

Diagnostic features of *Leptolyngbya* species:

- *Leptolyngbya* sp. 1 straight filaments, width 2.5-3.3 µm; sheaths clearly visible, colourless; in trichomes cells ± isodiametric.
- *Leptolyngbya* sp. 2 filaments width 0.8-1.0 µm; sheaths barely visible, thin, colourless, tightly adhering to the trichome; in trichomes cells ± isodiametric, rarely longer than wide.
- *Leptolyngbya* sp. 3 filaments wavy, width 1.1-1.7 µm; sheaths thick, pale blue-green to bright brown; clearly visible; in trichomes cells ± isodiametric, clearly constructed cross-walls, mostly with granules at cross-walls.

Supplementary Table 1. Sampling information and glacier features.

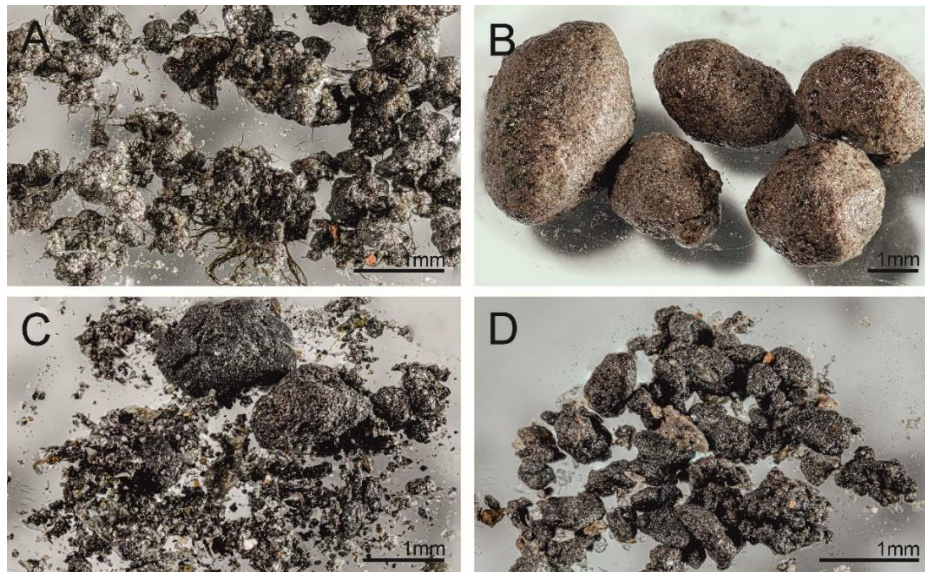
Glacier	Location	Collection date	Sampling altitude	Glacier thermal regime
GrIS	67°9'N 50°0'E	09.2015	~ 900 m a.s.l	polythermal
Longyearbreen	78°10'N 15°31'E	07.2019 ^a 08.2020 ^b	~ 350 m a.s.l	cold
Steindalsbreen	69°23'N 19°51'E	08.2019	~ 600 m a.s.l	NA
Forni	46°23'N 10°35'E	07.2019	~ 2500 m a.s.l	temperate

a – material used for light experiment; b – material used for long-term mechanical disturbance experiment; NA – no literature data available.

Supplementary Table 2. The cell count data of Algae

	G1	G2	G3	G4	G5	G6	G7	average
<i>Cylindrocystis</i> sp.	95	100	55	60	100	60	60	75,71
<i>Porpyrosiphon natarisii</i>	595	640	435	990	660	355	850	646,43
<i>Leptolyngbya</i> sp. 1	15	10	5	10	15	5	60	17,14
	F1	F2	F3	F4	F5	F6	F7	average
<i>Wilmottia murrayi</i>	180	290	180	255	150	25	125	172,14
<i>Leptolyngbya</i> sp. 2	1,25	11,5	14,5	0	0	0	0	3,89
<i>Klebsormidium</i> sp.	235	340	120	85	115	30	65	141,43
	FK1	FK2	FK3	FK4	FK5	FK6	FK7	average
<i>Wilmottia murrayi</i>	305	240	195	150	160	275	190	216,43
<i>Leptolyngbya</i> sp. 2	35	20	20	20	20	15	30	22,86
<i>Klebsormidium</i> sp.	275	220	100	85	185	155	215	176,43
	L1	L2	L3	L4	L5	L6	L7	average
<i>Wilmottia murrayi</i>	25	25	25	45	30	85	10	35,00
<i>Leptolyngbya</i> sp. 2	95	65	155	60	50	80	50	79,29
<i>Klebsormidium</i> sp.	15	15	15	35	10	5	35	18,57
	S1	S2	S3	S4	S5	S6	S7	average
<i>Porpyrosiphon natarisii</i>	125	125	125	225	150	425	50	175,00
<i>Leptolyngbya</i> sp.1	475	325	775	300	250	400	250	396,43
<i>Leptolyngbya</i> sp. 3	75	75	75	175	50	25	175	92,86

Supplementary Figure 1. Cryoconite sediment under camera with macro lens. A – GrIS, B – Longyearbreen, C – Steindalsbreen, D – Forni.



Supplementary Figure 2. Biomass of dominants cyanobacteria and algae separately for each sampled glacier.

