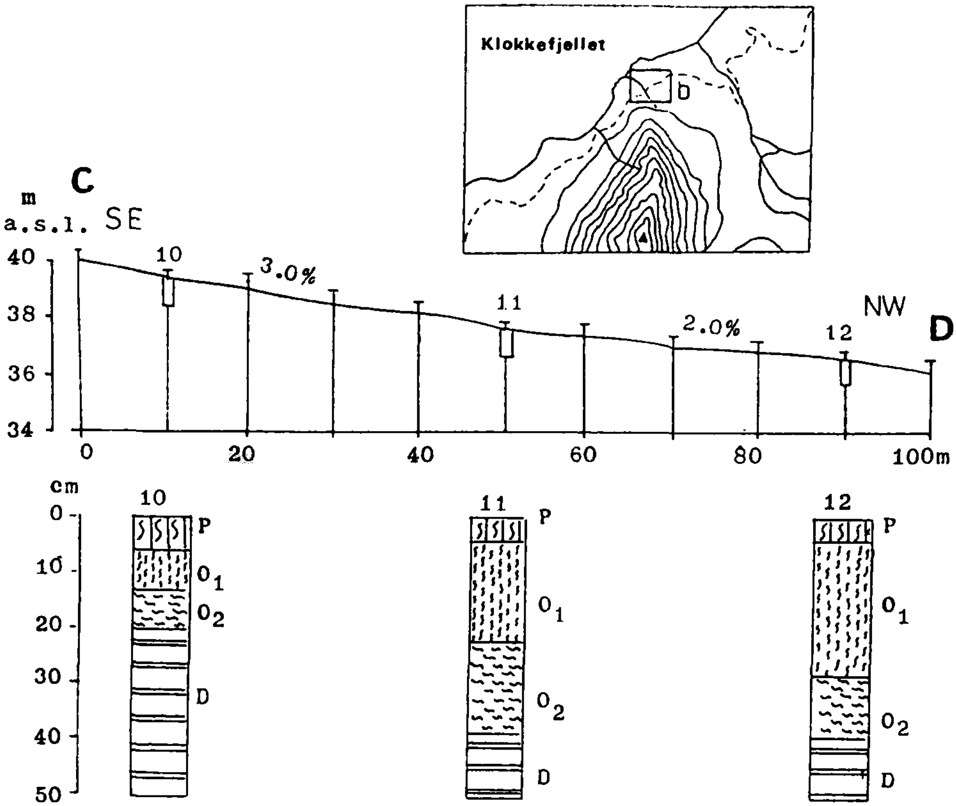

Fig. 4. Morphology of peats in the Klokkefjellet region (section C–D). b – study site, 10–12 – soil pits, T – examined sites, P – non-decomposed organic horizon, O_1 – poorly decomposed organic horizon, O_2 – medium decomposed organic horizon, D – parent rock.

Such a regularity does not occur in places which are strongly manured with animal faeces (mainly of birds).

The characteristics of the content of macro- and microelements is presented largely in relation to the location of organic formations (slope and terrace peats), crude ash content, as weel as morphology of the individual sections. As regards macroelements, their evidently average highest content concerns Al and Ca which are followed by Fe, Mg and P. There is distinctly little K and Ti, and only traces of Na are found (Table 2, Fig. 5). Slope peat soils are more rich in these elements than terrace ones, and there is almost three times more P (influence of avifauna). Ornithogenic soils according to Tatur and Myrcha (1984) are a good example for a very strong influence of birds. They were formed in ice-free oases in the Antarctic Peninsula and the King George Island. A formation of these soils is connected after the mentioned authors with mineralization of guano, deposited mostly by penguins and with phosphatization of the ground by the action of

Table 1

Chemical properties of soils.

