

Table S1 Core descriptions and sample positions**Table S1.1 Study sub-area A****Description and samples of core Bbg 2 at the CALM site (height above sea level: 75 m, 78, 09504 °N, 14.24096 °E)**

Depth (m)	Sediment description
0 – 1.3	Sand and gravel layer with rare inclusions of pebbles, in the upper part, a layer of soil loam, thawing during drilling
1.3 – 2.3	Gray loam, reticulated fine streaky cryostructure (sample bg-2/1 1.7)
2.3 – 3.15	Gray clay, reticulated cryostructure, ice lenses 1-2 mm thick, individual ice streaks up to 2 cm thick, no inclusions, the lower part is ice-rich (sample Bbg-2/2 2.3-2.45, Bbg-2/3 2.8)
3.15 – 3.95	Gray loam with inclusions of gravel and pebbles, cryostructure micro lens-like reticulated (samples Bbg-2/4 3.2, Bbg-2/5 3.5, Bbg-2/6 3.6)
3.95 – 4.8	Thin dark sand, inclusion of stones, cryostructure netlike fine lens-like to, with the depth ice streaks become less, from 4.5 m - interbedding of loam, sand, and gravel with massive cryostructure (samples Bbg-2/7 4.0, Bbg-2/8 4.5)
4.8 – 5.25	Dark gray dry (impact of drilling?) loam with inclusions of pebbles, from 5.1 m - interbedded gray dry loam with fine sand, gravel, and inclusions of pebbles (sample Bbg-2/9 5.1)
5.25 – 5.6	Dry (impact of drilling?) gray-brown clay in the lower part with stones, dark-gray smears are visible on the cut (samples Bbg-2/10 5.3, Bbg-2/11 5.5)
5.6 – 7.05	Dry (impact drilling?) dark sand interbedded with loam, stones increase with depth (samples Bbg-2/12 5.8, Bbg-2/13 7.0)
7.05 – 7.5	Rocky ground

Description and samples of core Bbg 3 (height above sea level: 60 m, 78.09695 °N, 14.23810 °E)

Depth (m)	Sediment description
0 – 1.8	Sandy loam with sparse pebbles and gravel (sample Bbg-3-0.75)
1.8 – 2.4	Frozen loam, a large amounts of pebbles, massive cryostructure (samples Bbg-3 1.9, Bbg-3 2.0, Bbg-3 2.2)
2.4-2.5	Ice-rich ground (sample Bbg-3 2.5)
2.5-3.0	sandy loam with large amounts of pebbles, massive cryostructure (samples Bbg-3 2.7, Bbg-3 3.0)
3.0 – 3.8	sandy loam with large amounts of pebbles, streaky cryostructure (samples Bbg-3 3.3, Bbg-3 3.4, Bbg-3 3.8)
3.78 – 4.0	Rocky ground

Description and samples of core Bbg 4 (height above sea level: 87 m, 78.09493 °N, 14.21062 °E)

Depth (m)	Sediment description
0 – 1.5	Gray loam with a small amount of pebbles and gravel inclusions (samples Bbg-4 0.5, Bbg-4 0.75, Bbg-4 1.0, Bbg-4 1.25)
1.5 – 2.4	gray loam with gravel inclusions, frozen, layered cryostructure, streak thickness up to 1 cm (samples Bbg-4 1.5, Bbg-4 1.8)

Description and samples of core Bbg 5 (height above sea level: 43 m, 78.098560 °N, 14.232990 °E)

Depth (m)	Sediment description
0 – 1.7	Gray loam with interlayers of gravelly-lumpy soil with loamy filler (samples Bbg-5 0.5, Bbg-5 0.75, Bbg-5 1.0, Bbg-5 1.25, Bbg-5 1.5)
1.7 – 3.25	Gray loam, rare pebbles, interlayers of fine sand and pebbles, streaky cryostructure (samples Bbg-5 1.75, Bbg-5 2.0, Bbg-5 2.5, Bbg-5 3.25)
3.25 – 3.9	Fine sand with gravel, massive cryostructure (samples Bbg-5 3.35, Bbg-5 3.4)
From 3.9	Rocky ground

Description and samples of core Bbg 6 (height above sea level: 9 m, 78.10282 °N, 14.23794 °E)

Depth (m)	Sediment description
0 – 1.1	Sandy-gravel soil, large amount of pebbles (samples Bbg-6 0.5, Bbg-6 1.0)
1.1 – 1.7	Dark coarse sand, large amount of pebbles and gravel with silty filler (samples Bbg-6 1.3, Bbg-6 1.5)
1.7 – 2.25	Frozen gravel-pebble soil with dark silty filler, massive cryostructure (sample Bbg-6 2.05)
From 2.25	Rocky ground

Table S1.2 Study sub-area B**Description and samples of core Bbg 7 at Cape Finneset (height above sea level: 8 m, 78.04703 °N, 14.21962 °E)**

Depth (m)	Sediment and ice description
0 – 1.8	Gray sand with interlayers of gravel and pebbles, during drilling thawed (samples Bbg-7/1 0.5 m, Bbg-7/2 1.0 m, Bbg-7/3 1.5 m)
1.8 – 8.5	Dark gray sand and gravel soil (sometimes with silty aggregates), inclusions of large pebbles, in some interlayers cross-bedding, separate interlayers of clean sand, cryostructure massive (samples 7/2,5 M 2.5 m, Bbg 7/4,1-4,2 4.15 M, Bbg 7/7,8-7,9 M 7.85 m, Bbg 7/8,4 M 8.4 m)
8.5 – 10.6	Interlayered and gravel and crushed debris with dark sandy loam with plant residues and organic smell, cryostructure massive, in the lower part with ice nests and inclusions of sea shells up to 3 cm long (samples Bbg-7/5 8.9 m, Bbg 7/9,7 M 9.7 m, Bbg 7/10,2 M 10.2 m)
10.6 – 11.7	Black clay, gray and yellowish interbedded loam and sandy loam, cryostructure ice lenses up to 0.4 cm thick, sub-horizontal orientation, individual ice nests up to 10 cm thick (samples Bbg7/10,8 M 10.8 m, Bbg-7/7 11.6 m)
11.7 – 12.0	Ice
12.0- 12.6	Loam with a lot of wood and pebbles (sample Bbg 7/6 11.6 m)
12.6	Rocky ground

