NGTS

REPORT

# Norwegian GeoTest Sites Project

FACTUAL REPORT - PERMAFROST RESEARCH SITE

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# Project

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# Summary

Two benchmark sites are established near Longyearbyen, Svalbard (78°13'N, 15°28'E) for long-term geotechnical testing and evaluation of field investigation methods in perennially frozen soils (i.e. permafrost). These sites, named "Adventdalen" and "UNIS East" based on their location, form part the research infrastructure of the Norwegian GeoTest Sites (NGTS) project. Since 2016, efforts have focused on characterization and instrumentation of the upper 30 m of the soil stratigraphy. This report contains all results from field and laboratory tests related to the NGTS permafrost site available as of the revision date. In situ methods include core drilling, electrical resistivity tomography (ERT), piezocone penetration testing (CPT), and monitoring of the ground thermal regime. Laboratory investigations include index, thermal characteristics, and unconfined compression testing.

Characterization of the Svalbard permafrost sites are summarized in two reports: (1) a factual report (20160154-06-R) and (2) an interpretation report (20160154-07-R). This report, 20160154-06-R, presents a factual summary of laboratory and in situ testing conducted at the sites in the 2016-2018 period. Site specific tests and methods are described in the present report. Standard methods for laboratory and *in situ* tests that apply for all NGTS sites are detailed in the general reports NGTS Report 02 (20160154-02-R) and NGTS Report 03 (20160154-03-R), respectively.

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# Review and reference page

# 1 Introduction

This report describes the work conducted at the Svalbard permafrost sites between January 2016 and the revision date as part of Research Council of Norway's (RCN) Norwegian GeoTest Sites (NGTS) infrastructure project. Activities at the permafrost site were coordinated by The University Centre in Svalbard (UNIS) and run in collaboration with SINTEF. The NGTS project has five sites in total. The report will be revised accordingly in the future to provide updates on new activities.

The NGTS project has developed two test sites in Svalbard: Adventdalen and UNIS East. The Adventdalen site is in the Adventdalen valley, ca. 5 km east of the settlement of Longyearbyen. The UNIS East site is immediately east of the University Centre in Svalbard (UNIS). The locations of these sites are indicated in Figure 1. Svalbard is located within the continuous permafrost zone, meaning permafrost is spatially ubiquitous. Saline permafrost is identified at both sites. The high concentration of pore-water solutes results in a freezing point depression and portions of the soil stratigraphy at each site is either unfrozen or plastic frozen at the ambient ground temperatures.

The Svalbard sites are included within the NGTS project to investigate topics including foundation methodology, site investigation techniques, embankment behaviour, and artificial cooling systems in saline marine clays and intermediate permafrost soils. Geotechnics in Svalbard and elsewhere in the Arctic has recently received increased attention due to the potentially adverse effect of climate changes on stability in the short term. Currently, most instances of infrastructure failure can be explained by a lack of knowledge regarding permafrost conditions during the original design. The NGTS permafrost sites will provide opportunity to monitor the response of instrumentation, design solutions, and soil behaviour to climatic changes.

Efforts during the first phase (June 2016 to June 2019) of the NGTS project in Svalbard have been directed towards site characterization. This includes the establishment of necessary site infrastructure for the 20-year operational phase – including ground thermal monitoring instrumentation.

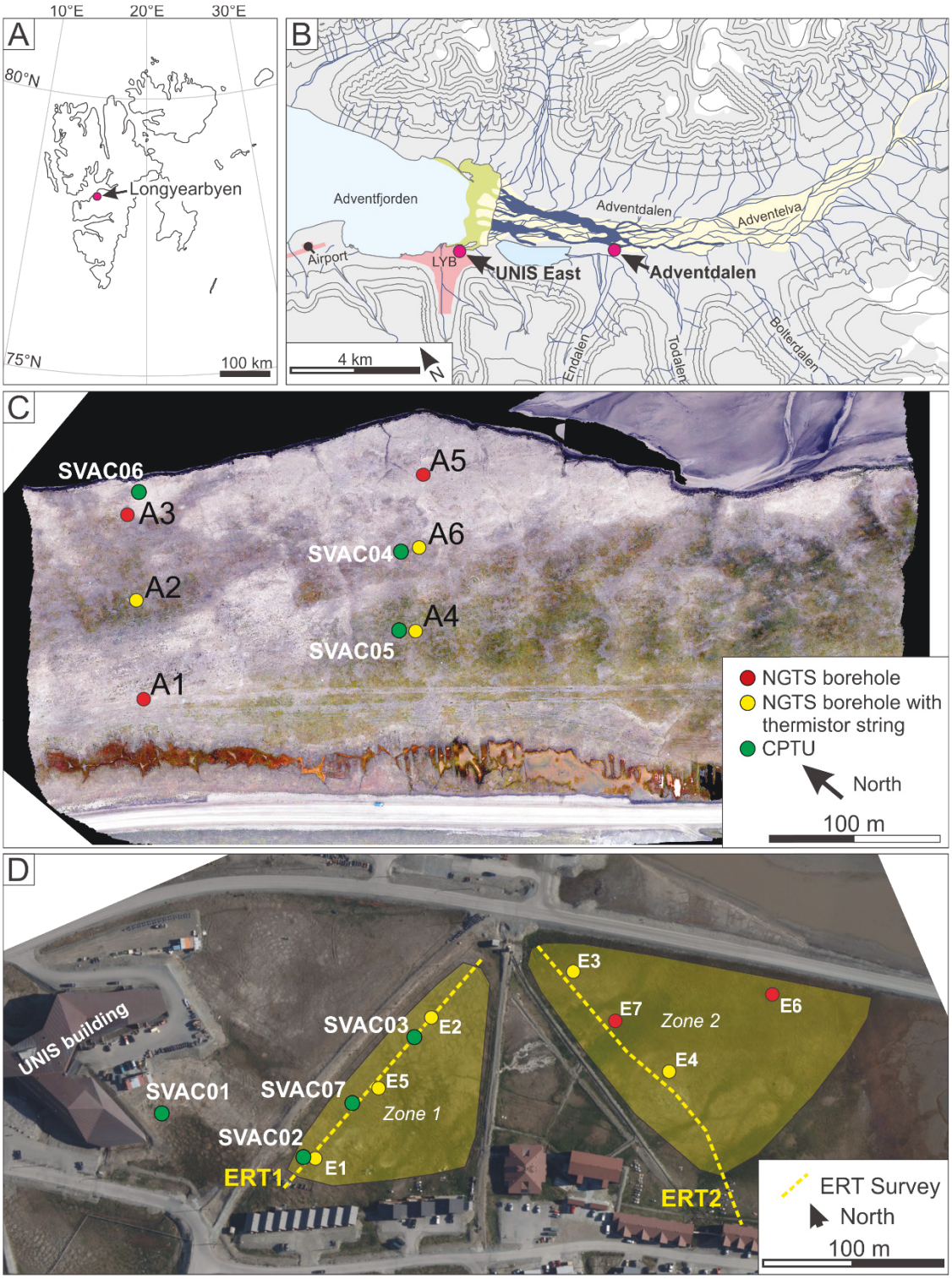


*Figure 1. A) Location of Longyearbyen in Svalbard. B) Location of the Adventdalen and UNIS East sites in relation to Longyearbyen (LYB). C) Details of the Adventdalen site. D) Details of the UNIS East site.*

# 2 Permafrost research sites – Longyearbyen, Svalbard

## 2.1 Site overview and topography

The *Adventdalen site* is in the Adventdalen Valley, ca. 5 km east of Longyearbyen at ca. 6 m a.s.l. (Figure 1). The site measures ca. 400 m x 200 m and is located on an aggrading loess terrace, elevated ca. 3-4 m above the Adventelva River, with ice wedges. The loess cover is 3 m thick and is underlain by fluvial, deltaic, marine, and glacial deposits. Permafrost between 4 m and 60 m depth is primarily ice poor. Ice-enriched, syngeneic permafrost is restricted to the upper 3-4 m of loess. The active-layer thickness is ca. 1 m and the ground temperature recorded at 10 m depth is -5 °C. The depth to bedrock is ca. 60 m.

The *UNIS East site* (Figure 1) is located at 1 to 8 m a.s.l. approximately 100 m southeast of the Svalbard Science Centre (UNIS building in Figure 1). The westernmost area (zone 1) is situated between 5 and 8 m a.s.l. and is routinely used for sampling of fine grained (silty, clayey) soil by UNIS. The area furthest east (zone 2) is situated between ca. 1 and 4 m a.s.l. The site has a total area of ca. 40 000 $m^2$.

## 2.2 Geological setting

The study area was carved in flat-laying Early Cretaceous and Palaeogene sedimentary rocks, mainly sandstones and shales. Maps of the regional geology and Quaternary geology are provided in Appendix A. The high-relief valley flanks shed debris, with colluvial and alluvial-fan deposits blanketing the lower valley-side slopes. Slope processes include solifluction, rockfalls, debris flows, and snow avalanches. The sediments at the valley floor comprise alluvium of the river Adventelva and its tributaries with local aeolian deposits (Bryant, 1982).

## 2.3 Glacial and sea-level history

Svalbard was glaciated several times during the late Quaternary (Mangerud et al. 1998). The last glaciation culminated during the Last Glacial Maximum, ca. 20 ka (Landvik et al. 2005). During this period, ice streams situated in the fjords and valleys removed most of the sedimentary record from previous interglacial and glacial periods (Elverhøi et al. 1995). Deglaciation commenced ca. 15 ka and proceeded rapidly (Landvik et al. 1998). The study area was ice free by ca. 11.3 ka (Gilbert et al. 2018).

Following deglaciation, sea level in the study region was ca. 62-70 m above present (Lønne 2005). This marine limit demarcates the maximum elevation of unconsolidated marine sediments found on land at present. Relative sea level declined exponentially during the Holocene as rates of isostatic rebound outpaced global eustatic sea-level rise. Contemporary sea level was reached ca. 5 ka (Lønne and Nemec 2004).

The two sites are located within sediment filled former fjords. Fjords are incised bedrock valleys which are formed during glaciation and afterwards inundated by the sea. These

depocenters are scoured by ice flow and accumulate subglacial deposits during glacial periods and are filled principally by fjord-head deltas during deglaciation and in post-glacial time (Corner 2006, Gilbert 2018). The sedimentary and permafrost history of the study area has been described by Gilbert et al. (2018). A typical fjord-valley fill succession consists of a veneer of till overlain by marine deposits, an upwards-coarsening sequence of deltaic sediments, and fluvial deposits. The bulk of the fjord-valley fill is deposited into a saline, marine setting. This is significant as: (i) residual solutes impact freezing behaviour and soil strength after permafrost formation and (ii) all settlements in Svalbard are partially or entirely located below the early Holocene marine limit. The response of saline permafrost to climate change is therefore of regional interest.

## 2.4 Source material and transport

Stratigraphic soil units represent different sediment sources and depositional environments. Till is present at both sites but only crops up into the upper 30 m of soil stratigraphy at UNIS East (c.f. Gilbert et al. 2018). The till bed was deposited during the last glaciation and likely contains sediment from throughout Svalbard. Stratigraphic units interpreted to reflect deposition in a quiescent marine setting and as part of a fjord-head delta are found at the UNIS East and Adventdalen sites, respectively. These deposits originate from reworked glacial deposits and local bedrock. In both cases most material would have been transported by Adventelva or another fluvial tributary prior to deposition in a saline, fjord environment. Additionally, transport of siliciclastic sediment by wind and biogenic production may have been secondary agent in the fjord environment. The uppermost soil unit in Adventdalen consists of aeolian sands and silts (c.f. Bryant 1982). The uppermost unit at the UNIS East site consists of gravels and sands, believed to be alluvial deposits.

## 2.5 Permafrost conditions

Permafrost grew downwards into the fjord-valley fill deposits following emergence and land surface stabilization. This type of epigenetic permafrost is characteristically ice poor. In the Adventdalen valley, the onset of permafrost growth coincided with the transition from fluvial to loess deposits (Gilbert et al. 2018). However, it is difficult exclude the possibility of permafrost forming under shallow channels or bars in the fluvial domain. In either case, permafrost below the marine limit is a Holocene phenomenon. Syngenetic permafrost, enriched with segregated ice, grew upwards in aggrading sedimentary deposits following emergence. Ice-rich permafrost is restricted to the upper few meters of the soil stratigraphy in Adventdalen and it is this zone which is anticipated to undergo the greatest degree of geomorphic change in response to permafrost degradation.

## 2.6 *In situ* testing and site investigations

Drilling and sampling was conducted during the spring in 2017 and 2018 as the impact of operating machinery on the tundra is lowest when the active layer is frozen and the ground surface is covered in snow. Cone penetration testing was primarily conducted in the interval between August and November. This was because the anchoring system on the Pagani Geotechnical TG63-150 test rig worked best with an unfrozen soil layer of ca. 1 m in thickness. Borehole locations are presented in Table 1. An overview of all *in situ* test locations is presented in Appendix B. A sign will be erected at the Adventdalen site to provide information to the public about the NGTS project.

*Table 1. Site information and borehole locations. Casing depth refers to the housings for the thermistor strings.*

| Location | UNIS site id. | NGTS borehole id. | Longitude | Latitude | Elev. (m a.s.l.) | Borehole depth (m) | Casing depth (m) | Samples |
|---|---|---|---|---|---|---|---|---|
| **Adventdalen** | A1 | SVAB01A | 78.2009°N | 15.8333°E | 5 | 10.0 | - | Bag samples |
| | A2 | SVAB02A<br>SVAB02_2A | 78.2012°N | 15.8350°E | 5 | 27.0 | 22.7 | Bag and core samples |
| | A3 | SVAB03A<br>SVAB03_2A | 78.2016°N | 15.8364°E | 5 | 30.0 | 23.0 | Bag and core samples |
| | A4 | SVAB04A<br>SVAB04_2A | 78.2000°N | 15.8389°E | 5 | 30.0 | 19.5 & 29.0 | Bag and core samples |
| | A5 | SVAB05A | 78.2005°N | 15.8420°E | 5 | 28.0 | 19.5 | Bag and core samples |
| | A6 | SVAB06A | 78.2003°N | 15.8397°E | 5 | 29.5 | 29.0 | Bag samples |
| **UNIS East** | E1 | SVAB01E | 78.2215°N | 15.6580°E | 7 | 30.0 | 30.0 | Bag samples |
| | E2 | SVAB02E | 78.2220°N | 15.6615°E | 6 | 30.0 | 30.0 | Bag samples |
| | E3 | SVAB03E | 78.2218°N | 15.6655°E | 2 | 30.0 | 30.0 | Bag samples |
| | E4 | SVAB04E | 78.2213°N | 15.6661°E | 3 | 30.0 | 30.0 | Bag samples |
| | E5 | SVAB05E | 78.2218°N | 15.6601°E | 6 | 26.1 | 26.0 | Bag and core samples |
| | E6 | SVAB06E | 78.2215°N | 15.6659°E | 2 | 12.0 | 10.0 | Bag and core samples |
| | E7 | SVAB07E | 78.2214°N | 15.6695°E | 2 | 15.7 | 14.0 | Bag and core samples |

## 2.7 Soil descriptions

### 2.7.1 Adventdalen site

Three soil units are identified in the upper 30 m of the soil stratigraphy at the Adventdalen site. The characteristics of each unit is summarized in Table 2 and images are in Fig. 2. The soil stratigraphy is comprised of a top layer of sandy clayey silt (Unit D3; terrain surface to ca. 4 m depth), followed by ca. 11 m of silty sand (Unit D2) over clay or silty clay (Unit D1; 15 m to 30 m depth).

### 2.7.2 UNIS East site

The soil stratigraphy at UNIS East consists of a top layer of gravelly, silty, sand (Unit U3; terrain surface to ca. 3 m depth) underlain by ca. 15 m of silty clay (Unit U2) over diamicton (Unit U1; sandy, silty, clay). The soil type, description, and interpretation are included in Table 2.

*Table 2. Type, description, and interpretation of soils identified at the NGTS Svalbard sites (see images in Figure 2).*

| Unit | Soil type | Geological description | Interpretation |
|---|---|---|---|
| D1 | Silty CLAY | Laminated to weakly-laminated muds | Deposition from suspended sediment fallout in a prodelta environment |
| D2 | Silty clayey SAND | Interlayered graded sand and silt | Deposition from turbidity currents and sediment fallout on delta front |
| D3 | Sandy clayey SILT | Faintly laminated sandy silt, plant bioturbated | Aeolian deposits on terrace adjacent to river channel |
| U1 | Silty sandy gravely CLAY | Diamicton with a muddy matrix | Subglacial till or melt-out till |
| U2 | Silty CLAY | Weakly laminated to massive silty mud with shell fragments and scattered gravel clasts, partially homogenized by bioturbation | Deposition by sediment fallout from suspension plumes in a deglaciated fjord. Scattered clasts due to ice rafting |
| U3 | Silty gravely SAND | Inter layered sand and gravel | |

The index testing results from each site are summarized in Fig 3. The borehole locations are indicated in Fig 1. Additional details are available in Gilbert et al. (2019).

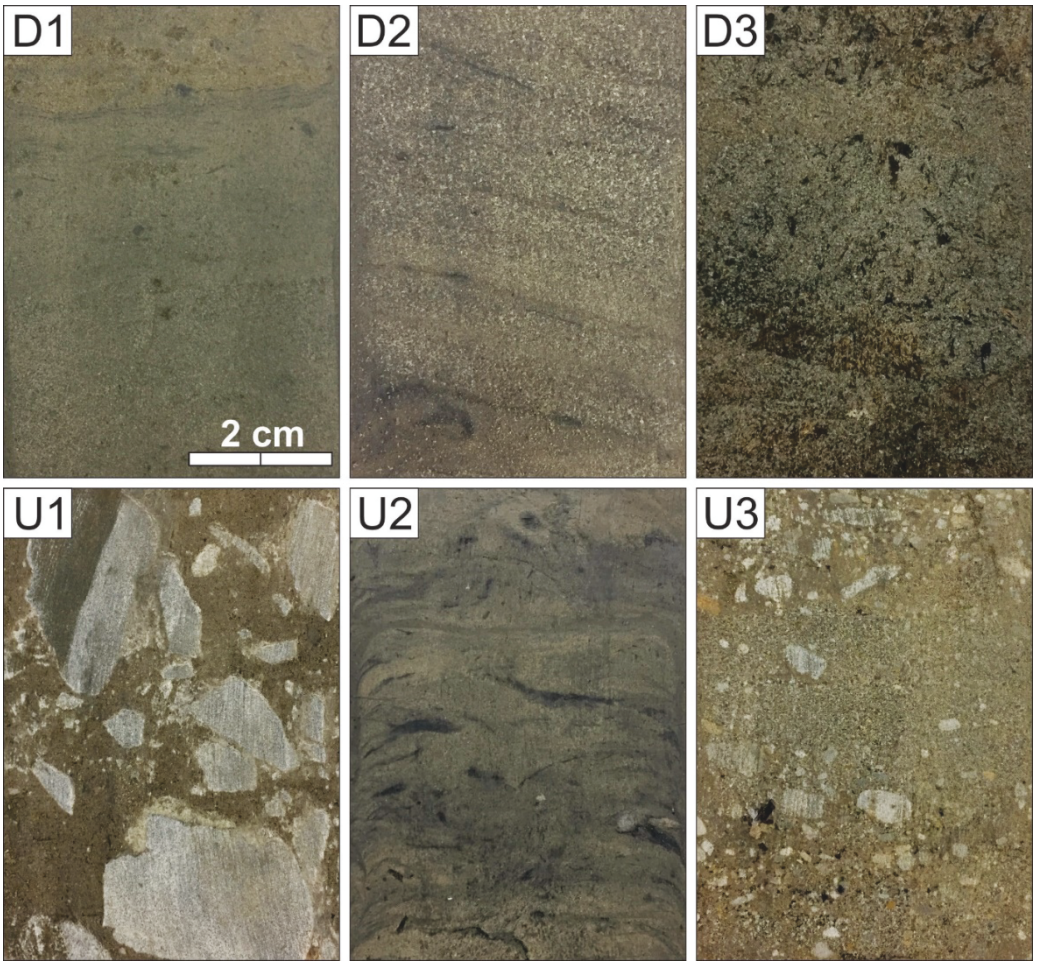


*Figure 2. Example images of soil beds at the Adventdalen (D1-D3) and UNIS East (U1-U3) sites. D1) laminated to weakly-laminated muds (ca. 16 – 30 m). D2) interlayered graded sand and silt (4 – 16 m). D3) Silt. U1) Diamicton with muddy matrix. U2) weakly laminated to massive silty mud. U3) interlayered sand and gravel.*

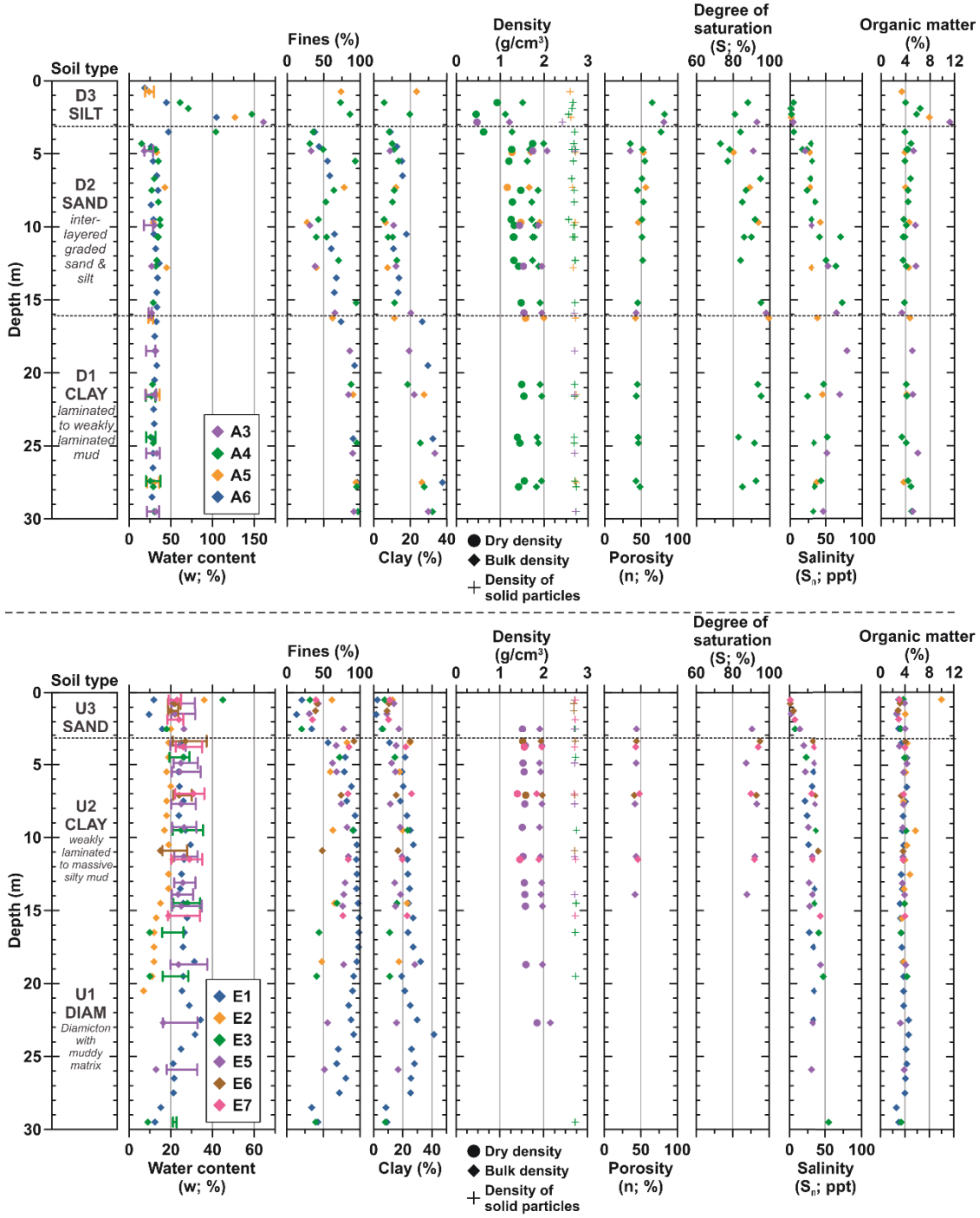


*Figure 3. Soil type and index parameters at the Adventdalen (upper row) and UNIS East (lower row) sites. Borehole locations (A1-A6 and E1-E7) are indicated in Figure 1. Note the boundary between U2 and U3 varies at the UNIS East site between borehole locations and is therefore not indicated on this chart.*

# 3 Field testing

Field investigations as part of the site characterization include drilling, core and sample retrieval, casing of boreholes, installation of temperature sensors, piezocone penetration (CPTU) testing, and electrical resistivity tomography (ERT). Samples were retrieved, and casings installed at 13 sites (Figure 1; Table 1).

## 3.1 Drilling and sampling

Five sampling methods were used to retrieve material for laboratory testing and to install casings for thermistor strings: (1) total sounding, (2) drilling and sampling with a conventional auger, (3) core sampling using a modified CRREL barrel, (4) piston sampling, and (5) down-the-hole (DTH) drill. Method 1-4 were utilized by SINTEF (Fig. 4). DTH drilling was conducted by a third-party contractor (Anleggsdrift AS). Retrieval of core samples of sufficient quality to conduct laboratory testing is often problematic in permafrost environments. The combination of methods above allowed for sample retrieval from the upper 30 m of the soil stratigraphy at both sites, through a variety of soil types.

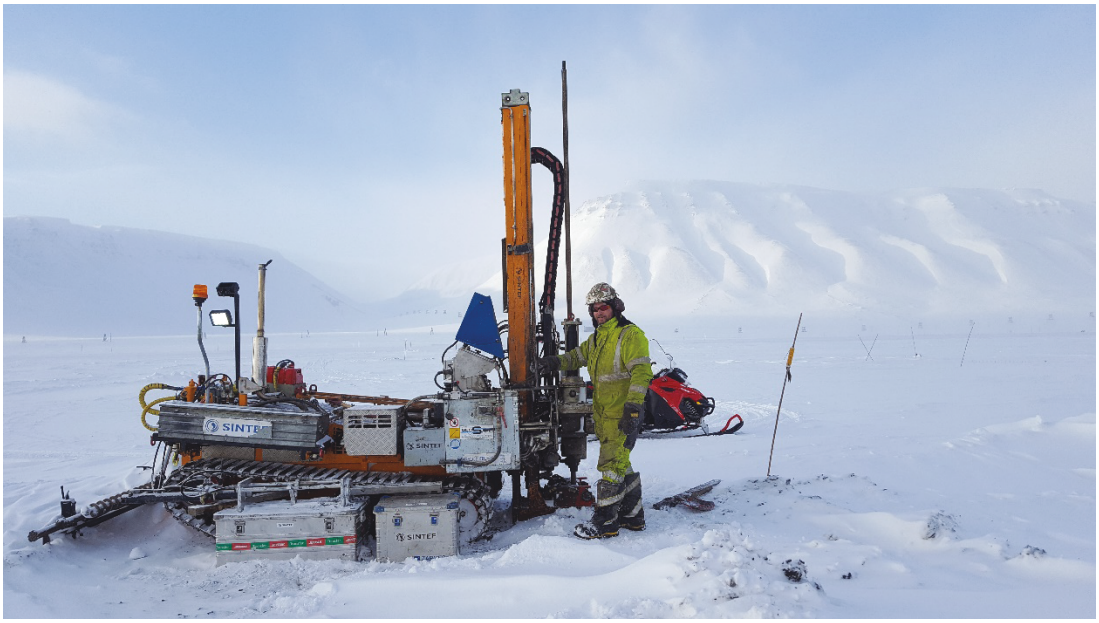


*Figure 4. SINTEF drill rig at the Adventdalen Site in Spring 2017.*

### 3.1.1 Total sounding (TS)

Collection of soil material while conducting total soundings was also possible. The samples from total sounding originate from the depths close to the drilling bit, since all material is transported with compressed air during the drilling (compressed air blows all the material from the tip up to the surface). Drilling with total sounding is also an effective method for making boreholes for deployment of casings for thermistor strings or can be used for making boreholes when thermistor strings are installed without casing. Details of the total sounding is discussed below in section 3.4.

### 3.1.2 Sampling with conventional auger

A conventional 75 mm auger (1.5 m long) was used, together with the extension bars, for soil sampling. Soil was collected from the auger flights. The auger is normally used to sample through the active layer prior to coring. This is done to avoid damage to the drill crowns on the core barrel in coarse-grained soils. The 75 mm auger is also used to clean the borehole before the deployment of the casing for thermistor string.

Auger sampling was performed between 0 m and 1 m depth and from the bottom of cryopegs 28–30 m. Auguring below the cryopeg zone was complicated by the incursion of saline water from the unfrozen zones and by the deformation of the plastic frozen soils causing contraction of the borehole diameter.

### 3.1.3 Core sampling

The SINTEF-modified CRREL coring auger for permafrost in presented in Fig. 5. The corer consists of a cutting bit attached to a thick-walled hollow core collecting auger. This type of corer has proven to be efficient in collecting cores in fine grained frozen soils. The inner diameter of the core barrel was 45 mm and samples were typically 400 mm in length. The corer uses durable poly-crystalline diamond composite (PCD) bit inserts. The core barrel is used without drilling fluids which is an advantage in cold climates where additives are used to prevent drilling fluids from freezing.

Core samples were obtained between 1 m and 12–14 m depth at sites in Adventdalen. Coring was challenging in the cryopeg zone. Difficulties were attributed to the unfrozen state of soil and the incursion of water. To resolve this, a steel casing was drilled by Anleggsdrift AS to 3 m below the unfrozen zone (i.e. ca. 20 m depth) around the location A2 (borehole A2-2). This casing was unsuccessful and filled with saline water up to 6 m below the ground surface. Installation of the second casing at the location A4-2 was successful and permitted coring down to 28 m. No cryopegs were detected at the depth 20–30 m.

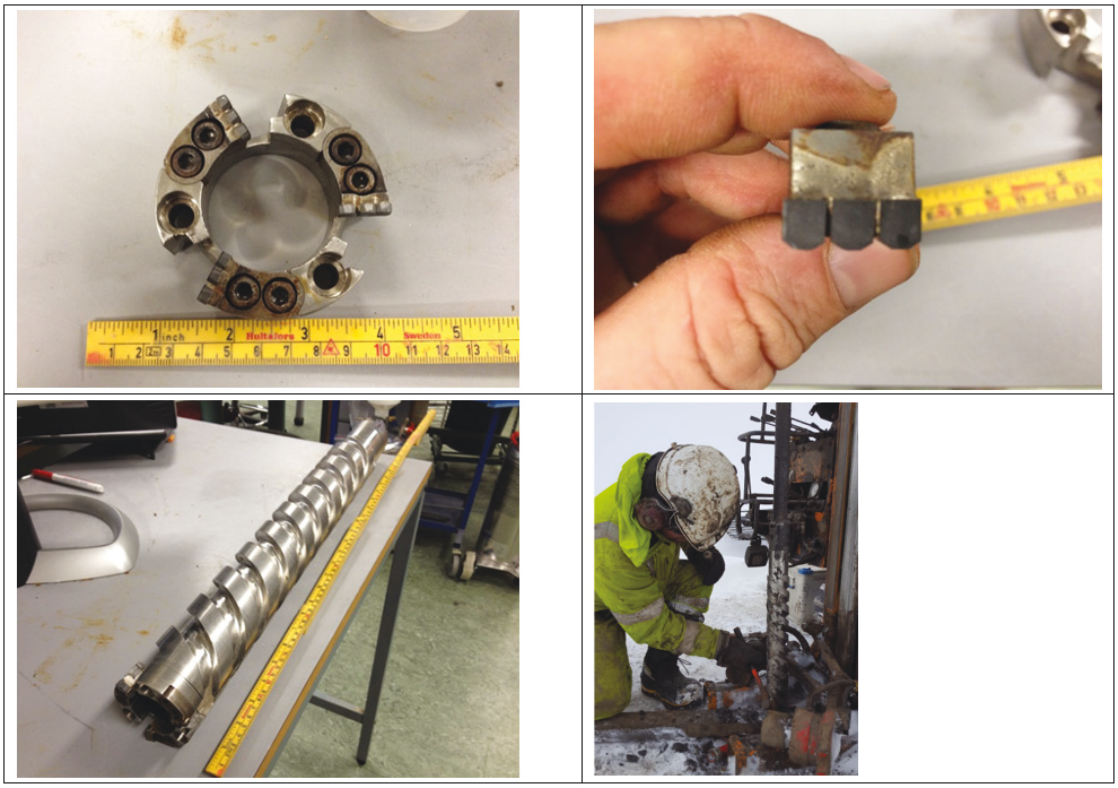

*Figure 5. Details of the modified CRREL barrel used by SINTEF.*

### 3.1.4 Piston sampling

A Geonor thin wall, stationary 54 mm piston sampler with cylinders of steel was used to obtain undisturbed samples of unfrozen fine-grained soils in the cryopegs. Typical length of samples is 0.8 m.

The piston sampling has been performed in the zones of unfrozen soil. The depth interval for piston sampling was defined based on total sounding. Auger sampling was first conducted to the desired depth, then the piston sampling was performed. Piston sampling was stopped at the interface of unfrozen layer with frozen soil, practically pushing force was monitored and the piston was pushed (presumably in frozen soil) to the limit when it was about to deform (some of tubes with samples at the bottom of unfrozen zone were slightly deformed).

### 3.1.5 DTH drilling

Down-the-hole (DTH) drilling was performed by Anleggsdrift AS at both the UNIS East (E1 – E4) and Adventdalen (A4 & A6) sites. Bag samples of the drill cuttings were collected for each 1 m interval. A steel casing (Ø = 159 mm) was installed in 3 m lengths during drilling. Sections were fully welded together during operation in the field.

### 3.1.6 Sample quality

Volume changes and alterations to the soil structure may occur during sampling and can be difficult to identify. Currently there is no quantitative methods for assessing the quality of frozen soil samples. In the laboratory, core alteration, particularly thawing and refreezing can be assessed by looking for disturbances in sedimentary structures or millimetre-scale ice lenses oriented parallel to the core – which would suggest freezing following sampling. Future studies may investigate the possibility of identifying disturbance from x-ray images or CT-scans of frozen sediment cores.

As fieldwork was conducted during the winter and spring, when air temperatures were below 0 °C. Samples were transferred directly to cold storage there was no opportunity for sample thawing. Core samples are of sufficient quality to conduct uniaxial compression tests.

### 3.1.7 Borehole casing

Borehole casings were used to: (1) stabilize the borehole during core sampling below unfrozen, cryopeg zones and (2) contain thermistor strings – enabling maintenance including sensor replacement. To stabilize the boreholes, steel casings (Ø = 159 mm) were installed using DTH drilling. This was conducted at E1–E4 locations at UNIS East and A4 and A6 in Adventdalen. At sites where a steel casing had been previously installed, the plastic casing (50 mm) was installed inside at a later stage, and the space between the two casings filled with dry sand. Thermistor strings were installed inside the plastic casing. At the A4 location, SINTEF conducted drilling investigations using the modified CRREL system through the installed casing to retrieve samples from 20 m to 30 m depth.

Plastic casings were also installed directly into boreholes after coring was completed by SINTEF. Boreholes were cleaned with an auger prior to installation. Deepest installation depth was 27 m (E5), in two other locations casing was installed to the depth of 12 m and 16 m (E6–E7). Saline water was observed inside of the casings at E6–E7 following installation.

## 3.2 Electrical resistivity tomography (ERT)

Two ERT surveys were performed by NGI at the UNIS East site in September 2017. The location of these surveys is presented in Fig 1. The results are summarized below in Section 3.2.1. The electrode spacing was 2 m for both surveys. The profile length was 160 m for ERT1 and 196 m for ERT2. The profile lengths allowed for the tests to penetrate to at least 30 m depth.

### 3.2.1 ERT survey results

Four layers were identified in the ERT profiles including: (1) bedrock/till, (2) saline plastic frozen silt and clay, (3) frozen sands, and (4) the unfrozen active layer. The transition between bedrock and the till layer is difficult to discern. ERT results are included in Appendix G.

## 3.3 Cone penetration testing (CPT)

Collaboration with Pagani Geotechnical Equipment provided access to a CPTU test rig (TG63-150; Figure 5). The CPTU test rig records cone-tip load, sleeve resistance, temperature, and pore pressure. Cone penetration testing was performed at the UNIS East site in late August 2018 and initial impressions were that the rig performed well in the permafrost soils. Anchoring the rig is problematic as the piles have difficulty gripping the frozen soil. To date the most successful tests have been conducted during August when the active layer is unfrozen. Testing was conducted at a target rate of penetration of 20 mm $s^{-1}$. Extension rods of 1 m length were used during testing. The tests were typically discontinued by 15 m depth as the force generated during testing exceeded the strength of the anchors. The application of these parameters in inferring the behavioural characteristics of the permafrost soils on Svalbard is currently being evaluated and preliminary results are presented here. These tests build on previous investigations using CPT in Svalbard (Ladanyi et al. 1995). Seismic cone penetration tests (SCPTU) can also be performed using this rig but have not yet been conducted in Svalbard.

Two cones were used during testing: MKj485 and MKj528. The results of the CPTU investigations are included in Appendix C.