Profile no.	Horizon	Depth cm	$CaCO_3$ %	pH KCl	Organic matter %	Crude ash %	N %
slope peat soils							
1	O_1	5-15	1.7	6.7	49.3	50.7	1.60
2	P	0-5	0.5	6.6	47.1	52.9	1.55
	O_1	6-10	2.3	7.1	31.7	68.3	1.09
3	O_1	4-8	9.2	6.8	35.2	64.8	0.77
4	O_1	5-15	4.5	5.6	53.9	46.1	1.90
	O_2	30-40	4.4	5.7	33.1	66.9	1.90
	P	0-6	3.8	6.2	76.3	23.7	2.09
5	O_1	8-15	1.9	6.2	64.8	35.2	2.58
	O_2	17-30	2.1	6.6	66.4	33.6	2.21
terrace peat soils							
6	P	0-3	1.9	6.1	90.5	9.5	1.32
	O_1	5-12	3.3	5.6	79.0	21.0	1.29
	O_2	18-25	1.0	5.5	62.7	37.3	2.38
	O_2	32-42	0.1	5.3	45.8	54.2	2.18
	O_2	45-50	1.2	5.3	46.2	53.8	1.93
7	O_1	2-8	0.0	4.1	94.9	5.1	2.17
	O_2	15-25	0.0	6.4	70.2	29.8	2.49
8	O_1	5-10	0.0	6.1	91.6	8.4	2.52
	O_1	15-25	0.0	6.6	88.5	11.5	1.36
	O_2	32-40	0.0	6.0	72.7	27.3	2.86
9	O_1	2-6	0.0	5.6	86.3	13.7	2.86
	O_1	6-10	0.0	5.5	82.0	18.0	2.58
	O_2	12-20	1.0	6.0	57.1	42.9	2.07
	D	25-35	1.4	6.6	16.1	83.9	0.59
10	O_2	14-19	0.6	6.5	67.3	32.7	1.57
	D	25-35	8.8	7.8	1.4	–	0.14
11	O_1	10-20	0.0	6.4	87.5	12.5	1.35
	O_2	25-35	0.0	6.2	68.3	31.7	1.65
	D	40-50	0.8	6.7	4.1	–	0.28
12	O_1	5-15	2.6	6.4	91.4	8.6	1.40
	O_1	18-25	0.0	6.5	90.9	9.1	1.02
	O_2	30-38	0.3	6.4	65.9	34.1	1.29
	D	42-50	0.8	6.6	16.4	83.6	0.34

guano-derived chemically aggressive solutions. In terrace peat soils, organic formations poor in ash (to 25%) contain the least components, except Ca. Also some regularities are noted in individual sections, *e.g.* the content of Al and Fe, and partially of Mg and Ti usually increases (like ash) with depth, reversely in the case of Ca, but only in terrace peat soils. Slope peat soils do not show any regularities in this respect.

Table 2

Total content of macroelements (% of dry mass).