Table S1.3 Study sub-area C 1

Description and samples of core Bbg 1 drilled directly at the mouth of the Grøn River (height above sea level: 2 m, 78.02289 °N, 14.29845 °E)

Depth (m)	Sediment and ice description
0-1,0	Active layer, pebbly sand, unfrozen
1.0-2.0	Pebbly sand. cryostructure layered
> 2 m	bedrock

Description of the exposure GD 1 (height above sea level: 16 m, 78.02181 °N, 14,39566 °E)

Depth (m)	Sediment and ice description
0.0-0.07	Modern soil-vegetation, peated litter
0.07-0.35	Brown silt and sand with inclusions of gravel, gleyish, plant roots
0.35-1.55	Bluish-gray silt and fine sand (interbedded), inclusion of plant material, and peaty interbeds
1.55-3.15	Sub-horizontal layered pebbly gravel, lenses of silt with gravels and pebbles.
3.15-3.70	Bluish-gray, diagonally layered, sandy silt with inclusions of plant remains and gravel. cryostructure ice steaks.

Description and samples of core Bbg 8 in the lower Grøndalen Valley (height above sea level: 21.5 m, 78.02056 °N, 14.40907 °E)

Depth (m)	Sediment and ice description
0-0.3	Medium gray-brown loam without frozen inclusions. cryostructure horizontally layered lenses (0.5 to 2 mm, distance 1-3 mm). Single ice lenses up to 2 cm thick (sample Bbg-8/1 0.1-0.3)
0.3-0.7	Gravel-pebble with up to 50% coarse sand and light gray-brown sandy loam. Pebbles up to 3 cm in diameter, dark-colored, of moderately rounded, mostly flattened, horizontal layered. cryostructure massive or less frequent porphyritic, sometimes dry (samples Bbg-8/2 0.3-0.45; Bbg-8/3 0.5-0.6; Bbg-8/4 0.6-0.65; Bbg-8/5 0.65-0.7).
0.7-1.5	Gravel with up to 30% of gray-brown loam, frozen. cryostructure massive, single ice lenses (0.5x2 cm). Single pebbles up to 3 cm in diameter (sample Bbg-8/6 0.7-1.0; Bbg-8/7 1.1-1.3).
1.5 – 1.8	Gray-brown loam with two layers of dark gray aleurit (2 cm), low-salty taste. cryostructure massive, single ice lenses, sparse thin horizontal lenses (0.1-0.2 mm, dist. 1-1.5 cm) (sample Bbg-8/8 1.5-1.7, Bbg-8/9 1.7-2.0).
1.8 – 2.3	Similar sediment. cryostructure netlike-layered, lenses 0.5-2 mm, dist. 1 cm. (sample Bbg-8/10 1.7-2, Bbg-8/11 2-2.0).
2.3 – 2.45	Brown loam interlayer, significant admixture of fine sand. cryostructure massive (sample Bbg-8/13 2.15-2.45).
2.45 – 2.55	Interlayers of gray-brown loam with gravel and small dark-colored pebbles up to 30%. cryostructure massive with ice lenses (sample Bbg-8/14 2.45 - 2.55).
2.55 – 2.65	Gray-brown loam without inclusions, at the bottom a 0.5-1 cm thin interbed of medium-brown peat. cryostructure massive. (sample Bbg-8/15 2.55 - 2.65).
2.65 – 3.85	The intercalation of medium gray-brown loam, dark gray aleurit and sparse thin (1 cm) interlayers of brown moderately decomposed peat. cryostructure massive, with individual ice lenses up to 2 cm in diameter (sample Bbg-8/16 2.65 - 3.25; Bbg-8/17 3.65 - 3.85).
3.85 – 4.25	Dark gray aleurit. Low-salty taste. cryostructure laminated netlike, lenses 1-1.5 mm, dist. 1.5-2.5 cm (sample Bbg-8/18 3.85-4.25).
4.25 – 4.5	Similar sediment. Ice-ground. cryostructure layered netlike with large lenses (sample Bbg-8/19 4.4-4.5).
4.5-4.55	Dark gray ice (sample Bbg 8 4.5-4.55).
4.55-4.7	Ice ground, dark gray aleurit, on contact with ice a gravel layer with small dark-colored pebbles (sample Bbg 8 4.55-4.7).
4.7-4.9	Dark gray aleurit, cryostructure ice lenses 0.5-1.5 cm wide.
4.9-4.95	Black organic interlayer (sample Bbg 8 4.9-4.95).
4.95-5.05	Ice (sample Bbg 8 4.95-5.05).
5.05-5.15	Gray-brown clay. cryostructure ice lenses (sample Bbg-8/20 5.05-5.15).
5.15-8.0	Dark gray clay with black interlayers up to 1 cm thick, salty in taste. Separate interlayers of gray-brown clay (10-15 cm). cryostructure laminated lenses, n 1-2mm, 1.5-2 cm apart, some large ice bands and rare thick ice lenses up to 2 cm wide. 5.7-5.8 – ice