## 3.4 Total sounding (TS)

Total sounding is traditionally performed by rotating a drill bit into the ground at constant rotation and speed of penetration while recording the soil resistance. In frozen soils, the resistance is too high to facilitate the required penetration rate. A modification to the total sounding procedure has therefore been adopted by SINTEF. The modified total sounding is performed with constant force while logging the penetration rate. Total soundings are used in permafrost areas is to distinguish between soil layering, identify of unfrozen zones, and detect the rock surface. The result from the total sounding can also be used to determine which sampling techniques are appropriate.

Total soundings were conducted at the boreholes A1–A3 to ca. 25 m depth. Total soundings were initially conducted to map cryopegs at the Adventdalen site. Cryopegs were identified between 13 m and 16 m depth at all TS locations by the saline soil slurry flushed to the surface upon encountering the unfrozen pockets. Total soundings were stopped at 25 m depth due to the weight of drilling column and concerns that adfreezing could lead to equipment loss. Drill cuttings were collected for each meter and stored in plastic bags. SINTEF conducted one, 25 m total sounding per day.

The identification of unfrozen zones at all sites suggests the size of cryopeg lenses in plane is at least of the order of 100 m, and it may most probably underline the whole field site and exist beyond its boundaries. Unfrozen water content in Adventdalen has previously been inferred from geophysical investigations conducted by Keating et al. (2018). The results of the TS are presented in the SINTEF report entitled: "Geotechnical site investigation, Svalbard Field Report – Permafrost Site – Adventdalen" (Appendix D).

## 3.5 Meteorological data

Weather and climate data are available from several stations near to the sites. Currently, official meteorological data can be obtained from the weather and climate station at the Longyearbyen airport. The site is maintained by the Norwegian Meteorological Institute and data is available through the Eklima portal. Local weather stations in Adventdalen, on Gruvefjellet and at Janssonhaugen are available through the UNIS webpage. Parameters available from these stations include:

- Time of measurement,
- Air pressure,
- Air temperature,
- Wind speed and direction, and
- Precipitation.

Metrological data from Longyearbyen during the first phase of the NGTS project is summarised in Fig. 6.

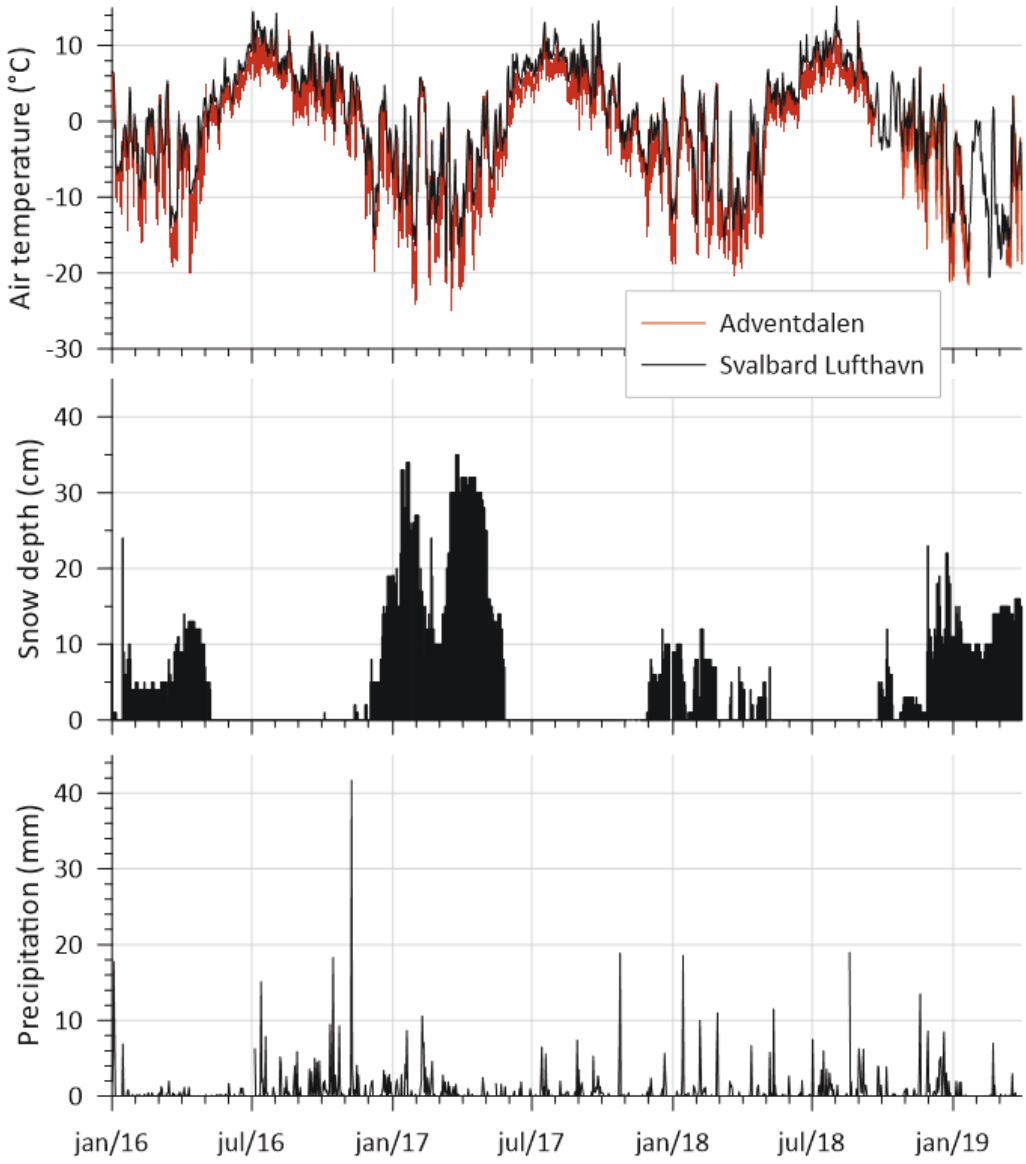


*Figure 6. Summary of air temperatures, snow pack, and precipitation (mm w.e.) during the first phase of the NGTS project on Svalbard.*

## 3.6 Ground temperature sensors

Boreholes were cased with plastic pipes (Ø=50 mm) and instrumented with thermistor strings (GeoPrecision M-Log5W). Ground thermal monitoring allowed for the characterization of permafrost temperatures at each site. This instrumentation will also enable the long-term monitoring of the thermal regime and assessment of the thermal response of permafrost to changes in climate and ground surface conditions over the lifespan of the NGTS project. Instrumentation and field set up is illustrated in Fig. 7.

**(a)** Thermistor string and recorder **(b)** Thermistor installations in Adventdalen

*Figure 7. (a) Temperature monitoring instrumentation and (b) field site in Adventdalen.*

Currently, five sites at UNIS East (E1 – E5) and two sites in Adventdalen (A4 and A6) are instrumented. Sites A3 and A4 in Adventdalen at E6 and E7 at UNIS East have partially filled with water following installation. It is unclear if the water has intruded from the saline soil pockets at depth or from the surface.

Ground temperatures at the Adventdalen and UNIS East sites are presented in Fig. 8. Ground temperatures at the depth of zero annual amplitude (8 m depth) at the Adventdalen site was ca. -4.0 °C while the mean temperature at the base of the borehole (29 m depth) was -5.5 °C. At the UNIS East site, mean annual ground surface temperatures ranged from -1.6 °C (E3) to -0.4 °C (E4), illustrating the spatial variability over short distances. Mean annual temperature at the permafrost surface ranged from -2.8 °C (E3) to -2.2 °C (E1). The depth of zero annual amplitude was encountered at approximately 9 m at all sites where mean temperatures ranged from -3.7 °C (E3) to -3.6 °C (E4). Temperatures at the base of the boreholes varied between -3.9 °C (E3) and -3.7 °C (E4).

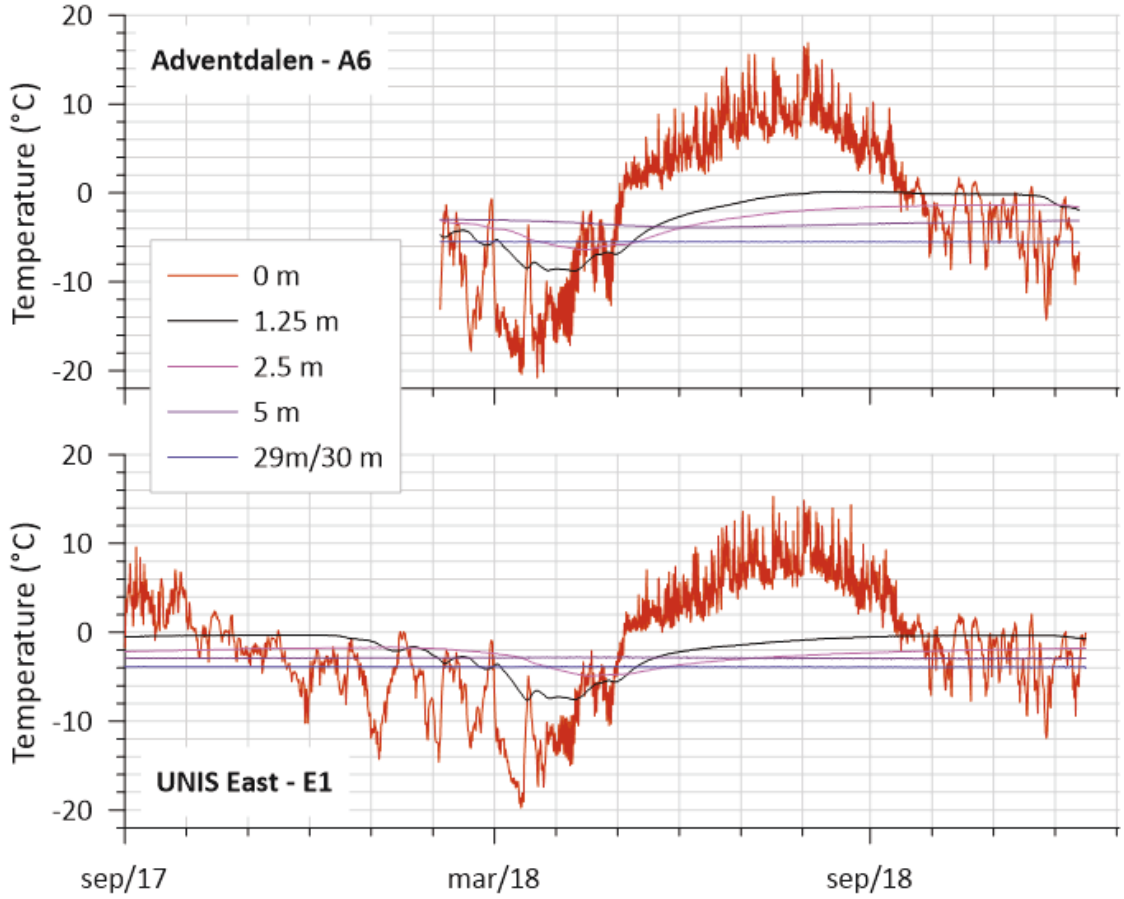


*Figure 8. Ground temperatures from thermistor strings at A6 in Adventdalen and E1 at UNIS East.*

# 4 Laboratory results

Following retrieval, samples were stored in a freezer at -18 °C. The samples were later used for determining the index properties.

Approximately 400 m of cores and bag samples were recovered from the 13 boreholes (Table 1). The soil samples were tested at the geotechnical laboratory at UNIS. The results of laboratory testing have included: grain-size distribution by wet sieving and hydrometer methods, water content and Atterberg limits, degree of saturation, dry densities, total (bulk) densities, density of solids, porosity, salinity of pore water, frozen and unfrozen thermal conductivities, and organic content.

*Table 3. Overview of laboratory testing.*

| Parameter | Symbol | Unit | Number of tests | Value |
|---|---|---|---|---|
| Natural water content | w | % | 158 | 7.0 – 161.0 |
| Bulk density | ρ | kg/m$^3$ | 47 | 1.1 – 2.2 |
| Unit weight | γ | kN/m$^3$ | 47 | 11.0 – 21.1 |
| Dry density | $\rho_d$ | kg/m$^3$ | 47 | 0.5 – 1.9 |
| Density of solid particles | $\rho_s$ | kg/m$^3$ | 64 | 2.4 – 2.8 |
| Unit weight of solid particles | $\gamma_s$ | kN/m$^3$ | 64 | 23.7 – 27.0 |
| Degree of saturation | $S_r$ | % | 37 | 73.0 – 99.5 |
| Porosity | n | % | 37 | 35.0 – 82.0 |
| Clay, silt, sand, and gravel content | - | % | 114 | *Clay*: 1.8 – 41.3<br>*Silt*: 11.3 – 83.4<br>*Sand*: 1.1 – 77.1<br>*Grvl*: 0 – 33.4 |
| Liquid Limit | $w_L$ | % | 51 | 22.8 – 37.4 |
| Plastic Limit | $w_p$ | % | 45 | 15.9 – 23.4 |
| Plasticity index | $I_p$ | % | 45 | 1.7 – 17.6 |
| Salinity | $S_n$ | ppt (‰) | 85 | 1.0 – 79.0 |
| Freezing-point depression | $T_f$ | °C | 61 | -0.1 – -5.1 |
| Total Organic Carbon | TOC | % | 121 | 2.6 – 11.2 |
| Frozen thermal conductivity | $K_f$ | W/mK | 21 | 1.6 – 3.1 |
| Thawed thermal conductivity | $K_t$ | W/mK | 22 | 1.2 – 1.6 |

## 4.1 Classification Tests

Classification tests have been performed in the laboratory to obtain basic soil characteristics of samples.

### 4.1.1 Natural Water Content

Water contents measured on all sample are presented on the borehole logs in Fig. 3 and the classification test summary table in Appendix F.

### 4.1.2 Density and Unit Weight

The measured results are presented on the borehole logs in Fig. 3 and the classification test summary table in Appendix F.

### 4.1.3 Atterberg Limits

The liquid limit, $w_L$, and the plastic limit, $w_p$, have been determined on selected samples. The measured $w_L$ and $w_p$ are presented with the plasticity index, $I_p = w_L - w_p$ on the borehole logs in Fig. 3 and in the classification test summary table in Appendix F. Plasticity charts are presented in Fig. 10.

### 4.1.4 Grain Size Distribution

A combination of wet sieving and hydrometer testing were performed on some selected samples. In the hydrometer test, the hydrometer is inserted in a 1000 mL glass cylinder with suspension at certain time intervals. The device is graduated to read in either specific gravity or grams per litre of suspension. This method is based on Stoke's law.

At the permafrost sites the clay content in the silty soil units ranges from about 2% to ca. 41%.

Numerical values for the clay, silt, sand, and gravel fractions are listed in the classification test summary table in Appendix F. A selection of grain size distribution curves is presented in Fig. 10.

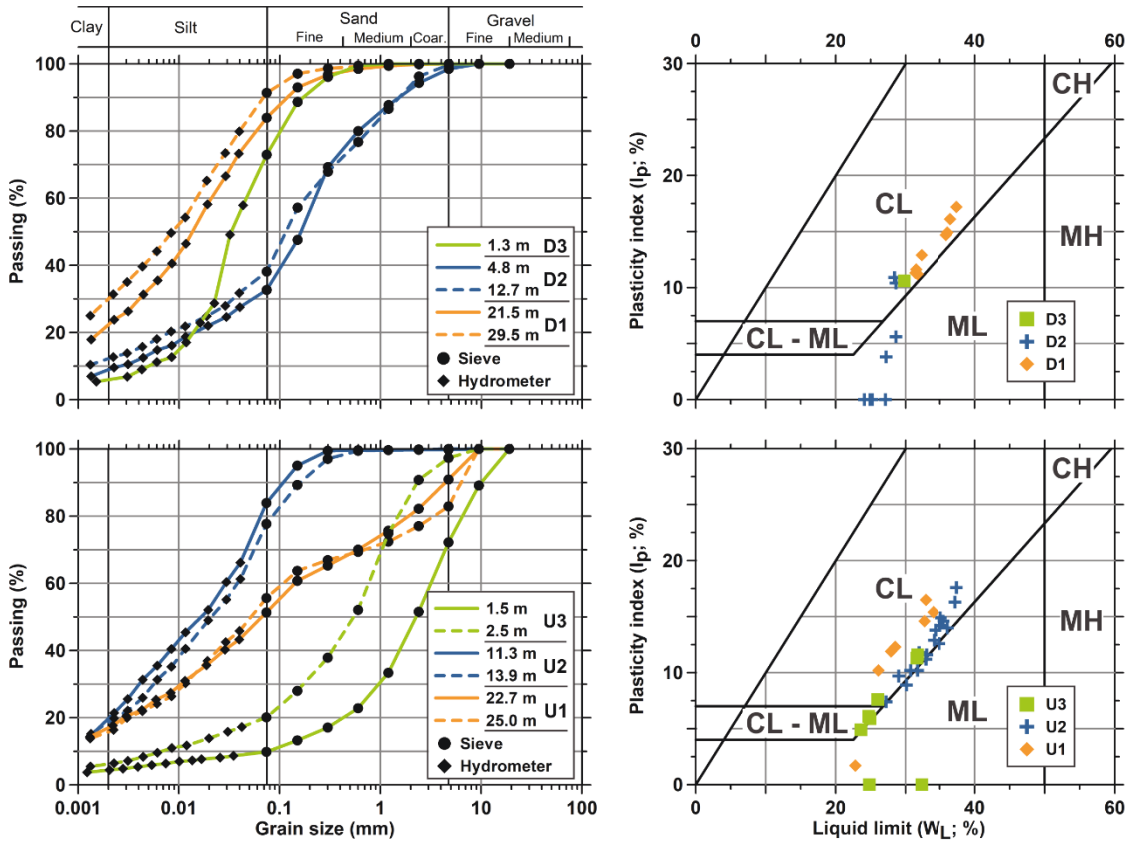


*Figure 9. Example grain size distribution curves and plasticity charts for the soil beds at the Adventdalen (Units D1-D3; upper row) and UNIS East (Units U1-U3; bottom row) sites.*

### 4.1.5 Salinity

To aid the understanding of soil and permafrost conditions in the Longyearbyen area the salinity of the pore water in 85 samples has been analysed following ISO 11265.

Results indicate a range in salinity from 1 ppt in U3 and D3 to between 20 ppt and 79 ppt in U1, U2, D1, and D2. Test results are presented in the laboratory summary table in Appendix F.

### 4.1.6 Soil freezing point depression

To investigate the effect of soil parameters, including salinity, on the state of permafrost soils the freezing point depression was analysed in 61 samples.

The soil freezing point was determined by inserting a temperature probe into a thawed sample and placing the sample in cold storage (-18 °C). The freezing curve was recorded and used to identify the temperature at which the soil began to freeze.

### 4.1.7 Unit weight of solid particles

The unit weight of solid particles, $\gamma_s$, was determined on selected samples. The individual results are presented in the classification test summary table in Appendix F.

The average value of $\gamma_s$ in the Svalbard soil units is 26.4 kN/m$^3$.

### 4.1.8 Total Carbon and Total Organic Carbon

Total organic carbon (TOC) tests were performed on selected soil samples. Organic content is found by using the loss of ignition method. The mass loss after drying equals the organic content and is expressed as a percentage of the oven dried mass.

### 4.1.9 Frozen and thawed thermal conductivity

Thermal properties of soils are determined by using a thermal needle probe following ASTM D5334. The KD2 Pro Thermal Properties Analyzer (Decagon Devices, Inc.) was the instrument used.

# 5 List of symbols and terms

## 5.1 General

According to ISO/DIS 19901-8 (E):

| | |
|---|---|
| a | net area ratio of the cone penetrometer |
| $c_v$ | coefficient of consolidation |
| $C_s$ | swelling index (for consolidation tests) |
| $h_{sf}$ | height of reference point above seafloor |
| $f_s$ | cone sleeve friction |
| $G_{max}$ | initial shear modulus |
| $I_L$ | liquidity index |
| $I_P$ | plasticity index |
| i | inclination |
| $K_o$ | coefficient of earth pressure at rest (= $\sigma'_{h0}/\sigma'_{v0}$) |
| $m_v$ | coefficient of compressibility |
| $p_0'$ | in situ vertical effective stress (=$\sigma'_{v0}$) |
| $q_c$ | cone penetration resistance |
| $q_t$ | cone penetration resistance corrected for pore water pressure effects |
| s | vane blade thickness |
| $s_u = c_u$ | undrained (undisturbed) shear strength of soil |
| $s_{uC}$ | static triaxial compression undrained shear strength |
| $s_{uD}$ | static DSS undrained shear strength |
| $s_{uE}$ | static triaxial extension undrained shear strength |
| $s_{ufv}$ | shear strength by vane testing |
| $s_{ufv\ rem}$ | remoulded shear strength by vane testing |
| $s_{ufv\ res}$ | residual shear strength by vane testing |
| $S_t$ | soil sensitivity |
| $u_2$ | pore pressure |
| $V_p$ | compression wave velocity |
| $V_s$ | shear wave velocity |
| $v_{vh}$ | vertically (v) propagated, horizontally (h) polarized shear wave velocity |
| $\xi$ | material damping ratio |
| z | height above seafloor for drilling mode *in situ* probe zero reference readings |
| $\gamma'$ | submerged unit weight of soil |
| $\gamma_m$ | material factor |
| $\nu$ | Poisson's ratio |
| $\sigma$ | stress |
| $\sigma'_{v0}$ | in situ vertical effective stress ( = $p_0'$ ) |
| $\sigma'_{h0}$ | in situ horizontal effective stress |
| $\phi'$ | effective angle of internal friction |

## 5.2 Units

According to ISO/DIS 19901-8 (E):

Units to be used may vary somewhat from one clause to another based on historical use. For example, a CPT cone cross-sectional area should be given in units of square millimetres ($mm^2$) as used today, and not for example in square metres ($m^2$). However, if there are no special historical reasons for deviating from the units listed below, then the units to be used are:

| | |
|---|---|
| force | kN |
| moment | kNm |
| density | $kg/m^3$ |
| unit weight | $kN/m^3$ |
| stress, pressure, strength and stiffness | kPa* |
| coefficient of permeability | m/s |
| coefficient of consolidation | $m^2/s$* |
| penetration rate CPT | cm/s* |

Rate of penetration is reported in mm/s.
Tip resistance, sleeve friction and pore pressure are reported in MPa.

## 5.3 Abbreviated terms

According to ISO/DIS 19901-8 (E):

| | |
|---|---|
| BHA | bottom hole assembly |
| CCV | consolidated constant volume |
| CD | consolidated drained test |
| CPT | cone penetration test |
| CPTU | cone penetration test with pore-pressure measurement |
| CRS | controlled rate of strain |
| CT | computerized tomography |
| CU | consolidated undrained |
| DS | direct shear (box) |
| DGPS | differential global positioning system |
| DSS | direct simple shear |
| ERP | emergency response plan |
| FVT | field vane test |
| GIS | geographical information system |
| GNSS | global navigation satellite system |
| HAZID | hazard identification |
| HAZOP | hazard and operability study |
| HSE | health, safety and environment |
| HVAC | heating, ventilation and air conditioning |
| IL | incremental loading |

| | |
|---|---|
| LAT | lowest astronomical tide |
| LBL | long baseline |
| MSL | mean sea level |
| MSCL | multi-sensory core logging |
| OCR | over-consolidation ratio |
| PEP | project execution plan |
| PPE | personal protective equipment |
| QA | quality assurance |
| QC | quality control |
| RFID | radio-frequency identification |
| ROP | rate of penetration |
| ROV | remotely operated vehicle |
| RS | ring shear |
| SCPT | seismic CPT |
| SH | shear waves |
| SHANSEP | stress history and normalized soil engineering parameters |
| SIMOPS | simultaneous operations |
| SOW | scope of work |
| SRB | sulphate-reducing bacteria |
| SWL | safe working load |
| TC | triaxial compression |
| TE | triaxial extension |
| TOC | total organic content |
| UCT | unconfined compression test |
| USBL | ultra-short baseline |
| UU | unconsolidated-undrained |
| WGS | World Geographic System |
| VSP | vertical seismic profiling |
| YSR | yield stress ratio |

Additional abbreviated terms:

| | |
|---|---|
| ASTM | American Standard for Testing and Materials |
| CAD | Consolidated Anisotropic Drained |
| CAU | Consolidated Anisotropic Undrained |
| CPT | Cone Penetration Test |
| CPTU | Cone Penetration Test |
| CRSC | Constant Rate of Strain Consolidation |
| DIS | Draft International Standard |
| ISO | International Organization for Standardization |
| NGF | Norsk Geoteknisk Forening (Norwegian Geotechnical Society) |
| NS | Norsk Standard (Norwegian Standard) |
| PGA | Peak Ground Acceleration |
| PSV | Pseudo Velocity |
| UU | Unconsolidated Undrained |

Coordinate table abbreviated terms:

| ABBR/Group Name | Abbreviation definition Sampler & In situ test | Term in LOCA_ID-HOLE_ID |
|---|---|---|
| BH54C | 54 mm composite sample borehole (with liner) | B |
| BH54 | 54 mm sample borehole (no liner) | B |
| BH72 | 72 mm sample borehole (no liner) | B |
| BH75 | 75 mm sample borehole (no liner) | B |
| BHSB | Sherbrooke block sample borehole (large) | B |
| BHSBm | Mini Sherbrooke block sample borehole | B |
| BHGPTr | Gel push Triple tube sampler | B |
| BHGPS | Gel push Static penetration | B |
| BHGUS | Gregory Undisturbed Fixed Piston Sample (GUS Sampler, manufactured by Acker Drill Company, PA) | B |
| BHDM | Dames and Moore Fixed Piston Sampler (DM Sampler, manufactured by GeoMatic, CA) | B |
| BG | Bag sample (unrelated to a BH) | BG |
| NA | Attempted test - no results reported | - |
| SCPTU-DIS | Seismic cone penetration tests with dissipation | C |
| CPTU-DIS | Cone penetration test with dissipation | C |
| RCPTU-DIS | Resistivity cone penetration test with dissipation | C |
| CPTU | Cone penetration test with pore pressure measurements | C |
| CPT | Cone penetration test without pore pressure measurements | C |
| RCPTU | Resistivity cone penetration test | C |
| SCPTU | Seismic cone penetration tests | C |
| SDMT | Seismic dilatometer test | D |
| DMT | Dilatometer test | D |
| ERT | Electrical resistivity tomography | ER |
| MASW | Multichannel analysis of surface waves | M |
| SRefra | Seismic refraction | SRR |
| VSP | vertical seismic profiling | VP |
| SBP | Self boring pressuremeter test | P |
| EPCT | Earth pressure cell test (hydraulic, Glötzl) | EP |
| HFST | Hydraulic fracture stress test | H |
| FVT | Field vane | V |
| INC | Inclinometer | I |
| Piezo | Piezometer (Electric reading) | PI |
| StandP | Stand pipe | S |
| THS | Thermistor string | TH |
| RWS | Rotary weight sounding | RW |

| ABBR/Group Name | Abbreviation definition Sampler & In situ test | Term in LOCA_ID-HOLE_ID |
|---|---|---|
| RCD | Rock control drilling | RC |
| SS | Simple Sounding | SS |
| RPS | Rotary pressure sounding | RP |
| TS | Total sounding | TS |
| SLU | Slug test | SL |
| PAC | Pack test | PA |
| XBseism | Crosshole seismic | XS |
| XBGPR | Crosshole GPR | XG |
| XBERT | Crosshole ERT | XE |
| DBseism | Downhole seismic | DS |
| DBGPR | Downhole GPR | DG |
| DBERT | Downhole ERT | DE |
| GPR | Ground penetrating radar | G |
| EM | Electromagnetic | E |
| SP | Self polarisation | SP |
| SRefle | Seismic reflection | SRL |
| HYP | Hydraulic piezometer (Manual reading) | HP |
| PS | Passive seismic | PS |
| SPLT | Screw-Plate Load Test | SPLT |
| WS | Weather station | WS |

## 5.4 Classification system

### 5.4.1 Shear strength of clays or density of sands (ISO 14688-2:2004(E) and NGF (2011))

| Undrained shear strength, $s_u = c_u$, of clays (in kPa) | | Density index, $I_D$, of sands (in %) | |
|---|---|---|---|
| Extremely low | <10 | Very loose | 0 to 15 |
| Very low | 10 to 20 | Loose | 15 to 35 |
| Low | 20 to 40 | Medium dense | 35 to 65 |
| Medium | 40 to 75 | Dense | 65 to 85 |
| High | 75 to 150 | Very dense | 85 to 100 |
| Very high | 150 to 300 | | |
| Extremely high*) | >300 | | |

*) Materials with shear strength greater than 300 kPa may behave as weak rock. Can be described according to ISO 14689-1

***Note: In this report $D_r$ is used for the relative density of sands, i.e. $I_D = D_r$.***

### 5.4.2 Grain size distribution (ISO 14688-1:2002(E) and NGF (2011))

The grain size distribution is presented as percentages of the various grain sizes present in the soil as determined by sieving and sedimentation. The terms used to describe grain sizes are:

| Soil fractions | Sub-fractions | Particle size (in mm) |
|---|---|---|
| Very coarse soil | Large boulder<br>Boulder<br>Cobble | > 630<br>200 to 630<br>63 to 200 |
| Coarse soil | Gravel<br>Coarse gravel<br>Medium gravel<br>Fine gravel | 2 to 63<br>20 to 63<br>6.3 to 20<br>2.0 to 6.3 |
| | Sand<br>Coarse sand<br>Medium sand<br>Fine sand | 0.063 to 2.0<br>0.63 to 2.0<br>0.2 to 0.63<br>0.063 to 0.2 |
| Fine soil | Silt<br>Coarse silt<br>Medium silt<br>Fine silt | 0.002 to 0.063<br>0.02 to 0.063<br>0.0063 to 0.02<br>0.002 to 0.0063 |
| | Clay | ≤ 0.002 |

### 5.4.3 Plasticity

The soil classification system used is described in NGF (2011).

| Descriptions | $I_p$ (%) |
|---|---|
| Low plasticity | < 10 |
| Medium plasticity | 10 – 20 |
| High plasticity | > 20 |

### 5.4.4 Terms characterizing soil structure (NGI standard practice)

| | |
|---|---|
| PARTING(S) | Horizontal inclusion(s) of different sediment type less than 3 mm thick |
| SEAM(S) | Horizontal inclusion(s) of different sediment type 3 mm to 75 mm thick |
| LAYER(S) | Horizontal inclusion(s) of different sediment type greater than 75 mm thick |
| POCKET(S) | Inclusion of different sediment type that is smaller than the diameter of the sample |
| BLOCKY | Containing discrete blocks of sediment set in a non-structured matrix |

| | |
|---|---|
| PSEUDO-BLOCKY | Block structures formed by intersecting fissures |
| PLATY | Containing discrete platelets with one dimension (vertical) limited and less than the other two |
| SLICKENSIDED | Having (inclined) planes of weakness that are slick and glossy in appearance |
| FISSURED | Containing small scale discontinuities in sediment fabric |
| LAMINATED | Composed of thin seams or partings of varying colour and texture |
| FOLIATED | Containing small scale laminar structure with no colour or textural variations |
| INTERLAYERED | Composed of alternate layers of different sediment types |
| WELL GRADED | Having a wide range of grain sizes. Similar to poorly sorted. |
| POORLY GRADED | Predominantly of one grain size. Similar to well sorted. |

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# Appendix A

LOCATION – ADDITIONAL MAPS AND SITE IMAGES

## Contents

| | | |
|---|---|---|
| **A1** | **Geological map** | **2** |
| **A2** | **Quaternary geology and geomorphology** | **3** |
| **A3** | **Aerial photo – Longyearbyen 1936** | **4** |
| **A4** | **Aerial photo – Adventdalen 1936** | **5** |
| **A5** | **UNIS East** | **6** |
| **A6** | **Adventdalen** | **8** |

# A1 Geological map

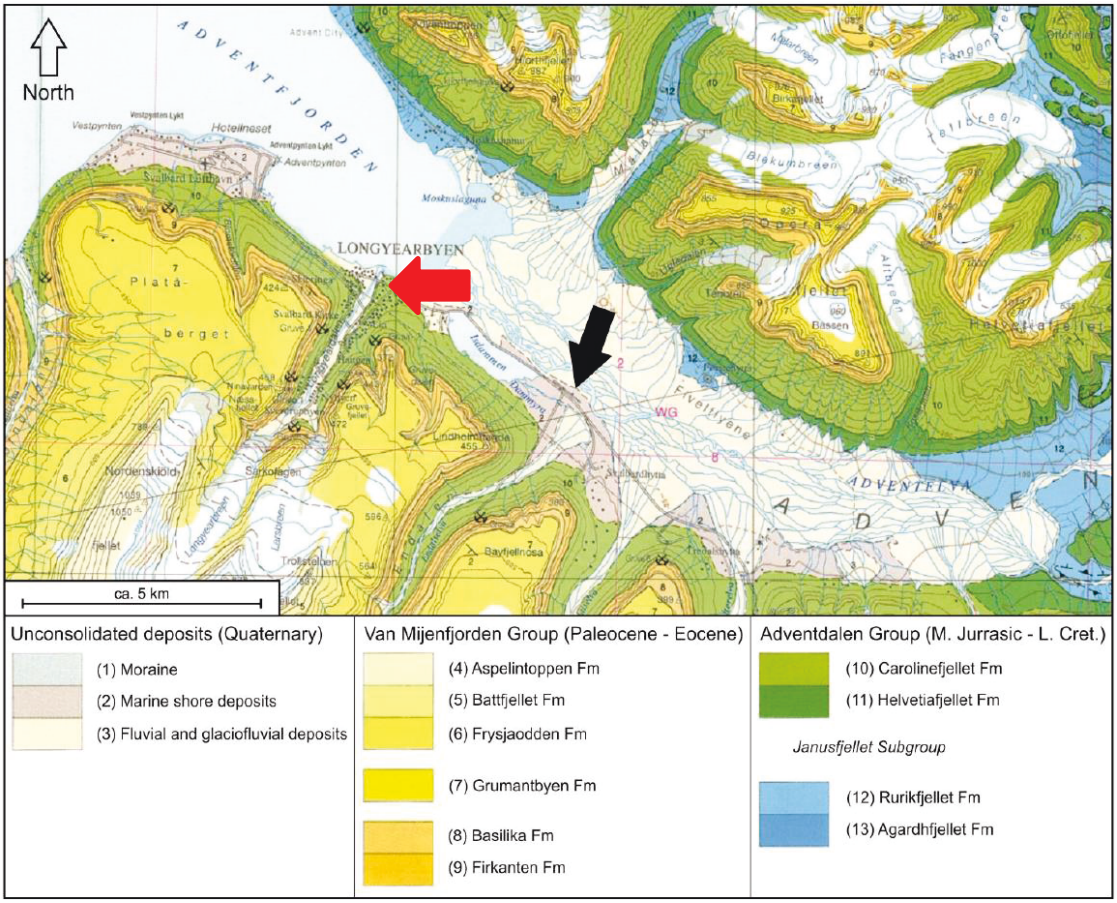



*Figure 1. Geological map of the Longyearbyen region. Black arrow indicates the location of the Adventdalen Site. Red arrow indicates the location of the UNIS East site. Modified from Major et al. (2000).*

# A2 Quaternary geology and geomorphology

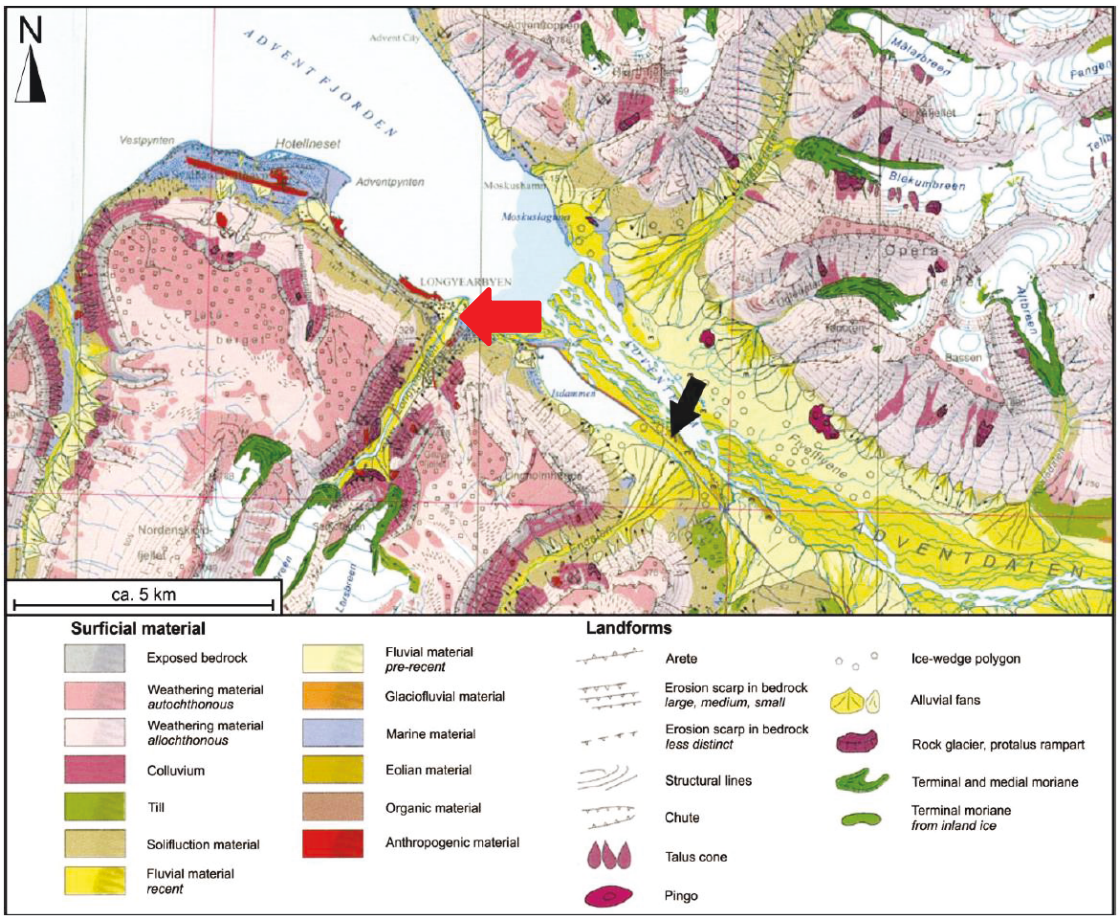



*Figure 2. Quaternary geology and geomorphological features within the Longyearbyen area. Figure modified from Tolgensbakk et al. (2000).*