Profile no.	Horizon	Depth cm	Al_2O_3	Fe_2O_3	CaO	MgO	Na_2O	K_2O	P_2O_5	TiO_2
slope peat soils										
1	O_1	5-15	6.18	2.38	3.35	1.23	0.04	0.15	0.69	0.33
2	P	0-5	6.67	2.83	2.89	1.47	0.05	0.18	0.67	0.40
	O_1	6-10	5.74	3.24	2.33	1.13	0.05	0.22	0.62	0.53
3	O_1	4-8	4.78	2.13	2.73	1.92	0.04	0.09	0.35	0.31
4	O_1	5-15	4.64	2.04	7.08	1.50	0.04	0.12	3.09	0.20
	O_2	30-40	2.93	1.33	4.59	1.14	0.03	0.06	0.72	0.11
5	P	0-6	1.93	0.81	4.45	0.88	0.02	0.04	0.58	0.04
	O_1	8-15	4.99	2.20	6.74	1.87	0.04	0.13	3.08	0.22
	O_2	17-30	2.90	1.35	5.18	1.00	0.03	0.06	0.72	0.11
terrace peat soils										
6	P	0-3	0.55	0.22	3.12	0.46	0.01	0.02	0.39	0.00
	O_1	5-12	2.59	1.06	2.16	0.71	0.02	0.06	0.53	0.14
	O_2	18-25	3.89	0.98	1.44	1.05	0.03	0.11	0.49	0.11
	O_2	32-42	3.72	1.52	1.15	0.74	0.05	0.13	0.42	0.20
	O_2	45-50	3.22	1.52	1.01	0.52	0.05	0.12	0.42	0.16
7	O_1	2-8	0.50	0.20	1.20	0.34	0.01	0.01	0.19	0.00
	O_2	15-25	3.56	1.45	2.72	0.75	0.03	0.07	0.49	0.17
8	O_1	5-10	0.85	0.36	4.20	0.52	0.02	0.02	0.53	0.03
	O_1	15-25	4.45	1.72	2.41	0.90	0.05	0.09	0.39	0.17
	O_2	32-40	2.91	1.39	3.15	0.75	0.02	0.06	0.42	0.06
9	O_1	2-6	1.30	0.50	2.99	0.51	0.01	0.02	0.53	0.05
	O_1	6-10	1.93	0.52	2.91	0.52	0.02	0.03	0.44	0.07
	O_2	12-20	4.26	1.74	2.21	0.78	0.05	0.08	0.44	0.17
	D	25-35	5.97	3.50	0.81	1.28	0.09	0.16	0.39	0.38
10	O_2	14-19	4.87	1.91	2.98	1.77	0.04	0.13	0.67	0.15
	D	25-35	5.54	3.22	1.98	3.95	0.07	0.26	0.56	0.44
11	O_1	10-20	1.04	0.47	3.28	0.65	0.01	0.03	0.35	0.01
	O_2	25-35	5.87	2.21	2.73	2.27	0.02	0.15	0.44	0.13
	D	40-50	9.49	3.63	0.44	3.86	0.05	0.39	0.32	0.45
12	O_1	5-15	0.87	0.32	3.49	0.64	0.01	0.02	0.39	0.00
	O_1	18-25	0.71	0.33	3.52	0.60	0.01	0.01	0.52	0.00
	O_2	30-38	4.54	2.06	2.46	1.67	0.02	0.15	0.39	0.24
	D	42-50	5.93	3.53	0.47	2.70	0.05	0.29	0.42	0.85

The content of microelements is also distinctly higher in slope than terrace peat soils (Table 3, Fig. 6). This could be associated with their greater ash content and partly with more intensive manuring by bird colonies. In general, the highest content of mentioned elements is that of Mg (on average 363 ppm in slope peat soils and 88 ppm in terrace ones). The known biogenic character of this element is confirmed here. The sequence (with regard to content) of the other elements

Table 3

Total content of microelements (ppm of dry mass).

Profile no.	Horizon	Depth cm	Cu	Co	Zn	Mn	Cr	Ni	Pb	Cd
slope peat soils										
1	O1	5-15	33.9	14.0	39.1	605	41	40	19	0.30
2	P	0-5	43.3	17.1	48.3	646	57	51	25	0.40
	O1	6-10	55.0	23.3	55.8	690	89	65	18	0.40
3	O1	4-8	20.6	15.4	53.5	223	27	37	10	0.25
4	O1	5-15	52.6	19.6	275.8	371	24	28	22	8.05
	O2	30-40	15.6	5.8	31.9	108	17	15	22	2.25
5	P	0-6	11.7	10.2	48.3	83	10	8	17	1.95
	O1	8-15	39.2	22.4	208.0	387	19	28	30	7.55
	O2	17-30	18.7	12.4	22.4	155	16	12	20	2.15
terrace peat soils										
6	P	0-3	8.1	6.8	32.4	317	8	6	28	0.45
	O1	5-12	21.9	9.6	34.4	90	14	16	24	1.95
	O2	18-25	33.6	7.4	24.9	9	26	15	15	1.30
	O2	32-42	29.4	5.7	66.9	26	36	19	22	0.75
	O2	45-50	27.1	10.1	25.4	28	22	15	13	1.20
7	O1	2-8	2.9	5.3	18.6	12	3	5	11	0.15
	O2	15-25	10.5	7.6	31.7	64	25	7	13	0.00
8	O1	5-10	12.3	3.0	15.1	25	4	2	12	0.00
	O1	15-25	9.4	4.6	23.9	124	11	4	12	0.70
	O2	32-40	15.7	7.3	22.7	26	19	10	12	0.20
9	O1	2-6	7.2	2.2	31.4	39	8	5	22	0.25
	O1	6-10	10.0	6.2	14.9	23	9	4	0	0.85
	O2	12-20	9.2	5.4	19.4	124	19	7	17	0.80
	D	25-35	16.4	18.4	77.3	569	31	14	29	0.25
10	O2	14-19	43.1	9.6	57.2	145	14	19	20	1.15
	D	25-35	38.0	17.8	78.6	381	30	34	16	0.00
11	O1	10-20	33.1	4.2	23.4	172	4	10	17	0.10
	O2	25-35	52.0	10.0	45.6	245	15	14	18	0.75
	D	40-50	42.6	17.9	89.4	249	51	40	28	0.50
12	O1	5-15	19.7	0.4	21.3	39	2	5	7	0.05
	O1	18-25	24.0	5.5	13.8	41	2	3	15	0.75
	O2	30-38	46.0	8.3	48.8	131	30	21	21	0.00
	D	42-50	35.6	19.9	81.1	320	73	31	10	0.00