	<p>6.2-6.5 - lenses up to 1 cm thick, 1.5-2.5 cm distance</p> <p>6.5-6.8 - ice-ground, large ice bands up to 3 cm thick, up to 70% of the volume.</p> <p>6.8-7.05 - lenses up to 1 cm, 2 cm distance.</p> <p>7.0-7.01 - dark-colored gravel with horizontal bedded debris.</p> <p>7.05-8.0 - lenses up to 1 cm thick, 2 cm distance, without gravel interlayers,</p> <p>7.9-7.91 - black organic interlayer</p> <p>(samples Bbg 8 5.15-5.4; Bbg-8/21 5.4-5.7; Bbg 8 5.7-5.8 ice; Bbg 8 5.7-6.2; Bbg-8/22 6.2-6.5; Bbg 8 6.8-7.05; Bbg 8 7.05-7.50; Bbg-8/23 7.5-8.0).</p>
8.0-10.7	<p>Dark gray clay with sparse 0.5-1 mm thick black interlayers (organic?), salty in taste. cryostructure coarse lens-like laminated</p> <p>8.0-8.15 - ice content up to 50%, lenses 1-2cm, 1 cm distance</p> <p>8.15-8.4 - lenses 0.2-0.8 cm, 1.5-2 cm distance, diagonal 30°</p> <p>8.4-8.8 - lenses 1-2cm, 1 cm distance</p> <p>8.8-9.1 - large lenses 1-2 cm, 10 cm distance Between them diagonal net 30°</p> <p>9.1-9.8 - clay with internal black layers of up to 0.5 cm diagonal bedded 30°</p> <p>9.8-10.0 - Layered-net-like texture, diagonal large lenses to 45%, 2-3 mm, 1.5-2 cm distance. A thin 0.5 mm black uneven interlayer with a bend lines.</p> <p>10.0-10.45 – netlike CS, lenses 1-2 mm, distance 0.5-3 cm. Separate ice nests up to 2 cm wide, diagonal 30°. Rare thin black lenses and interlayers up to 1 mm, single dark-colored flattened gravel grains.</p> <p>10.45-10.7 netlike CS, large lenses 1-1.5 cm, 1-2 cm distance, ice content up to 50%. Rare black clay interlayers up to 1 cm thick. They lie with a bend at the cut. Single thin black lenses up to 0.5 mm (samples Bbg-8/24 8.15-8.4; Bbg 8 8.4-8.8; Bbg 8 8.8-8.9, Bbg-8/25 8.8-9.1; Bbg-8/26 9.1-9.8; Bbg-8/27 9.8-10.0; Bbg-8/28 10.0-10.2; Bbg-8/29 10.2-10.45; Bbg-8/30 10.45-10.7).</p>
10.7-12.2	<p>Dark gray clay, salty taste, ice rich cryostructure lens-like nets.</p> <p>10.7-12.12 - ice content 40-50%, lenses 0.2 to 1.5 cm, distance 0.5 to 1 cm.</p> <p>11.0-11.25 - ice ground, ice content 60-70%</p> <p>11.25-11.70 - ice content 40-50%, lenses 0.2 to 1.5 cm, distance 0.5 to 1 cm.</p> <p>11.7-12.0 – ice ground, ice content 50-60%.</p> <p>12.0-12.2 - laminated-netlike CS, lenses 0.3-1 cm, distance 0.5-1.2 cm.</p> <p>(samples Bbg-8/31 10.7-11.0; Bbg 8 10.7-11.25 ice; Bbg-8/32 11.2-11.7; Bbg 8 11.7-12.0; Bbg-8/33 12.0-12.2).</p>
12.2-12.6	Dark gray aleurit with thin 0.5–2 mm black interlayers every 0.4–1.5 cm taste salty. Diagonal bedded, inclination of 30-40°. cryostructure lens-like laminated, lenses 0.4-2 mm, 0.1-1 cm distance. At the contact with underlying ice for 10 cm no lenses. (sample Bbg-8/34 12.2-12.6)
12.6-13.1	Ice, (samples Bbg 8 12.6-12.85, 12.85-13.0).
13.1-13.4	Ice ground, ice content up to 80%.
13.4-13.6	Ice.
13.6-13.7	Ice ground, ice content up to 80%.
13.7-13.8	Dark gray aleurit, not salty in taste, cryostructure layered netlike, lenses 0.5-1.5 cm, 1-2 cm distance, ice content up to 40-50%.
13.8-14.0	Ice, (sample Bbg 8 13.8-14.0).
14.0-14.3	Dark gray aleurit, single interlayers of black clay up to 1 cm, interlayers are vertical or diagonal bedded at 20°, single thin up to 1 mm reddish lenses of fine silty sand, not salty. cryostructure laminated netlike, lenses 1-2 cm, distance 2-3 cm. (sample Bbg 8 14.0-14.3).
14.3-14.55	Ice ground, ice content up to 90%.
14.55-14.7	Ice (sample Bbg 8 14.55-14.7).
14.7-15.15	Ice ground, ice content up to 90%.
15.15-17.0	<p>Clay is dark gray, salty</p> <p>15.15-15.35 – cryostructure netlike, lenses 0.2-1.5 cm, distance 1-3 cm</p> <p>15.35-15.65 – cryostructure laminated-netlike, lenses 1-2 cm, distance 3-6 cm</p> <p>15.65-16.1 - dark gray aleurit interlayer with a of 1-1.5 cm thickness of, cryostructure massive, thin layer of black gravel 0.2 cm thick, possibly trapped from the walls of the well,</p> <p>16.1-16.45 – cryostructure layered, lenses 0.7-1.2 cm, 1-7 cm distance</p> <p>16.45-16.7 - cryostructure layered, lenses 0.7–1.2 cm, distance 9–11 cm. Between lenses in clay porphyritic CS, separate lenses of dark gray to black clay up to 10 cm, bent vertically at the contact</p>

	<p>16.7-17.0 - cryostructure layered, lenses 0.7-1 cm, 9-10 cm distance, separate lenses up to 2 mm thick and up to 3 cm long, bent vertically (sample Bbg 8 15.15-15.35; Bbg-8/35 15.35-15.65; Bbg-8/36 15.65-16.1; Bbg-8/37 16.1-16.45, Bbg-8/38 16.7-17.0).</p>
17.0-21.35	<p>Dark gray clay with some thin black 1-2 mm thick crushed lenses and interlayers, salty 17.0-17.7 – cryostructure layered-netlike, horizontal intercalations of ice bands up to 1 cm are distinguished, up to 10 cm distance, between interbeds are porphyritic CS on homogeneous clay. 17.7-18.1 - black clay interlayers of 2-5 mm thickness 18.1-18.7 - porphyritic CS disappears 18.7-19.7 – cryostructure netlike, lenses 2-4 mm, 2-4 cm distance 19.7-20.35 - cryostructure netlike, lenses 1-2 cm, distance 2-4 cm. (samples Bbg-8/39 17.0–17.35; Bbg-8/40 17.35 – 17.7; Bbg-8/41 17.7–18.1; Bbg-8/42 18.1–18.35; Bbg-8/43 18.35–18.7; Bbg-8/44 18.7–19.1; Bbg-8/45 19.1-19.4; Bbg-8/46 19.4-19.7; Bbg-8/47 19.7-20.1; Bbg-8/48 20.1-20.35).</p>

