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1.PS-14

Microbial communities in different Antarctic mineral deposits characterised by denaturing gradient gel electrophoresis (DGGE)

Introduction

Livingston Island, located at the tip of the Antarctic Peninsula (Fig. 1), is characterised by an oceanic polar climate with temperatures above 0°C for 4 months per year and a mean annual precipitation between 400 and 500 mm. Under these conditions a soil formation can be observed and lichens, mosses and some higher plants are able to grow in this environment. Since cultivation-independent methods have become an important tool to investigate environmental microbes, it is possible to analyze complex microbial networks in the face of diversity, abundance, ecology and their reaction on climate change. Here, we investigated the bacterial community structure of different soil and sediment habitats located on Livingston Island by polymerase chain reaction (PCR) using a specific primer set followed by denaturing gradient gel electrophoresis (DGGE) to get a first insight in the diversity of bacteria existing under these conditions. The aim of these studies is to identify the main microbial players in nutrient turnover and to get an idea of the functioning of microbes within periglacial ecosystems.

Investigation Area

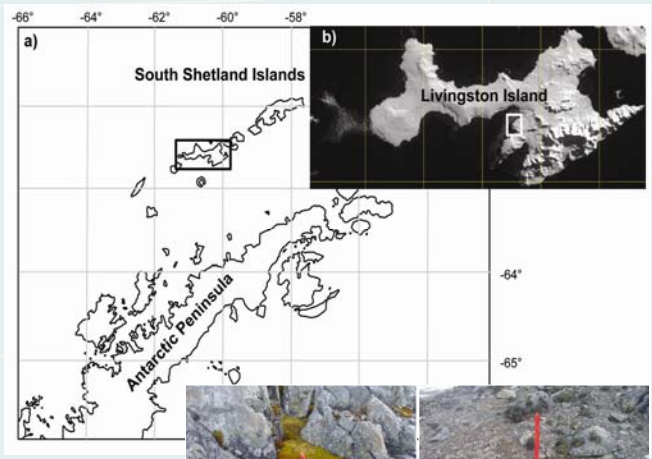
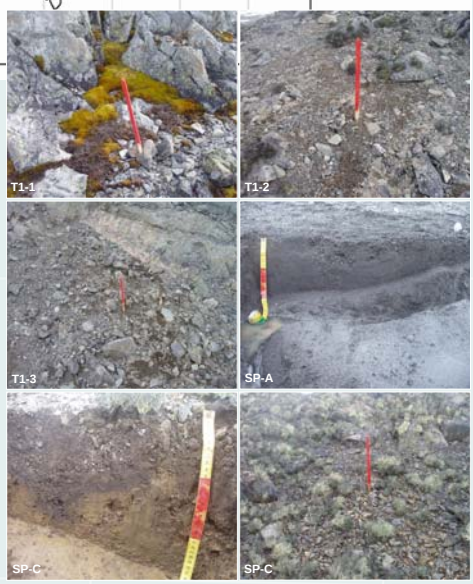


Fig. 1 Investigation area with sampling sites



Results

One transect and four separate profiles were sampled within walking distance of the Bulgarian station *St. Kliment Ohridski* (62°38`S/60°21`W) on Livingston Island (Fig. 1). Two soil profiles were characterised by permafrost. The investigated mineral soils showed mostly gravely sand texture (Table 1). Moisture content of the soils ranged from 2.6% up to 15.6% and was partly quite variable within the different profiles. The values of total carbon and nitrogen were extremely low with < 0.10 to 0.46% and < 0.10%, respectively, except for the upper layers of the profiles T1-1 and T1-4 that were covered by mosses. DGGE patterns from amplification of DNA showed large varieties in the vertical profiles and between the different sites (Fig. 2).

Table 1 Geochemical and geophysical parameters of the investigated mineral deposits