# A3 Aerial photo – Longyearbyen 1936

*Figure 3. Aerial photo of Longyearbyen taken in 1936. Blue circle indicates the approximate position of the UNIS east site.*

# A4 Aerial photo – Adventdalen 1936

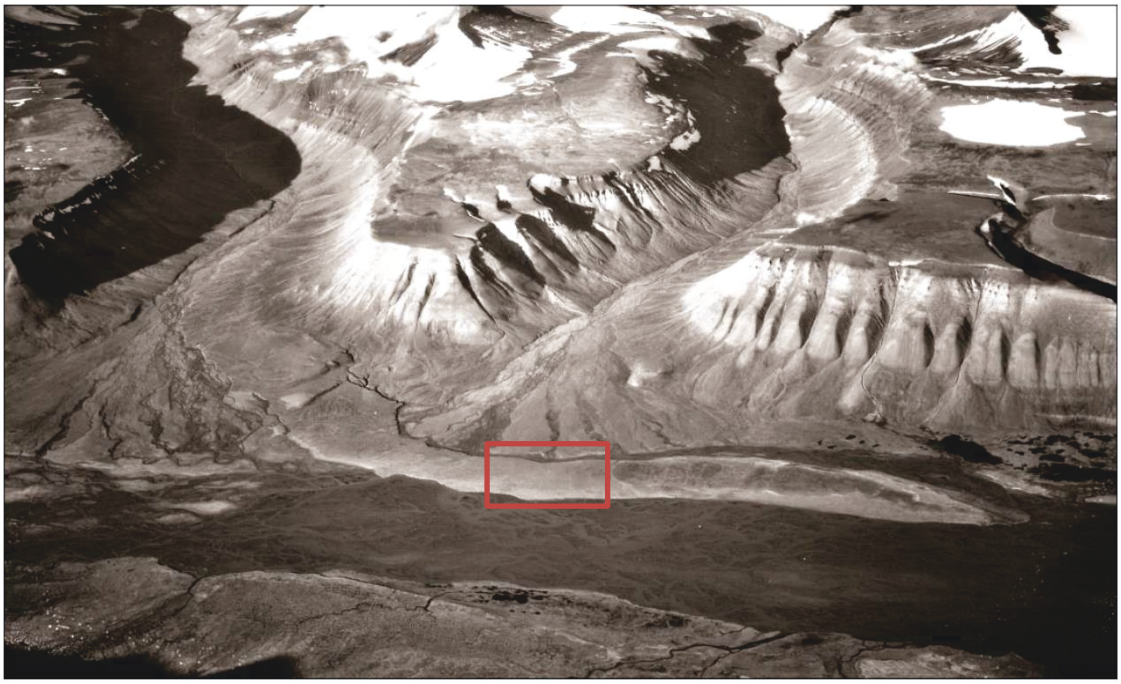


*Figure 4. Aerial photo of Adventdalen taken in 1936 (NP). Adventdalen site indicated by red box.*

# A5 UNIS East

Zone 1 - Looking north

Looking South

Looking East

Zone 2 in February 2018 – looking North

Looking west

# Appendix B

COORDINATE TABLE

| | |
|---|---|
| HEADING | Coordinate list |
| PROJ_ID | 20160154 |
| PROJ_NAME | National GeoTest Sites (NGTS) |
| PROJ_LOC | Svalbard (SVA) |
| PROJ_CLNT | NGTS |
| PROJ_CONT | UNIS |
| PROJ_END | UNIS |

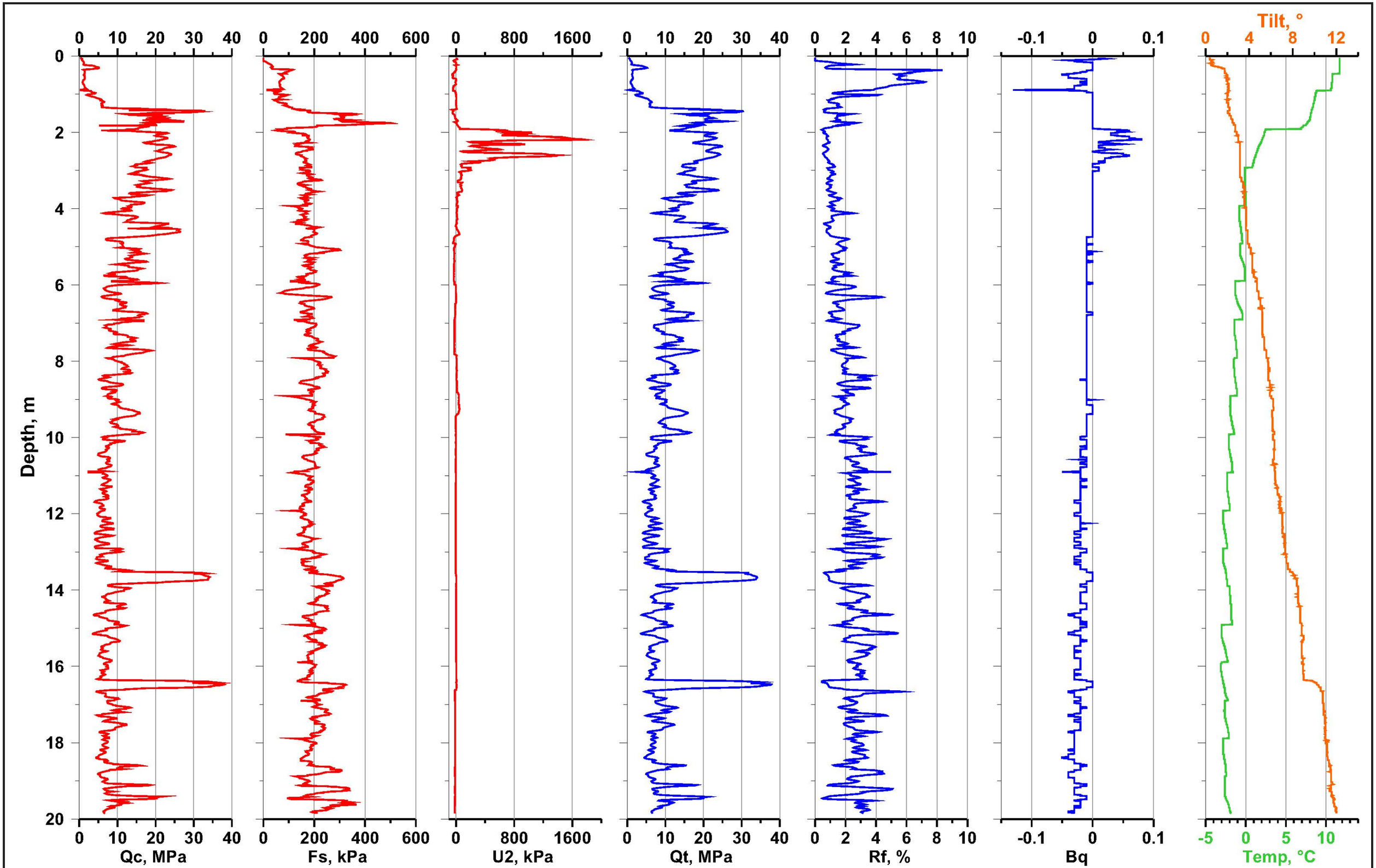

| OLD ID | LOCA_ID-HOLE_ID | ABBR | UTM | Datum | CM | Northing | Easting | Elevation surface, NN2000 | GPS Equipment ID | HDOP | VDOP | Field Equipment ID | Cone factor (a) | Depth to end of test | Depth to bedrock | DATE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| - | - | - | - | - | - | m | m | m | - | m | m | - | - | m | m | YYYY-MM-YY |
| A1 | SVAB01A | BHBG | 33X | WGS84 | | 8,680,930 | 519,020 | 4 | | | | | | 24.6 | na | 2017-03-31 |
| A2 | SVAB02A | BHBG | 33X | WGS84 | | 8,680,962 | 519,061 | 4 | | | | THS | | 27.0 | na | 2017-03-31 |
| A2_2 | SVAB02_2A | BHBG | 33X | WGS84 | | 8,680,962 | 519,061 | 4 | | | | | | 21.0 | na | 2018-04-01 |
| A3 | SVAB03A | BHBG | 33X | WGS84 | | 8 680 997 | 519,094 | 4 | | | | THS | | 30.0 | na | 2017-03-31 |
| A3_2 | SVAB03_2A | BHCR | 33X | WGS84 | | 8 680 998 | 519,094 | 4 | | | | THS | | | na | 2017-03-31 |
| A4 | SVAB04A | BHCR | 33X | WGS84 | | 8,680,830 | 519,149 | 4 | | | | THS | | 29.0 | na | 2017-03-31 |
| A4_2 | SVAB04_2A | BHCR | 33X | WGS84 | | 8,680,830 | 519,149 | 4 | | | | THS | | | na | 2018-04-01 |
| A5 | SVAB05A | BHCR | 33X | WGS84 | | 8,680,883 | 519,221 | 4 | | | | THS | | 28.0 | na | 2017-03-31 |
| A6 | SVAB06A | BHCR | 33X | WGS84 | | | | 4 | | | | THS | | 29.5 | na | 2017-12-07 |
| E1 | SVAB01E | BHBG | 33X | WGS84 | | 8,683,177 | 514,995 | 7 | | | | THS | | 30.0 | na | 2017-05-31 |
| E2 | SVAB02E | BHBG | 33X | WGS84 | | 8,683,228 | 515,074 | 6 | | | | THS | | 30.0 | 21.0 | 2017-05-31 |
| E3 | SVAB03E | BHBG | 33X | WGS84 | | 8,683,214 | 515,165 | 2 | | | | THS | | 30.0 | na | 2017-05-31 |
| E4 | SVAB04E | BHBG | 33X | WGS84 | | 8,683,152 | 515,179 | 3 | | | | THS | | 30.0 | na | 2017-05-31 |
| E5 | SVAB05E | BHCR | 33X | WGS84 | | 8,683,205 | 515,037 | 6 | | | | THS | | | 26.0 | 2018-04-01 |
| E6 | SVAB06E | BHCR | 33X | WGS84 | | 8,683,180 | 515,174 | 2 | | | | THS | | | na | 2018-04-01 |
| E7 | SVAB07E | BHCR | 33X | WGS84 | | 8,683,162 | 515,251 | 1 | | | | THS | | | na | 2018-04-01 |
| | | | | | | | | | | | | | | | | |
| A1 | SVATS01A | TS | 33X | WGS84 | | 8,680,930 | 519,020 | 4 | | | | | | 24.6 | | 2017-03-31 |
| A2 | SVATS02A | TS | 33X | WGS84 | | 8,680,962 | 519,061 | 4 | | | | | | 25.4 | | 2017-03-31 |
| A3 | SVATS03A | TS | 33X | WGS84 | | 8 680 997 | 519,094 | 4 | | | | | | 26.0 | | 2017-03-31 |
| | | | | | | | | | | | | | | | | |
| 180814_unis_01_glg | SVAC01 | CPTU | 33X | WGS84 | | 8,683,229 | 514,831 | 9 | | | | | | | na | 2018-08-14 |
| 180816_uniseast_01_glg | SVAC02 | CPTU | 33X | WGS84 | | 8,683,180 | 514,991 | 7 | | | | | | | na | 2018-08-16 |
| 180818_uniseast2_02_glg | SVAC03 | CPTU | 33X | WGS84 | | 8,683,222 | 515,066 | 6 | | | | | | | na | 2018-08-18 |
| 180825_advenr_03_glg | SVAC04 | CPTU | 33X | WGS84 | | | | 4 | | | | | | | na | 2018-08-25 |

| | |
|---|---|
| PROJ_NAME | National GeoTest Sites (NGTS) |
| PROJ_LOC | Svalbard (SVA) |
| PROJ_CLNT | NGTS |
| PROJ_CONT | UNIS |
| PROJ_END | UNIS |


| OLD ID | LOCA_ID-HOLE_ID | ABBR | UTM | Datum | CM | Northing | Easting | Elevation surface, NN2000 | GPS Equipment ID | HDOP | VDOP | Field Equipment ID | Cone factor (a) | Depth to end of test | Depth to bedrock | DATE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| - | - | - | - | - | - | m | m | m | - | m | m | - | - | m | m | YYYY-MM-YY |
| 180825_advent_01_glg | SVAC05 | CPTU | 33X | WGS84 | | | | 4 | | | | | | | na | 2018-08-25 |
| 180826_advent_02_glg | SVAC06 | CPTU | 33X | WGS84 | | | | 4 | | | | | | | na | 2018-08-26 |
| 180828_uniseast_02_glg | SVAC07 | CPTU | 33X | WGS84 | | | | 6 | | | | | | | na | 2018-08-28 |
| | | | | | | | | | | | | | | | | |
| GEOTEST_SVAL_P1_N-S | SVAER01 | ERT | 33X | WGS84 | | | | 5 to 12 | | | | | | | | |
| GEOTEST_SVAL_P2_N-S | SVAER02 | ERT | 33X | WGS84 | | | | 2 to 10 | | | | | | | | |

# Appendix C

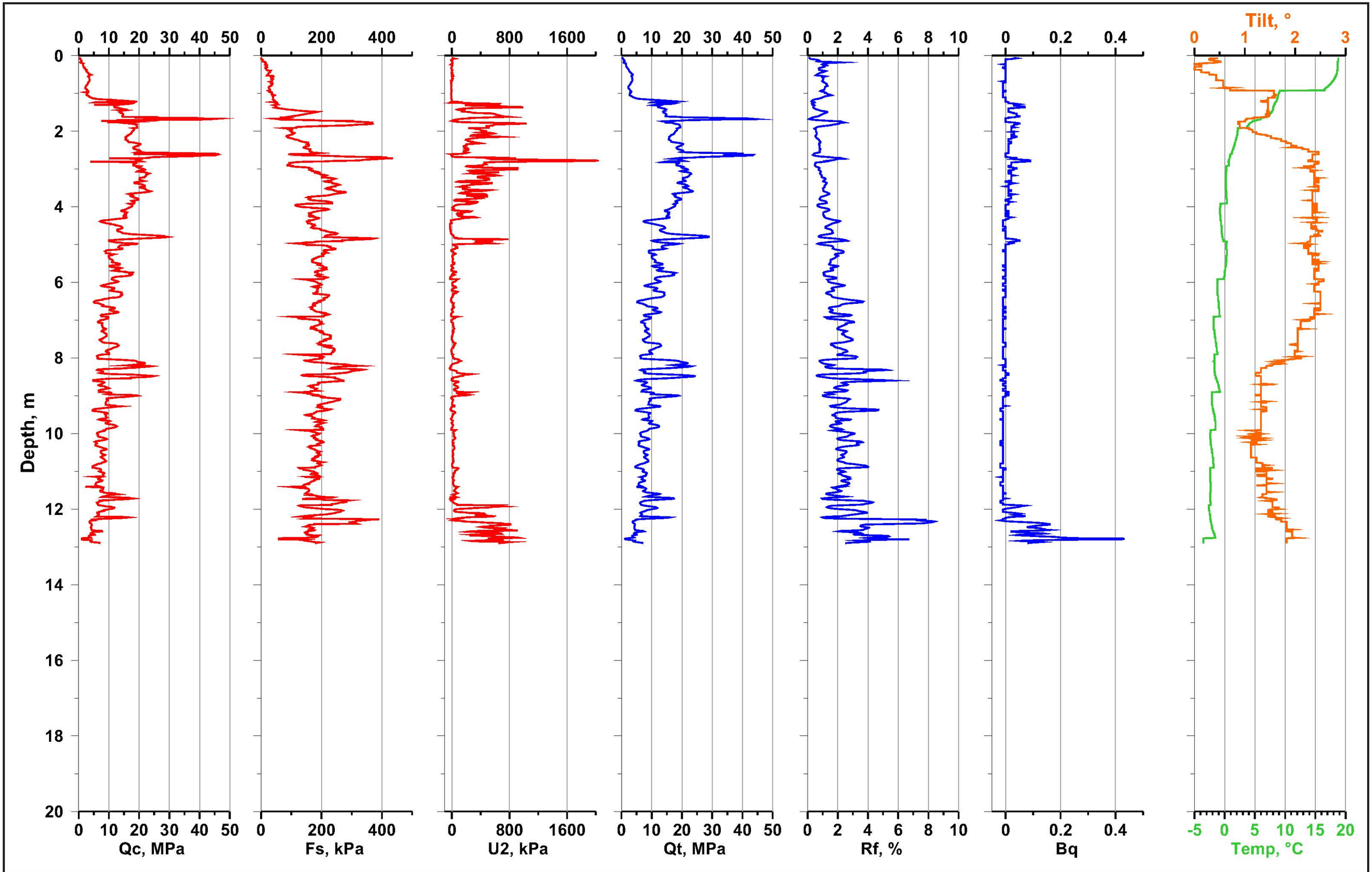
CPTU RESULTS




Test date: *2018-08-14*
Test ID: *180814_unis_01_glg*

Lat.: 78° 13.3208' N
Lon.:15° 39.3276' E

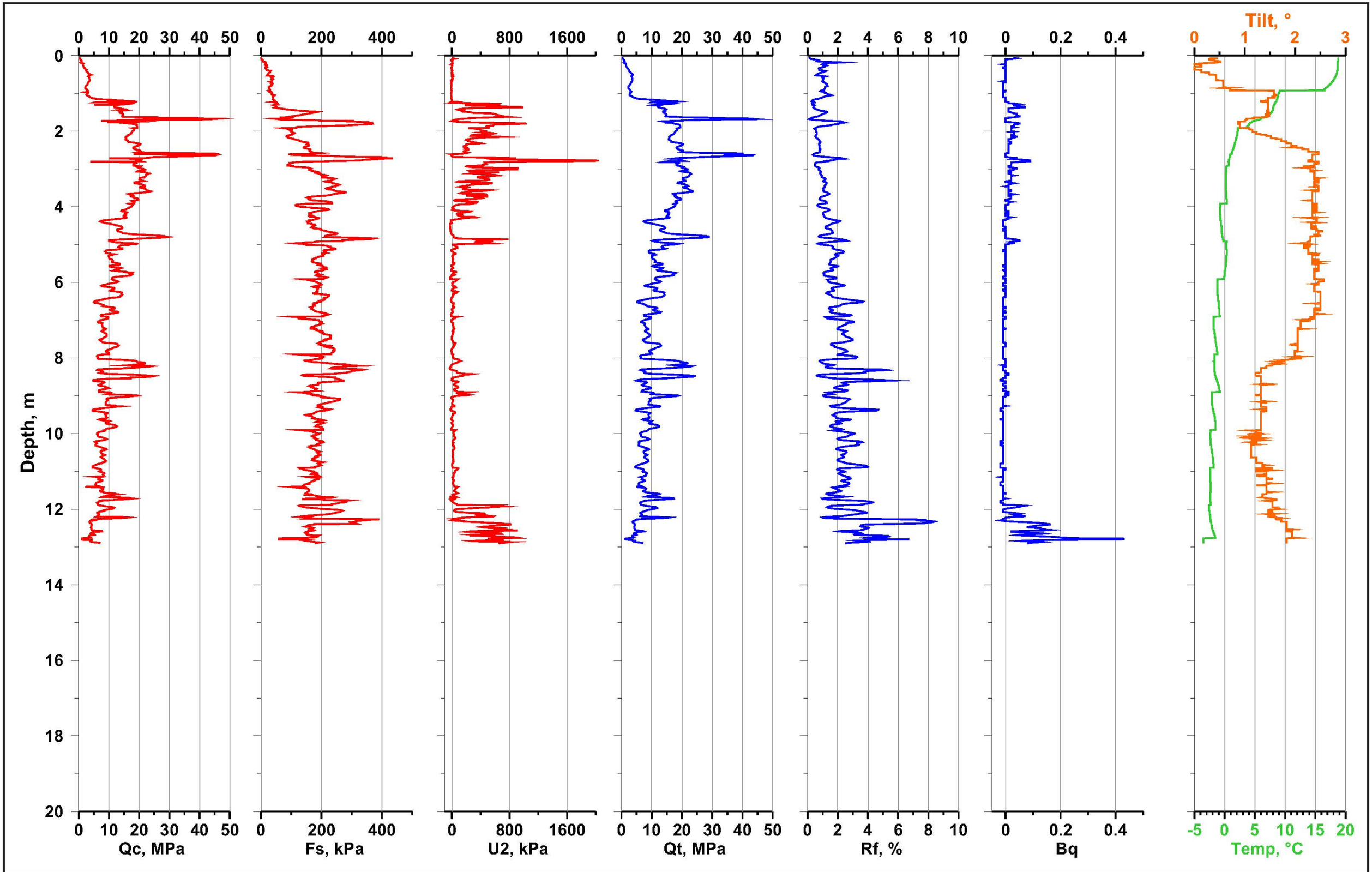
NGTS




Test date: *2018-08-16*
Test ID: *180816_uniseasr_01_glg*

Lat.: 78° 13.2934' N
Lon.:15° 39.4728' E

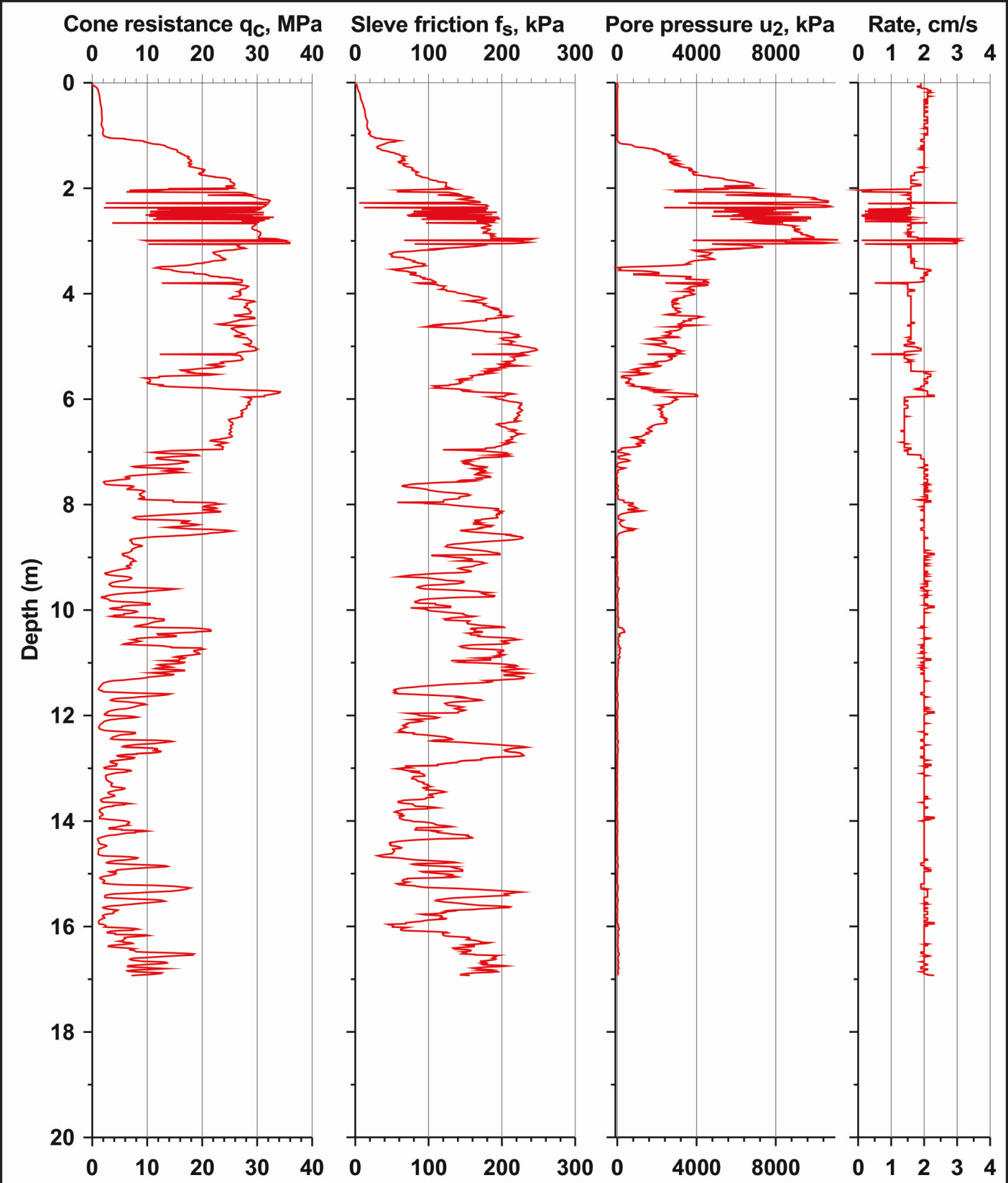
NGTS




Test date: *2018-08-16*
Test ID: *180816_uniseasr_01_glg*

Lat.: 78° 13.2934' N
Lon.:15° 39.4728' E

NGTS




Test date
*2018-08-25*

Conducted by
*GrG*

NGTS

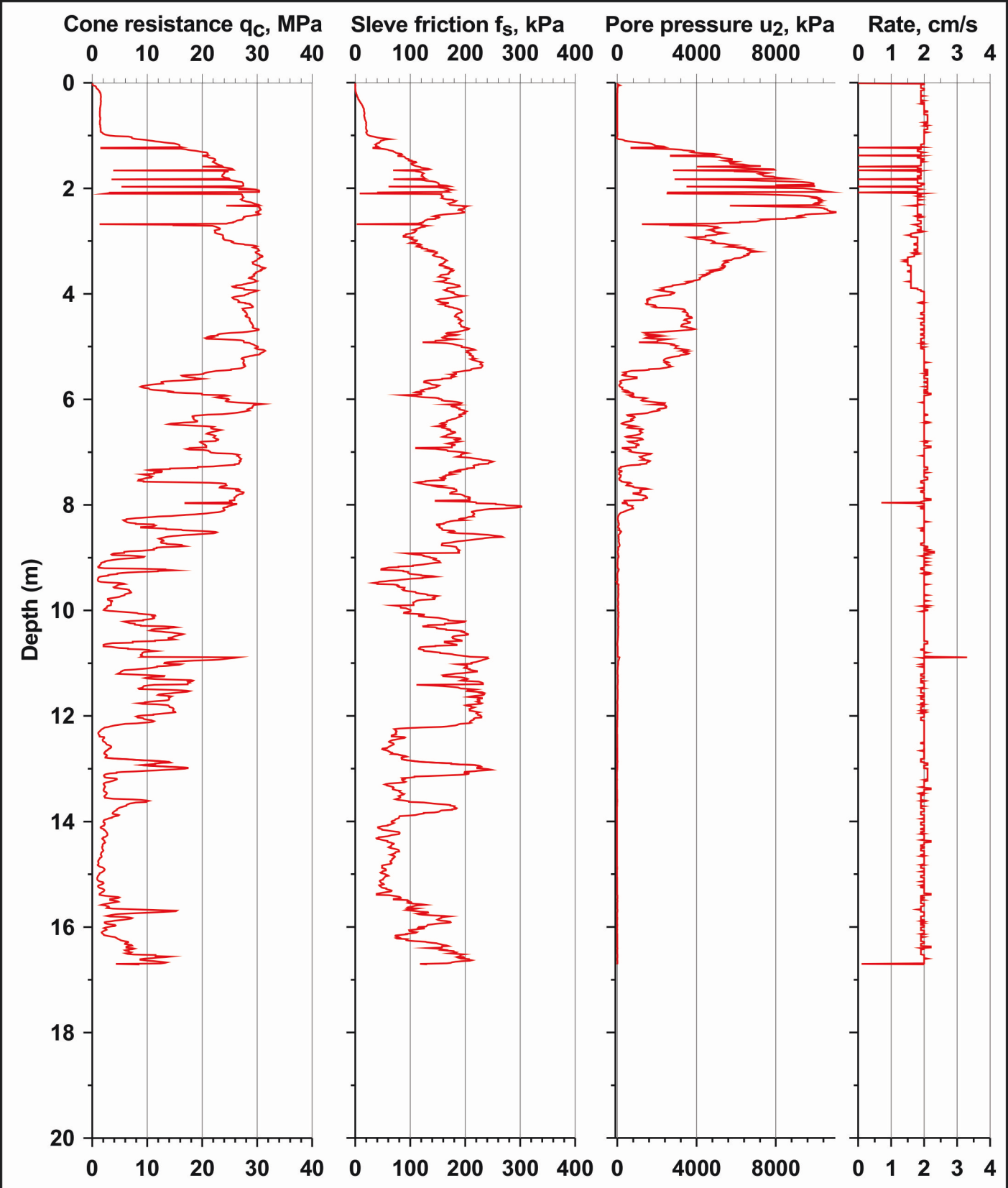
# NGTS - Svalbard research site

**Test ID: SVAC04**

***Former test ID: 180825_advenr_03_glg***

**Description: qc, fs, and u2 from CPTu test, constant rate**

**Lat.: 78.200245° N**
**Lon.:15.840198° E**




Test date
*2018-08-25*

Conducted by
*GrG*

NGTS

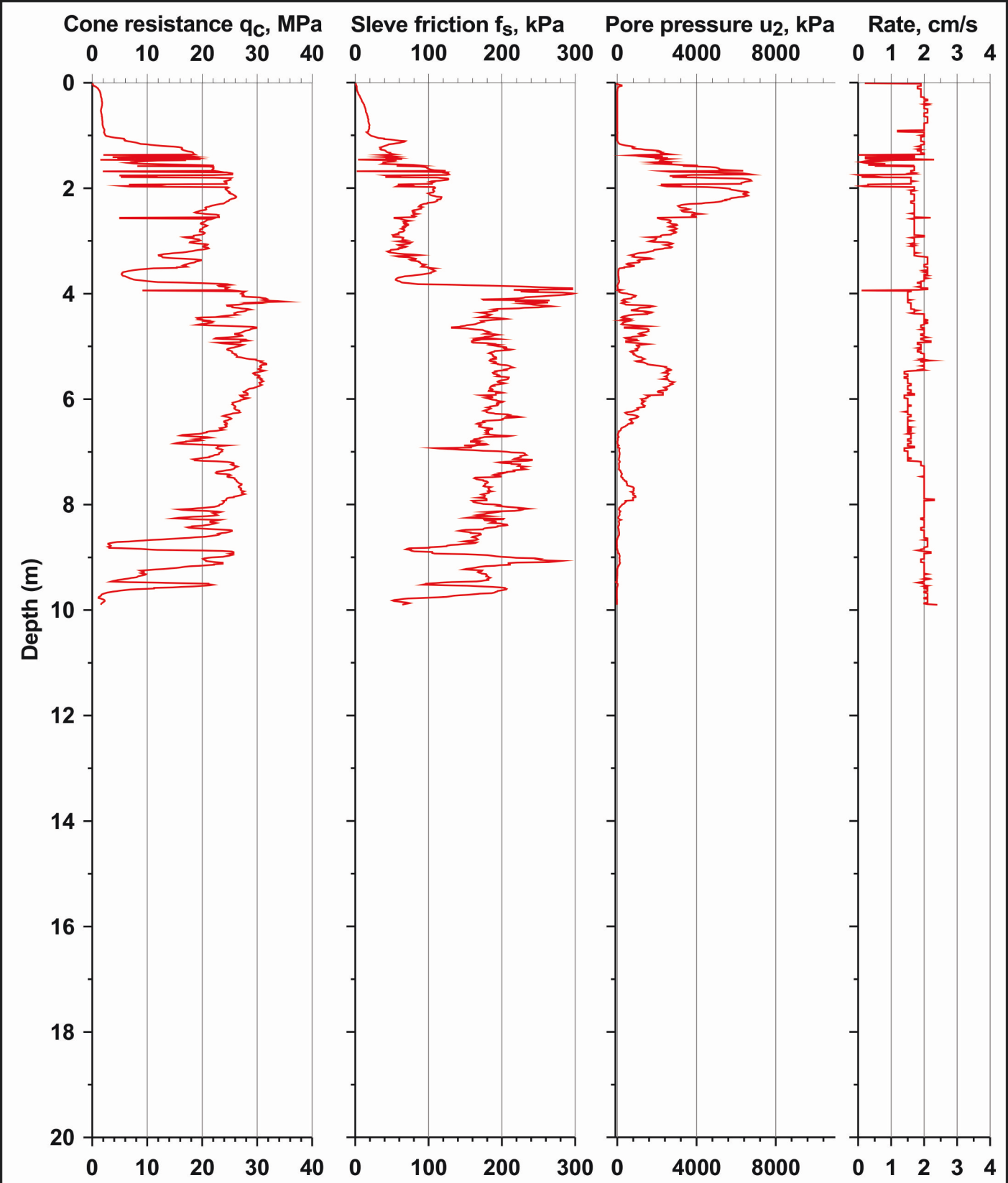
# NGTS - Svalbard research site

**Test ID: SVAC05**

***Former test ID: 180825_advent_01_glg***

**Description: qc, fs, and u2 from CPTu test, constant rate**

**Lat.: 78.200048° N**
**Lon.:15.838705° E**




Test date
*2018-08-26*

Conducted by
*GrG*

NGTS

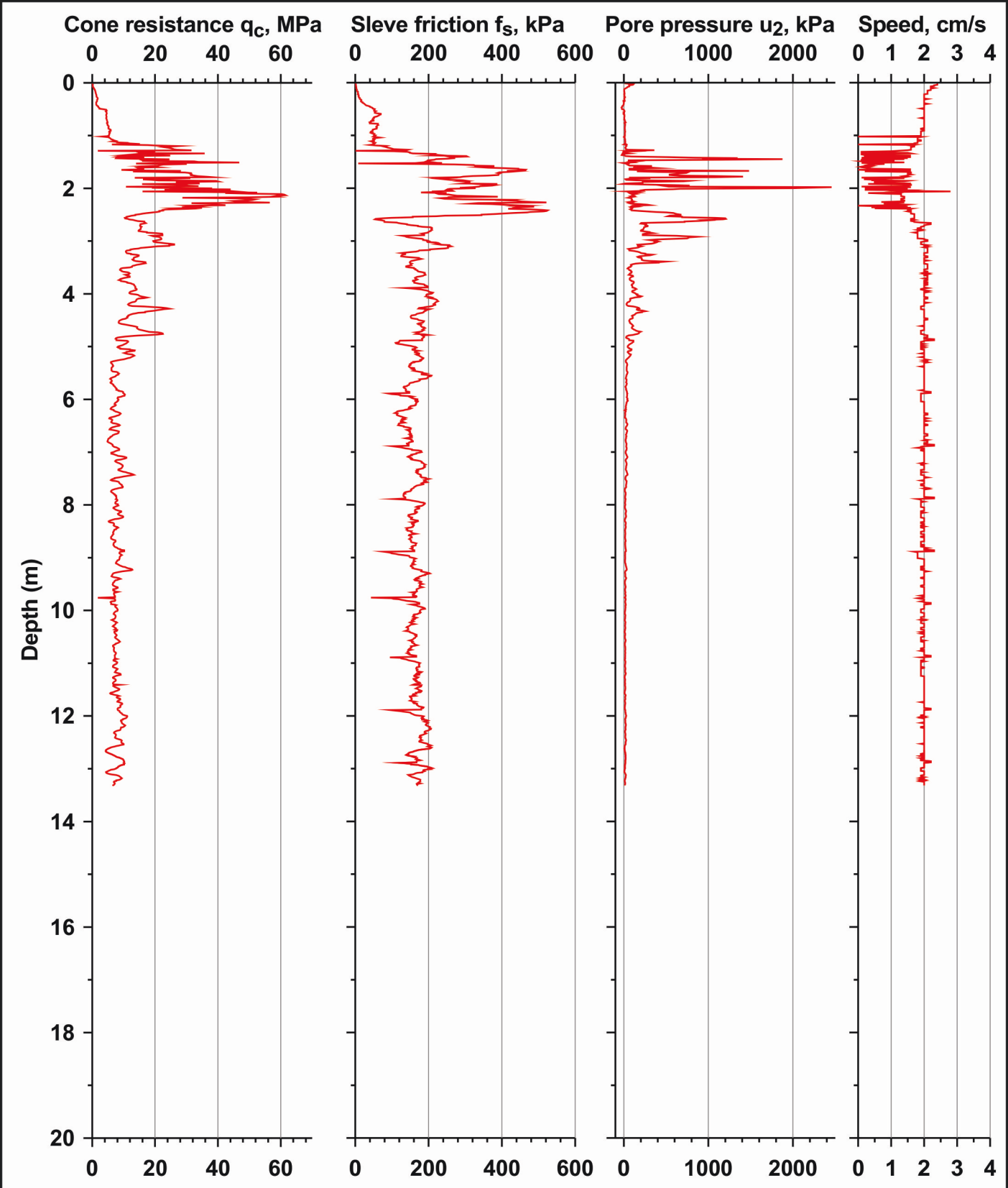
# NGTS - Svalbard research site

**Test ID: SVAC06**

***Former test ID: 180826_advent_02_glg***

**Description: qc, fs, and u2 from CPTu test, constant rate**

**Lat.: 78.201538° N**
**Lon.:15.836863° E**




Test date
*2018-08-28*

Conducted by
*GrG*

NGTS

# NGTS - Svalbard research site

**Test ID: SVAC07**

***Former test ID: 180828_uniseast_02_glg***

**Description: qc, fs, and u2 from CPTu test, constant rate**

**Lat.: 78.22176° N**
**Lon.:15.658838° E**

# Appendix D

TOTAL SOUNDING (TS) AND SAMPLING REPORT
– SINTEF

REPORT

# Norwegian GeoTest Sites (NGTS)

## GEOTECHNICAL SITE INVESTIGATION, SVALBARD
## FIELD REPORT – PERMAFROST SITE - ADVENTDALEN

DOC.NO. bmDokumentnr
REV.NO. bmRevNr / bmDato

# Project

| | |
|---|---|
| Project title: | Norwegian GeoTest Sites (NGTS) |
| Document title: | Geotechnical site investigation, Svalbard<br>Field report – Permafrost site - Advendtdalen |
| Document no.: | bmDokumentnr2 |
| Date: | bmDato2 |
| Revision no. /rev. date: | bmRevNr2 / bmRevDato |

# Client

| | |
|---|---|
| Client: | Research Council of Norway (RCN) |
| Client contact person: | Herman Fabrot |
| Contract reference: | RCN project number 245650 |

# for NGTS

| | |
|---|---|
| Project manager: | Jean-Sebastien L'Heureux |
| Prepared by: | Stein Christensen |
| Reviewed by: | Anatoly Sinitsyn |



# Summary

The NORWEGIAN GEOTEST SITES research infrastructure, with funding from The Research Council of Norway, creates a national research test site facility for geotechnical research.