Description and samples of core Bbg 18 in the lower Grøndalen Valley (height above sea level: 1 m, 78.02107 °N, 14.30550 °E)

Depth (m)	Sediment and ice description
0.00-0.05	Gravel in sandy aggregate (up to 20%), cryostructure porous.
0.05-0.15	Gravel fine-grained sand, cryostructure porous (sample Bbg 18 0-0.15).
0.15-0.60	Gravel in sand fill (up to 30%), cryostructure porous cryostructure, contact, massive.
0.6-1.7	Gravel subhorizontal oriented, cryostructure contact, porous (sample Bbg 18 0.6-0.8).
1.7-4.0	Silt (aleurite), black freshwater with rare coarse pebbles, gravel, sand cryostructure massive, nested, and layered micro streaks Smell of hydrogen sulfide. At a depth of 2.3 m, shell fragments (<i>Mytilus edulis</i>). 2.7 to 3.4 m, the silt is low-water. From 3.4 m, a lot of shells and shell fragments. (samples Bbg 18 1.8-1.9, 2.2-2.4, 3.0-3.2, 3.5-3.6, 3.8-3.9, 4.1-4.3, 4.9-5.0).
4.0-5.0	Aleurite is a gray, melted, tightly packed plastic with rare pebbles, gravel, and sand. Brackish water appeared in the borehole.

Description and samples of core Bbg 19 in the lower Grøndalen Valley (height above sea level: 9 m, 78.01773 °N, 14.40249 °E)

The surface is covered with 30 cm of dense snow.

Depth (m)	Sediment and ice description
0.0-1.0	Pebble-gravel layer with loamy aggregate (up to 15%), cryostructure contact, porous.
0.6-1.7	Subhorizontally oriented gravel, cryostructure contact, porous.
1.0-2.3	Gravel. cryostructure contact, porous.
2.3-2.7	Interbedded gravel, sand, and sandy loam (interlayers 1-4 cm thick) with inclusions of peated organic matter, cryostructure Porous, massive, layered, nested.
2.7-3.9	Gravel. cryostructure contact, porous.
3.9-5.5	Fine-grained gray sand with inclusions of plant remains and rare horizontal interlayers of gravel and sandy loam, cryostructure massive, water appeared highly saline at 4.0.
5.5-6.0	Melted gray plastic silt.

Table S1.4 Study sub-area C 2

Description and samples of cores Bbg 13 on top of the pingo Nori (height above sea level: 42.5 m, 77.99483 °N, 14.59009 °E).

Depth (m)	Sediment description
0-0.5	Gravel bed with sparse pebbles (sub-horizontal orientation) and inclusions of plant roots and peaty part. CS. porous, isolated ice nests up to 1 cm in diameter. (samples Bbg 13/1 0-0.2, Bbg 13/2 0.2-0.3, Bbg 13/3 0.3-0.5).
0.5-0.8	Gravel layer with sparse pebbles up to 2 cm in diameter, with up to 40% aggregates of light brown-gray loam, cryostructure massive /sample Bbg 13/4 0.7-0.8).
0.8-1.2	Gravel bed with sparse pebbles and up to 40% aggregate of gray-brown fine and medium poorly sorted sand and light sandy loam, cryostructure massive and porous (sample Bbg 13/5 0.8-1.0).
1.2-1.3	Layer of gravel and rare pebbles, cryostructure contact (sample Bbg 13 1.2-1.3).
1.3-2.3	Gravel bed with sparse pebbles and sandy loam aggregates up to 15%. cryostructure porous (samples Bbg 13/6 1.6-1.7, Bbg 13 1.7-1.8).
2.3-3.0	Gravel bed with sparse pebbles and sandy loam aggregate up to 10% cryostructure porous, nests up to 2 cm in diameter, ice content up to 50% (samples Bbg 13 2.6-2.7).
3.0-3.4	Gray sandy loam, freshwater, separate interlayers of gravel up to 0.5 mm thick, ice-rich to 50 wt%, cryostructure streaks from 1 mm to 1 cm thickness. (Bbg 13/7 3.3-3.4).
3.4-4.4	Gravel layer with sparse pebbles (chaotic, oblique, and subhorizontal orientation) with up to 30% of aggregate of gray loam. cryostructure porous (samples Bbg 13/8 3.5-3.6, Bbg 13/9 3.6-3.7).
4.4-17.0	Ice 4.4-5.5 m: transparent with inclusion of bubbles and rare inclusions of clay material 5.5-5.8 m: inclusions of black freshwater silty organic matter 5.8-8.5 m: sparse organic material inclusions 8.5-14.5 m: no inclusions of organic material, large number of subvertically oriented elongated bubbles 14.5-17.0 m: clear transparent ice almost without bubbles (samples: Bb 13 4.5-4.6, 4.9-5.0, 5.5-5.6, 6.0-6.1, 6.4-6.5, 7.0-7.1, 7.5-7.6, 8.0-8.1, 8.5-8.6, 9.0-9.1, 9.5-9.6, 10.0-10.1, 10.4-10.5, 10.9-11.0, 11.4-11.5, 11.9-12.0, 12.5-12.6, 13.0-13.1, 13.5-13.7, 14.0-14.2, 14.5-14.6, 15.0-15.1, 15.5-15.6, 16.0-16.2, 16.5-16.7, 16.8-17.0).
17.0-18.0	Gravel with sparse dark gray pebbles and up to 15-20% aggregate of coarse sand and dark gray loam, tasting sodic. The orientation is subvertical. cryostructure, individual nests, and interlayers of ice. (samples Bbg 13/10 17.0-17.2, Bbg 13/11 17.4-17.5, Bbg 13 17.8-17.9).
18.0-20.5	Ice: Transparent without bubbles in some places, dirty with inclusions of clay material, slightly salty. Ice was melted by drilling. The water level was set at 19 m depth, and the water was not frozen (Samples Bbg 13 18.0-18.1, Bbg 13 18.9-19.0, Bbg 13 19.7-19.8).
20.5-21.8	Gravel-pebble layer with up to 30% light brown loam aggregate, pebbles are ferruginized. cryostructure porous (samples: Bbg 13/12 21.0-21.2, Bbg 13/13 21.5-21.6, Bbg 13/14 21.6-21.8, Bbg 13/15 21.7-21.8).