Site location	Depth (cm)	Moisture (%)	Sand* (%)	Silt* (%)	Clay* (%)	Total C (%)	Total N (%)
T 1-1	0-4	7.1	n.d.	n.d.	n.d.	26.50	0.84
	4-7	4.7	80.4	14.0	5.6	2.22	0.20
	7-14	5.5	58.3	37.2	4.6	0.46	< 0.10
T 1-2	0-5	3.3	62.7	17.5	19.9	0.11	< 0.10
	5-12	4.1	64.4	23.5	12.1	< 0.10	< 0.10
	12-24	3.9	70.4	16.0	13.5	< 0.10	< 0.10
T 1-3	0-9	3.6	72.3	21.6	6.1	0.13	< 0.10
	9-16	6.5	51.6	35.9	12.5	0.11	< 0.10
	16-23	3.6	83.1	12.3	4.6	< 0.10	< 0.10
	23-30	8.3	51.1	35.1	13.8	< 0.10	< 0.10
T 1-4	0-5	10.0	n.d.	n.d.	n.d.	9,34	0,32
	5-8	9.2	69.2	21.6	9.2	2,31	0,19
	8-13	5.4	78.6	16.2	5.2	0,28	< 0,10
	13-18	5.9	81.6	15.1	3.3	0,14	< 0,10
T 1-5	0-10	3.3	85.2	14.0	0.8	< 0.10	< 0.10
	10-20	3.8	87.9	10.2	2.0	< 0.10	< 0.10
	20-30	4.5	83.2	15.2	1.6	< 0.10	< 0.10
	30-40	5.0	79.5	20.1	0.4	< 0.10	< 0.10
	40-50	3.1	54.6	45.3	0.1	0.23	< 0.10
SP-A	0-5	6.6	81.0	14.5	4.5	< 0.10	< 0.10
	5-10	7.0	83.0	13.4	3.5	< 0.10	< 0.10
	10-15	7.4	90.5	7.7	1.7	< 0.10	< 0.10
	15-20	9.9	94.5	5.1	0.5	< 0.10	< 0.10
	20-25	15.6	92.2	6.5	1.3	< 0.10	< 0.10
SP-B	0-5	2.6	90.3	7.7	2.0	0.15	< 0.10
	5-10	9.9	56.3	40.7	3.0	0.19	< 0.10
	10-15	7.8	48.6	48.9	2.5	0.11	< 0.10
	15-20	10.3	37.5	58.8	3.7	< 0.10	< 0.10
	20-25	6.4	43.3	53.5	3.2	0.10	< 0.10
	25-30	11.1	47.6	48.2	4.1	0.14	< 0.10
	30-35	10.3	35.5	57.7	6.7	< 0.10	< 0.10
SP-C	0-10	2.7	85.8	11.2	3.0	0.21	< 0.10
	10-20	5.6	48.3	43.8	7.9	0.38	< 0.10
	20-30	5.3	12.6	78.2	9.2	0.17	< 0.10
SP-D	0-5	4.5	76.8	19.3	3.9	n.d.	n.d.
	5-10	5.1	73.0	20.9	6.0	n.d.	n.d.
	10-15	6.2	49.6	45.8	4.6	n.d.	n.d.
	15-20	5.4	48.3	40.4	11.3	n.d.	n.d.

* part of the grain size fraction < 2mm, n.d. - not determined

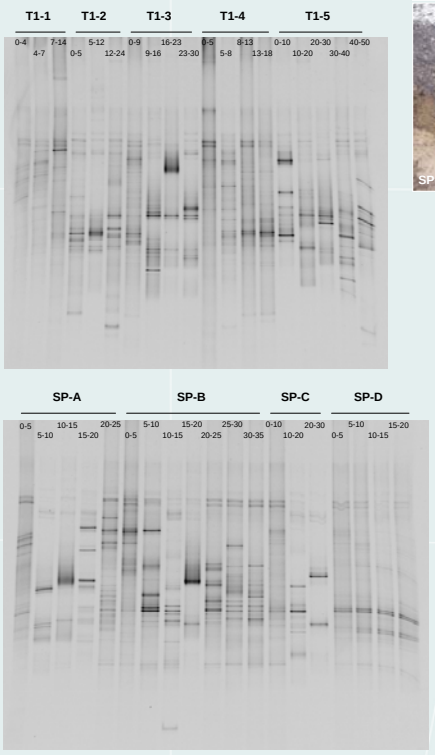


Fig. 2 DGGE profiles of 16S rRNA gene amplicons from different mineral soil profiles from Livingston Island. T1-1 to T1-5 represent five profiles of the investigated transect, whereas SP-A, SP-B, SP-C and SP-D stand for a single profile. Numbers in the DGGE pictures indicate the sample depth.

Conclusions

DGGE pictures show a high diversity in most of the samples. The main influence on heterotrophic microbial growth and activity in low-nutrient habitats, like in this study, is probably the availability of organic compounds. Water can also be a limiting factor, but microorganism must be well adapted to these conditions as could be seen on the DGGE pattern. It is conceivable that the ways of C and N cycling in cold antarctic habitats are very short, so that no or only slow accumulation of organic matter is possible. Further ecological and biomolecular analyses are in progress.

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