This report covers the field work on the NGTS Permafrost site performed by SINTEF during the time period March-April 2017 at the Adventdalen site, located in the Longyearbyen area at the old airport/Aurora research station.

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**3 Field location** **5**
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4.2 Total sounding 8
4.3 Permafrost coring 8
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**10 Installation of casings** **16**
**11 General soil description** **16**
**12 References** **17**

# Appendix

Appendix A Total sounding results and sample pictures

# Review and reference page

# 1 Introduction

The NORWEGIAN GEOTEST SITES research infrastructure, with funding from The Research Council of Norway, creates a national research test site facility for geotechnical research. The five national test sites are located in Norway and on Svalbard. The research consortium consists of NGI and NTNU, SINTEF/UNIS and NPRA (Norwegian Public Roads Administration). The research project will develop the five sites as field laboratories for the testing and verification of innovative soil investigation and testing methods, and foundation solutions. These sites cover the soil conditions of soft clay, quick clay, silt, sand and permafrost.

This report covers the field work on the Permafrost site performed by SINTEF during the time period March-April 2017 at the Adventdalen site, located in the Longyearbyen area at the old airport/Aurora research station.

# 2 Background

The field work performed on Svalbard is covered by the subcontract signed by UNIS and SINTEF. The work comprises:

i) Site supervision
ii) Drilling and sampling
iii) Installation of field instrumentation

Responsible for site supervision: Anatoly Sinitsyn

Drilling and sampling crew: Trond Larsen and Kjartan Følke

Installation of casings: Trond Larsen and Kjartan Følke

# 3 Field location

The national test site for permafrost is located in the Svalbard Archipelago in the surroundings of Longyearbyen (see *Figure 1*). Four proposed sites comprise the NGTS Permafrost site. An overview of the proposed sites for NGTS Permafrost site is presented in Figure 2, these sites are:

- *Adventdalen (1)*
- *Endalen (2)*
- *UNIS East (3)*
- *Longyearbyen Slope (4)*

This report covers field works on the Adventdalen site in March-April 2017. Detailed map of borehole locations is presented in Figure 3.


*Figure 1 Overview map of the Svalbard Archipelago.*

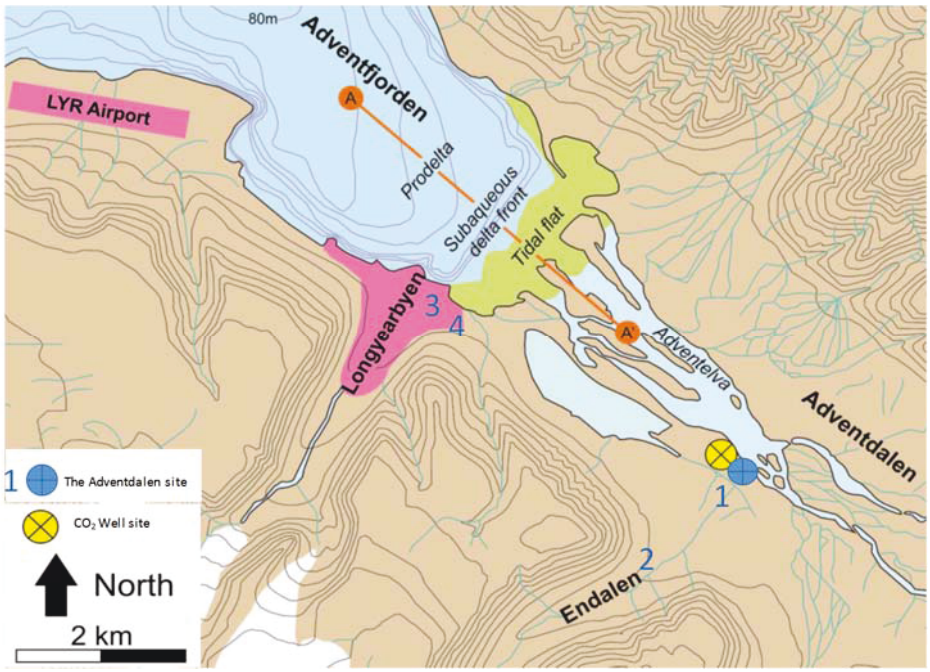



*Figure 2 Overview of the Longyearbyen area and proposed sites for NGTS Permafrost site (after [1]).*

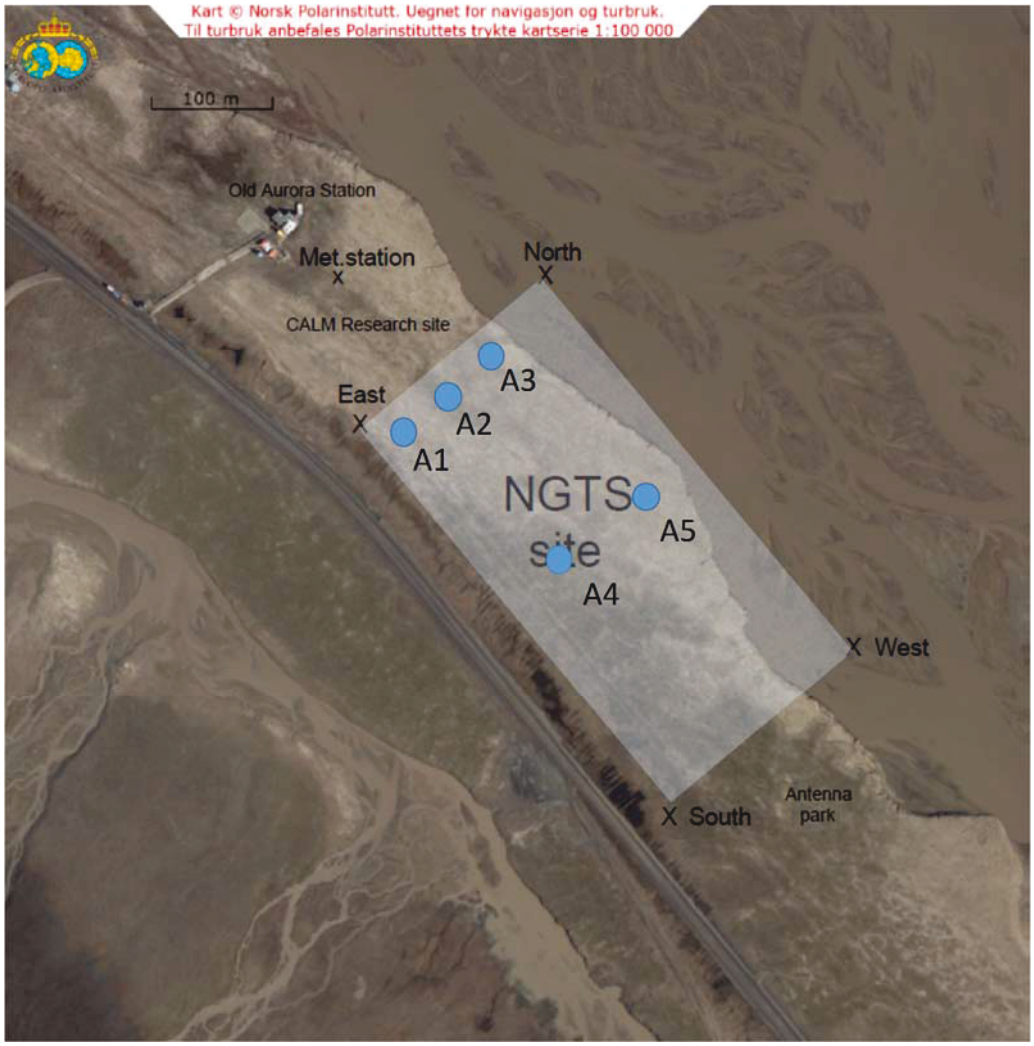



*Figure 3 Detailed map of borehole locations at the NGTS site in Adventdalen.*

Specification of the field work:

- Sampling from active layer:
  - Collection of bag samples with normal auger drilling.
- Sampling of permafrost:
  - Debris form total sounding was collected in plastic bags.
  - SINTEF-modified CRREL coring auger.
  - Sampling with 54 mm piston sampler and steel cylinders.
  - Sampling with auger was performed below thick cryopegs and in other challenging ground conditions.
- Installation of casing in boreholes: the boreholes made after total sounding, coring or augering were used for this purpose.

No sampling was performed from the bedrock. Samples was delivered in cold storage facility at UNIS.

# 4 Methods and equipment

## 4.1 Drilling rig

Field work is performed with SINTEFs custom built Geotech 504. The drilling rig can be disassembled to make it easy to transport in parts with helicopter if necessary. The drilling rig is equipped for different types of drilling and sounding, cone penetration testing, permafrost coring and conventional piston sampling. The drilling rig in operation in Adventdalen is shown in Figure 4.

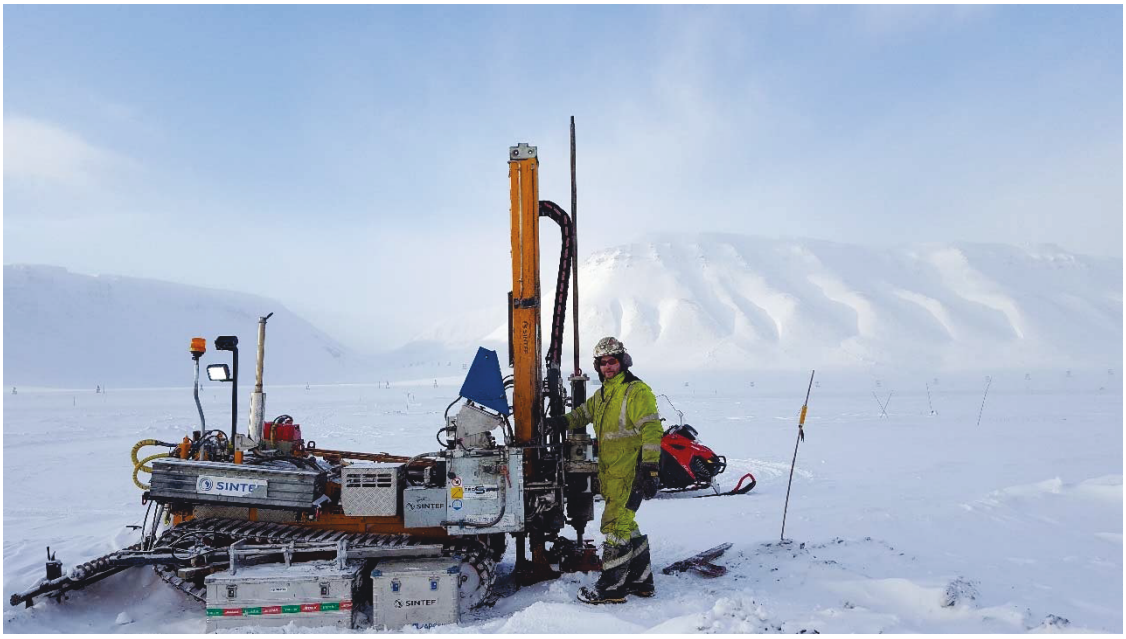


*Figure 4 The SINTEF drilling rig in operation in Adventdalen.*

## 4.2 Total sounding

The standard method for total soundings, as specified by the Norwegian Road Authorities (NPRA 2014), is performed by rotating a drill bit into the ground at constant rotation and speed of penetration while recording the soil resistance. Increased rotation speed, flushing and drill hammer is used to penetrate hard layers or rocks. In frozen soils, the resistance is too high to facilitate the required penetration rate, i.e. increased rotation is used at all time and valuable information is lost. Based on this, a modification to the total sounding procedure has been developed by SINTEF [3] which allows for obtaining detailed information of the soil profile while maintaining the effectiveness of sounding. The modified total sounding is performed with constant force while logging the penetration rate. Hammering and flushing (in permafrost with air) is performed continuously [4].

## 4.3 Permafrost coring

The SINTEF-modified CRREL coring auger for permafrost in presented in Figure 5. The corer consists of a cutting bit attached to a thick walled hollow core collecting auger.

This type of corer has proven to be efficient in collecting cores in fine grained frozen soils.

The SINTEF permafrost corer ensures penetration in most materials due to the use of poly-crystalline diamond composite (PCD) bit inserts. These inserts are very durable and can even cut cores in rock. This coring barrel is used without drilling fluids. This is a big advantage when operating in cold climate where environmentally unfriendly additives have to be used in order to prevent the liquids from freezing.

*Figure 5 The SINTEF permafrost corer; drill piece (top left), PCD inserts (top right), frost corer assembled (lower left) and sampling in Adventdalen (bottom right).*

## 4.4 Piston sampling

In unfrozen fine-grade soils piston sampling is used to obtain undisturbed samples of soil. SINTEF use the Geonor thin wall, stationary 54 mm piston sampler with cylinders of steel. Typical length of samples is 0,8 m. The piston sampling has been performed in unfrozen zones, typically at 12-17 m below terrain in Advendtdalen.

# 5 Event log

The event log is presented in Table 1.

*Table 1 Event log.*

| Day | Date | Activity |
|---|---|---|
| Wednesday | 2017-03-01 | Travel to Svalbard. |
| Thursday | 2017-03-02 | Project meeting. Preparation and checking equipment for field work. |
| Friday | 2017-03-02 | Office work. |
| Monday | 2017-03-06 | Location of the drilling rig on the site, check A1-A3 with metal detector. |
| Tuesday | 2017-03-07 | Total sounding at A1, collection of bag samples. |
| Wednesday | 2017-03-08 | Total sounding at A2, collection of bag samples. |
| Thursday | 2017-03-09 | Total sounding at A2, collection of bag samples. |
| Friday | 2017-03-10 | Total sounding at A3, collection of bag samples. |
| Monday | 2017-03-13 | Total sounding at A3 and A2, collection of bag samples. |
| Tuesday | 2017-03-14 | Preparations for coring. |
| Wednesday | 2017-03-15 | Coring at A3. |
| Thursday | 2017-03-16 | Coring at A3. |
| Friday | 2017-03-17 | Office work. |
| Saturday | 2017-03-18 | Field work was stopped due to very low air temperatures. Drilling rig did not start. |
| Monday | 2017-03-20 | Coring at A3. |
| Tuesday | 2017-03-21 | Coring at A3. |
| Wednesday | 2017-03-22 | Preparations for 54mm sampling at A3. |
| Thursday | 2017-03-23 | Sampling with 54 mm sampler in unfrozen zone of A3. |
| Friday | 2017-03-24 | Augering A3 to the depth 30 m after sampling with 54 mm sampler was stopped. |
| Saturday | 2017-03-25 | Cleaning (augering) and installation of casing at A3. Casing installed to the depth 23 m. |
| Sunday | 2017-03-26 | Cleaning A2 to the depth 30 m, installation of casing down to the depth 22,7 m. |
| Monday | 2017-03-27 | Augering and coring at A4. |
| Tuesday | 2017-03-28 | Coring at A4. |
| Wednesday | 2017-03-29 | Coring at A4. |
| Thursday | 2017-03-30 | Coring at A4. |
| Friday | 2017-03-31 | Cleaning bore hole A4: 0–14 m, 54 mm sampling from 14 to 17 m. Not much water was observed. |
| Saturday | 2017-04-01 | Augering at A4. Installation of casing down to 19.5 m: bore hole was filled up with water up to the ground surface after the casing was installed. Bore hole collapsed due to water flowing into it from 14–17 m depth, hence casing was installed at shallower (19.5 m) then initially planned depth (30 m). |
| Sunday | 2017-04-02 | Augering (0 - ca 0.5 m) and coring (ca 0.5–4 m) at A5. |
| Monday | 2017-04-03 | Coring at A5. |

| | | |
|---|---|---|
| Tuesday | 2017-04-04 | Coring and augering at A5. |
| Wednesday | 2017-04-05 | Traveling from Svalbard. |
| Tuesday | 2017-04-18 | Traveling to Svalbard. Stop for one day in Tromsø due to bad weather. |
| Wednesday | 2017-04-19 | Arrival in Svalbard. |
| Thursday | 2017-04-20 | Meeting with WP-leader. Continued coring and 54mm sampling at A5. |
| Friday | 2017-04-21 | Augering and installation of casing in A5. |
| Saturday | 2017-04-22 | Maintenance of drilling rig. |
| Monday | 2017-04-24 | Cleaning and packing of drilling rig and equipment. |
| Tuesday | 2017-04-25 | Travel from Svalbard. |

Note: A1–A5 – borehole locations.

# 6 Weather conditions

The field work was performed in air temperatures down to -20 ºC and with windchill effect the temperatures were down to -30 ºC during fieldwork as seen in *Figure 6*.

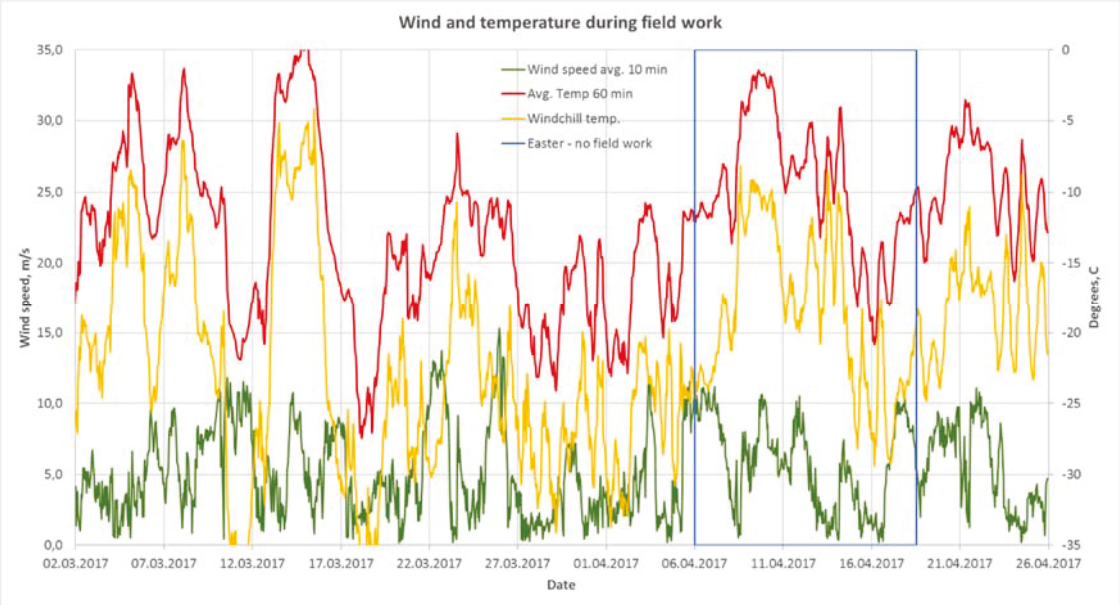



*Figure 6 Overview of temperature and wind during the field campaign.*

# 7 Coordinates

The preliminary coordinates for the geotechnical boreholes in Adventdalen site are shown in Table 2. More precise coordinates will be presented when geodetic measurements have been performed with the DGPS.

*Table 2 Location of geotechnical boreholes in Adventdalen site.*

| Place | Borehole | Easting | Northing |
|---|---|---|---|
| Adventdalen site | A1 | 519020 | 8680930 |
| Adventdalen site | A2 | 519060 | 8680960 |
| Adventdalen site | A3 | 519090 | 8681000 |
| Adventdalen site | A4 | 519150 | 8680830 |
| Adventdalen site | A5 | 519220 | 8680880 |

# 8 Total sounding

In the field campaign in Adventdalen site in spring 2017 totally 3 holes with total sounding have been performed. The depths of total soundings are shown in Table 3.

*Table 3 Total soundings in Advendtdalen site.*

| Place | Borehole | Sounding depth (m) |
|---|---|---|
| Adventdalen | A1 | 24,6 |
| Adventdalen | A2 | 25,4 |
| Adventdalen | A3 | 26,0 |

The plots of total sounding from holes A1-A3 are shown in Appendix 1.

Cryopegs were discovered during total sounding and drilling in all boreholes, typically at 12-17m depth. Potential presence of cryopegs was not excluded at the preparatory stage of field works, it was however not expected to encounter this permafrost feature in the field.

# 9 Sampling overview

Cryopegs were encountered at the depth ca 13-16 m in all drilling locations. Presence of cryopegs caused certain effect on sampling rates. Samples were collected with auger, from debris when performing total sounding, with permafrost corer or 54 mm conventional coring with steel cylinders. All samples were properly named, packed (wrapped on plastic and packed in plastic bags) and brought to cold storage at UNIS. Details regarding samples from the different boreholes are shown in Table 4−Table 8. Pictures of samples taken with the permafrost corer are shown in Appendix A.

*Table 4 Samples collected in borehole A1.*

| Depth top | Depth bottom | Sampling method | Sample wrap | Picture |
|---|---|---|---|---|
| 0,0 | 0,5 | Auger | Bag | No |
| 0,5 | 1.0 | Auger | Bag | No |
| 1,0 | 1,5 | Collected from total sounding | Bag | No |
| 2,0 | 3,0 | Collected from total sounding | Bag | No |
| 3,0 | 4,0 | Collected from total sounding | Bag | No |
| 5,0 | 7,0 | Collected from total sounding | Bag | No |
| Ca 10,0 | | Collected from total sounding | Bag | No |

*Table 5 Samples collected in borehole A2.*

| Depth top | Depth bottom | Sampling method | Sample wrap | Picture |
|---|---|---|---|---|
| 0,0 | 0,5 | Auger | Bag | No |
| 0,5 | 1.0 | Auger | Bag | No |
| 1,0 | 2,0 | Collected from total sounding | Bag | No |
| 2,0 | 3,0 | Collected from total sounding | Bag | No |
| 3,0 | 4,0 | Collected from total sounding | Bag | No |
| 4,0 | 5,0 | Collected from total sounding | Bag | No |
| 5,0 | 6,0 | Collected from total sounding | Bag | No |
| 6,0 | 7,0 | Collected from total sounding | Bag | No |
| 7,0 | 8,0 | Collected from total sounding | Bag | No |
| 8,0 | 9,0 | Collected from total sounding | Bag | No |
| 9,0 | 10,0 | Collected from total sounding | Bag | No |
| 12,0 | 14,0 | Collected from total sounding | Bag | No |
| 26,0 | 27,0 | Auger | Bag | No |

*Table 6 Samples collected in borehole A3.*

| Depth top | Depth bottom | Sampling method | Sample name | Sample wrap | Picture |
|---|---|---|---|---|---|
| 0,0 | 0,4 | Auger | | Bag | No |
| 0,4 | 1.0 | Collected from total sounding | | Bag | No |
| 1,0 | 2,0 | Collected from total sounding | | Bag | No |
| 2,0 | 3,2 | Collected from total sounding | | Bag | No |
| 3,2 | 4,0 | Collected from total sounding | | Bag | No |
| 4,0 | 5,0 | Collected from total sounding | | Bag | No |
| 5,0 | 6,0 | Collected from total sounding | | Bag | No |
| 6,0 | 7,0 | Collected from total sounding | | Bag | No |
| 7,0 | 8,0 | Collected from total sounding | | Bag | No |
| 8,0 | 9,0 | Collected from total sounding | | Bag | No |
| 9,0 | 10,0 | Collected from total sounding | | Bag | No |
| 10,0 | 11,0 | Collected from total sounding | | Bag | No |
| 11,0 | 12,0 | Collected from total sounding | | Bag | No |
| 20,0 | 30,0 | Collected from total sounding | | Bag | No |
| 0,8 | 1,2 | Permafrost corer | Pr.1 | Bag | Yes |
| 1,3 | 1,7 | Permafrost corer | Pr.2 | Bag | Yes |
| 1,8 | 2,2 | Permafrost corer | Pr.3 | Bag | Yes |
| 2,2 | 2,7 | Permafrost corer | Pr.4 | Bag | Yes |
| 2,7 | 3,0 | Permafrost corer | Pr.5 | Bag | Yes |
| 3,0 | 3,4 | Permafrost corer | Pr.6 | Bag | Yes |
| 3,4 | 3,8 | Permafrost corer | Pr.7 | Bag | Yes |
| 3,8 | 4,2 | Permafrost corer | Pr.8 | Bag | Yes |
| 4,2 | 4,6 | Permafrost corer | Pr.9 | Bag | Yes |
| 4,6 | 5,0 | Permafrost corer | Pr.10 | Bag | Yes |
| 5,0 | 5,4 | Permafrost corer | Pr.11 | Bag | Yes |
| 5,4 | 5,8 | Permafrost corer | Pr.12 | Bag | Yes |

| | | | | | |
|---|---|---|---|---|---|
| 5,8 | 6,2 | Permafrost corer | Pr.13 | Bag | Yes |
| 6,2 | 6,6 | Permafrost corer | Pr.14 | Bag | Yes |
| 6,6 | 7,0 | Permafrost corer | Pr.15 | Bag | Yes |
| 7,0 | 7,4 | Permafrost corer | Pr.16 | Bag | Yes |
| 7,4 | 7,8 | Permafrost corer | Pr.17 | Bag | Yes |
| 7,8 | 8,2 | Permafrost corer | Pr.18 | Bag | Yes |
| 8,2 | 8,6 | Permafrost corer | Pr.19 | Bag | Yes |
| 8,6 | 9,0 | Permafrost corer | Pr.20 | Bag | Yes |
| 9,0 | 9,4 | Permafrost corer | Pr.21 | Bag | Yes |
| 9,3 | 9,7 | Permafrost corer | Pr.22 | Bag | Yes |
| 9,7 | 10,1 | Permafrost corer | Pr.23 | Bag | Yes |
| 10,1 | 10,5 | Permafrost corer | Pr.24 | Bag | Yes |
| 10,5 | 10,9 | Permafrost corer | Pr.25 | Bag | Yes |
| 10,9 | 11,3 | Permafrost corer | Pr.26 | Bag | Yes |
| 11,3 | 11,7 | Permafrost corer | Pr.27 | Bag | Yes |
| 11,7 | 12,1 | Permafrost corer | Pr.28 | Bag | Yes |
| 12,1 | 12,5 | Permafrost corer | Pr.29 | Bag | Yes |
| 12,5 | 12,9 | Permafrost corer | Pr.30 | Bag | Yes |
| 12,9 | 13,3 | Permafrost corer | Pr.31 | Bag | Yes |
| 13,3 | 13,7 | Permafrost corer | Pr.32 | Bag | No |
| 13,7 | 14,1 | Permafrost corer | Pr.33 | Bag | Yes |
| 14,5 | 15,3 | 54 mm sampler | Prøve 1 | Steel cylinder | No |
| 15,5 | 16,3 | 54 mm sampler | Prøve 2 | Steel cylinder | No |
| 16,3 | 16,8 | 54 mm sampler | Prøve 3 | Steel cylinder | No |
| 18,0 | 19,0 | Auger | | Bag | No |
| 21,0 | 22,0 | Auger | | Bag | No |
| 23,0 | 24,0 | Auger | | Bag | No |
| 25,0 | 26,0 | Auger | | Bag | No |
| 27,0 | 28,0 | Auger | | Bag | No |
| 29,0 | 30,0 | Auger | | Bag | No |

*Table 7 Samples collected in borehole A4.*

| Depth top | Depth bottom | Sampling method | Sample name | Sample wrap | Picture |
|---|---|---|---|---|---|
| 0,0 | 1,0 | Auger | | Bag | No |
| 1,0 | 1,3 | Auger | | Bag | No |
| 1,3 | 1,7 | Permafrost corer | Pr.1 | Bag | Yes |
| 1,7 | 2,1 | Permafrost corer | Pr.2 | Bag | Yes |
| 2,1 | 2,5 | Permafrost corer | Pr.3 | Bag | Yes |
| 2,5 | 2,9 | Permafrost corer | Pr.4 | Bag | Yes |
| 2,9 | 3,3 | Permafrost corer | Pr.5 | Bag | Yes |
| 3,3 | 3,7 | Permafrost corer | Pr.6 | Bag | Yes |
| 3,7 | 4,1 | Permafrost corer | Pr.7 | Bag | Yes |
| 4,1 | 4,5 | Permafrost corer | Pr.8 | Bag (not frozen) | Yes |
| 4,5 | 4,9 | Permafrost corer | Pr.9 | Bag (not frozen) | Yes |
| 4,9 | 5,3 | Permafrost corer | Pr.10 | Bag | Yes |
| 5,3 | 5,7 | Permafrost corer | Pr.11 | Bag | Yes |

| | | | | | |
|---|---|---|---|---|---|
| 5,7 | 6,1 | Permafrost corer | Pr.12 | Bag | Yes |
| 6,1 | 6,5 | Permafrost corer | Pr.13 | Bag | Yes |
| 6,5 | 6,9 | Permafrost corer | Pr.14 | Bag | Yes |
| 6,9 | 7,3 | Permafrost corer | Pr.15 | Bag | Yes |
| 7,3 | 7,7 | Permafrost corer | Pr.16 | Bag | Yes |
| 7,7 | 8,1 | Permafrost corer | Pr.17 | Bag | Yes |
| 8,1 | 8,5 | Permafrost corer | Pr.18 | Bag | Yes |
| 8,5 | 8,9 | Permafrost corer | Pr.19 | Bag | Yes |
| 8,9 | 9,3 | Permafrost corer | Pr.20 | Bag | Yes |
| 9,3 | 9,7 | Permafrost corer | Pr.21 | Bag | Yes |
| 9,7 | 10,1 | Permafrost corer | Pr.22 | Bag | Yes |
| 10,5 | 10,9 | Permafrost corer | Pr.23 | Bag | Yes |
| 10,9 | 11,3 | Permafrost corer | Pr.24 | Bag | Yes |
| 11,3 | 11,7 | Permafrost corer | Pr.25 | Bag | Yes |
| 11,7 | 12,1 | Permafrost corer | Pr.26 | Bag | Yes |
| 12,1 | 12,5 | Permafrost corer | Pr.27 | Bag | Yes |
| 12,5 | 12,9 | Permafrost corer | Pr.28 | Bag | Yes |
| 12,9 | 13,7 | No sample | | - | - |
| Ca 14 | Ca 15 | 54 mm sampler | | Steel cylinder | No |
| Ca 15 | Ca 16 | 54 mm sampler | | Steel cylinder | No |
| Ca 16 | Ca 17 | 54 mm sampler | | Steel cylinder | No |
| 26,0 | 27,0 | Auger | | Bag | No |
| 28,0 | 29,0 | Auger | | Bag | No |

*Table 8 Samples collected in borehole A5.*

| Depth top | Depth bottom | Sampling method | Sample name | Sample wrap | Picture |
|---|---|---|---|---|---|
| 0,0 | 0,5 | Auger | Prøve 1 | Bag | No |
| 0,5 | 1,5 | Auger | Prøve 2 | Bag | No |
| 1,5 | 1,9 | Permafrost corer | Pr.3 | Bag | Yes |
| 1,9 | 2,3 | Permafrost corer | Pr.3 | Bag | Yes |
| 2,3 | 2,7 | Permafrost corer | Pr.5 | Bag | Yes |
| 2,7 | 3,1 | Permafrost corer | Pr.6 | Bag | Yes |
| 3,1 | 3,5 | Permafrost corer | Pr.7 | Bag | Yes |
| 3,5 | 3,9 | Permafrost corer | Pr.8 | Bag | Yes |
| 3,9 | 4,3 | Permafrost corer | Pr.9 | Bag | Yes |
| 4,3 | 4,7 | Permafrost corer | Pr.10 | Bag | Yes |
| 4,7 | 5,1 | Permafrost corer | Pr.11 | Bag | Yes |
| 5,1 | 5,5 | Permafrost corer | Pr.12 | Bag | Yes |
| 5,5 | 5,9 | Permafrost corer | Pr.13 | Bag | Yes |
| 5,9 | 6,3 | Permafrost corer | Pr.14 | Bag | Yes |
| 6,3 | 6,7 | Permafrost corer | Pr.15 | Bag | Yes |
| 6,7 | 7,1 | Permafrost corer | Pr.16 | Bag | Yes |
| 7,1 | 7,5 | Permafrost corer | Pr.17 | Bag | Yes |
| 7,5 | 7,9 | Permafrost corer | Pr.18 | Bag | Yes |
| 7,9 | 8,3 | Permafrost corer | Pr.19 | Bag | Yes |
| 8,3 | 8,7 | Permafrost corer | Pr.20 | Bag | Yes |

| | | | | | |
|---|---|---|---|---|---|
| 8,7 | 9,1 | Permafrost corer | Pr.21 | Bag | Yes |
| 9,1 | 9,5 | Permafrost corer | Pr.22 (soft) | Bag | Yes |
| 9,5 | 9,9 | Permafrost corer | Pr.23 | Bag | Yes |
| 9,9 | 10,3 | Permafrost corer | Pr.24 | Bag | Yes |
| 10,3 | 10,7 | No sample obtained | - | Bag | No |
| 10,7 | 12,0 | Auger | | Bag | No |
| 12,2 | 12,6 | Permafrost corer | Pr.24B | Bag | Yes |
| 12,6 | 13,0 | Permafrost corer | Pr.25 | Bag | Yes |
| 15,2 | 16,0 | 54 mm sampler | | Steel cylinder | No |
| 16,0 | 16,5 | 54 mm sampler | | Steel cylinder | No |
| 19,0 | 20,0 | Auger | | Bag | No |
| 21,0 | 22,0 | Auger | | Bag | No |
| 23,0 | 24,0 | Auger | | Bag | No |
| 25,0 | 26,0 | Auger | | Bag | No |
| 26,0 | 27,0 | Auger | | Bag | No |
| 27,0 | 28,0 | Auger | | Bag | No |

# 10 Installation of casings

In this project thermistors for measuring ground temperature in depth should be installed in casings. The casings consisted of 2m sections of Ø50mm PEHD pipes satisfying DS2119 ([2]) and KIWA certified. Thread tape were used in the threaded coupling between casing sections. The casings were pushed down in the holes A2−A5. Total sounding had been performed in these holes previously, and the holes were cleaned by auger prior to installation of casings. The installed casing depths in boreholes A2−-A5 are shown in *Table 9*.

*Table 9 Casing depths in Adventdalen.*

| Place | Borehole | Installation depth (m) |
|---|---|---|
| Adventdalen site | A2 | 22,7 |
| Adventdalen site | A3 | 23,0 |
| Adventdalen site | A4 | 19,5 |
| Adventdalen site | A5 | 19,5 |

Thermistor strings will be installed by UNIS-personnel.

# 11 General soil description

The active layer at the site in Advendtdalen is supposed to have a thickness of 1 m. This layer was frozen during the field campaign. The sediments above the cryopeg layer consist mainly of silts and sands, which can be seen from total soundings and samples taken with the frost corer. Within the cryopeg layer (13−16m depth) some 54 mm piston samples have been taken. Silts and sands seem also to dominate below the cryopeg layer down to 22-23m depth. Below this depth the sediments seem to be more fine-grained.