Description and samples of cores Bbg 16, 75 m south at the edge of pingo Nori (height above sea level: 35 m, 77.99416 °N, 14.58904 °E).

Depth (m)	Sediment and ice description
0.0-0.05	Green moss cover on weakly decomposed peat pad and brownish-gray loam with lots of roots.
0.05-1.4	Silty loam, brownish-gray. From 0.9 m, rare dark-colored gravel. cryostructure micro-lenslike, individual ice nests up to 1 cm thickness. From 0.5 m, low-moisture, sparse thin lenses (samples Bbg 16 0.05-0.1, Bbg 16 0.3-0.5, Bbg 16 0.7-0.8, Bbg 16 1.2-1.3).

1.4-1.7	Gravel with loamy filling up to 15%. cryostructure pore ice and contact cryostructure (samples Bbg 16 1.5-1.6, Bbg 16 1.6-1.7).
1.7-2.6	Gravel with sparse fine and medium pebbles and with loamy filling up to 15%, cryostructure pore ice and contact cryostructure (samples Bbg 16 1.8-2.1, Bbg 16 2.0-2.1, Bbg 2.3-2.4, Bbg 16 2.5-2.7).
2.6-3.2	Gravel and silt with up to 30% grey silty material. cryostructure icy ground (sample Bbg 16 2.7-2.9).
3.2-3.5	Gray aleurit. cryostructure Layered and layered-lenslike, fine lenslike (sample Bbg 16 3.1-3.3, Bbg 16 3.4-3.6).
3.5-4.0	Gravel with single small pebbles and silty filling up to 15%. cryostructure Contact, pore ice (samples Bbg 16 3.6-3.7, Bbg 16 3.7-3.8).
4.0-4.3	Gray aleurit, separate interlayers of gravel and small pebbles. cryostructure ice-ground (sample Bbg 16 4.1-4.3).
4.3-4.6	Medium-sized pebbles and gravel in a loamy filling up to 30%. cryostructure low ice content (samples: Bbg 16 4.3-4.4, Bbg 16 4.4-4.7).
4.6-5.0	Gray aleurit. cryostructure Layered and layered-lenslike, fine lenslike (samples: Bbg 16 4.7-5.8, Bbg 16 4.8-5.0).
5.0-7.0	Medium-sized pebbles and gravel in a loamy filling up to 15%, with rare plant remains. cryostructure pore ice and contact cryostructure (samples: Bbg 16 5.4-5.6, Bbg 16 5.8-6.0, Bbg 16 6.3-6.5, Bbg 16 6.5-6.7, Bbg 16 6.8-7.0).

Description and samples of cores Bbg 9 on top of the pingo Fili in the middle Grøndalen Valley (height above sea level: 49.3 m, 77.99355° N, 14.66211° E).

Depth (m)	Sediment description
0-1.15	Brownish gray loam, not salty. 0-0.15 – uniformly with inclusions of gravel and small pebbles up to 15%. cryostructure micro lens-like, 0.1-1 mm, 0.2-0.5 cm distance 0.15-0.25 – uniformly with inclusions of gravel and rare small pebbles up to 15%. cryostructure layered-lenticular, 0.5-3 mm, 0.4-0.7 cm distance. 0.25-0.4 - single gravel. cryostructure micro lens-like, 0.1-0.7 mm, 0.4-1.0 cm distance 0.4-0.75 - without gravel. cryostructure micro lens-like, 0.1-0.7 mm, 0.4-1.0 cm distance 0.75-0.95 - single gravel. cryostructure micro lens-like, 0.1-0.6 mm, 1-3 cm distance 0.95-1.15 - uniformly with inclusions of gravel and small pebbles up to 20%. cryostructure ice-poor, no lenses (samples Bbg 9 0-0.15; 0,15-0.25; 0.25-0.4; 0.4-0.6; 0.95-1.15).
1.15-12.0	Ice 1.15-1.4 -dirty muddy ice. 1.4-1.9 - ice clear transparent. 1.9-2.05 - ice with individual spots of soil. 2.05-2.20 - ice mixed with soil over cracks. 2.20-2.45 - clear ice with soil inclusions up to 20V%. 2.45-6.0 - clear ice, transparent. 6.0-6.25 - transparent ice with small patches of soil up to 0.5% by volume. 6.25-7.6 - clear ice. 7.6-9.6 - clear ice, transparent bubbly. 9.6-11.0 - ice clear, transparent. (samples Bbg 9 1.15-1.25; 1.4-1.5; 2.0-2.05; 2.45-2.60; 3.0-3.10; 3, 5-3.65; 4.0-4.05; 4.5-4.7; 5.0-5.05; 5.5-5.6; 6, 0-6.1; 6.5-6.6; 7.0-7.1; 7.5-7.6; 8.0-8.1; 8.5-8.6; 9.0-9.05; 9.5-9.6; 10.1-10.2; 10.5-10.6; 10.9-11.0).
12.3 – 13.5	Polluted ice (samples Bbg 9 12.3 -12.7, 12.7 – 12.9)
13.5 – 15.5	Ice, transparent, uniform structure with inclusions of dark to black, thin silt inclusions from 0.1 to 1-2 cm, air bubbles are round, chaotic distributed; up to 15.2 m bubbles are small and large (from 1 to 3 mm), at a depth of 15.2 - 15.5 m - small. (samples Bbg 9 13.6, 14.0, 14.75, 15.2).