is: Zn, Cu, Cr, Ni, Pb, Co and Cd. Dependence on ash content is generally similar as in the case of macroelements, *i.e.* in formations with low ash content (to 25% of ash) a small content of elements is usually found. This value always increases in 25–50% interval of ash. However, when 50% content is exceeded, the mentioned regularity does not always occur. In the vertical arrangament only the content of Co, Cr and partially Ni in terrace peat soils generally increases with

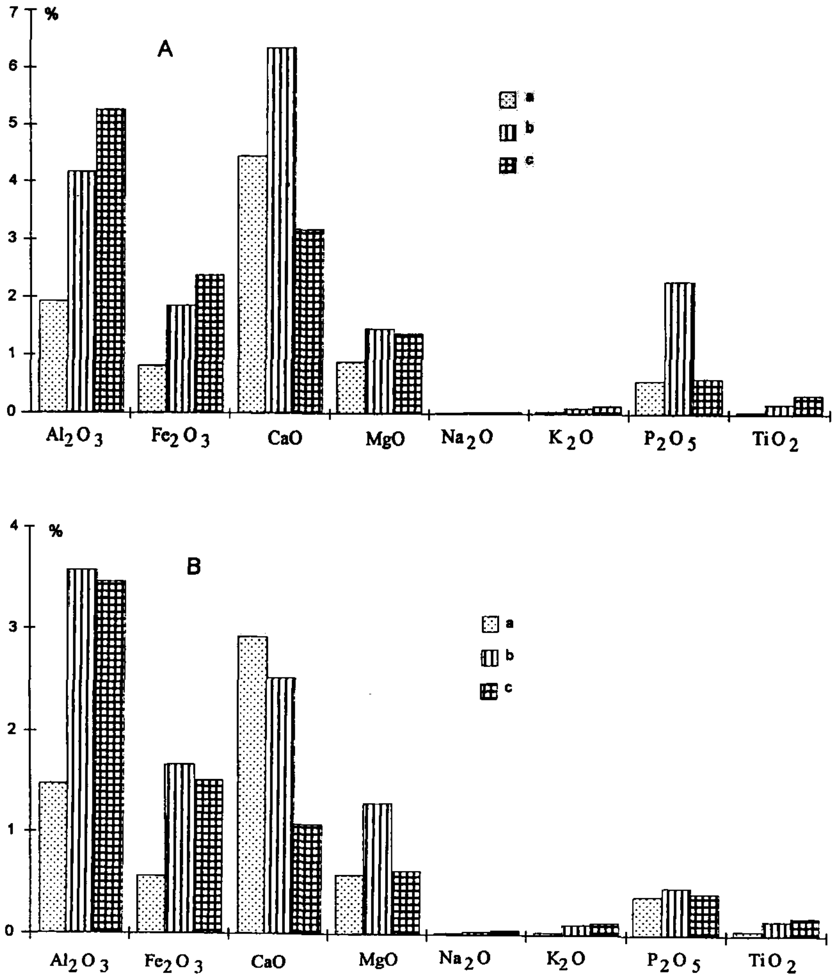

Fig. 5. Total content of macroelements (medium values). A – slope peat soils, B – terrace peat soils; ash content: a – below 25%, b – 25–50%, c – over 50%.

depth, and is the highest in the underlying mineral layer what indicates its distinct influence. The content distribution of the other elements does not show any regularity, irrespectively of peat location. Peat soils, which seem to be manured more intensively by birds (profile 4, 5 on the Dundrabeisen slope) than those on the Observatoriefjellet slope (profiles 1–3), are distinctly richer in Ca, P, Zn, Pb and Cd, and generally poorer if the other elements are concerned.