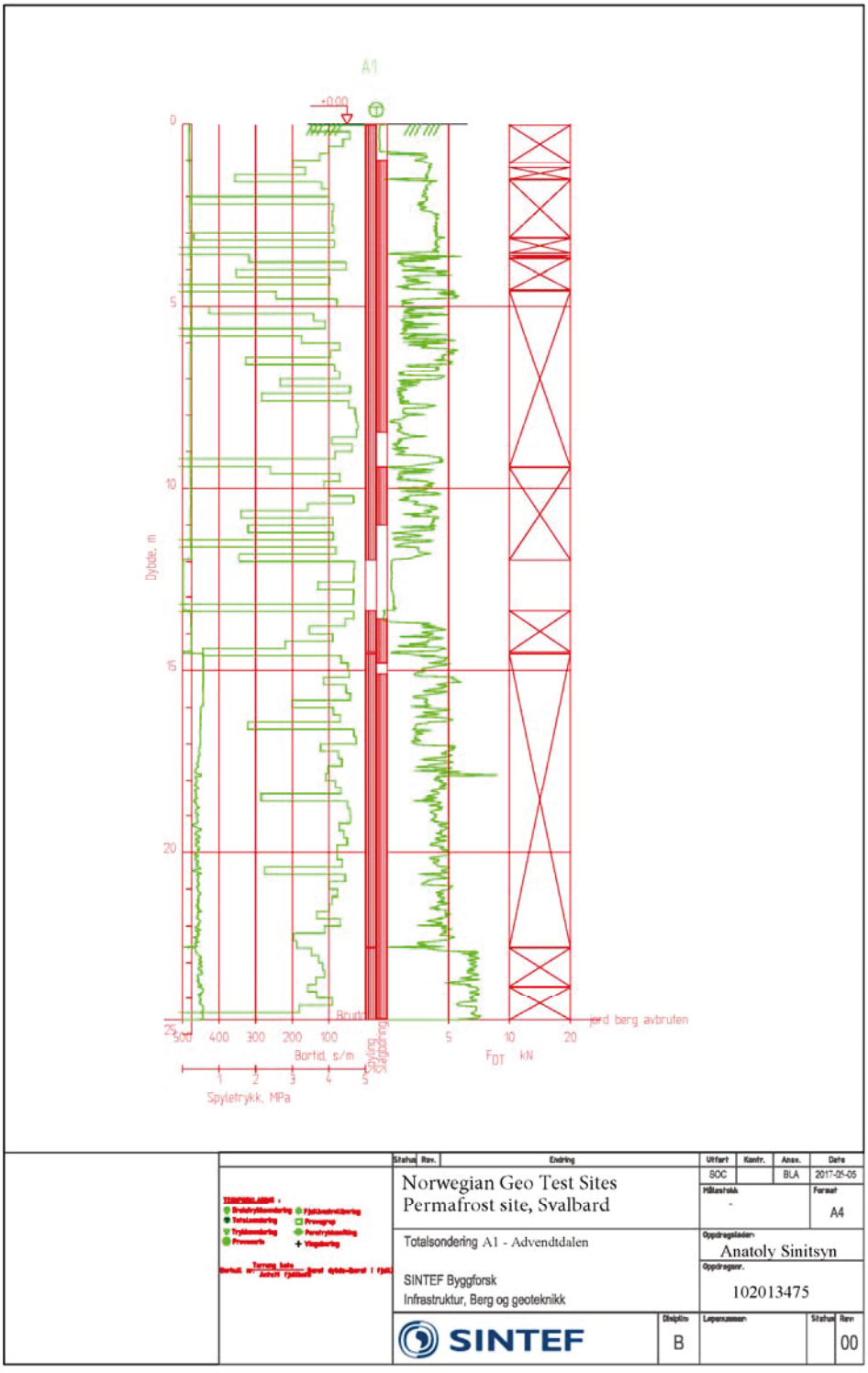
# 12 References

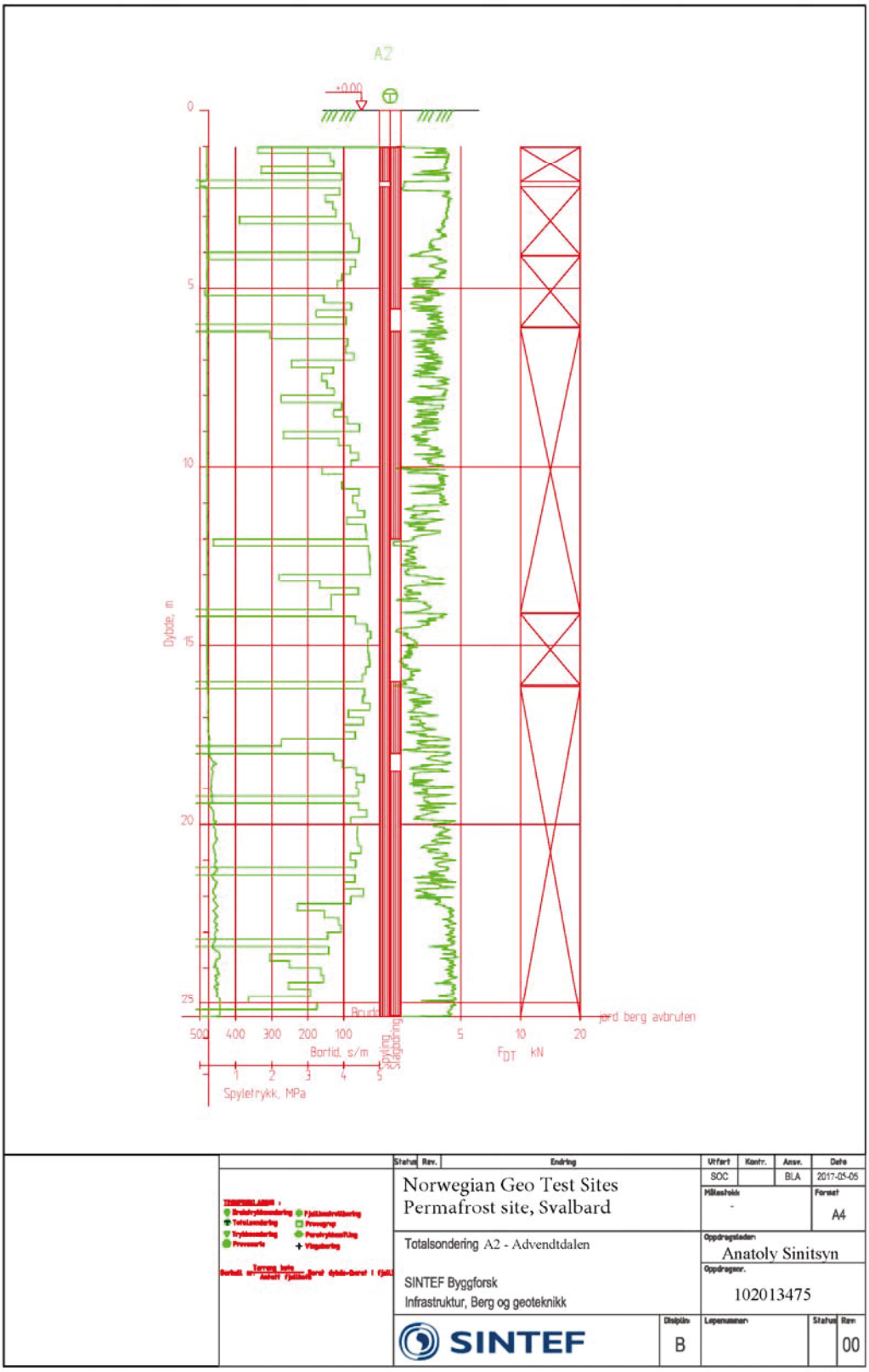
1. Gilbert, G.L., Sedimentology and geocryology of an Arctic fjord head delta (Adventdalen, Svalbard), in Department of Geosciences, Faculty of Mathematics and Natural Sciences. 2014, University of Oslo. p. 133.
2. Van Everdingen, R.O., Muli-Language Glossary of Permafrost and Related Ground-Ice Terms. 1998, International Permafrost Association: The Arctic Institute of North America, The University of Calgary, Calgary, Alberta, Canada T2N 1N4.3. DS 2119 TILLÆG:1989 (withdrawn), *Pressure pipes of polyethylene (PEL, PEM and PEH) for water supply*. p. 4.
3. Finseth, J. and Wold, M., Experiences from geotechnical sampling and sounding in Permafrost. EUCOP 2010, Svalbard, Norway.
4. Husdal, E., The application of modified total sounding techniques in frozen ground, Trondheim, Master Thesis NTNU, June, 2011

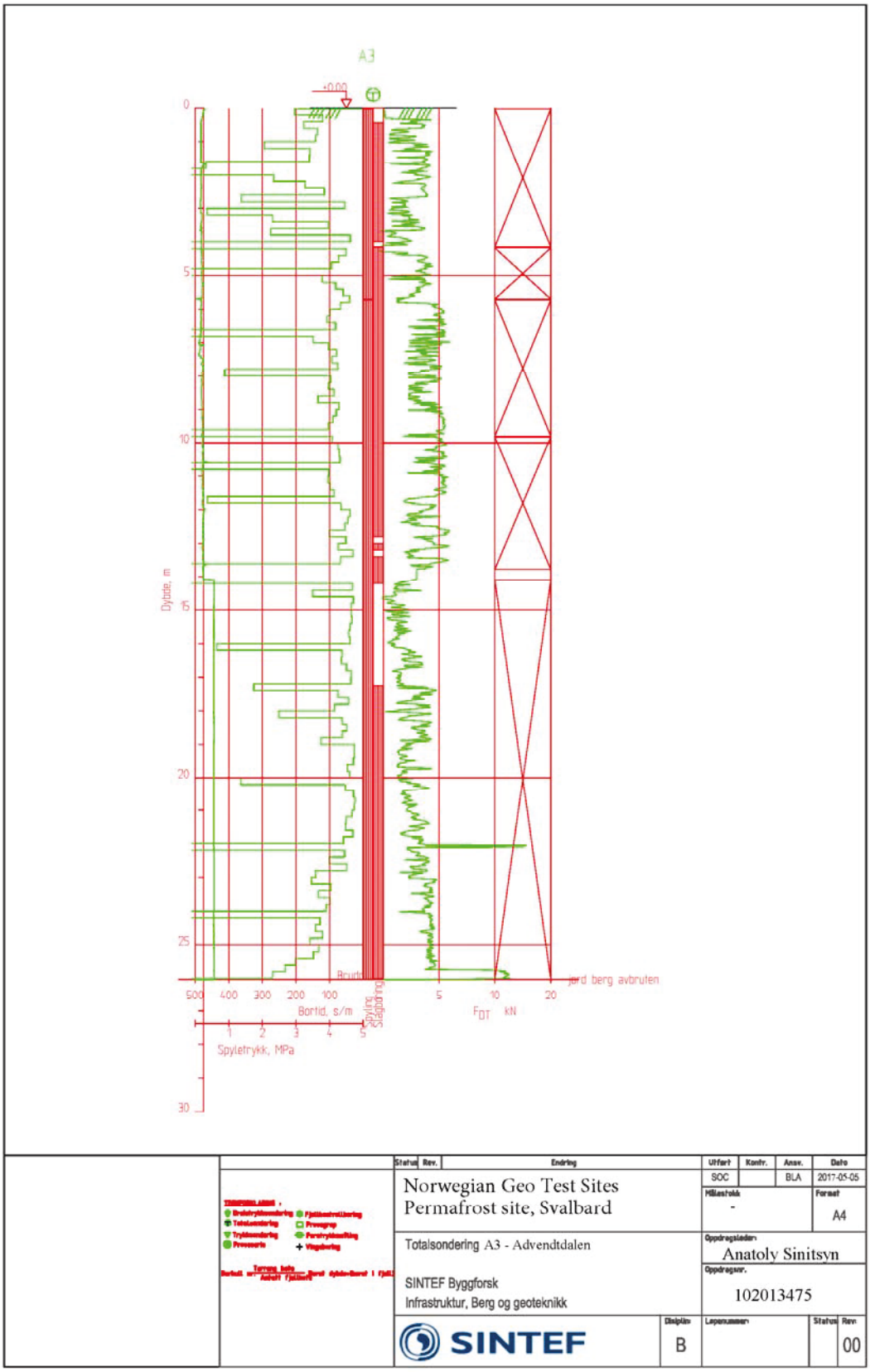
# Appendix A

TOTAL SOUNDINGS AND SAMPLE PICTURES

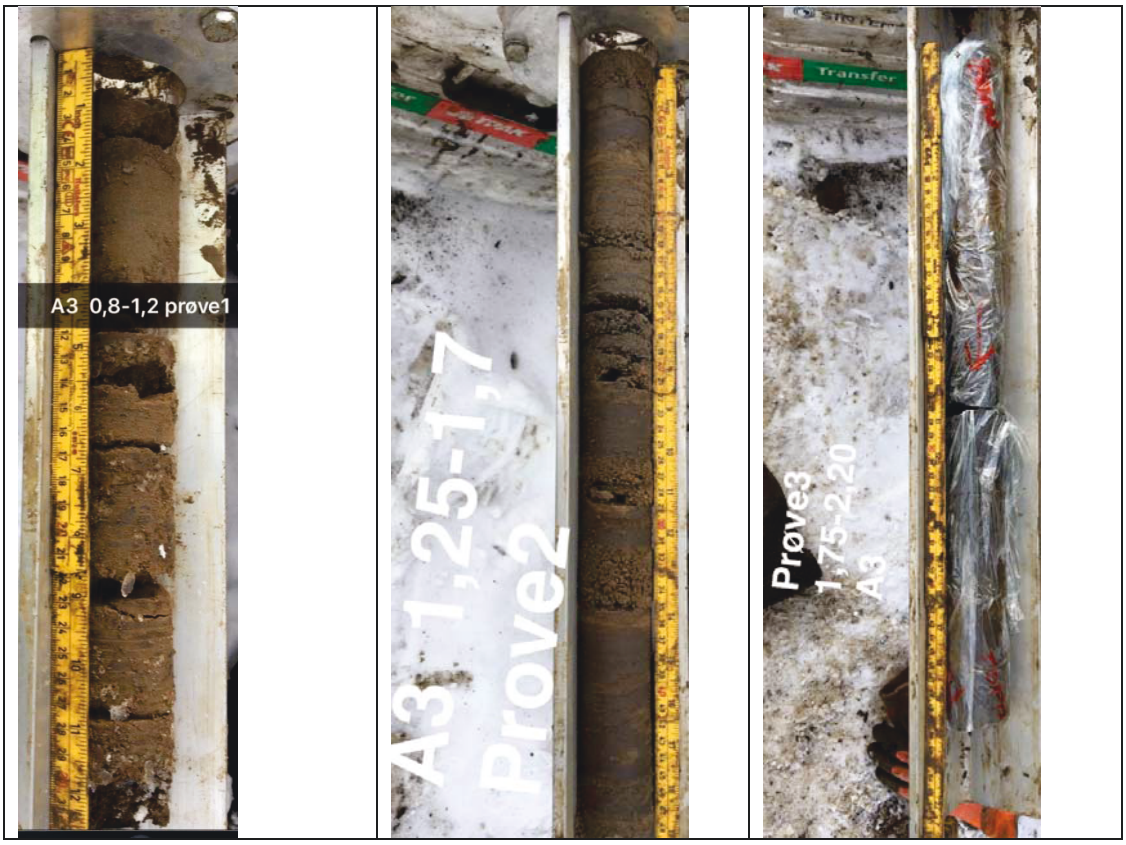
# 1 Total sounding results




A2
±0.00
0
5
10
15
20
25
Dybde, m
500
400
300
200
100
Bortid, s/m
1
2
3
4
5
Spyletrykk, MPa
spyling
Slagboring
Brudd
5
10
20
$F_{DT}$ kN
jord berg avbruten
Status
Rev.
Endring
Utført
Kontr.
Ansv.
Dato
SOC
BLA
2017-05-05
Norwegian Geo Test Sites
Permafrost site, Svalbard
Målestokk
-
Format
A4
Totalsondering A2 - Advendtdalen
Oppdragsleder
Anatoly Sinitsyn
SINTEF Byggforsk
Infrastruktur, Berg og geoteknikk
Oppdragsnr.
102013475
SINTEF
Disiplin
B
Løpenummer
Status
Rev
00

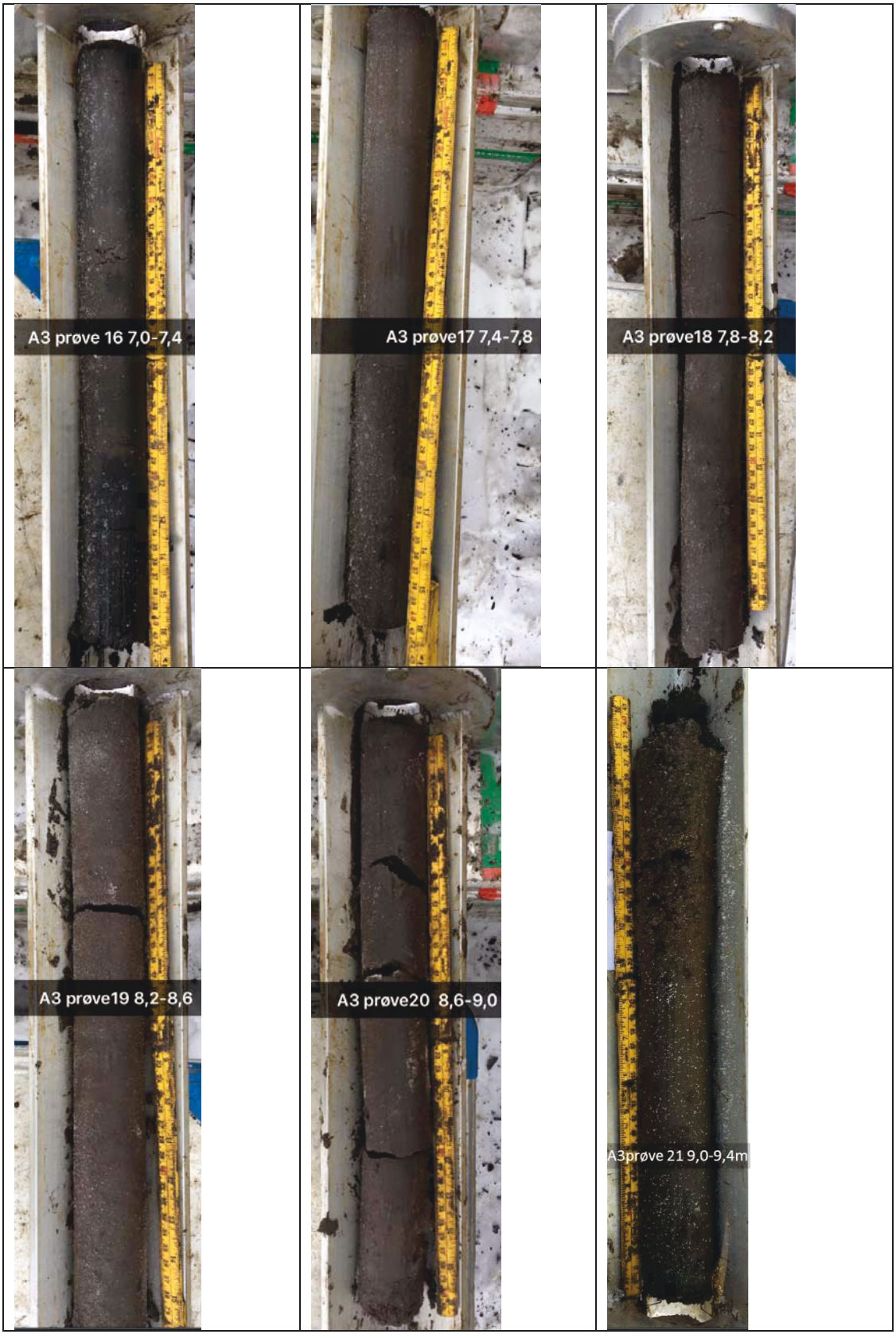

A3
+0.00
0
5
10
15
20
25
30
Dybde, m
Brutt
jord berg avbruten
500
400
300
200
100
Bortid, s/m
5
10
20
FDT kN
Spyling
Slagboring
1
2
3
4
5
Spyletrykk, MPa
Status
Rev.
Endring
Utført
Kontr.
Ansv.
Dato
SOC
BLA
2017-05-05
Målestokk
-
Format
A4
Norwegian Geo Test Sites
Permafrost site, Svalbard
Totalsondering A3 - Advendtdalen
Oppdragsleder:
Anatoly Sinitsyn
SINTEF Byggforsk
Infrastruktur, Berg og geoteknikk
Oppdragsnr.
102013475
Disiplin
B
Løpenummer
Status
Rev
00
SINTEF

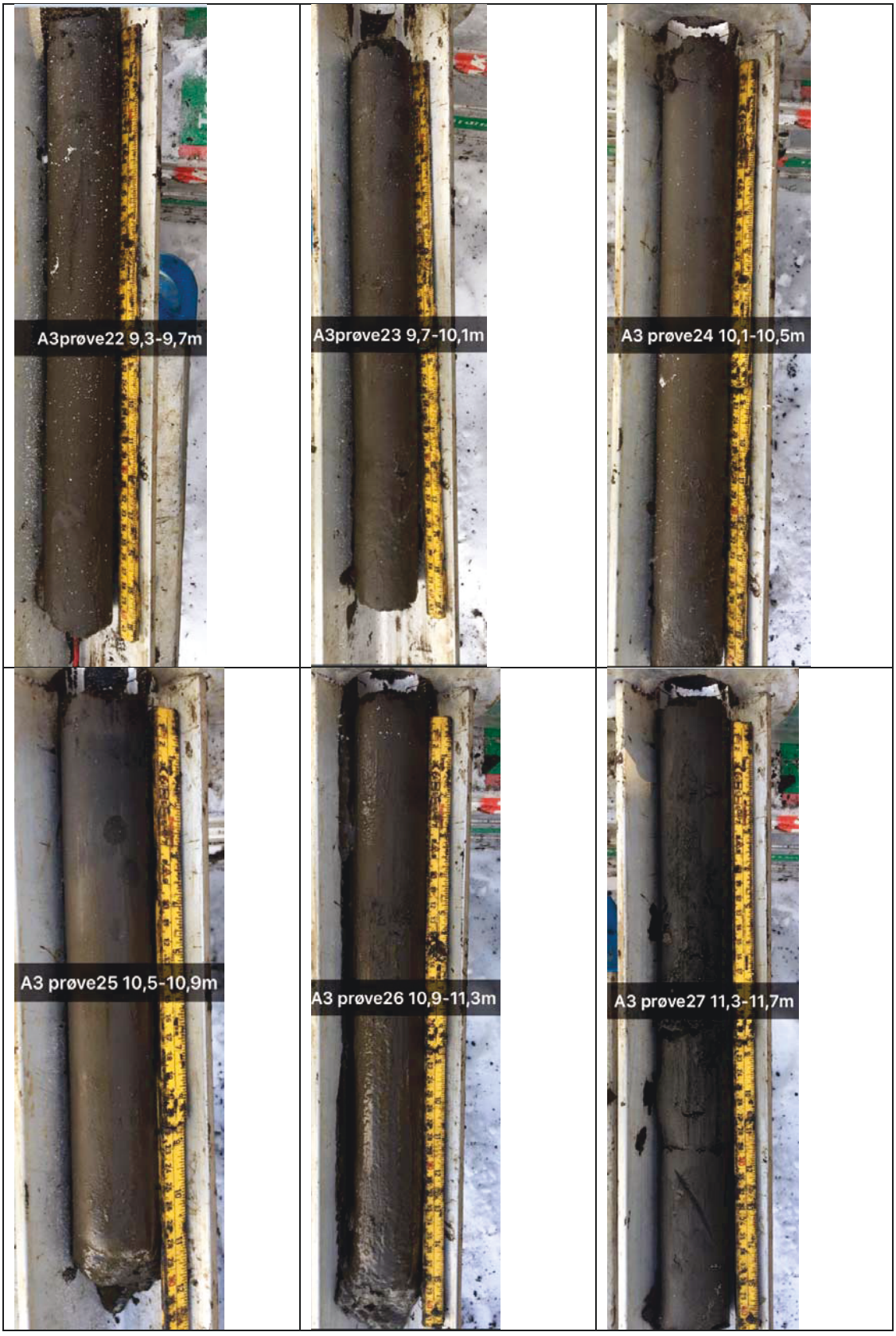
## 2 Pictures of core samples – borehole A3



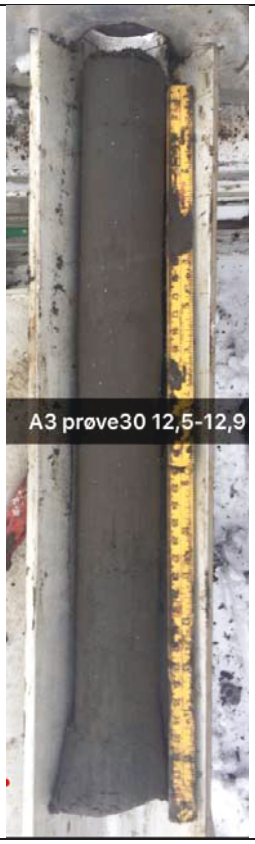

A3 Prøve4 2,2-2,65
Prøve5 2,65-3,0m
Prøve6 3,0-3,4m A3
A3 Prøve7 3,4-3,8m
A3 prøve8 3,8-4,2
A3 prøve9 4,2-4,6m


A3 prøve10 4,6-5,0m
A3 prøve11 5,0-5,4m
A3 prøve12 5,4-5,8m
A3 prøve13 5,8-6,2m
A3 prøve14 6,2 -6,6
A3 prøve15 6,6-7,0m


A3 prøve 16 7,0-7,4
A3 prøve17 7,4-7,8
A3 prøve18 7,8-8,2
A3 prøve19 8,2-8,6
A3 prøve20 8,6-9,0
A3prøve 21 9,0-9,4m


A3prøve22 9,3-9,7m
A3prøve23 9,7-10,1m
A3 prøve24 10,1-10,5m
A3 prøve25 10,5-10,9m
A3 prøve26 10,9-11,3m
A3 prøve27 11,3-11,7m


A3 prøve28 11,7-12,1

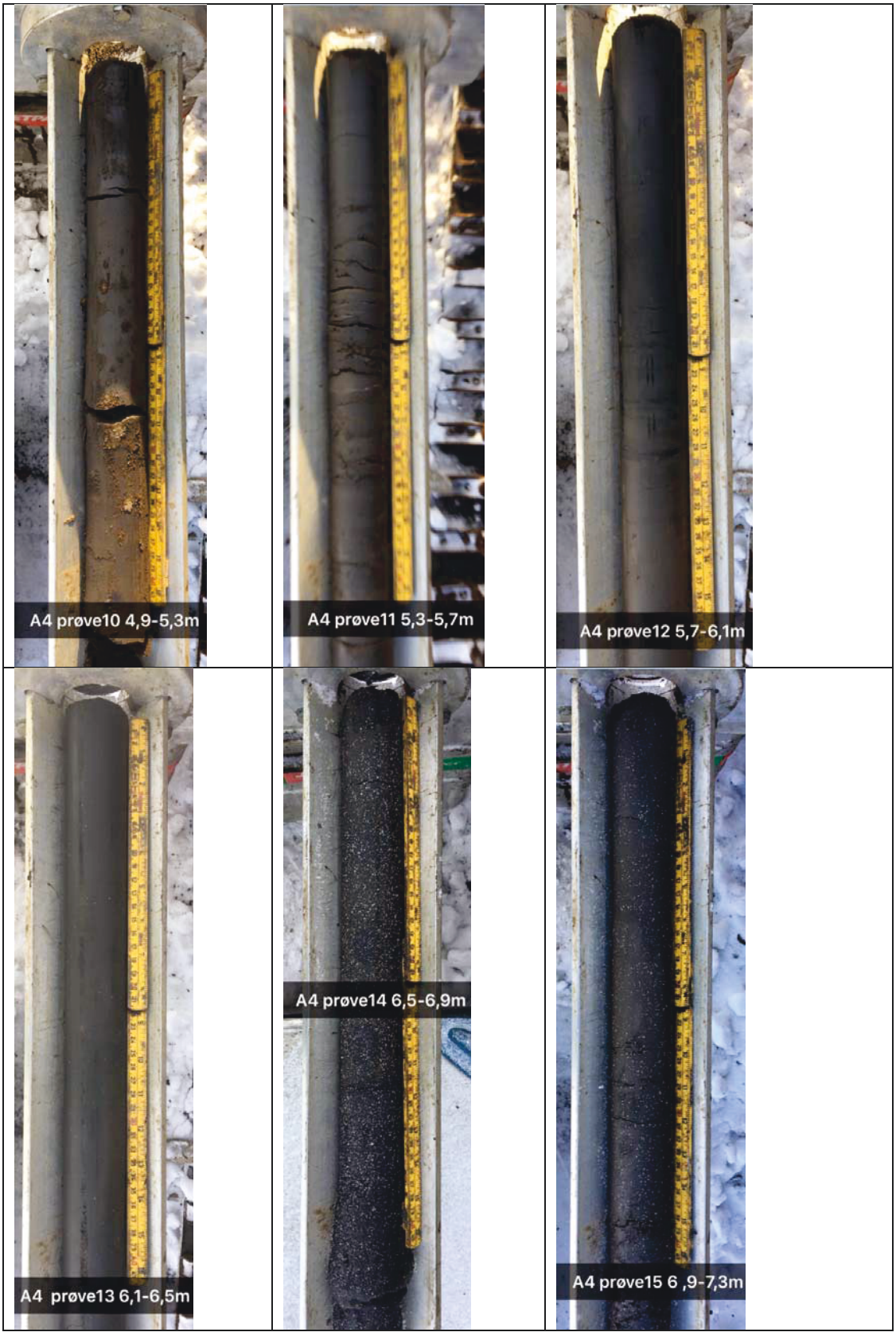

A3 prøve30 12,5-12,9


A3 prøve31 12,9-13,3m

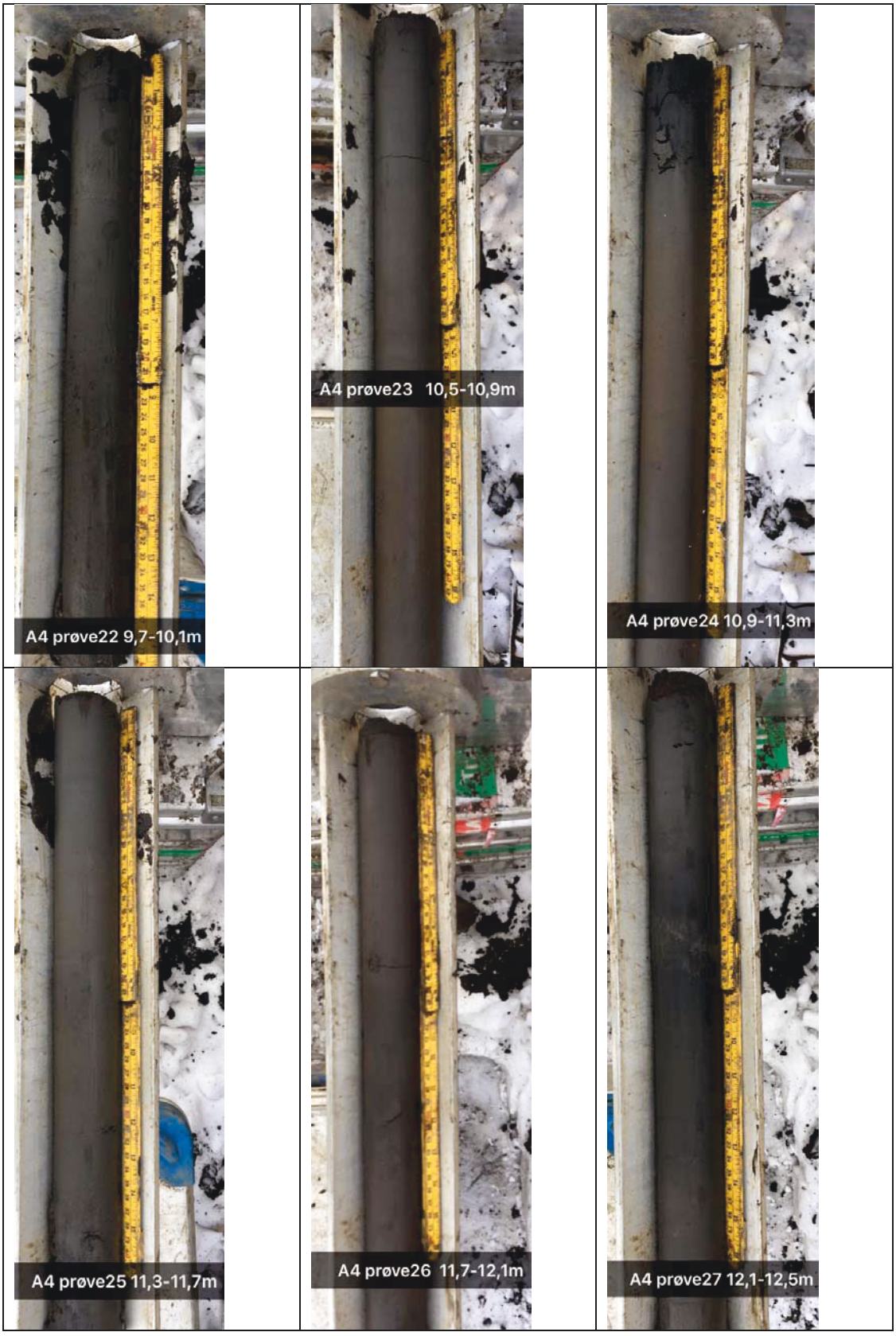

A3 prøve33 13,7-14,1m

# 3 Pictures of core samples – borehole A4


A4 prøve4 2,5-2,9m
A4 prøve5 2,9-3,3m
A4 prøve6 3,3-3,7m
A4 prøve 7 3,7-4,1m
A4 prøve8 4,1-4,5m
A4 prøve9 4,5-4,9m

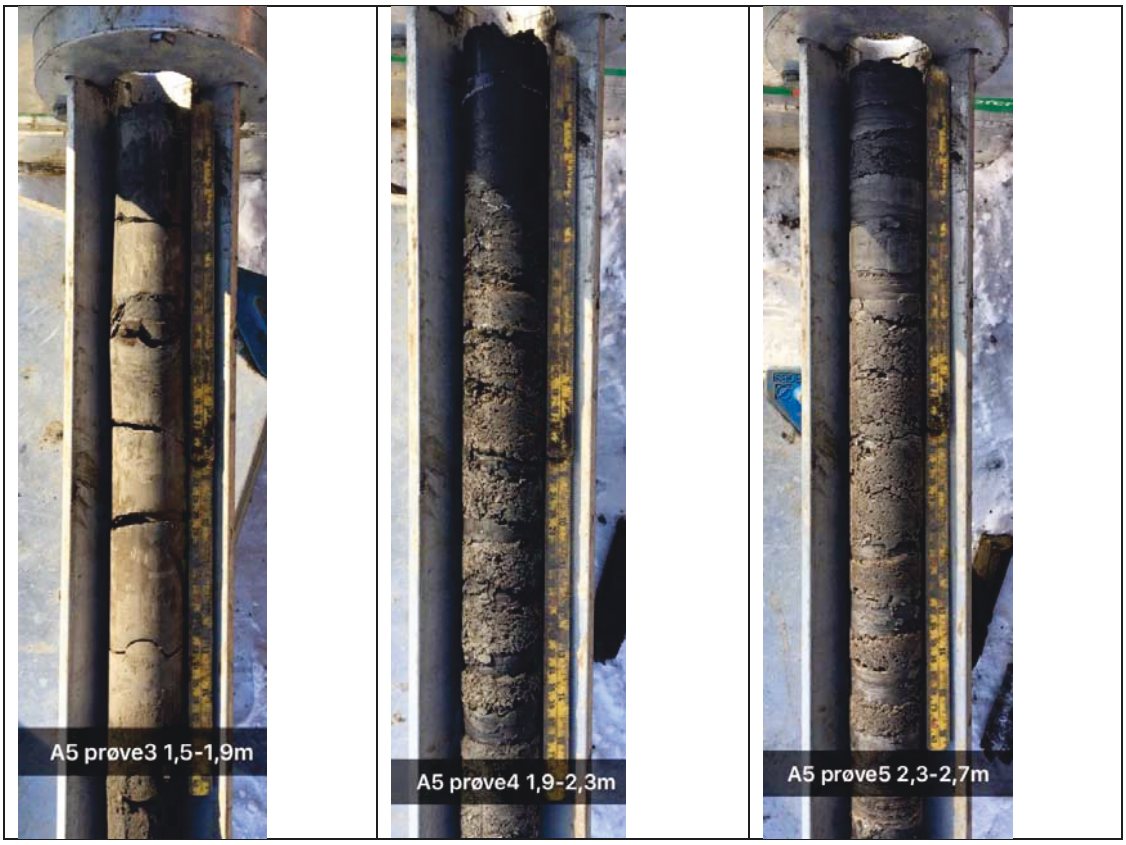

A4 prøve10 4,9-5,3m
A4 prøve11 5,3-5,7m
A4 prøve12 5,7-6,1m
A4 prøve13 6,1-6,5m
A4 prøve14 6,5-6,9m
A4 prøve15 6 ,9-7,3m