15.5 – 16.7	Ice as previous up to 16.5 m, from 15.5 m mineral inclusions are subvertical extended, their sizes increase. 16.5 - 16.7 m - the number of mineral inclusions decrease, the number of air bubbles increases (up to 4-5 mm diameter). (samples 15.7, 16.0, 16.5).
16.7 – 20.5	Transparent ice, without mineral inclusions, with air rounded bubbles in different quantities (samples Bbg 9 16.9 – 17.0, 17.5 – 17.7, 18.0 – 18.3, 18.7 – 18.9, 19.3 – 19.5, 19.9 – 20.0).
20.5 – 22.1	Transparent ice, rare mineral inclusions (samples Bbg 9 20.5 – 20.6, 21.0 – 21.2, 21.5 – 21.6, 22.0 – 22.1).
22.1 – 22.8	Dark gray clay, cryostructure brackish ice lenses, 0.5 - 2 cm. Contact with the overlying clear ice (samples Bbg-9/1 22.4 – 22.5, Bbg 9 22.4 – 22.55, Bbg 9 22.55 – 22.65, Bbg 9/2 22.65 – 22.8).
22.8 – 23.5	Clear ice, without inclusions (sample Bbg 9 23.4 – 23.5).
23.5 – 23.7	Dark gray clay, cryostructure rare ice lenses up to 3 mm in diameter (sample Bbg-9/3 23.5 – 23.7).
23.7 – 23.8	Transparent ice without mineral inclusions.
23.8 – 24.3	Clay without ice lenses, cryostructure rare subhorizontal black lenses (up to 2 mm long) (sample Bbg-9/4 23.8 – 24.0).
24.3 – 24.6	Clay with rare large lenses, 1-2 cm thick. cryostructure porphyritic, nesting (sample Bbg-9/5 24.5 – 24.6).
24.6 – 25.0	Clay, ice content 40-50%; porphyry and netlike cryostructure, lenses 1-3 mm to 10 mm thick (sample Bbg-9/6 24.9 – 25.0).

Description and samples of cores Bbg 14 on top of the pingo Fili (height above sea level: 49 m, 77.99354°N, 14.66173°E).

Depth (m)	Sediment and ice description
0.0-0.1	Surface ice and medium brown loam (sample: Bbg 14 0.0-0.1).
0.1-1.0	Medium brown loam. cryostructure micro-streaks (sample: Bbg 14 0.6-0.8).
1.0-1.35	Medium brown loam with sparse gravel and 1-2 mm peat nests. cryostructure streaks, mostly vertically oriented, diameter 1-2 mm (sample: Bbg 14 1.0-1.2).
1.35-4.0	Ice - 1.35-3.0 clear without bubbles, with occasional small 1-2 mm inclusions of brown loamy material, 3.0-4.0 clear transparent without bubbles and inclusions.

Description and samples of cores Bbg 10 at the southern slope of pingo Fili (height above sea level: 53 m, 77.99332 °N, 14.66114 °E).

Depth (m)	Sediment description
0.0 – 0.1	Soil and plant cover in sand - sandy loam with gravel and small fragments (sample Bbg-10/1 0.0 – 0.1).
0.1 – 0.3	Dense, light brownish sandy loam, indistinctly layered, with gravel, with plant roots. At a depth of 0.25 m, a layer of buried soil enriched with plant residues begins, frozen (sample Bbg-10/0.1–0.3).
0.3 – 0.39	Buried soil in sand, enriched with plant residues, with gravel and rare debris (sample Bbg-10/3 0.3 – 0.39).
0.39 – 0.8	Sand with gravel and pebbles (fine, single medium), medium roundness (samples Bbg 10 0.39 – 0.46, 0.53 – 0.6, Bbg-10/4 0.6 – 0.7, Bbg 10 0.7 – 0.77, Bbg-10/5 0.77 – 0.8).
0.8 – 0.9	Sandy loam with gravel and small pebbles (sample Bbg 10 0.8 – 0.9).
0.9 – 2.5	Sand with gravel and pebbles (small, single medium), medium rounding. 1.35 - 1, 55 - more clay aggregate. 1.75 - reduction of clastic material (up to 60%). 2.35 - 2.45 - increase of clay material.

	(samples Bbg-10/6 0.9 – 1.0, Bbg-10/7 1.0 – 1.2, Bbg-10/8 1.2 – 1.3, Bbg 10 1.3 – 1.35, Bbg 10 1.35 – 1.55, Bbg-10/9 1.55 – 1.75, Bbg-10/10 1.75 – 2.03, Bbg-10/11 2.03 – 2.35, Bbg 10 2.35 – 2.45, Bbg-10 2.45 – 2.5).
2.5 – 2.8	Increase in clay content, cryostructure appearance of ice streaks, large fragments up to 4 cm in diameter (sample Bbg-10/12 2.5 – 2.8).
2.8 – 3.0	Growth of clay content, decrease of detrital material, cryostructure increase ice content, netlike lenses (sample Bbg-10/13 2.8 – 3.0).
3.0 – 3.3	Growth of clay content, decrease of detrital material, increase in ice content, netlike lenses (sample Bbg 10 3.0-3.3).
3.3 – 3.55	Clay with ice lenses, inclusions of rare debris (samples Bbg-10/14 3.3-3.4, Bbg-10/15 3.4 – 3.55).
3.55 – 4.1	Homogeneous clay /samples Bbg-10/16 3.55 – 3.8, Bbg-10/17 3.8 – 4.1).
4.1 – 4.5	Clay with ice lenses and small, rounded pebbles (sample Bbg-10/18, 4.1 –4.5).
4.5 – 4.7	Clay, very icy (up to 50%), less clastic material (sample Bbg-10/19 4.5 – 4.7).
4.7 – 5.9	Ice-rich ground (ice content up to 80%) in clay material, with rare fragments. 4.95 – 5.20 - clay, without fragments. 5.20 - 5.30 m - without debris. 5.30 - 5.70 m - slanting ice layers, without debris. 5.70 - 5.90 m - more ice, less clay, fragments of rock. (samples Bbg 10 4.77 – 4.95, Bbg-10/20 4.95 – 5.2, Bbg-10/21 5.3 – 5.55, Bbg 10 5.75 – 5.9).
5.9 – 6.20	Pebbles of medium-good roundness up to 1.5-2 cm in diameter, in sandy aggregate. From a depth of 6.05 m, more than sandy material, rare fibers of vegetation, cryostructure massive (samples Bbg-10/22 6.05 – 6.2).
6.20 – 6.65	Clay with a large amount of detritus (pebbles up to 3 cm in diameter), cryostructure, ice content of up to 6.40 m is low. 6.40 - 6.65 m – transparent thick ice lenses (length 3 cm, thickness 1 cm) (sample Bbg-10/23 6.2 – 6.4).
6.65 – 6.75	Cryostructure, transparent ice is with an admixture of mineral material.
6.75 – 6.9	Cryostructure, dirty ice.
6.9 – 7.05	Icy ground - detrital material (small pebbles) in loam, cryostructure ice content up to 80%. (sample Bbg-10/24 6.9 – 7.05).
7.05 – 7.60	Gravel, poorly rounded (up to 3 cm in diameter) in clay, cryostructure ice content 50%.
7.6 – 8.1	Clay with a small amount of debris, cryostructure very ice-rich, large ice lenses (up to 0.5 cm thick). 7.95 - 8.1 – CS horizontal layered lenses (samples Bbg-10/25 7.6 – 7.75, Bbg-10/26 8.0 – 8.1).
8.1 – 8.2	Clay, dense, without detritus, cryostructure rare sub-horizontal ice lenses.
8.2 – 8.3	cryostructure ice with silt inclusions.
8.3 – 8.55	cryostructure ice, cleared from mineral inclusions toward the bottom, with many round air bubbles, up to 2 mm in diameter.
8.55 – 8.6	Icy ground with clay.
8.6 – 8.8	Clay, cryostructure diagonal large ice lenses (sample Bbg 10 8.6 – 8.65).
8.8 – 9.0	Icy ground, small content of clay /sample Bbg-10/27 8.8 – 9.0).
9.0 – 10.7	Clay, cryostructure ice diagonal lens-like, lenses of varying thickness (up to 2 cm) (samples Bbg-10/28 9.25 – 9.5, Bbg-10/29 9.5 – 9.75, Bbg-10/29b 9.75 – 10.0, Bbg-10/30 10.2 – 10.4, Bbg-10 10.6 – 10.7).
10.7 – 11.3	Clay with rare debris (rounded pebbles less than 1 cm in diameter), cryostructure netlike lenses, increasing ice content (samples Bbg-10/31 10.9 – 10.95, Bbg-10/32 11.25-11.3).
11.3 – 11.75	Clay, decreasing ice content, sub-horizontal ice lenses (sample Bbg-10/33 11.65 – 11.75).
11.75 – 12.0	Loam, cryostructure rare diagonal ice lenses (sample Bbg-10/34 11.9 – 12.0).