There are few publications concerning the chemical composition of organic formations in Spitsbergen. The papers of Zelikson (1971), Göttlich and Hornburg (1982), Serebryannyi *et al.* (1985) and Lag (1988) focused largely on location of peats, their basic morphological features and age, being estimated at about 4500 years (Göttlich and Hornburg 1982, Serebryannyi *et al.* 1985).

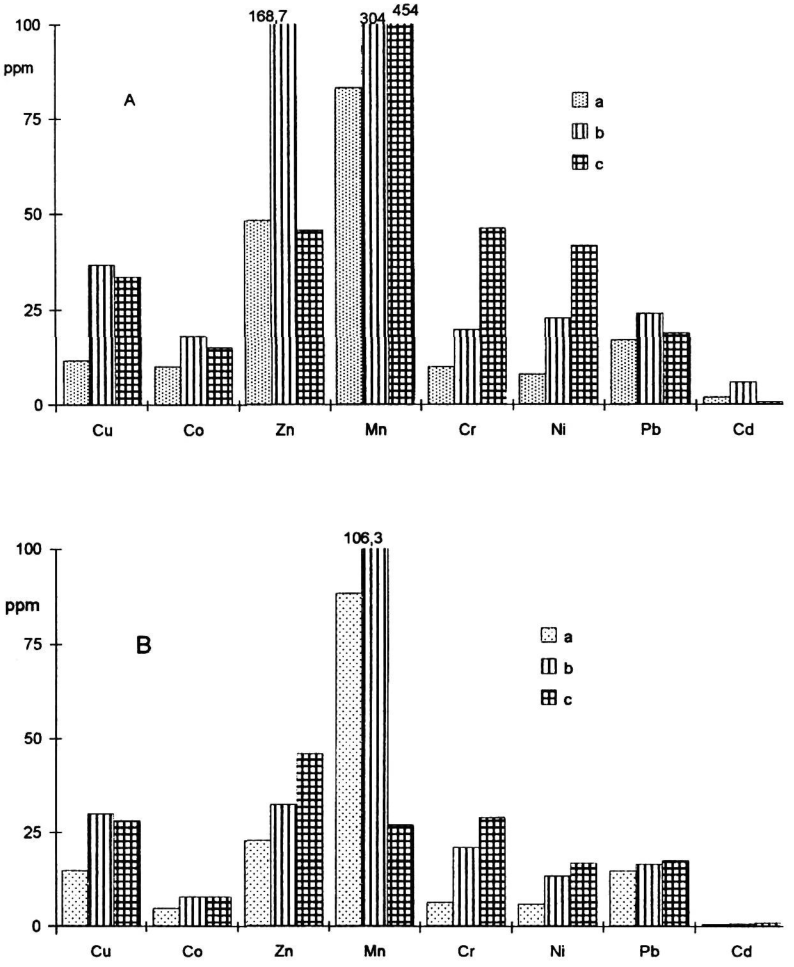

Fig. 6. Total content of microelements (medium values). A – slope peat soils, B – terrace peat soils; ash content: a – below 25%, b – 25–50%, c – over 50%.

Stratigraphy of peats and composition of plant species in southwestern Spitsbergen were presented by Fabiszewski (1976) and Klementowski (1977). Similar problems were also discussed in relatively detailed studies of peats in Scandinavia by Hafsten and Solem (1976).