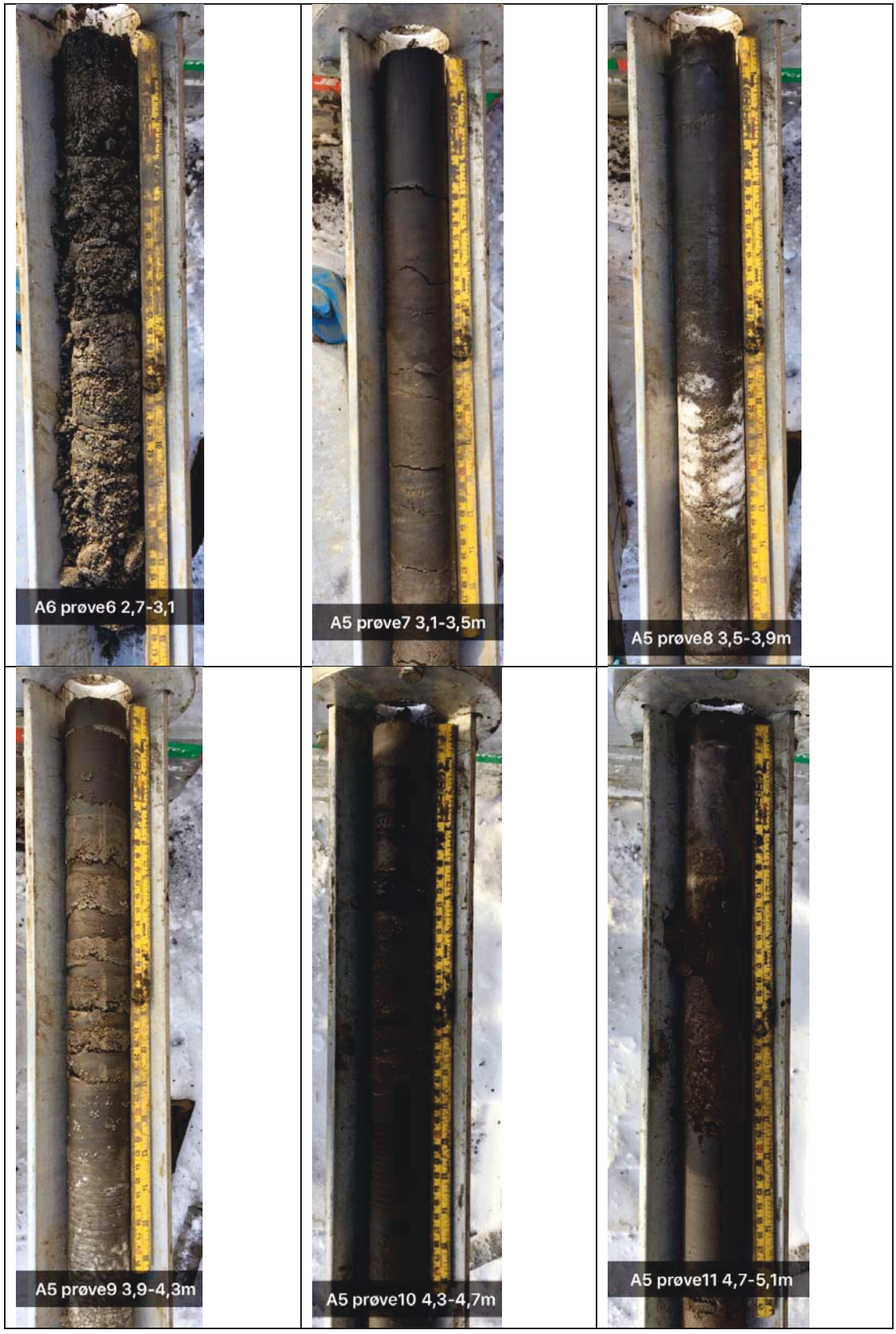

A4 prøve16 7,3-7,7m
A4 prøve17 7,7-8,1m
A4 prøve18 8,1-8,5m
A4 prøve19 8,5-8,9m
A4 prøve20 8,9-9,3m
A4 prøve21 9,3-9,7m

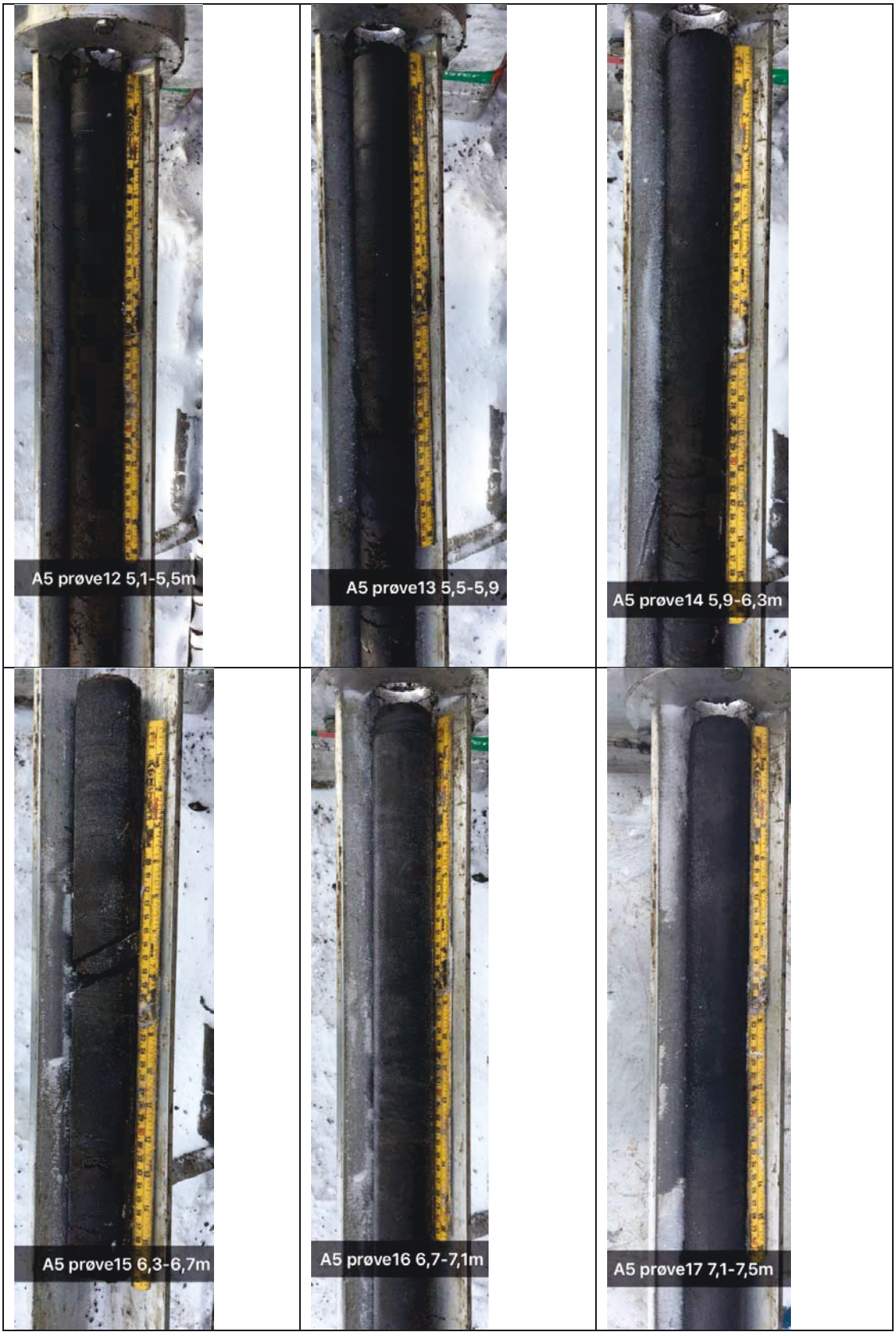

A4 prøve22 9,7-10,1m
A4 prøve23 10,5-10,9m
A4 prøve24 10,9-11,3m
A4 prøve25 11,3-11,7m
A4 prøve26 11,7-12,1m
A4 prøve27 12,1-12,5m

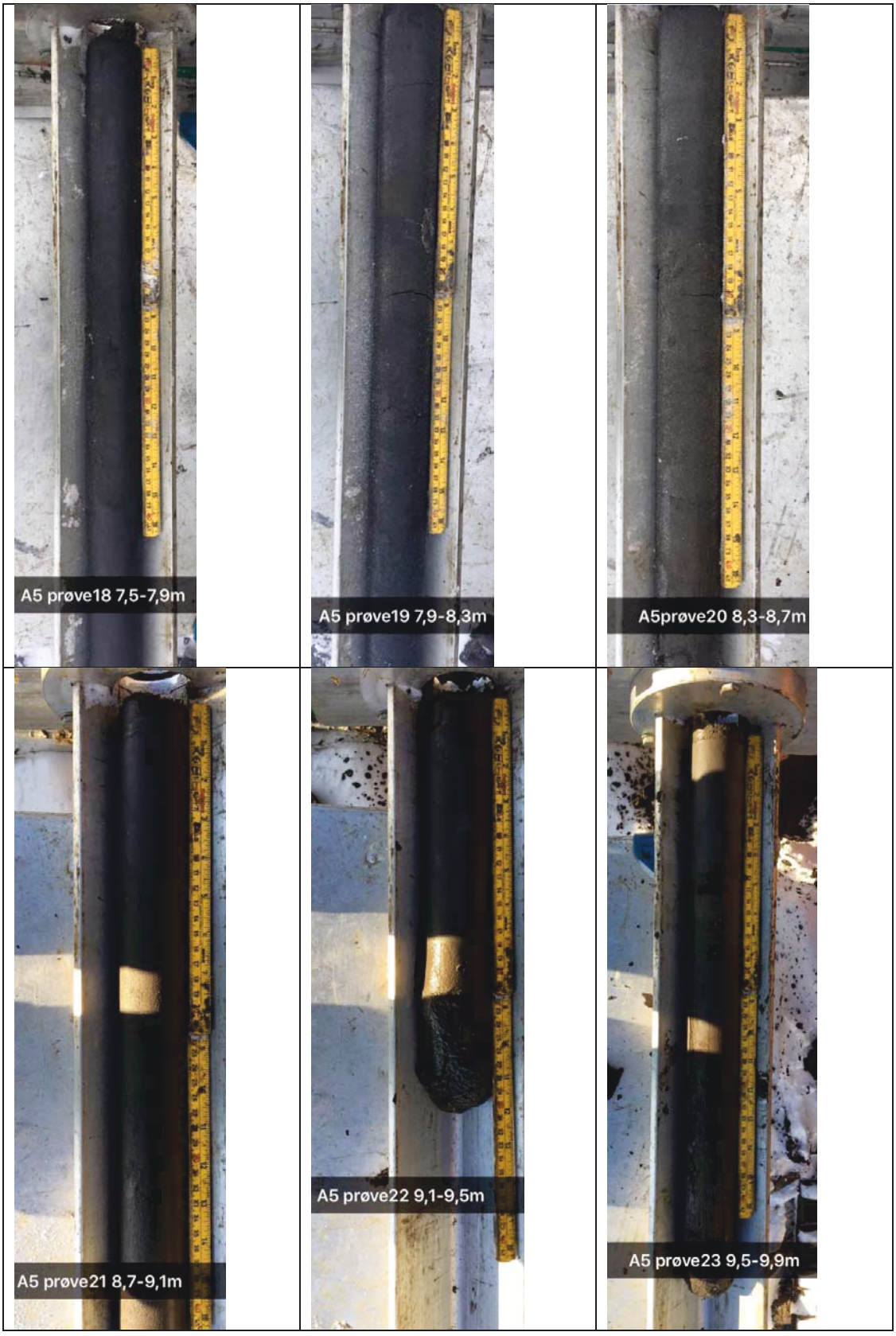
| | | |
|---|---|---|
|  A4 prøve28 12,5-12,9m | | |

# 4 Pictures of core samples – borehole A5

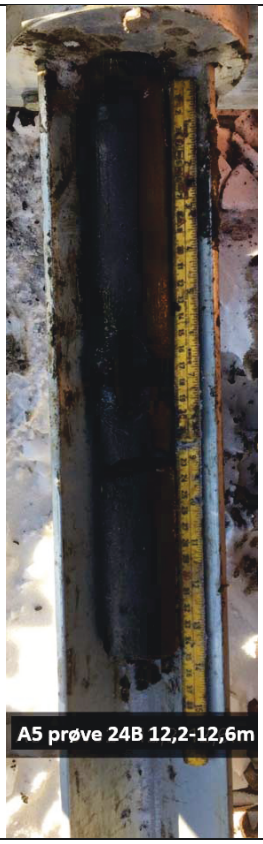



A6 prøve6 2,7-3,1
A5 prøve7 3,1-3,5m
A5 prøve8 3,5-3,9m
A5 prøve9 3,9-4,3m
A5 prøve10 4,3-4,7m
A5 prøve11 4,7-5,1m


A5 prøve12 5,1-5,5m
A5 prøve13 5,5-5,9
A5 prøve14 5,9-6,3m
A5 prøve15 6,3-6,7m
A5 prøve16 6,7-7,1m
A5 prøve17 7,1-7,5m


A5 prøve18 7,5-7,9m
A5 prøve19 7,9-8,3m
A5prøve20 8,3-8,7m
A5 prøve21 8,7-9,1m
A5 prøve22 9,1-9,5m
A5 prøve23 9,5-9,9m


A5 prøve24 9,9-10,3m


A5 prøve 24B 12,2-12,6m


A5 prøve25 12,6-13,0m

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| **Kommune/*Municipality***<br>bmMunicipality | **Feltnavn/*Field name***<br>bmFieldName |
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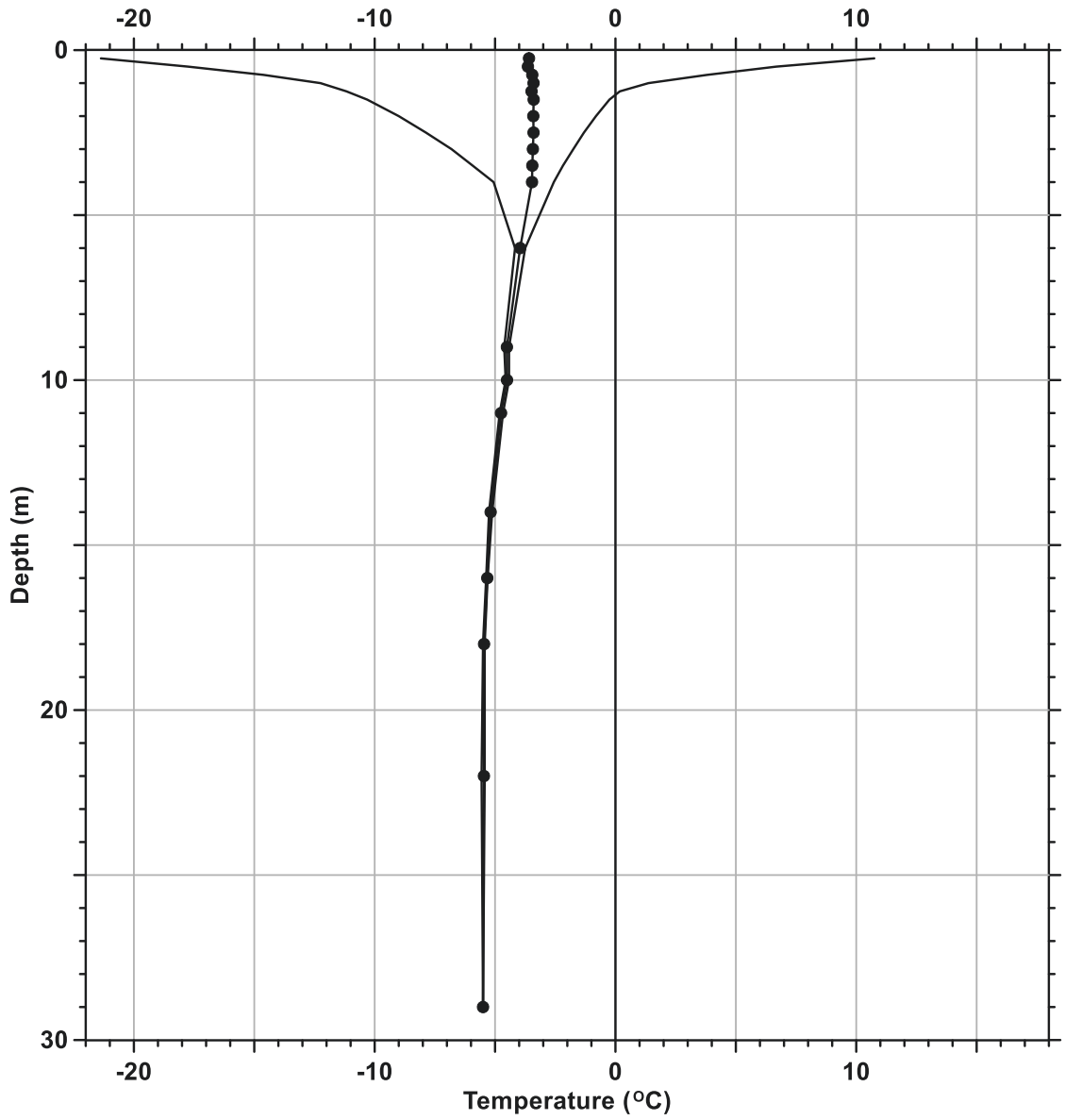
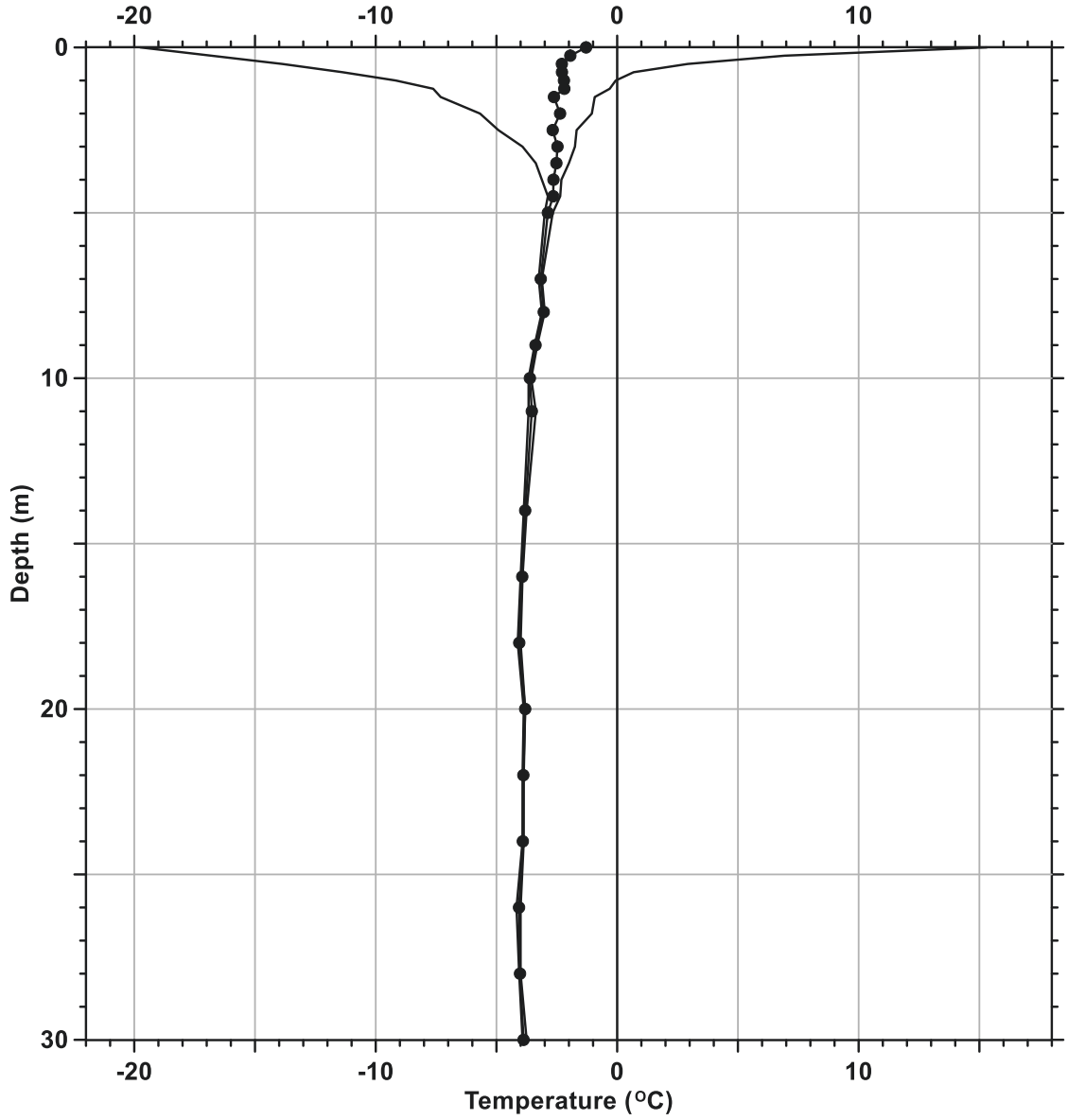
|---|---|---|
| | *Select date* | Jean-Sebastien L'Heureux |

# Appendix E

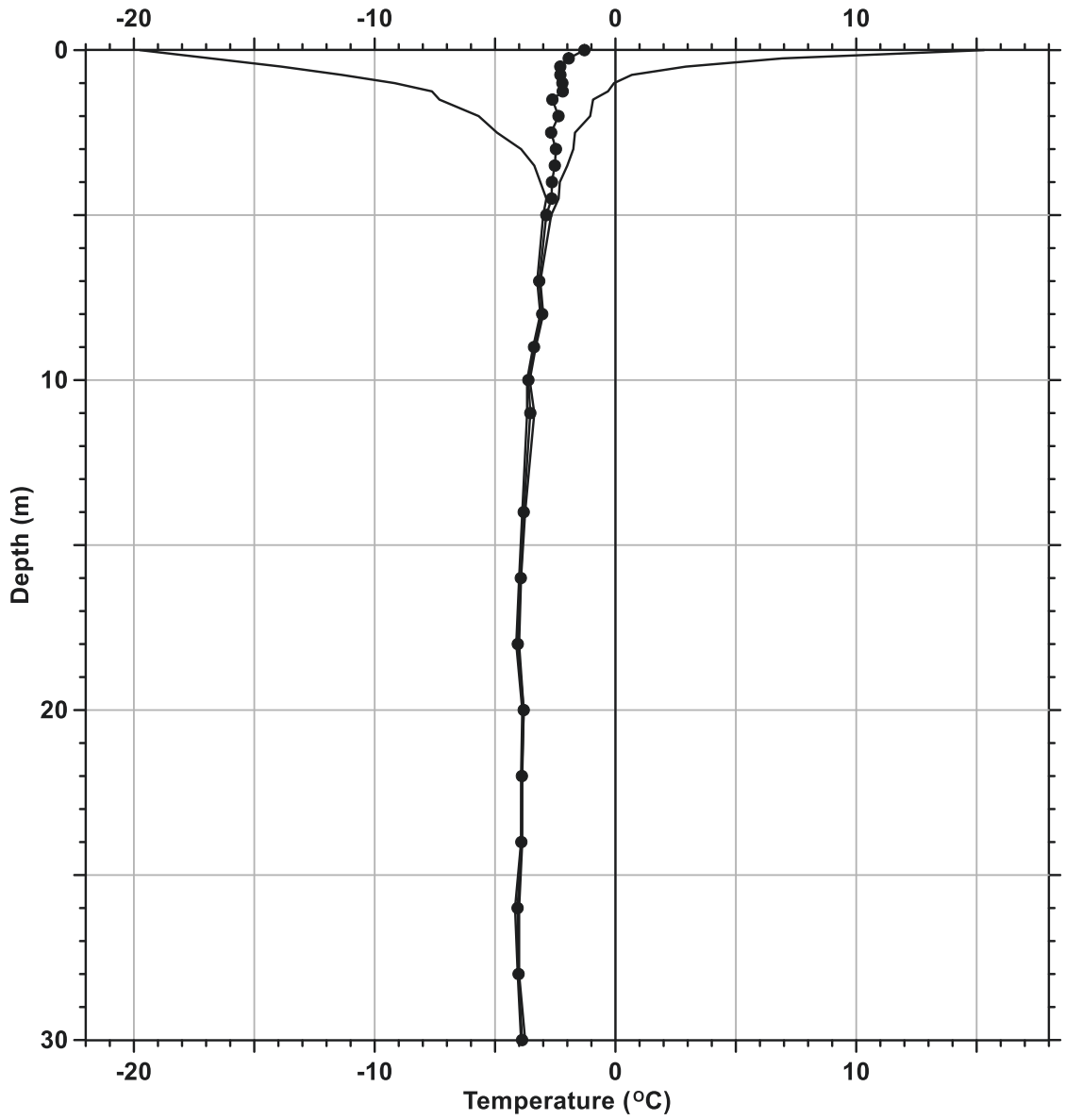
SOIL TEMPERATURES




Annual temperature envelope – Adventdalen (A6).




Annual temperature envelope – UNIS East (E1)




Annual temperature envelope – UNIS East (E4)

# Appendix F

CLASSIFICATION TESTS SUMMARY

| Site/Boring No. | Sample | Depth | Water content | Soil density and unit weight | | | Soilid particles, saturation, and porosity | | | | Grain size distribution | | | | Plasticity data | | | Total organic carbon | Salinity and Freezing point | | Thermal conductivity | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Gravel | Sand | Silt | Clay | Plastic limit | Liquid limit | Plast. Index | | Salinity | Freezing point depression | Frozen | Thawed |
| | | | w (%) | Bulk density, ρ (kg/m3) | ϒ (kN/m³) | Dry density, ρd (kg/m3) | Density of solid particles, ρs (kg/m3) | Unit weight of solid particles, ϒs (kN/m³) | Degree of saturation, Sr (%) | Porosity, n (%) | 63-2 mm (%) | 2 - 0.063mm (%) | 63 - 2µm (%) | >2 µm (%) | Wp (%) | Wl (%) | IP (%) | TOC (%) | Sn (‰) | Tf (°C) | Kf (W/mK) | Kt (W/mK) |
| A3 - SVAB03A/ SVAB03_2A | Pr.5 | 2.825 | 161.0 | 1.21 | 11.86 | 0.47 | 2.42 | 23.74 | 93.0 | 81.0 | | | | | | | | 11.2 | 4.3 | -0.7 | | |
| | Pr. 10 | 4.8 | 18.0 | 2.07 | 20.29 | 1.74 | 2.70 | 26.49 | 91.0 | 35.0 | 1.5 | 65.6 | 24.0 | 8.9 | 18.2 | 28.6 | 10.4 | 5.3 | 20.5 | -1.6 | | |
| | Pr. 23 | 9.9 | 30.0 | 1.87 | 18.33 | 1.44 | | | | | 0.7 | 68.2 | 20.4 | 10.8 | 17.5 | 28.4 | 10.9 | 5.6 | 30.0 | -2.2 | | |
| | Pr. 30 | 12.7 | 27.0 | 1.95 | 19.11 | 1.53 | | | | | 0.3 | 61.3 | 26.3 | 12.1 | - | 24.1 | | 5.7 | 53.1 | -2.4 | | |
| | Steel 15.5-16.3 | 15.9 | 27.0 | 1.95 | 19.11 | 1.54 | 2.69 | 26.39 | 98.0 | 43.0 | 0.0 | 34.6 | 45.1 | 20.3 | 23.4 | 27.2 | 3.8 | 3.4 | 64.8 | -3.7 | | |
| | Auger 18/19 | 18.5 | 32.0 | | | | 2.70 | 26.49 | | | 0.0 | 14.0 | 66.6 | 19.4 | 20.1 | 31.4 | 11.3 | 5.1 | 79.0 | -5.1 | | |
| | Auger 21/22 | 21.5 | 30.0 | | | | 2.70 | 26.49 | | | 0.0 | 15.9 | 62.0 | 22.1 | 19.4 | 32.3 | 12.9 | 5.2 | 69.1 | -4.8 | | |
| | Auger 25/26 | 25.5 | 33.0 | | | | 2.70 | 26.49 | | | 0.0 | 10.2 | 56.5 | 33.4 | 20.5 | 36.5 | 16.1 | 6.0 | 51.8 | -3.2 | | |
| | Auger 29/30 | 29.5 | 32.0 | | | | 2.72 | 26.68 | | | 0.0 | 8.5 | 61.6 | 29.8 | 21.2 | 35.9 | 14.7 | 5.2 | 46.8 | -3.7 | | |
| A4_1 - SVAB04A | Pr. 1 | 1.5 | 61.0 | 1.51 | 14.80 | 0.93 | 2.66 | 26.09 | 88.0 | 65.0 | 0.0 | 26.8 | 67.6 | 5.6 | | | | 4.0 | 4.8 | | 2.9 | 1.4 |
| | Pr. 2 | 1.9 | 71.0 | | | | 2.64 | 25.90 | | | | | | | | | | 6.4 | 1.0 | -0.1 | | |
| | Pr. 3 | 2.3 | 147.0 | 1.12 | 10.98 | 0.45 | 2.56 | 25.11 | 81.0 | 82.0 | 0.0 | 13.8 | 66.5 | 19.7 | | | | 5.8 | 1.9 | | | |
| | Pr. 6 | 3.5 | 104.0 | 1.27 | 12.45 | 0.62 | 2.70 | 26.49 | 84.0 | 77.0 | 0.0 | 64.4 | 27.2 | 8.5 | | | | 3.9 | 5.0 | | | |
| | Pr. 8 | 4.3 | 15.0 | 1.99 | 19.50 | 1.74 | 2.68 | 26.29 | 73.0 | 35.0 | 0.0 | 63.4 | 26.6 | 10.0 | | | | 4.9 | 28.9 | | 1.9 | 1.4 |
| | Pr. 9 | 4.7 | 26.0 | | | | 2.72 | 26.68 | | | | | | | | | | 4.2 | 22.7 | -2.1 | | |
| | Pr. 11 | 4.7 | 32.0 | 1.67 | 16.37 | 1.26 | 2.64 | 25.90 | 78.0 | 52.0 | 0.0 | 50.5 | 38.5 | 11.0 | | | | 4.4 | 16.9 | | | |
| | Pr. 13 | 5.5 | 35.0 | 1.62 | 15.88 | 1.20 | 2.67 | 26.19 | 77.0 | 55.0 | 0.0 | 6.6 | 79.7 | 13.6 | | | | 3.9 | 30.8 | | 2.0 | 1.4 |
| | Pr. 14 | 6.7 | 30.0 | | | | 2.63 | 25.80 | 95.0 | 51.0 | | | | | | | | 4.8 | 28.1 | -1.9 | | |
| | Pr. 16 | 7.5 | 27.0 | 1.86 | 18.23 | 1.47 | 2.69 | 26.39 | 87.0 | 45.0 | 0.0 | 35.8 | 53.1 | 11.1 | | | | 4.4 | 23.3 | | 2.3 | 1.5 |
| | Pr. 18 | 8.3 | 35.0 | 1.72 | 16.86 | 1.28 | 2.69 | 26.39 | 85.0 | 53.0 | 0.0 | 47.0 | 42.8 | 10.2 | | | | 4.4 | 35.5 | | 3.1 | 1.5 |
| | Pr. 21 | 9.5 | 37.0 | 1.72 | 16.86 | 1.25 | 2.56 | 25.11 | 92.0 | 51.0 | 0.0 | 57.1 | 37.2 | 5.7 | | | | 3.7 | 29.8 | | 2.7 | 1.6 |
| | Pr. 22 | 9.9 | 37.0 | 1.81 | 17.74 | 1.32 | 2.68 | 26.29 | | | | | | | | | | 4.1 | | | | |
| | Pr. 23 | 10.7 | 35.0 | 1.78 | 17.44 | 1.31 | 2.70 | 26.49 | 90.0 | 51.0 | 0.0 | 60.1 | 29.6 | 10.3 | | | | 3.6 | 41.7 | | 2.4 | 1.5 |
| | Pr. 25 | 11.3 | 34.0 | 1.74 | 17.05 | 1.30 | 2.66 | 26.09 | 86.0 | 51.0 | 0.0 | 45.7 | 46.5 | 7.8 | | | | 3.9 | 70.2 | | 2.4 | 1.5 |
| | Pr. 27 | 12.3 | 33.0 | 1.74 | 17.05 | 1.31 | 2.71 | 26.59 | 84.0 | 52.0 | 0.0 | 29.5 | 58.0 | 12.6 | | | | 3.6 | 50.5 | | 2.7 | 1.5 |
| | Pr. 28 | 12.7 | 32.0 | 1.88 | 18.42 | 1.42 | | | | | | | | | | | | 4.1 | 63.8 | -4.1 | | |
| | Steel Cylinder (15m) | 15.2 | 29.0 | 1.91 | 18.72 | 1.48 | 2.70 | 26.53 | 95.2 | 45.2 | 0.0 | 5.4 | 83.4 | 11.3 | | | | 3.8 | 72.4 | -4.2 | 1.7 | 1.2 |
| A4_2 - SVAB04_2A | Pr. 2 | 20.8 | 28.0 | 1.91 | 18.72 | 1.49 | 2.70 | 26.46 | 93.5 | 44.7 | 0.0 | 12.4 | 69.1 | 18.5 | | | | 4.1 | 47.1 | -2.8 | | |
| | Pr. 4 | 21.6 | 26.7 | 1.95 | 19.11 | 1.54 | 2.70 | 26.46 | 95.3 | 43.0 | | | | | 19.9 | 31.5 | 11.6 | 4.2 | 23.9 | -1.5 | | |
| | Pr. 7 | 24.4 | 25.9 | 1.84 | 18.03 | 1.39 | 2.69 | 26.38 | 82.9 | 45.7 | | | | | 20.5 | 31.7 | 11.2 | 3.4 | 52.1 | -3 | | |
| | Pr. 8 | 24.8 | 29.0 | 1.87 | 18.33 | 1.45 | 2.69 | 26.38 | 91.7 | 45.9 | 0.0 | 4.3 | 70.3 | 25.4 | | | | 4.1 | 33.5 | -2.3 | 1.9 | 1.3 |
| | Pr. 10 | 27.4 | 25.5 | 1.94 | 19.01 | 1.55 | 2.70 | 26.52 | 92.5 | 42.7 | | | | | 20.2 | 37.4 | 17.2 | 4.4 | 43.6 | -2.6 | | |
| | Pr. 11 | 27.8 | 29.0 | 1.83 | 17.93 | 1.42 | 2.74 | 26.84 | 85.1 | 48.2 | 0.0 | 4.9 | 67.5 | 27.6 | | | | 4.9 | 34.4 | -2.5 | 2.0 | 1.4 |
| | Auger prove (29m) | 29.5 | 30.6 | | | | 2.73 | 26.78 | | | 0.0 | 3.2 | 64.7 | 32.1 | | | | 5.0 | 32.4 | -2.3 | | |
| A5 - SVAB05A | Auger 0.5 | 0.75 | 24.0 | | | | 2.60 | 25.46 | | | 0.0 | 26.1 | 50.5 | 23.4 | 19.2 | 29.8 | 10.6 | 3.4 | | | | |
| | Pr 5 | 2.5 | 127.0 | | | | 2.61 | 25.62 | | | | | | | | | | 7.9 | 1.4 | -0.2 | | |
| | Pr. 11 | 4.9 | 33.0 | 1.70 | 16.66 | 1.27 | 2.72 | 26.66 | 80.2 | 53.1 | | | | | | | | 3.9 | 27.0 | -1.8 | | |
| | Pr. 17 | 7.3 | 43.0 | 1.66 | 16.27 | 1.16 | 2.65 | 25.98 | 89.1 | 56.1 | 0.0 | 21.8 | 66.1 | 12.1 | - | 27.1 | | 4.0 | 27.6 | -1.8 | | |
| | Pr. 23 | 9.7 | 29.0 | 1.90 | 18.62 | 1.47 | 2.71 | 26.60 | 93.8 | 46.0 | 0.0 | 72.6 | 20.9 | 6.5 | - | 24.9 | | 4.6 | 42.6 | -3 | | |
| | Pr. 25 | 12.8 | 45.0 | | | | 2.66 | 26.13 | | | 1.3 | 58.8 | 32.3 | 7.5 | - | 25.2 | | 4.5 | 29.6 | -2 | | |
| | Steel (16m) | 16.25 | 26.0 | 2.00 | 19.60 | 1.58 | 2.72 | 26.67 | 99.5 | 41.9 | 0.0 | 37.7 | 51.1 | 11.2 | 23.0 | 28.6 | 5.6 | 4.7 | 38.8 | -2.1 | | |
| | Auger 21 | 21.5 | 33.0 | | | | 2.73 | 26.81 | | | 0.0 | 9.7 | 62.8 | 27.5 | 20.3 | 36.5 | 16.1 | 4.2 | 45.8 | -2.4 | | |
| | Auger 27 | 27.5 | 30.0 | | | | 2.73 | 26.75 | | | 0.0 | 5.9 | 67.8 | 26.3 | 21.2 | 36.1 | 14.9 | 3.7 | 37.7 | -2.3 | | |
| A6 - SVAB06A | 1 | 0.5 | 18.7 | | | | | | | | | | | | | | | | | | | |
| | 2 | 1.5 | 44.8 | | | | | | | | | | | | | | | | | | | |
| | 3 | 2.5 | 104.7 | | | | | | | | | | | | | | | | | | | |
| | 4 | 3.5 | 47.1 | | | | | | | | 0.0 | 62.2 | 28.8 | 9.0 | | | | | | | | |
| | 5 | 4.5 | 26.6 | | | | | | | | 0.0 | 56.3 | 31.1 | 12.6 | | | | | | | | |
| | 6 | 5.5 | 28.8 | | | | | | | | 0.0 | 44.7 | 40.0 | 15.3 | | | | | | | | |
| | 7 | 6.5 | 33.2 | | | | | | | | 0.0 | 41.6 | 42.7 | 15.7 | | | | | | | | |
| | 8 | 7.5 | 34.6 | | | | | | | | | | | | | | | | | | | |
| | 9 | 8.5 | 26.3 | | | | | | | | | | | | | | | | | | | |
| | 10 | 9.5 | 29.1 | | | | | | | | | | | | | | | | | | | |
| | 11 | 10.5 | 29.7 | | | | | | | | 0.0 | 35.2 | 47.0 | 17.8 | | | | | | | | |
| | 12 | 11.5 | 31.7 | | | | | | | | 0.0 | 39.5 | 49.8 | 10.7 | | | | | | | | |
| | 13 | 12.5 | 36.1 | | | | | | | | | | | | | | | | | | | |
| | 14 | 13.5 | 34.1 | | | | | | | | 0.0 | 32.7 | 53.6 | 13.7 | | | | | | | | |
| | 15 | 14.5 | 33.2 | | | | | | | | 0.0 | 35.4 | 51.3 | 13.3 | | | | | | | | |
| | 16 | 15.5 | 33.3 | | | | | | | | | | | | | | | | | | | |
| | 17 | 16.5 | 32.6 | | | | | | | | 0.0 | 26.1 | 47.4 | 26.5 | | | | | | | | |
| | 18 | 17.5 | 30.8 | | | | | | | | | | | | | | | | | | | |
| | 19 | 18.5 | 30.8 | | | | | | | | | | | | | | | | | | | |
| | 20 | 19.5 | 33.1 | | | | | | | | 0.0 | 7.7 | 62.8 | 29.6 | | | | | | | | |
| | 21 | 20.5 | 30.4 | | | | | | | | | | | | | | | | | | | |
| | 22 | 21.5 | 32.8 | | | | | | | | | | | | | | | | | | | |
| | 23 | 22.5 | 29.4 | | | | | | | | | | | | | | | | | | | |
| | 24 | 23.5 | 30.0 | | | | | | | | | | | | | | | | | | | |
| | 25 | 24.5 | 28.8 | | | | | | | | 0.0 | 9.7 | 58.0 | 32.3 | | | | | | | | |