Description and samples of cores Bbg 11 about 150 m north of the Pingo Kili (height above sea level: 44 m, 77.99531 °N, 14.66538 °E).

Depth (m)	Sediment description
0.0 – 0.07	Vegetation soil cover, cryostructure frozen (sample Bbg-11/1 0.0 – 0.07).
0.07 – 0.2	Sandy loam with gravel (0.17 - 0.2 m large fragments), cryostructure fine lens-like, layered (sample Bbg-11/2 0.07 – 0.20).
0.2 – 0.3	Sandy loam with rock fragments (up to 4 cm in diameter), not frozen (sample Bbg-11/3 0.2 – 0.3).
0.3 – 0.65	Sandy loam with detritus medium roundness (many small pebbles), up to 0.5 m - rare fiber vegetation, 0.5 - 0.65 - without vegetation (sample Bbg 11 0.5 – 0.65).
0.65 – 1.63	Sandy loam and sand, detritus of different rounding and sizes 0.65 - 0.8 m - increase of small pebbles. 0.9 - 1.0 m - more silt, fragments larger and less rounded. 1.0 - 1.63 m - diameter of individual pebbles reaches 6 cm, medium roundness (samples: Bbg 11 0.8 – 0.9, Bbg 11 0.9 – 1.0).
1.63 – 1.7	Sandy loam enriched with small pebbles and gravel, cryostructure frozen (sample Bbg-11/4 1.6 – 1.7).
1.7 – 1.85	Small rounded detritus (rare - pebbles to 2 cm), almost no silt, cryostructure ice-rich, massive, one lens of 2 cm thickness (sample Bbg-11/5 1.7 – 1.85).
1.85 – 3.9	Sandy loam with high content of detritus, with slight variations of silt content and the dimension of debris (some - up to 5 cm in diameter). 3.2 - 3.9 m - general increase of silt and clay material. (samples Bbg 11 2.0 – 2.1, Bbg-11/6 2.4 – 2.5, Bbg 11 2.65 – 2.75, Bbg 11 2.8 – 3.0, Bbg-11/7 3.4 – 3.5, Bbg-11/8 3.8 – 3.9)
3.9 – 4.0	Gravel with small pebbles and coarse sand, horizontally layered, cryostructure frozen.
4.0 – 5.2	Sandy loam, high content of detritus, slight variations of silt and of the dimension of debris. 4.0 - 4.3 m - pebbles were drilled (diameter of 7 cm, thickness of 1.5 cm) 4.55 - 5.2 m - reducing number of large fragments, increasing the content of clay (samples bbg-11/9 4.55 – 4.75, Bbg-11/10 5.0 – 5.1).
5.2 – 5.4	Loam with detritus, relatively uniform in size small pebbles, gravel, cryostructure frozen, icy interlayers (sample Bbg-11/11 5.2 – 5.4).

Description and samples of cores Bbg 15 on top of the pingo Kili (height above sea level: 60.5 m, 77.99398 °N, 14.66742 °E).

Depth (m)	Sediment and ice description
0.0-0.8	Gravel-pebble sequence with coarse pebbles and isolated small boulders with infill of unsorted sand and loam up to 10%. cryostructure pore ice, low ice content (samples: Bbg 15 0.0-0.3, Bbg 15 0.3-0.4, Bbg 15/1 0.5-0.6).
0.8-1.3	Pebbles and boulders, gravel 40-50%. cryostructure pore ice (sample: Bbg 15/2 0.9-1.1)
1.3-2.2	Gravel with sparse fine pebbles and infill of gray unsorted sand up to 10%. cryostructure pore ice (samples: Bbg 15/3 1.4-1.5, Bbg 15/4 2.0-2.2).
2.2-3.5	Gravel with unsorted sand up to 10%. cryostructure pore ice (samples: Bbg 15 2.2-2.4, Bbg 15 2.4-2.5, Bbg 15/5 2.9-3.1, Bbg 15 3.1-3.2).
3.5-4.0	Gravel and pebbles with up to 10% gray unsorted sand. cryostructure pore ice (sample Bbg 15 3.7-3.8).
4.0-4.2	Strongly ferruginous gravel-pebble sequence with up to 10% gray unsorted sand. cryostructure pore ice.
4.2-4.3	Dark-gray sand, horizontally layered. Contact with the overlying stratum is clear and even. cryostructure massive (sample: Bbg 15/6 4.2-4.3).
4.3-5.0	Light sandy gray-brown loam with interlayers of gravel and small pebbles up to 40%. cryostructure low ice content (sample: Bbg 15/7 4.7-4.8).
5.0-5.5	Gravel with sparse pebbles and loamy filling up to 10%. cryostructure pore ice (sample Bbg 15 5.0-5.2).