Contents of Al_2O_3 in the studied peat soils seems to be usually higher than in peats from the territory of Poland. Peats of the Bellsund region are a little richer in P_2O_5, CaO and generally poorer in total N if compared to the Polish ones. According to Czajkowska (1984), only some N forms result from manuring with bird faeces, which exerted the biggest effect on the plant growth. Among the Polish peatlands, the organic formations of the Carpathian and Sudety Mts are the most similar to the ones in the arctic tundra, with regard to their genesis and partially, properties. They were formed in conditions with a very short vegetation period, supplied by precipitation water and (particularly in the case of the Karkonosze Mts peats) by a rich discharge of spring water. Like in Spitsbergen, they occur also on a "rugged ground", including slopes. However, they are characterized by considerably higher acidification (Walczak 1968, Komornicki *et al.* 1975, Obidowicz 1975, Tołpa 1985)

As regards microelements, their occurrence is spatially very differentiated. Besides Mg, there is a high concentration of Zn, Pb, Cu and Cd. This refers particularly to slope peat soils, more intensively manured. Increased concentration of heavy metals such as Cd, Pb, Zn, Cu and Fe was found in some mosses in the area bird nesting in southwestern Spitsbergen (Godzik 1991). Considerable accumulation of Pb, Cd and Zn in some moss species in the Bellsund region was found by Jóźwik (1992), and Jóźwik and Magierski (1992). Distribution of some elements has a global character (Kabata-Pendias and Pendias 1992), therefore their increased concentration in Spitsbergen may result from their excess accumulation in some areas, particularly in the northern hemisphere. Neither the influence of coal mines, working in Spitsbergen for many years can be excluded here.

Conclusions

1. In the Bellsund region the peatlands occur in very small areas on slopes and on terraces. They are different, particularly if their chemical properties are concerned.

2. The formation of peat soils (FAO — *Gelic Histosols*) in the region studied depends largely on adequate moistening and manuring which stimulate a growth of plants. Such conditions are satisfied by narrow terrace fragments (near a seashore), close to the mountain ridges, which are nesting places of numerous bird colonies and additional source for water supply.

3. Slope peats compared to terrace ones, are characterized by increased content of macroelements (Al, Ca, Fe, Mg, P) and almost all microelements. Higher content of elements could be associated with the increased ash content in peats and partly with more intensive manuring (influence of avifauna).

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Streszczenie

Gleby torfowe (FAO — *Gelic Histosols*) na obszarze południowego obrzeża Bellsundu występują w dwu położeniach: na stokach oraz na terasach (fig. 1). Tworzą się one w miejscach sprzyjających rozwojowi roślinności, tj. odpowiednio uwilgotnionych i użyźnionych głównie odchodami ptaków. Warunki takie spełniają wąskie fragmenty teras (w pobliżu brzegu morskiego), sąsiadujące z grzbietami górskimi, stanowiącymi miejsca gniazdowania licznych kolonii ptasich oraz dodatkowe źródło zasilania w wodę. Wspomniane utwory należą do torfów mszystych, na ogół słabo i średnio rozłożonych, o miąższości do około 0,5 m (fig. 2–4). Zawartość substancji organicznej waha się w nich w szerokich granicach, od około 30 do 90%, przy czym zasobniejsze w omawiany składnik są torfy terasowe. Te ostatnie są też bardziej zakwaszone niż torfy na stoku. Z reguły odczyn omawianych utworów w obydwu położeniach jest lekko kwaśny lub obojętny, a zawartość $CaCO_3$ nie przekracza 10% (tab. 1).

Wśród makroelementów najwięcej jest Al, w dalszej kolejności występują Ca, Fe, Mg i P. Mało jest K i Ti, i tylko ślady Na (tab. 2, fig. 5). Kolejność występowania mikropierwiastków jest następująca: Mn, Zn, Cu, Cr, Ni, Pb, Co, Cd. Stwierdzono zwiększoną koncentrację zwłaszcza Mn oraz Zn a także Cu i Cd (tab. 3, fig. 6). Zdecydowanie bardziej zasobne w makro- i mikroelementy są torfy stokowe niż występujące na terasach, w przypadku Mn aż 4-krotnie. Najmniej składników zawierają torfy ubogie w części popiołowe (do 25% popiołu). Pewne prawidłowości dotyczą też dystrybucji składników w układzie pionowym poszczególnych profili (np. wzrost koncentracji Co, Cr i częściowo Ni wraz z głębokością), ale tylko w odniesieniu do utworów organicznych terasowych. Generalnie wyższą zawartość makro- i mikroelementów można wiązać z większą popielnością badanych torfów, a także — w przypadku niektórych pierwiastków — z intensywniejszym nawożeniem (wpływ awifauny).