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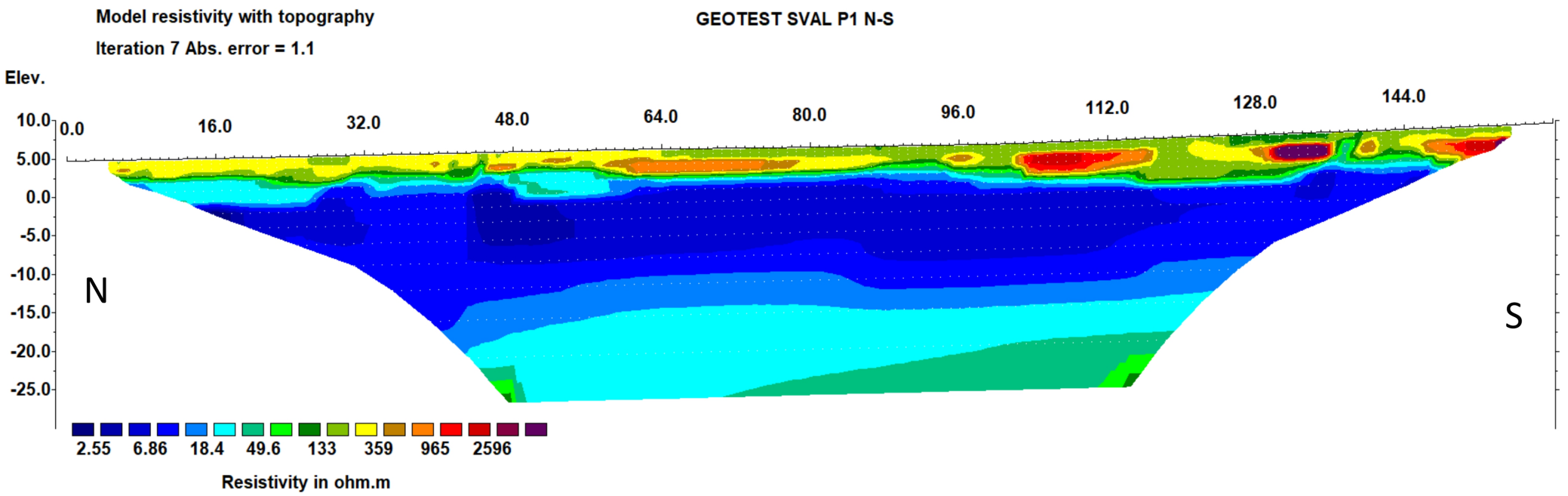
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **26** | **25.5** | 28.8 | | | | | | | | | | | | | | | | | | | | |
| | **27** | **26.5** | 28.4 | | | | | | | | | | | | | | | | | | | | |
| | **28** | **27.5** | 29.2 | | | | | | | | 0.0 | 3.9 | 58.5 | 37.6 | | | | | | | | | |
| | **29** | **28.5** | 27.4 | | | | | | | | | | | | | | | | | | | | |
| | **30** | **29.5** | 30.1 | | | | | | | | | | | | | | | | | | | | |
| **E1 - SVAB01E** | **1** | **0.5** | 11.9 | | | | | | | | 5.0 | 74.5 | 17.9 | 2.6 | | | | 3.0 | | | | | |
| | **2** | **1.5** | 9.6 | | | | | | | | 10.9 | 76.0 | 11.3 | 1.8 | | | | 2.7 | | | | | |
| | **3** | **2.5** | 15.9 | | | | | | | | 10.0 | 56.1 | 28.2 | 5.7 | | | | 3.0 | | | | | |
| | **4** | **3.5** | 25.1 | | | | | | | | 0.0 | 43.6 | 45.5 | 10.9 | | | | 3.4 | | | | | |
| | **5** | **4.5** | 26.3 | | | | | | | | 0.0 | 20.2 | 58.3 | 21.5 | | | | 4.3 | | | | | |
| | **6** | **5.5** | 23.6 | | | | | | | | 0.0 | 21.2 | 59.2 | 19.5 | | | | 4.1 | 33.0 | | | | |
| | **7** | **6.5** | 24.1 | | | | | | | | 0.0 | 11.6 | 68.1 | 20.3 | | | | 4.3 | 31.0 | | | | |
| | **8** | **7.5** | 26.1 | | | | | | | | 0.0 | 18.0 | 63.6 | 18.4 | | | | 4.1 | 21.0 | | | | |
| | **9** | **8.5** | 23.9 | | | | | | | | 0.0 | 6.5 | 70.7 | 22.8 | | | | 3.7 | 24.0 | | | | |
| | **10** | **9.5** | 27.1 | | | | | | | | 0.0 | 8.5 | 66.4 | 25.1 | | | | 3.6 | | | | | |
| | **11** | **10.5** | 29.5 | | | | | | | | 0.0 | 4.0 | 68.8 | 27.2 | | | | 3.8 | 26.0 | | | | |
| | **12** | **11.5** | 26.3 | | | | | | | | 0.0 | 4.8 | 72.1 | 23.1 | | | | 3.8 | | | | | |
| | **13** | **12.5** | 25.2 | | | | | | | | 0.0 | 4.0 | 72.5 | 23.5 | | | | 3.4 | | | | | |
| | **14** | **13.5** | 24.6 | | | | | | | | 0.0 | 4.5 | 70.7 | 24.8 | | | | 3.6 | 35.0 | | | | |
| | **15** | **14.5** | 26.0 | | | | | | | | 0.0 | 2.6 | 73.5 | 23.9 | | | | 3.2 | | | | | |
| | **16** | **15.5** | 27.8 | | | | | | | | 0.0 | 1.1 | 71.9 | 27.1 | | | | 3.3 | | | | | |
| | **17** | **16.5** | 26.5 | | | | | | | | 0.0 | 1.2 | 75.2 | 23.6 | | | | 3.4 | 27.0 | | | | |
| | **18** | **17.5** | 25.9 | | | | | | | | 0.0 | 1.7 | 71.1 | 27.2 | | | | 3.5 | 33.0 | | | | |
| | **19** | **18.5** | 31.3 | | | | | | | | 0.0 | 4.1 | 63.7 | 32.2 | | | | 3.7 | | | | | |
| | **20** | **19.5** | 26.0 | | | | | | | | 0.0 | 8.5 | 72.3 | 19.2 | | | | 3.8 | | | | | |
| | **21** | **20.5** | 25.4 | | | | | | | | 0.0 | 9.9 | 68.8 | 21.3 | | | | 3.8 | 34.0 | | | | |
| | **22** | **21.5** | 28.9 | | | | | | | | 0.0 | 15.2 | 59.8 | 25.1 | | | | 3.8 | | | | | |
| | **23** | **22.5** | 34.3 | | | | | | | | 1.8 | 10.1 | 58.3 | 29.8 | | | | 4.6 | 33.0 | | | | |
| | **24** | **23.5** | 31.7 | | | | | | | | 0.0 | 8.6 | 50.1 | 41.3 | | | | 4.6 | | | | | |
| | **25** | **24.5** | 24.9 | | | | | | | | 7.1 | 22.5 | 44.4 | 26.0 | | | | 4.2 | | | | | |
| | **26** | **25.5** | 21.2 | | | | | | | | 11.2 | 20.7 | 40.2 | 28.0 | | | | 4.3 | | | | | |
| | **27** | **26.5** | 21.6 | | | | | | | | 0.0 | 19.3 | 55.1 | 25.6 | | | | 4.1 | | | | | |
| | **28** | **27.5** | 21.3 | | | | | | | | 7.1 | 20.9 | 46.7 | 25.3 | | | | 4.0 | | | | | |
| | **29** | **28.5** | 15.2 | | | | | | | | 27.6 | 38.3 | 25.6 | 8.4 | | | | 2.6 | | | | | |
| | **30** | **29.5** | 12.4 | | | | | | | | 0.0 | 57.5 | 33.3 | 9.2 | | | | 3.0 | | | | | |
| **E2 - SVAB02E** | **1** | **0.5** | 36.0 | | | | | | | | 7.0 | 31.4 | 48.8 | 12.8 | | | | 10.0 | | | | | |
| | **2** | **1.5** | 22.0 | | | | | | | | | | | | | | | 4.1 | | | | | |
| | **3** | **2.5** | 20.0 | | | | | | | | | | | | | | | | | | | | |
| | **4** | **3.5** | 19.0 | | | | | | | | 0.4 | 17.3 | 57.4 | 25.0 | | | | 4.4 | | | | | |
| | **5** | **4.5** | 19.0 | | | | | | | | | | | | | | | 4.0 | | | | | |
| | **6** | **5.5** | 18.0 | | | | | | | | 0.3 | 40.1 | 41.9 | 17.7 | | | | 4.1 | | | | | |
| | **7** | **6.5** | 20.0 | | | | | | | | | | | | | | | | | | | | |
| | **8** | **7.5** | 18.0 | | | | | | | | | | | | | | | 3.8 | | | | | |
| | **9** | **8.5** | 18.0 | | | | | | | | | | | | | | | | | | | | |
| | **10** | **9.5** | 17.0 | | | | | | | | 0.4 | 36.7 | 43.1 | 19.9 | | | | 5.7 | | | | | |
| | **11** | **10.5** | 19.0 | | | | | | | | | | | | | | | 4.3 | | | | | |
| | **12** | **11.5** | 21.0 | | | | | | | | | | | | | | | 4.0 | | | | | |
| | **13** | **12.5** | 19.0 | | | | | | | | | | | | | | | 4.8 | | | | | |
| | **14** | **13.5** | 19.0 | | | | | | | | | | | | | | | 3.9 | | | | | |
| | **15** | **14.5** | 15.0 | | | | | | | | 13.6 | 21.1 | 42.3 | 23.0 | | | | 4.0 | | | | | |
| | **16** | **15.5** | 13.0 | | | | | | | | | | | | | | | 3.5 | | | | | |
| | **17** | **16.5** | 12.0 | | | | | | | | | | | | | | | 3.4 | | | | | |
| | **18** | **17.5** | 12.0 | | | | | | | | | | | | | | | | | | | | |
| | **19** | **18.5** | 12.0 | | | | | | | | 2.0 | 50.2 | 30.4 | 17.3 | | | | 3.8 | | | | | |
| | **20** | **19.5** | 11.0 | | | | | | | | | | | | | | | | | | | | |
| | **21** | **20.5** | 7.0 | | | | | | | | | | | | | | | | | | | | |
| **E3 - SVAB03E** | **1** | **0.5** | 45.0 | | | | 2.71 | 26.59 | | | 3.8 | 64.5 | 24.2 | 7.6 | - | 32.3 | | 3.7 | 1.0 | -0.1 | | | |
| | **3** | **2.5** | 18.0 | | | | 2.72 | 26.68 | | | 2.7 | 77.1 | 14.0 | 6.2 | - | 24.8 | | 3.3 | 7.6 | -0.6 | | | |
| | **5** | **4.5** | 26.0 | | | | 2.73 | 26.78 | | | 0.0 | 27.9 | 57.5 | 14.6 | 19.3 | 29.0 | 9.7 | 4.0 | 22.7 | -1.2 | | | |
| | **10** | **9.5** | 25.0 | | | | 2.75 | 26.98 | | | 0.0 | 9.6 | 67.1 | 23.4 | 20.9 | 35.5 | 14.6 | 4.2 | 36.9 | -2.1 | | | |
| | **15** | **14.5** | 28.0 | | | | 2.74 | 26.88 | | | 0.0 | 31.6 | 52.5 | 15.9 | 21.2 | 34.1 | 12.9 | 3.9 | 34.9 | -1.9 | | | |
| | **20** | **19.5** | 10.0 | | | | 2.73 | 26.78 | | | 30.4 | 29.0 | 29.6 | 11.0 | 16.1 | 28.5 | 12.3 | 4.3 | 47.5 | -3.0 | | | |
| | **27** | **16.5** | 10.0 | | | | 2.72 | 26.68 | | | 11.1 | 44.9 | 33.0 | 11.0 | 15.9 | 26.1 | 10.2 | 3.4 | 41.2 | -2.5 | | | |
| | **30** | **29.5** | 9.0 | | | | 2.72 | 26.68 | | | 20.8 | 39.6 | 31.4 | 8.1 | 21.1 | 22.8 | 1.7 | 3.4 | 54.8 | | | | |
| **E5 - SVAB05E** | **Auger prøve** | **0.75** | 21.2 | | | | | | | | 1.5 | 55.4 | 29.1 | 14.0 | 20.3 | 31.6 | 11.3 | 4.0 | 1.2 | -0.1 | | | |
| | **Auger prøve** | **1.45** | 22.0 | | | | | | | | 1.5 | 67.8 | 21.6 | 9.1 | 20.1 | 31.7 | 11.6 | 2.7 | 2.3 | -0.2 | | | |
| | **Pr. 2** | **2.5** | 26.3 | 1.91 | 18.75 | 1.51 | 2.70 | 26.49 | 90.6 | 44.0 | 0.0 | 22.3 | 60.3 | 17.4 | | | | 4.0 | 14.1 | -0.8 | | | |
| | **Pr.5** | **3.7** | 24.3 | 1.96 | 19.24 | 1.58 | | | | | 1.6 | 30.8 | 52.1 | 15.5 | 19.8 | 27.2 | 7.4 | 3.1 | 19.5 | -1.8 | 1.6 | 1.2 | |
| | **Pr. 8** | **4.9** | 24.9 | 1.91 | 18.72 | 1.53 | 2.71 | 26.59 | 87.4 | 43.5 | 0.3 | 37.1 | 50.3 | 12.3 | 21.4 | 33.0 | 11.6 | 4.4 | 34.4 | -1.9 | | | |
| | **Pr. 12** | **5.5** | 24.3 | 1.93 | 18.95 | 1.56 | | | | | 0.0 | 32.1 | 52.9 | 15.0 | 20.5 | 34.3 | 13.8 | 3.8 | 21.7 | -2.3 | 1.9 | 1.4 | |
| | **Pr. 15** | **7.7** | 25.0 | 1.96 | 19.23 | 1.57 | 2.71 | 26.59 | 93.2 | 42.1 | 0.1 | 25.5 | 62.9 | 11.5 | 20.2 | 31.9 | 11.8 | 3.8 | 35.6 | -2.5 | | | |
| | **Pr. 19** | **9.3** | 26.4 | 1.91 | 18.71 | 1.51 | | | | | 0.0 | 17.5 | 64.2 | 18.3 | 20.7 | 32.3 | 11.6 | 3.6 | 25.9 | -2.3 | 2.1 | 1.5 | |
| | **Pr. 24** | **11.3** | 26.3 | 1.93 | 18.92 | 1.53 | 2.71 | 26.59 | 92.3 | 43.6 | 0.2 | 15.7 | 64.7 | 19.4 | 21.6 | 32.9 | 11.2 | 3.7 | 31.2 | -2.1 | | | |
| | **Pr. 28** | **13.1** | 25.8 | 1.96 | 19.20 | 1.56 | | | | | 0.0 | 20.2 | 65.3 | 14.5 | 21.6 | 31.7 | 10.2 | 3.6 | 26.9 | | | | |
| | **Pr. 30** | **13.9** | 23.5 | 1.94 | 19.02 | 1.57 | 2.71 | 26.59 | 87.8 | 42.1 | 0.0 | 22.1 | 59.5 | 18.4 | 20.5 | 30.7 | 10.2 | 4.0 | 31.5 | -2.0 | | | |
| | **Pr. 32** | **14.7** | 25.0 | 1.98 | 19.37 | 1.58 | | | | | 0.0 | 23.6 | 61.5 | 14.9 | 20.7 | 35.0 | 14.2 | | 27.6 | -2.2 | | 1.3 | |
| | **Pr. 37** | **18.7** | 23.7 | 1.97 | 19.34 | 1.60 | | | | | 4.6 | 17.8 | 49.4 | 28.2 | 19.9 | 37.4 | 17.6 | 4.1 | 43.9 | -3.6 | 1.8 | 1.3 | |
| | **Pr. 43** | **22.7** | 16.4 | 2.16 | 21.13 | 1.85 | | | | | 17.1 | 27.1 | 40.1 | 15.7 | 16.3 | 32.9 | 16.5 | 3.3 | 32.1 | -2.5 | 1.8 | 1.4 | |
| | **Auger prøve** | **25.9** | 13.0 | | | | | | | | 9.1 | 39.5 | 34.6 | 16.9 | 18.1 | 32.7 | 14.6 | 3.9 | 30.0 | -2.4 | | | |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **E6 - SVAB06E** | **Auger (0.5m)** | **0.75** | 22.0 | | | | 2.69 | 26.39 | | | 0.5 | 58.2 | 30.8 | 10.5 | 18.6 | 24.7 | 6.1 | 3.2 | 1.1 | -0.1 | | |
| | **Auger (1.0m)** | **1.25** | 20.0 | | | | 2.69 | 26.39 | | | 4.7 | 56.0 | 30.0 | 9.2 | 18.7 | 23.6 | 4.9 | 2.9 | 5.5 | -0.3 | | |
| | **Pr. 4** | **3.40** | 27.0 | 1.94 | 19.01 | 1.52 | 2.72 | 26.68 | 95.0 | 44.0 | 1.7 | 6.3 | 66.9 | 25.1 | 20.9 | 37.2 | 16.3 | 4.1 | 32.3 | -2.3 | 1.7 | 1.3 |
| | **Pr. 8** | **7.10** | 24.0 | 1.97 | 19.31 | 1.59 | 2.71 | 26.59 | 93.0 | 41.0 | 2.2 | 23.7 | 58.7 | 15.4 | 21.2 | 30.1 | 8.9 | 3.4 | 36.0 | -2.2 | 1.9 | 1.4 |
| | **Pr. 13** | **10.90** | 15.0 | | | | 2.71 | 26.59 | | | 15.7 | 35.8 | 31.8 | 16.7 | 16.0 | 27.9 | 11.9 | 3.7 | 40.6 | -2.6 | | |
| **E7 - SVAB07E** | **Auger (0.3m)** | **0.5** | 23.0 | | | | 2.72 | 26.68 | | | 1.5 | 58.8 | 28.7 | 10.9 | 19.0 | 24.9 | 5.9 | 3.1 | 1.1 | -0.1 | | |
| | **Auger (1.7m)** | **1.85** | 24.0 | | | | 2.72 | 26.68 | | | 2.1 | 62.9 | 24.8 | 10.3 | 18.4 | 26.0 | 7.6 | 3.0 | 7.4 | -0.5 | | |
| | **Pr. 5** | **3.8** | 26.0 | 1.96 | 19.21 | 1.56 | 2.71 | 26.59 | 94.0 | 43.0 | 0.9 | 14.0 | 63.1 | 22.0 | 22.4 | 34.9 | 12.6 | 4.0 | 34.1 | -2.0 | | |
| | **Pr. 10** | **7** | 31.0 | 1.84 | 18.03 | 1.40 | 2.70 | 26.49 | 90.0 | 48.0 | 0.0 | 16.3 | 57.8 | 25.9 | 22.1 | 36.1 | 14.0 | 3.8 | 30.3 | -2.0 | 1.9 | 1.3 |
| | **Pr.14** | **11.5** | 29.0 | 1.89 | 18.52 | 1.46 | 2.73 | 26.78 | 92.0 | 46.0 | 0.0 | 16.1 | 64.2 | 19.7 | 20.2 | 35.1 | 14.9 | 3.7 | 31.6 | -2.0 | 2.3 | 1.5 |
| | **Auger (15m)** | **15.35** | 19.0 | | | | 2.72 | 26.68 | | | 1.7 | 21.4 | 53.8 | 23.0 | 18.6 | 34.0 | 15.4 | 4.0 | 43.6 | -2.6 | | |

# Appendix G

ERT SURVEYS




Horizontal scale is 10.50 pixels per unit spacing

Vertical exaggeration in model section display = 0.83

First electrode is located at 0.0 m.

Last electrode is located at 160.0 m. Unit Electrode Spacing = 1.00 m.

Date/Rev.: 2015-01-21/01

| | |
|---|---|
| **NGTS - Svalbard Research Site** | Document No. 20160154-06-R |
| Electrical resistivity profile - P1 | Figure No. 01 |
| SVAER01 | Date 2019-12-18 / Drawn by SBa/GrG |

NGTS

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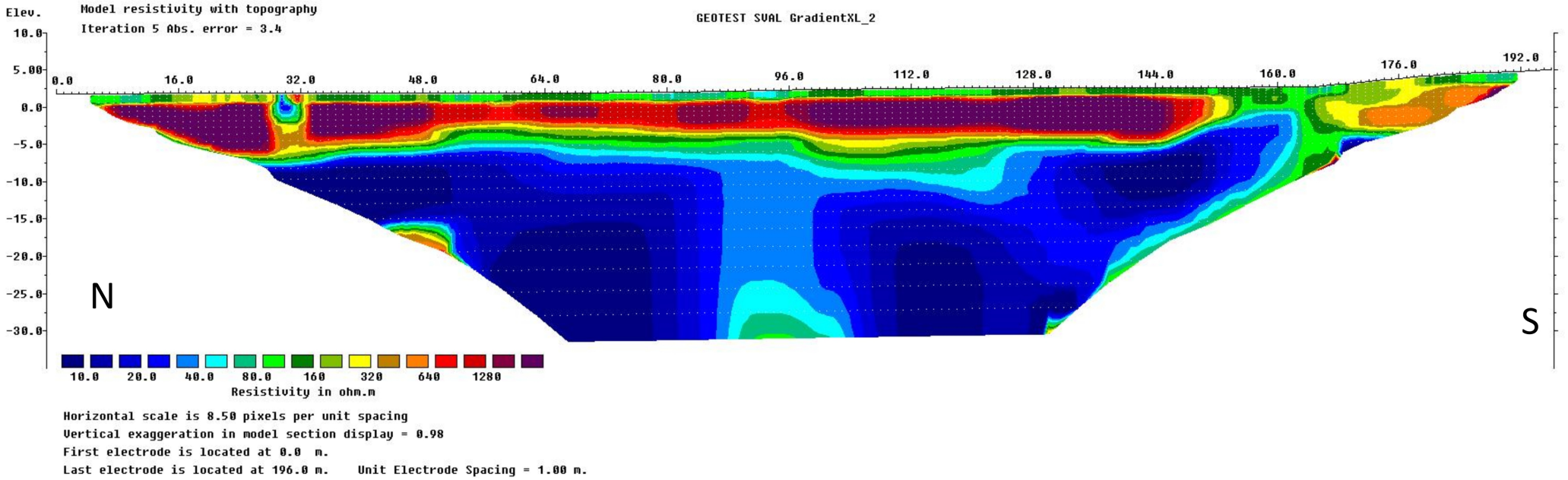


Horizontal scale is 8.50 pixels per unit spacing
Vertical exaggeration in model section display = 0.98
First electrode is located at 0.0 m.
Last electrode is located at 196.0 m. Unit Electrode Spacing = 1.00 m.

Date/Rev.: 2015-01-21/01

| | |
|---|---|
| **NGTS - Svalbard Research Site** | Document No. 20160154-06-R |
| Electrical resistivity profile - P2 | Figure No. 01 |
| SVAER02 | Date 2019-12-18 / Drawn by SBa/GrG |

NGTS

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# Appendix H

SAMPLE INVENTORY

| | | | | | |
|---|---|---|---|---|---|
| GROUP | SAMP | | | | |
| HEADING | Sample list | | | | |
| PROJ_ID | 20160154 | | | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | Adventdalen | | |
| PROJ_CLNT | NGTS | | | | |
| PROJ_CONT | UNIS | | | | |
| PROJ_ENG | SINTEF | | | Reach bedrock | NO |
| LOCA_ID | SVAB01A | | | Depth to bedrock if reached | |
| SAMP_TYPE | BHBG | | | | |
| Full description | Bag sample borehole | | | | |
| SAMP_DATE | 2017-03-17 | | | | |
| LOCA_DRIL | SINTEF | | | | |
| Temperature | ca. -4 | | ISO Field classification | | |
| | | | NO | | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM |
|---|---|---|---|---|---|
| 0 | 0,5 | S1_A1_01 | | Frozen | Auger |
| 0,5 | 1 | S1_A1_02 | | Frozen | Auger |
| 1 | 1,5 | S1_A1_03 | | Frozen | Total sounding |
| 2 | 3 | S1_A1_04 | | Frozen | Total sounding |
| 3 | 4 | S1_A1_05 | | Frozen | Total sounding |
| 5 | 7 | S1_A1_06 | | Frozen | Total sounding |
| ca. 10 | n/a | S1_A1_07 | | Frozen | Total sounding |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB01A

BHBG

Document No.
20160154-XX-R

Figure No.
XXX

| Date | Drawn by |
|---|---|
| 22.05.2018 | GLG |

NGTS

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| | | | | | |
|---|---|---|---|---|---|
| GROUP | SAMP | | | | |
| HEADING | Sample list | | | | |
| PROJ_ID | 20160154 | | | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | Adventdalen | | |
| PROJ_CLNT | NGTS | | | | |
| PROJ_CONT | UNIS | | | | |
| PROJ_ENG | UNIS | | | Reach bedrock | NO |
| LOCA_ID | SVAB02_2A | | | Depth to bedrock if reached | |
| SAMP_TYPE | BHBG | | | | |
| Full description | Bag sample borehole | | | | |
| SAMP_DATE | 2018-04-10 | | | | |
| LOCA_DRIL | Anleggsdrift AS | | | | |
| Temperature | ca. -4 | | | ISO Field classification | |
| | | | | NO | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM |
|---|---|---|---|---|---|
| 0 | 1 | S1_A2.2_01 | | Frozen | Bag sample |
| 1 | 2 | S1_A2.2_02 | | Frozen | Bag sample |
| 2 | 3 | S1_A2.2_03 | | Frozen | Bag sample |
| 3 | 4 | S1_A2.2_04 | | Frozen | Bag sample |
| 4 | 5 | S1_A2.2_05 | | Frozen | Bag sample |
| 5 | 6 | S1_A2.2_06 | | Frozen | Bag sample |
| 6 | 7 | S1_A2.2_07 | | Frozen | Bag sample |
| 7 | 8 | S1_A2.2_08 | | Frozen | Bag sample |
| 8 | 9 | S1_A2.2_09 | | Frozen | Bag sample |
| 9 | 10 | S1_A2.2_10 | | Frozen | Bag sample |
| 10 | 11 | S1_A2.2_11 | | Frozen | Bag sample |
| 11 | 12 | S1_A2.2_12 | | Frozen | Bag sample |
| 12 | 13 | S1_A2.2_13 | | Frozen | Bag sample |
| 13 | 14 | S1_A2.2_14 | | Frozen | Bag sample |
| 14 | 15 | S1_A2.2_15 | | Frozen | Bag sample |
| 15 | 16 | S1_A2.2_16 | | Frozen | Bag sample |
| 16 | 17 | S1_A2.2_17 | | Frozen | Bag sample |
| 17 | 18 | S1_A2.2_18 | | Frozen | Bag sample |
| 18 | 19 | S1_A2.2_19 | | Frozen | Bag sample |
| 19 | 20 | S1_A2.2_20 | | Frozen | Bag sample |
| 20 | 21 | S1_A2.2_21 | | Frozen | Bag sample |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB02_2A

BHBG

Document No.
20160154-XX-R

Figure No.
XXX

Date
22.05.2018

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GLG

NGTS

| | | | |
|---|---|---|---|
| GROUP | SAMP | | |
| HEADING | Sample list | | |
| PROJ_ID | 20160154 | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | Adventdalen |
| PROJ_CLNT | NGTS | | |
| PROJ_CONT | UNIS | | |
| PROJ_ENG | SINTEF | Reach bedrock | NO |
| LOCA_ID | SVAB02A | Depth to bedrock if reached | |
| SAMP_TYPE | BHBG | | |
| Full description | Bag sample borehole | | |
| SAMP_DATE | 2017-03-18 | | |
| LOCA_DRIL | SINTEF | | |
| Temperature | ca. -4 | ISO Field classification | |
| | | NO | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM |
|---|---|---|---|---|---|
| 0 | 0,5 | S1_A2_01 | | Frozen | Auger |
| 0,5 | 1 | S1_A2_02 | | Frozen | Auger |
| 1 | 2 | S1_A2_03 | | Frozen | TS |
| 2 | 3 | S1_A2_04 | | Frozen | TS |
| 3 | 4 | S1_A2_05 | | Frozen | TS |
| 4 | 5 | S1_A2_06 | | Frozen | TS |
| 5 | 6 | S1_A2_07 | | Frozen | TS |
| 6 | 7 | S1_A2_08 | | Frozen | TS |
| 7 | 8 | S1_A2_09 | | Frozen | TS |
| 8 | 9 | S1_A2_10 | | Frozen | TS |
| 9 | 10 | S1_A2_11 | | Frozen | TS |
| 12 | 14 | S1_A2_12 | | Frozen | TS |
| 26 | 27 | S1_A2_13 | | Frozen | Auger |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB02A

BHBG

Document No.
20160154-XX-R

Figure No.
XXX

Date
22.05.2018

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| | | | | | |
|---|---|---|---|---|---|
| GROUP | SAMP | | | | |
| HEADING | Sample list | | | | |
| PROJ_ID | 20160154 | | | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | Adventdalen | | |
| PROJ_CLNT | NGTS | | | | |
| PROJ_CONT | UNIS | | | | |
| PROJ_ENG | SINTEF | | | Reach bedrock | NO |
| LOCA_ID | SVAB03_2A | | Depth to bedrock if reached | | |
| SAMP_TYPE | BHCR | | | | |
| Full description | CRELL 54 mm sample borehole (no liner) | | | | |
| SAMP_DATE | 2017-03-18 | | | | |
| LOCA_DRIL | SINTEF | | | | |
| Temperature | ca. -10 | | ISO Field classification | | |
| | | | NO | | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM | NGTS ID |
|---|---|---|---|---|---|---|
| 0 | 0,8 | | | | Predrill | |
| 0,8 | 1,2 | Pr.1 | | Frozen | CRREL | S1_A3.2_01 |
| 1,3 | 1,7 | Pr.2 | | Frozen | CRREL | S1_A3.2_02 |
| 1,8 | 2,2 | Pr.3 | | Frozen | CRREL | S1_A3.2_03 |
| 2,2 | 2,7 | Pr.4 | | Frozen | CRREL | S1_A3.2_04 |
| 2,7 | 3 | Pr.5 | | Frozen | CRREL | S1_A3.2_05 |
| 3 | 3,4 | Pr.6 | | Frozen | CRREL | S1_A3.2_06 |
| 3,4 | 3,8 | Pr.7 | | Frozen | CRREL | S1_A3.2_07 |
| 3,8 | 4,2 | Pr.8 | | Frozen | CRREL | S1_A3.2_08 |
| 4,2 | 4,6 | Pr.9 | | Frozen | CRREL | S1_A3.2_09 |
| 4,6 | 5 | Pr.10 | | Frozen | CRREL | S1_A3.2_10 |
| 5 | 5,4 | Pr.11 | | Frozen | CRREL | S1_A3.2_11 |
| 5,4 | 5,8 | Pr.12 | | Frozen | CRREL | S1_A3.2_12 |
| 5,8 | 6,2 | Pr.13 | | Frozen | CRREL | S1_A3.2_13 |
| 6,2 | 6,6 | Pr.14 | | Frozen | CRREL | S1_A3.2_14 |
| 6,6 | 7 | Pr.15 | | Frozen | CRREL | S1_A3.2_15 |
| 7 | 7,4 | Pr.16 | | Frozen | CRREL | S1_A3.2_16 |
| 7,4 | 7,8 | Pr.17 | | Frozen | CRREL | S1_A3.2_17 |
| 7,8 | 8,2 | Pr.18 | | Frozen | CRREL | S1_A3.2_18 |
| 8,2 | 8,6 | Pr.19 | | Frozen | CRREL | S1_A3.2_19 |
| 8,6 | 9 | Pr.20 | | Frozen | CRREL | S1_A3.2_20 |
| 9 | 9,4 | Pr.21 | | Frozen | CRREL | S1_A3.2_21 |
| 9,3 | 9,7 | Pr.22 | | Frozen | CRREL | S1_A3.2_22 |
| 9,7 | 10,1 | Pr.23 | | Frozen | CRREL | S1_A3.2_23 |
| 10,1 | 10,5 | Pr.24 | | Frozen | CRREL | S1_A3.2_24 |
| 10,5 | 10,9 | Pr.25 | | Frozen | CRREL | S1_A3.2_25 |
| 10,9 | 11,3 | Pr.26 | | Frozen | CRREL | S1_A3.2_26 |
| 11,3 | 11,7 | Pr.27 | | Frozen | CRREL | S1_A3.2_27 |
| 11,7 | 12,1 | Pr.28 | | Frozen | CRREL | S1_A3.2_28 |
| 12,1 | 12,5 | Pr.29 | | Frozen | CRREL | S1_A3.2_29 |
| 12,5 | 12,9 | Pr.30 | | Frozen | CRREL | S1_A3.2_30 |
| 12,9 | 13,3 | Pr.31 | | Frozen | CRREL | S1_A3.2_31 |
| 13,3 | 13,7 | Pr.32 | | Frozen | CRREL | S1_A3.2_32 |
| 13,7 | 14,1 | Pr.33 | | Frozen | CRREL | S1_A3.2_33 |
| 14,5 | 15,3 | Prøve 1 | | Frozen | Sampler | S1_A3.2_34 |
| 15,5 | 16,3 | Prøve 2 | | Frozen | Sampler | S1_A3.2_35 |
| 16,3 | 16,8 | Prøve 3 | | Frozen | Sampler | S1_A3.2_36 |
| 18 | 19 | | | Frozen | Auger | S1_A3.2_37 |
| 21 | 22 | | | Frozen | Auger | S1_A3.2_38 |
| 23 | 24 | | | Frozen | Auger | S1_A3.2_39 |
| 25 | 26 | | | Frozen | Auger | S1_A3.2_40 |
| 27 | 28 | | | Frozen | Auger | S1_A3.2_41 |
| 29 | 30 | | | Frozen | Auger | S1_A3.2_42 |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB03_2A

BHCR

| | |
|---|---|
| Document No. | 20160154-XX-R |
| Figure No. | XXX |
| Date | 22.05.2018 |
| Drawn by | GLG |

NGTS

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| | | | |
|---|---|---|---|
| GROUP | SAMP | | |
| HEADING | Sample list | | |
| PROJ_ID | 20160154 | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | Adventdalen |
| PROJ_CLNT | NGTS | | |
| PROJ_CONT | SINTEF | | |
| PROJ_ENG | UNIS | Reach bedrock | NO |
| LOCA_ID | SVAB03A | Depth to bedrock if reached | |
| SAMP_TYPE | BHBG | | |
| Full description | Bag sample borehole | | |
| SAMP_DATE | 2017-03-12 | | |
| LOCA_DRIL | SINTEF | | |
| Temperature | ca. -4 | ISO Field classification | |
| | | NO | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM |
|---|---|---|---|---|---|
| 0 | 0,4 | S1_A3.1_01 | | Frozen | Auger |
| 0,4 | 1 | S1_A3.1_02 | | Frozen | TS |
| 1 | 2 | S1_A3.1_03 | | Frozen | TS |
| 2 | 3,2 | S1_A3.1_04 | | Frozen | TS |
| 3,2 | 4 | S1_A3.1_05 | | Frozen | TS |
| 4 | 5 | S1_A3.1_06 | | Frozen | TS |
| 5 | 6 | S1_A3.1_07 | | Frozen | TS |
| 6 | 7 | S1_A3.1_08 | | Frozen | TS |
| 7 | 8 | S1_A3.1_09 | | Frozen | TS |
| 8 | 9 | S1_A3.1_10 | | Frozen | TS |
| 9 | 10 | S1_A3.1_11 | | Frozen | TS |
| 10 | 11 | S1_A3.1_12 | | Frozen | TS |
| 11 | 12 | S1_A3.1_13 | | Frozen | TS |
| 20 | 30 | S1_A3.1_14 | | Frozen | TS |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB03A