5.5-6.3	Interstratification of yellowish-gray sands, sandy loam, thin 1-2 mm lenses of organics, and gravel and pebble interlayers. cryostructure massive and subvertical streaks up to 3 mm (samples: Bbg 15/8 5.6-5.7, Bbg 15/9 5.7-5.9, Bbg 15 5.9-6.0).
6.3-6.6	Gravel. cryostructure pore ice (samples: Bbg 15 6.3-6.5, Bbg 15 6.5-6.6).
6.6-6.8	Transparent ice without bubbles, the contact is clearly uneven.
6.8-8.0	Interbedded (slope ~10°) gray-brown sandy loam and loam with separate interlayers of gravel and small pebbles and lenses of organics. cryostructure low ice content, separate vertical streaks up to 2 mm thickness. at 7.6 m, a separate streak up to 4 cm (sample: Bbg 15/10 7.1-7.3).
8.0-10.1	Loam heavy silty, fine-layered, inclined 10°, brownish-gray with individual lenses of black organic matter up to 2 mm thickness. cryostructure massive, rare thin 1-2 mm streaks, at 8.5 m, vertical extended streaks up to 3 mm. From 9.5 m without streaks, low ice content, semi-solid (samples: Bbg 15/11 8.3-8.6, Bbg 15/12 9.3-9.5, Bbg 15/13 10.0-10.1).
10.1-10.3	Sand layer overlapping the gravel with 3 cm ice layer.
10.3-13.3	Clay, silty brownish-gray fine-layered, plastic, inclined ~5°. Between 11.5-12.0 m 0.5 cm interlayers of gravel. cryostructure up to 11.0 m without streaks, from 11.0, coarse reticulate with a predominance of extended vertical streaks up to 2 cm wide and 4-25 cm apart (samples: Bbg 15/14 10.7-10.8, Bbg 15 10.8-10.9, Bbg 15/15 11.2-11.5, Bbg 15/16 11.5-11.7, Bbg 15/17 12.2-12.4, Bbg 15 12.6-12.7, Bbg 15/18 12.0-13.0) .
13.3-13.8	Transparent ice without bubbles, rare small to 3 mm inclusions of clay material, horizontal contact (sample: Bbg 15 13.7-13.8).

Description and samples of cores Bbg17 between the pingos Kili and Oin (height above sea level: 43, 77.99592 °N, 14.66862 °E).

Depth (m)	Sediment and ice description
	The surface is covered with ice (probably river ice) of 20 cm and dense snow of 30 cm
0.0-1.5	Gravel and pebble strata with loamy filling up to 15%. Pebbles are coarse, medium, and fine. cryostructure pore ice, contact cryostructure (samples: Bbg 17 0.0-0.2, Bbg 17 0.8-1.0).
1.5-2.7	Gravel layer with up to 10% loamy aggregate. cryostructure pore ice and contact cryostructure (samples: Bbg 17 1.5-1.7, Bbg 17 2.0-2.15).
2.7-3.0	Interstratification of gray silts, sandy loam, rarely thin 1-2 cm interlayers of multi-grained sand and small gravel. There are black lenses and interlayers of iron mono-sulfide. cryostructure layered, diameter 0.5-1 mm, spacing 1-2 cm (sample: Bbg 17 2.8-2.9).
3.0-3.5	Gray silt, changing downward into ice-poor clay. At a depth of 3.2 m in the silty layer there are single fragments of coarse gravel cryostructure vertical lenses (1 mm) of reticulate texture. (sample: Bbg 17 3.4-3.5).

Table S1.5 Study sub-area D (Hollendardalen Valley)**Description and samples of cores Bbg 20 top the pingo Ulli (height above sea level: 68 m, 78.05216 °N, 14.51170 °E)**

The surface was covered with 20 cm thick snow

Depth (m)	Sediment and ice description
0.0-0.1	Vegetation, mosses, lichens, cereals, plant rhizomes.
0.1-1.8	Brownish-gray loam with large amounts of gravel and crushed stone (up to 50%). cryostructure nesting, gradually passes into the underlying horizon (sample: Bbg 20 1.4-1-6).
1.8-2.3	Gravel and silty layer with up to 20% loamy aggregate. cryostructure pore ice (samples: Bbg 20 1.8-2.0, Bbg 20 2.2-2.3).
2.3-3.4	Coarse crushed stone and blocks of aleurolite (sample: Bbg 20 3.0-3.2)
3.4-4.9	Gravel and pebble bed with poorly rounded debris and aggregates of gray-brown heavy loam. Rare boulders and blocks. At 3.4 m, fragments of shells. (samples: Bbg 20 3.5-3.6, Bbg 20 3.7-3.8, Bbg 20 4.0-4.1, Bbg 20 4.3-4.4, Bbg 20 4.4-4.5, Bbg 20 4.7-4.8).
4.9-12.0	Gray-brown heavy loam with gravel inclusions up to 25%. Single small pebbles. From 8.5 m gravel and pebbles up to 40% of volume cryostructure nesting, vertically oriented nests up to 1 cm wide., large nests of ice up to 3x4 cm in size. Ice up to 30% by volume (samples: Bbg 20 5.0-5.2, Bbg 20 5.5-5.7, Bbg 20 6.0-6.2, Bbg 20 6.7-6.9, Bbg 20 7.5-7.6, Bbg 20 8.9-9.0, Bbg 20 9.5-9.6, Bbg 20 9.5-9.7, Bbg 20 10.2-10.4, Bbg 20 11.0-11.1, Bbg 20 11.8-12.0).