BHBG

Document No.
20160154-XX-R

Figure No.
XXX

Date
22.05.2018

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| | | | | |
|---|---|---|---|---|
| GROUP | SAMP | | | |
| HEADING | Sample list | | | |
| PROJ_ID | 20160154 | | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | Adventdalen | |
| PROJ_CLNT | NGTS | | | |
| PROJ_CONT | UNIS | | | |
| PROJ_ENG | SINTEF | | Reach bedrock | NO |
| LOCA_ID | SVAB04_2A | | Depth to bedrock if reached | |
| SAMP_TYPE | BHCR | | | |
| Full description | CRELL 54 mm sample borehole (no liner) | | | |
| SAMP_DATE | 2018-04-14 | | | |
| LOCA_DRIL | SINTEF | | | |
| Temperature | ca. -10 | | ISO Field classification | |
| | | | NO | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM | NGTS ID |
|---|---|---|---|---|---|---|
| 0 | 20 | | | | Predrill (Anleggsdrift AS) | |
| 20,2 | 20,6 | Pr.1 | | Frozen | CRREL | S1_A4.2_1 |
| 20,6 | 21 | Pr.2 | | Frozen | CRREL | S1_A4.2_2 |
| 21 | 21,4 | Pr.3 | | Frozen | CRREL | S1_A4.2_3 |
| 21,4 | 21,8 | Pr.4 | | Frozen | CRREL | S1_A4.2_4 |
| 21,8 | 22,2 | Pr.5 | | Frozen | CRREL | S1_A4.2_5 |
| 22,2 | 22,6 | Pr.6 | | Frozen | CRREL | S1_A4.2_6 |
| 24 | 24,2 | Augerprøve | | Frozen | Auger | S1_A4.2_7 |
| 24,2 | 24,6 | Pr.7 | | Frozen | CRREL | S1_A4.2_8 |
| 24,6 | 25 | Pr.8 | | Frozen | CRREL | S1_A4.2_9 |
| 25 | 25,4 | Pr.9 | | Frozen | CRREL | S1_A4.2_10 |
| 27,2 | 27,6 | Pr.10 | | Frozen | CRREL | S1_A4.2_11 |
| 27,6 | 28 | Pr.11 | | Frozen | CRREL | S1_A4.2_12 |
| 28 | 29 | Augerprøve | | Frozen | Auger | S1_A4.2_13 |
| 29 | 30 | Augerprøve | | Frozen | Auger | S1_A4.2_14 |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB04_2A

BHCR

Document No.
20160154-XX-R

Figure No.
XXX

Date
22.05.2018

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NGTS

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| | | | | | |
|---|---|---|---|---|---|
| GROUP | SAMP | | | | |
| HEADING | Sample list | | | | |
| PROJ_ID | 20160154 | | | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | Adventdalen | | |
| PROJ_CLNT | NGTS | | | | |
| PROJ_CONT | UNIS | | | | |
| PROJ_ENG | SINTEF | | | Reach bedrock | NO |
| LOCA_ID | SVAB04A | | | Depth to bedrock if reached | |
| SAMP_TYPE | BHCR | | | | |
| Full description | CRELL 54 mm sample borehole (no liner) | | | | |
| SAMP_DATE | 2017-03-29 | | | | |
| LOCA_DRIL | SINTEF | | | | |
| Temperature | ca. -10 | | | ISO Field classification | |
| | | | | NO | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM | NGTS ID |
|---|---|---|---|---|---|---|
| 0 | 1 | | | Frozen | Auger | S1_A4_01 |
| 1 | 1,3 | | | Frozen | Auger | S1_A4_02 |
| 1,3 | 1,7 | Pr.1 | | Frozen | Corer | S1_A4_03 |
| 1,7 | 2,1 | Pr.2 | | Frozen | Corer | S1_A4_04 |
| 2,1 | 2,5 | Pr.3 | | Frozen | Corer | S1_A4_05 |
| 2,5 | 2,9 | Pr.4 | | Frozen | Corer | S1_A4_06 |
| 2,9 | 3,3 | Pr.5 | | Frozen | Corer | S1_A4_07 |
| 3,3 | 3,7 | Pr.6 | | Frozen | Corer | S1_A4_08 |
| 3,7 | 4,1 | Pr.7 | | Frozen | Corer | S1_A4_09 |
| 4,1 | 4,5 | Pr.8 | | Frozen | Corer | S1_A4_10 |
| 4,5 | 4,9 | Pr.9 | | Frozen | Corer | S1_A4_11 |
| 4,9 | 5,3 | Pr.10 | | Frozen | Corer | S1_A4_12 |
| 5,3 | 5,7 | Pr.11 | | Frozen | Corer | S1_A4_13 |
| 5,7 | 6,1 | Pr.12 | | Frozen | Corer | S1_A4_14 |
| 6,1 | 6,5 | Pr.13 | | Frozen | Corer | S1_A4_15 |
| 6,5 | 6,9 | Pr.14 | | Frozen | Corer | S1_A4_16 |
| 6,9 | 7,3 | Pr.15 | | Frozen | Corer | S1_A4_17 |
| 7,3 | 7,7 | Pr.16 | | Frozen | Corer | S1_A4_18 |
| 7,7 | 8,1 | Pr.17 | | Frozen | Corer | S1_A4_19 |
| 8,1 | 8,5 | Pr.18 | | Frozen | Corer | S1_A4_20 |
| 8,5 | 8,9 | Pr.19 | | Frozen | Corer | S1_A4_21 |
| 8,9 | 9,3 | Pr.20 | | Frozen | Corer | S1_A4_22 |
| 9,3 | 9,7 | Pr.21 | | Frozen | Corer | S1_A4_23 |
| 9,7 | 10,1 | Pr.22 | | Frozen | Corer | S1_A4_24 |
| 10,5 | 10,9 | Pr.23 | | Frozen | Corer | S1_A4_25 |
| 10,9 | 11,3 | Pr.24 | | Frozen | Corer | S1_A4_26 |
| 11,3 | 11,7 | Pr.25 | | Frozen | Corer | S1_A4_27 |
| 11,7 | 12,1 | Pr.26 | | Frozen | Corer | S1_A4_28 |
| 12,1 | 12,5 | Pr.27 | | Frozen | Corer | S1_A4_29 |
| 12,5 | 12,9 | Pr.28 | | Frozen | Corer | S1_A4_30 |
| 12,9 | 13,7 | | | Frozen | No sample | |
| Ca 14 | Ca 15 | | | Frozen | Sampler | S1_A4_31 |
| Ca 15 | Ca 16 | | | Frozen | Sampler | S1_A4_32 |
| Ca 16 | Ca 17 | | | Frozen | Sampler | S1_A4_33 |
| 26 | 27 | | | Frozen | Auger | S1_A4_34 |
| 28 | 29 | | | Frozen | Auger | S1_A4_35 |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB04A

BHCR

Document No.
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Figure No.
XXX

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| | | | | | |
|---|---|---|---|---|---|
| GROUP | SAMP | | | | |
| HEADING | Sample list | | | | |
| PROJ_ID | 20160154 | | | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | Adventdalen | | |
| PROJ_CLNT | NGTS | | | | |
| PROJ_CONT | UNIS | | | | |
| PROJ_ENG | SINTEF | | | Reach bedrock | NO |
| LOCA_ID | SVAB05A | | | Depth to bedrock if reached | |
| SAMP_TYPE | BHCR | | | | |
| Full description | CRELL 54 mm sample borehole (no liner) | | | | |
| SAMP_DATE | 2017-04-10 | | | | |
| LOCA_DRIL | SINTEF | | | | |
| Temperature | ca. -10 | | | ISO Field classification | |
| | | | | NO | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM | NGTS ID |
|---|---|---|---|---|---|---|
| 0 | 0,5 | Prøve 1 | | Frozen | Auger | S1_A5_01 |
| 0,5 | 1,5 | Prøve 2 | | Frozen | Auger | S1_A5_02 |
| 1,5 | 1,9 | Pr.3 | | Frozen | Corer | S1_A5_03 |
| 1,9 | 2,3 | Pr.3 | | Frozen | Corer | S1_A5_04 |
| 2,3 | 2,7 | Pr.5 | | Frozen | Corer | S1_A5_05 |
| 2,7 | 3,1 | Pr.6 | | Frozen | Corer | S1_A5_06 |
| 3,1 | 3,5 | Pr.7 | | Frozen | Corer | S1_A5_07 |
| 3,5 | 3,9 | Pr.8 | | Frozen | Corer | S1_A5_08 |
| 3,9 | 4,3 | Pr.9 | | Frozen | Corer | S1_A5_09 |
| 4,3 | 4,7 | Pr.10 | | Frozen | Corer | S1_A5_10 |
| 4,7 | 5,1 | Pr.11 | | Frozen | Corer | S1_A5_11 |
| 5,1 | 5,5 | Pr.12 | | Frozen | Corer | S1_A5_12 |
| 5,5 | 5,9 | Pr.13 | | Frozen | Corer | S1_A5_13 |
| 5,9 | 6,3 | Pr.14 | | Frozen | Corer | S1_A5_14 |
| 6,3 | 6,7 | Pr.15 | | Frozen | Corer | S1_A5_15 |
| 6,7 | 7,1 | Pr.16 | | Frozen | Corer | S1_A5_16 |
| 7,1 | 7,5 | Pr.17 | | Frozen | Corer | S1_A5_17 |
| 7,5 | 7,9 | Pr.18 | | Frozen | Corer | S1_A5_18 |
| 7,9 | 8,3 | Pr.19 | | Frozen | Corer | S1_A5_19 |
| 8,3 | 8,7 | Pr.20 | | Frozen | Corer | S1_A5_20 |
| 8,7 | 9,1 | Pr.21 | | Frozen | Corer | S1_A5_21 |
| 9,1 | 9,5 | Pr.22 (soft) | | Frozen | Corer | S1_A5_22 |
| 9,5 | 9,9 | Pr.23 | | Frozen | Corer | S1_A5_23 |
| 9,9 | 10,3 | Pr.24 | | Frozen | Corer | S1_A5_24 |
| 10,3 | 10,7 | | | Frozen | No sample | S1_A5_25 |
| 10,7 | 12 | | | Frozen | Auger | S1_A5_26 |
| 12,2 | 12,6 | Pr.24B | | Frozen | Corer | S1_A5_27 |
| 12,6 | 13 | Pr.25 | | Frozen | Corer | S1_A5_28 |
| 15,2 | 16 | | | Frozen | Sampler | S1_A5_29 |
| 16 | 16,5 | | | Frozen | Sampler | S1_A5_30 |
| 19 | 20 | | | Frozen | Auger | S1_A5_31 |
| 21 | 22 | | | Frozen | Auger | S1_A5_32 |
| 23 | 24 | | | Frozen | Auger | S1_A5_33 |
| 25 | 26 | | | Frozen | Auger | S1_A5_34 |
| 26 | 27 | | | Frozen | Auger | S1_A5_35 |
| 27 | 28 | | | Frozen | Auger | S1_A5_36 |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB05A

BHCR

| | |
|---|---|
| Document No. | 20160154-XX-R |
| Figure No. | XXX |
| Date | 22.05.2018 |
| Drawn by | GLG |

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| | | | | | |
|---|---|---|---|---|---|
| GROUP | SAMP | | | | |
| HEADING | Sample list | | | | |
| PROJ_ID | 20160154 | | | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | Adventdalen | | |
| PROJ_CLNT | NGTS | | | | |
| PROJ_CONT | UNIS | | | | |
| PROJ_ENG | UNIS | | | Reach bedrock | NO |
| LOCA_ID | SVAB06A | | | Depth to bedrock if reached | |
| SAMP_TYPE | BHCR | | | | |
| Full description | CRELL 54 mm sample borehole (no liner) | | | | |
| SAMP_DATE | 2018-12-10 | | | | |
| LOCA_DRIL | Anleggsdrift | | | | |
| Temperature | ca. -10 | | | ISO Field classification | |
| | | | | NO | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM |
|---|---|---|---|---|---|
| 0 | 1 | S1_A6_01 | | Frozen | Auger |
| 1 | 2 | S1_A6_02 | | Frozen | Auger |
| 2 | 3 | S1_A6_03 | | Frozen | Auger |
| 3 | 4 | S1_A6_04 | | Frozen | Auger |
| 4 | 5 | S1_A6_05 | | Frozen | Auger |
| 5 | 6 | S1_A6_06 | | Frozen | Auger |
| 6 | 7 | S1_A6_07 | | Frozen | Auger |
| 7 | 8 | S1_A6_08 | | Frozen | Auger |
| 8 | 9 | S1_A6_09 | | Frozen | Auger |
| 9 | 10 | S1_A6_10 | | Frozen | Auger |
| 10 | 11 | S1_A6_11 | | Frozen | Auger |
| 11 | 12 | S1_A6_12 | | Frozen | Auger |
| 12 | 13 | S1_A6_13 | | Frozen | Auger |
| 13 | 14 | S1_A6_14 | | Frozen | Auger |
| 14 | 15 | S1_A6_15 | | Frozen | Auger |
| 15 | 16 | S1_A6_16 | | Frozen | Auger |
| 16 | 17 | S1_A6_17 | | Frozen | Auger |
| 17 | 18 | S1_A6_18 | | Frozen | Auger |
| 18 | 19 | S1_A6_19 | | Frozen | Auger |
| 19 | 20 | S1_A6_20 | | Frozen | Auger |
| 20 | 21 | S1_A6_21 | | Frozen | Auger |
| 21 | 22 | S1_A6_22 | | Frozen | Auger |
| 22 | 23 | S1_A6_23 | | Frozen | Auger |
| 23 | 24 | S1_A6_24 | | Frozen | Auger |
| 24 | 25 | S1_A6_25 | | Frozen | Auger |
| 25 | 26 | S1_A6_26 | | Frozen | Auger |
| 26 | 27 | S1_A6_27 | | Frozen | Auger |
| 27 | 28 | S1_A6_28 | | Frozen | Auger |
| 28 | 29 | S1_A6_29 | | Frozen | Auger |
| 29 | 29,5 | S1_A6_30 | | Frozen | Auger |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB06A

BHCR

| | |
|---|---|
| Document No. | 20160154-XX-R |
| Figure No. | XXX |
| Date | 22.05.2018 |
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| | | | |
|---|---|---|---|
| GROUP | SAMP | | |
| HEADING | Sample list | | |
| PROJ_ID | 20160154 | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | UNIS East |
| PROJ_CLNT | NGTS | BH_COOR | 33X 514995, 8683177 |
| PROJ_CONT | UNIS | | |
| PROJ_ENG | UNIS | Reach bedrock | NO |
| LOCA_ID | SVAB01E | Depth to bedrock if reached | m |
| SAMP_TYPE | BHBG | | |
| Full description | Bag sample borehole | | |
| SAMP_DATE | XX.05.2017 | | |
| LOCA_DRIL | Anleggsdrift AS | | |
| Temperature | -10 | ISO Field classification | |
| | | NO | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM |
|---|---|---|---|---|---|
| 0 | 1 | S3_E1_01 | | Frozen | |
| 1 | 2 | S3_E1_02 | | Frozen | |
| 2 | 3 | S3_E1_03 | | Frozen | |
| 3 | 4 | S3_E1_04 | | Frozen | |
| 4 | 5 | S3_E1_05 | | Frozen | |
| 5 | 6 | S3_E1_06 | | Frozen | |
| 6 | 7 | S3_E1_07 | | Frozen | |
| 7 | 8 | S3_E1_08 | | Frozen | |
| 8 | 9 | S3_E1_09 | | Frozen | |
| 9 | 10 | S3_E1_10 | | Frozen | |
| 10 | 11 | S3_E1_11 | | Frozen | |
| 11 | 12 | S3_E1_12 | | Frozen | |
| 12 | 13 | S3_E1_13 | | Frozen | |
| 13 | 14 | S3_E1_14 | | Frozen | |
| 14 | 15 | S3_E1_15 | | Frozen | |
| 15 | 16 | S3_E1_16 | | Frozen | |
| 16 | 17 | S3_E1_17 | | Frozen | |
| 17 | 18 | S3_E1_18 | | Frozen | |
| 18 | 19 | S3_E1_19 | | Frozen | |
| 19 | 20 | S3_E1_20 | | Frozen | |
| 20 | 21 | S3_E1_21 | | Frozen | |
| 21 | 22 | S3_E1_22 | | Frozen | |
| 22 | 23 | S3_E1_23 | | Frozen | |
| 23 | 24 | S3_E1_24 | | Frozen | |
| 24 | 25 | S3_E1_25 | | Frozen | |
| 25 | 26 | S3_E1_26 | | Frozen | |
| 26 | 27 | S3_E1_27 | | Frozen | |
| 27 | 28 | S3_E1_28 | | Frozen | |
| 28 | 29 | S3_E1_29 | | Frozen | |
| 29 | 30 | S3_E1_30 | | Frozen | |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB01E

BHBG

Document No.
20160154-XX-R

Figure No.
XXX

Date
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| | | | |
|---|---|---|---|
| GROUP | SAMP | | |
| HEADING | Sample list | | |
| PROJ_ID | 20160154 | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | UNIS East |
| PROJ_CLNT | NGTS | BH_COOR | 33X 515074, 8683228 |
| PROJ_CONT | UNIS | | |
| PROJ_ENG | UNIS | Reach bedrock | YES |
| LOCA_ID | SVAB02E | Depth to bedrock if reached | 21 m |
| SAMP_TYPE | BHBG | | |
| Full description | Bag sample borehole | | |
| SAMP_DATE | XX.05.2017 | | |
| LOCA_DRIL | Anleggsdrift AS | | |
| Temperature | -10 | ISO Field classification | |
| | | NO | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM |
|---|---|---|---|---|---|
| 0 | 1 | S3_E2_01 | Gravels | Frozen | |
| 1 | 2 | S3_E2_02 | Gravels | Frozen | |
| 2 | 3 | S3_E2_03 | Gravels | Frozen | |
| 3 | 4 | S3_E2_04 | Gravels | Frozen | |
| 4 | 5 | S3_E2_05 | Sand/silt | Frozen | |
| 5 | 6 | S3_E2_06 | Sand/silt | Frozen | |
| 6 | 7 | S3_E2_07 | Sand/silt | Frozen | |
| 7 | 8 | S3_E2_08 | Sand/silt | Frozen | |
| 8 | 9 | S3_E2_09 | Sand/silt | Frozen | |
| 9 | 10 | S3_E2_10 | Sand/silt | Frozen | |
| 10 | 11 | S3_E2_11 | Sand/silt | Frozen | |
| 11 | 12 | S3_E2_12 | Sand/silt | Frozen | |
| 12 | 13 | S3_E2_13 | Sand/silt | Frozen | |
| 13 | 14 | S3_E2_14 | Sand/silt | Frozen | |
| 14 | 15 | S3_E2_15 | Sand/silt | Frozen | |
| 15 | 16 | S3_E2_16 | Sand/silt | Frozen | |
| 16 | 17 | S3_E2_17 | Sand/silt | Frozen | |
| 17 | 18 | S3_E2_18 | Sand/silt | Frozen | |
| 18 | 19 | S3_E2_19 | Sand/silt | Frozen | |
| 19 | 20 | S3_E2_20 | Sand/silt | Frozen | |
| 20 | 21 | S3_E2_21 | Sand/silt | Frozen | |
| 21 | 22 | S3_E2_22 | drock fragmer | Frozen | |
| 22 | 23 | S3_E2_23 | drock fragmer | Frozen | |
| 23 | 24 | S3_E2_24 | drock fragmer | Frozen | |
| 24 | 25 | S3_E2_25 | drock fragmer | Frozen | |
| 25 | 26 | S3_E2_26 | drock fragmer | Frozen | |
| 26 | 27 | S3_E2_27 | drock fragmer | Frozen | |
| 27 | 28 | S3_E2_28 | drock fragmer | Frozen | |
| 28 | 29 | S3_E2_29 | drock fragmer | Frozen | |
| 29 | 30 | S3_E2_30 | drock fragmer | Frozen | |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB02E

BHBG

| | |
|---|---|
| Document No. | 20160154-XX-R |
| Figure No. | XXX |
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| | | | |
|---|---|---|---|
| GROUP | SAMP | | |
| HEADING | Sample list | | |
| PROJ_ID | 20160154 | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | UNIS East |
| PROJ_CLNT | NGTS | BH_COOR | 33X 515165, 8683214 |
| PROJ_CONT | UNIS | | |
| PROJ_ENG | UNIS | Reach bedrock | NO |
| LOCA_ID | SVAB03E | Depth to bedrock if reached | m |
| SAMP_TYPE | BHBG | | |
| Full description | Bag sample borehole | | |
| SAMP_DATE | XX.05.2017 | | |
| LOCA_DRIL | Anleggsdrift AS | | |
| Temperature | -10 | ISO Field classification | |
| | | NO | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM |
|---|---|---|---|---|---|
| 0 | 1 | S3_E3_01 | | Frozen | |
| 1 | 2 | S3_E3_02 | | Frozen | |
| 2 | 3 | S3_E3_03 | | Frozen | |
| 3 | 4 | S3_E3_04 | | Frozen | |
| 4 | 5 | S3_E3_05 | | Frozen | |
| 5 | 6 | S3_E3_06 | | Frozen | |
| 6 | 7 | S3_E3_07 | | Frozen | |
| 7 | 8 | S3_E3_08 | | Frozen | |
| 8 | 9 | S3_E3_09 | | Frozen | |
| 9 | 10 | S3_E3_10 | | Frozen | |
| 10 | 11 | S3_E3_11 | | Frozen | |
| 11 | 12 | S3_E3_12 | | Frozen | |
| 12 | 13 | S3_E3_13 | | Frozen | |
| 13 | 14 | S3_E3_14 | | Frozen | |
| 14 | 15 | S3_E3_15 | | Frozen | |
| 15 | 16 | S3_E3_16 | | Frozen | |
| 16 | 17 | S3_E3_17 | | Frozen | |
| 17 | 18 | S3_E3_18 | | Frozen | |
| 18 | 19 | S3_E3_19 | | Frozen | |
| 19 | 20 | S3_E3_20 | | Frozen | |
| 20 | 21 | S3_E3_21 | | Frozen | |
| 21 | 22 | S3_E3_22 | | Frozen | |
| 22 | 23 | S3_E3_23 | | Frozen | |
| 23 | 24 | S3_E3_24 | | Frozen | |
| 24 | 25 | S3_E3_25 | | Frozen | |
| 25 | 26 | S3_E3_26 | | Frozen | |
| 26 | 27 | S3_E3_27 | | Frozen | |
| 27 | 28 | S3_E3_28 | | Frozen | |
| 28 | 29 | S3_E3_29 | | Frozen | |
| 29 | 30 | S3_E3_30 | | Frozen | |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB03E

BHBG

Document No.
20160154-XX-R

Figure No.
XXX

Date
22.05.2018

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NGTS

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| | | | |
|---|---|---|---|
| GROUP | SAMP | | |
| HEADING | Sample list | | |
| PROJ_ID | 20160154 | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | UNIS East |
| PROJ_CLNT | NGTS | BH_COOR | 33X 515179, 8683152 |
| PROJ_CONT | UNIS | | |
| PROJ_ENG | UNIS | Reach bedrock | NO |
| LOCA_ID | SVAB04E | Depth to bedrock if reached | m |
| SAMP_TYPE | BHBG | | |
| Full description | Bag sample borehole | | |
| SAMP_DATE | XX.05.2017 | | |
| LOCA_DRIL | Anleggsdrift AS | | |
| Temperature | -10 | ISO Field classification | |
| | | NO | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM |
|---|---|---|---|---|---|
| 0 | 1 | S3_E4_01 | | Frozen | |
| 1 | 2 | S3_E4_02 | | Frozen | |
| 2 | 3 | S3_E4_03 | | Frozen | |
| 3 | 4 | S3_E4_04 | | Frozen | |
| 4 | 5 | S3_E4_05 | | Frozen | |
| 5 | 6 | S3_E4_06 | | Frozen | |
| 6 | 7 | S3_E4_07 | | Frozen | |
| 7 | 8 | S3_E4_08 | | Frozen | |
| 8 | 9 | S3_E4_09 | | Frozen | |
| 9 | 10 | S3_E4_10 | | Frozen | |
| 10 | 11 | S3_E4_11 | | Frozen | |
| 11 | 12 | S3_E4_12 | | Frozen | |
| 12 | 13 | S3_E4_13 | | Frozen | |
| 13 | 14 | S3_E4_14 | | Frozen | |
| 14 | 15 | S3_E4_15 | | Frozen | |
| 15 | 16 | S3_E4_16 | | Frozen | |
| 16 | 17 | S3_E4_17 | | Frozen | |
| 17 | 18 | S3_E4_18 | | Frozen | |
| 18 | 19 | S3_E4_19 | | Frozen | |
| 19 | 20 | S3_E4_20 | | Frozen | |
| 20 | 21 | S3_E4_21 | | Frozen | |
| 21 | 22 | S3_E4_22 | | Frozen | |
| 22 | 23 | S3_E4_23 | | Frozen | |
| 23 | 24 | S3_E4_24 | | Frozen | |
| 24 | 25 | S3_E4_25 | | Frozen | |
| 25 | 26 | S3_E4_26 | | Frozen | |
| 26 | 27 | S3_E4_27 | | Frozen | |
| 27 | 28 | S3_E4_28 | | Frozen | |
| 28 | 29 | S3_E4_29 | | Frozen | |
| 29 | 30 | S3_E4_30 | | Frozen | |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB04E

BHBG

Document No.
20160154-XX-R

Figure No.
XXX

Date
22.05.2018

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GLG

NGTS

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| | | | | | |
|---|---|---|---|---|---|
| GROUP | SAMP | | | | |
| HEADING | Sample list | | | | |
| PROJ_ID | 20160154 | | | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | UNIS East | | |
| PROJ_CLNT | NGTS | | | | |
| PROJ_CONT | UNIS | | | | |
| PROJ_ENG | SINTEF | | Reach bedrock | NO | |
| LOCA_ID | SVAB05E | | Depth to bedrock if reached | | m |
| SAMP_TYPE | BHCR | | | | |
| Full description | CRELL 54 mm sample borehole (no liner) | | | | |
| SAMP_DATE | 2018-04-17 | | | | |
| LOCA_DRIL | SINTEF | | | | |
| Temperature | ca. -4 | | ISO Field classification | | |
| | | | NO | | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM | NGTS ID |
|---|---|---|---|---|---|---|
| 0 | 0.5 | | | Frozen | Predrill | |
| 0.5 | 1.0 | Auger prøve | | Frozen | Auger | S3_E5_01 |
| 1.0 | 1.9 | Auger prøve | | Frozen | Auger | S3_E5_02 |
| 1.9 | 2.3 | Pr.1 | | Frozen | CRREL | S3_E5_03 |
| 2.3 | 2.7 | Pr.2 | | Frozen | CRREL | S3_E5_04 |
| 2.7 | 3.1 | Pr.3 | | Frozen | CRREL | S3_E5_05 |
| 3.1 | 3.5 | Pr.4 | | Frozen | CRREL | S3_E5_06 |
| 3.5 | 3.9 | Pr.5 | | Frozen | CRREL | S3_E5_07 |
| 3.9 | 4.3 | Pr.6 | | Frozen | CRREL | S3_E5_08 |
| 4.3 | 4.7 | Pr.7 | | Frozen | CRREL | S3_E5_09 |
| 4.7 | 5.1 | Pr.8 | | Frozen | CRREL | S3_E5_10 |
| 5.1 | 5.5 | Pr.9 | | Frozen | CRREL | S3_E5_11 |
| 5.5 | 5.9 | Pr.10 | | Frozen | CRREL | S3_E5_12 |
| 5.9 | 6.3 | Pr.11 | | Frozen | CRREL | S3_E5_13 |
| 6.3 | 6.7 | Pr.12 | | Frozen | CRREL | S3_E5_14 |
| 6.7 | 7.1 | Pr.13 | | Frozen | CRREL | S3_E5_15 |
| 7.1 | 7.5 | Pr.14 | | Frozen | CRREL | S3_E5_16 |
| 7.5 | 7.9 | Pr.15 | | Frozen | CRREL | S3_E5_17 |
| 7.9 | 8.3 | Pr.16 | | Frozen | CRREL | S3_E5_18 |
| 8.3 | 8.7 | Pr.17 | | Frozen | CRREL | S3_E5_19 |
| 8.7 | 9.1 | Pr.18 | | Frozen | CRREL | S3_E5_20 |
| 9.1 | 9.5 | Pr.19 | | Frozen | CRREL | S3_E5_21 |
| 9.5 | 9.9 | Pr.20 | | Frozen | CRREL | S3_E5_22 |
| 9.9 | 10.3 | Pr.21 | | Frozen | CRREL | S3_E5_23 |
| 10.3 | 10.7 | Pr.22 | | Frozen | CRREL | S3_E5_24 |
| 10.7 | 11.1 | Pr.23 | | Frozen | CRREL | S3_E5_25 |
| 11.1 | 11.5 | Pr.24 | | Frozen | CRREL | S3_E5_26 |
| 11.5 | 11.9 | Pr.25 | | Frozen | CRREL | S3_E5_27 |
| 11.9 | 12.3 | Pr.26 | | Frozen | CRREL | S3_E5_28 |
| 12.3 | 12.7 | Pr.27 | | Frozen | CRREL | S3_E5_29 |
| 12.9 | 13.3 | Pr.28 | | Frozen | CRREL | S3_E5_30 |
| 13.3 | 13.7 | Pr.29 | | Frozen | CRREL | S3_E5_31 |
| 13.7 | 14.1 | Pr.30 | | Frozen | CRREL | S3_E5_32 |
| 14.1 | 14.5 | Pr.31 | | Frozen | CRREL | S3_E5_33 |
| 14.5 | 14.9 | Pr.32 | | Frozen | CRREL | S3_E5_34 |
| 14.9 | 15.3 | Pr.33 | | Frozen | CRREL | S3_E5_35 |
| 15.3 | 15.7 | Pr.34 | | Frozen | CRREL | S3_E5_36 |
| 17.7 | 18.1 | Pr.35 | | Frozen | CRREL | S3_E5_37 |
| 18.1 | 18.5 | Pr.36 | | Frozen | CRREL | S3_E5_38 |
| 18.5 | 18.9 | Pr.37 | | Frozen | CRREL | S3_E5_39 |
| 18.9 | 19.3 | Pr.38 | | Frozen | CRREL | S3_E5_40 |
| 19.3 | 19.7 | Pr.39 | | Frozen | CRREL | S3_E5_41 |
| 19.7 | 20.1 | Pr.40 | | Frozen | CRREL | S3_E5_42 |
| 21.5 | 21.7 | Auger prøve | | Frozen | Auger | S3_E5_43 |
| 21.7 | 22.1 | Pr.41 | | Frozen | CRREL | S3_E5_44 |
| 22.1 | 22.5 | Pr.42 | | Frozen | CRREL | S3_E5_45 |
| 22.5 | 22.9 | Pr.43 | | Frozen | CRREL | S3_E5_46 |
| 23.5 | 23.7 | Auger prøve | | Frozen | Auger | S3_E5_47 |
| 25.0 | 25.3 | Auger prøve | | Frozen | Auger | S3_E5_48 |
| 25.7 | 26.1 | Auger prøve | | Frozen | Auger | S3_E5_49 |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB05E

BHCR

| | |
|---|---|
| Document No. | 20160154-XX-R |
| Figure No. | XXX |
| Date | 22.05.2018 |
| Drawn by | GLG |

NGTS

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| | | | | | |
|---|---|---|---|---|---|
| GROUP | SAMP | | | | |
| HEADING | Sample list | | | | |
| PROJ_ID | 20160154 | | | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | UNIS East | | |
| PROJ_CLNT | NGTS | | | | |
| PROJ_CONT | UNIS | | | | |
| PROJ_ENG | SINTEF | | | Reach bedrock | NO |
| LOCA_ID | SVAB06E | | | Depth to bedrock if reached | m |
| SAMP_TYPE | BHCR | | | | |
| Full description | CRELL 54 mm sample borehole (no liner) | | | | |
| SAMP_DATE | 2018-04-22 | | | | |
| LOCA_DRIL | SINTEF | | | | |
| Temperature | ca. -4 | | ISO Field classification | | |
| | | | NO | | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM | NGTS ID |
|---|---|---|---|---|---|---|
| | | | | | Predrill | |
| 0.5 | 1.0 | Augerprøve | | Frozen | Auger | S3_E6_01 |
| 1.0 | 1.5 | Augerprøve | | Frozen | Auger | S3_E6_02 |
| 2.0 | 2.4 | Pr.1 | | Frozen | CRREL | S3_E6_03 |
| 2.4 | 2.8 | Pr.2 | | Frozen | CRREL | S3_E6_04 |
| 2.8 | 3.2 | Pr.3 | | Frozen | CRREL | S3_E6_05 |
| 3.2 | 3.6 | Pr.4 | | Frozen | CRREL | S3_E6_06 |
| 5.4 | 5.7 | Augerprøve | | Frozen | Auger | S3_E6_07 |
| 5.7 | 6.1 | Pr.5 | | Frozen | CRREL | S3_E6_08 |
| 6.1 | 6.5 | Pr.6 | | Frozen | CRREL | S3_E6_09 |
| 6.5 | 6.9 | Pr.7 | | Frozen | CRREL | S3_E6_10 |
| 6.9 | 7.3 | Pr.8 | | Frozen | CRREL | S3_E6_11 |
| 7.3 | 7.7 | Pr.9 | | Frozen | CRREL | S3_E6_12 |
| 9.3 | 9.7 | Augerprøve | | Frozen | Auger | S3_E6_13 |
| 9.7 | 10.1 | Pr.10 | | Frozen | CRREL | S3_E6_14 |
| 10.1 | 10.4 | Pr.11 | | Frozen | CRREL | S3_E6_15 |
| 10.4 | 10.7 | Pr.12 | | Frozen | CRREL | S3_E6_16 |
| 10.7 | 11.1 | Pr.13 | | Frozen | CRREL | S3_E6_17 |
| 11.1 | 12.0 | Augerprøve | | Frozen | Auger | S3_E6_18 |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB06E

BHCR

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| | | | | | |
|---|---|---|---|---|---|
| GROUP | SAMP | | | | |
| HEADING | Sample list | | | | |
| PROJ_ID | 20160154 | | | | |
| PROJ_NAME | National GeoTest Sites (NGTS) | | | | |
| PROJ_LOC | Svalbard (SVA) | SUBSITE | UNIS East | | |
| PROJ_CLNT | NGTS | | | | |
| PROJ_CONT | UNIS | | | | |
| PROJ_ENG | SINTEF | | | Reach bedrock | NO |
| LOCA_ID | SVAB07E | | | Depth to bedrock if reached | m |
| SAMP_TYPE | BHCR | | | | |
| Full description | CRELL 54 mm sample borehole (no liner) | | | | |
| SAMP_DATE | 2018-04-23 | | | | |
| LOCA_DRIL | SINTEF | | | | |
| Temperature | ca. -5 | | ISO Field classification | | |
| | | | NO | | |

| SAMP_TOP | SAMP_BASE | SAMP_REF | SAMP_CLASS | Samples in lab | DREM_REM | NGTS ID |
|---|---|---|---|---|---|---|
| 0 | 0.3 | | | | Predrill | |
| 0.3 | 0.7 | Augerprøve | | Frozen | Auger | S3_E7_01 |
| 1.1 | 1.4 | Augerprøve | | Frozen | Auger | S3_E7_02 |
| 1.7 | 2.0 | Augerprøve | | Frozen | Auger | S3_E7_03 |
| 2.0 | 2.4 | Pr.1 | | Frozen | CRREL | S3_E7_04 |
| 2.4 | 2.8 | Pr.2 | | Frozen | CRREL | S3_E7_05 |
| 2.8 | 3.2 | Pr.3 | | Frozen | CRREL | S3_E7_06 |
| 3.2 | 3.6 | Pr.4 | | Frozen | CRREL | S3_E7_07 |
| 3.6 | 4.0 | Pr.5 | | Frozen | CRREL | S3_E7_08 |
| 5.5 | 6.0 | Augerprøve | | Frozen | Auger | S3_E7_09 |
| 6.0 | 6.4 | Pr.6 | | Frozen | CRREL | S3_E7_10 |
| 6.4 | 6.8 | Pr.7 | | Frozen | CRREL | S3_E7_11 |
| 6.8 | 7.2 | Pr.8 | | Frozen | CRREL | S3_E7_12 |
| 7.2 | 7.6 | Pr.9 | | Frozen | CRREL | S3_E7_13 |
| 7.6 | 8.0 | Pr.10 | | Frozen | CRREL | S3_E7_14 |
| 8.5 | 9.0 | Augerprøve | | Frozen | Auger | S3_E7_15 |
| 9.5 | 10.0 | Augerprøve | | Frozen | Auger | S3_E7_16 |
| 10.1 | 10.5 | Pr.11 | | Frozen | CRREL | S3_E7_17 |
| 10.5 | 10.9 | Pr.12 | | Frozen | CRREL | S3_E7_18 |
| 10.9 | 11.3 | Pr.13 | | Frozen | CRREL | S3_E7_19 |
| 11.3 | 11.7 | Pr.14 | | Frozen | CRREL | S3_E7_20 |
| 13.5 | 14.0 | Augerprøve | | Frozen | Auger | S3_E7_21 |
| 14.5 | 15.0 | Augerprøve | | Frozen | Auger | S3_E7_22 |
| 15.0 | 15.7 | Augerprøve | | Frozen | Auger | S3_E7_23 |

**National GeoTest Sites (NGTS)**

Description

Sample list

SVAB07E

BHCR

Document No.
20160154-XX-R

Figure No.
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| 0 | Original document | 2020-01-10<br>Graham Gilbert, Arne Instanes | 2020-01-09<br>Ørjan Nerland | | |
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|---|---|---|
| | 14 January 2020 | Graham Gilbert |