

PERSPECTIVE

Svalbard Rock Vault: towards safeguarding geological cores and borehole data

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Abstract

Continuous sedimentary drill cores provide crucial data for deciphering past climate variations and characterizing the subsurface for the energy industry (e.g., coal, petroleum, CO₂ storage, geothermal energy). The Norwegian High-Arctic archipelago of Svalbard offers a diverse geological record that has been investigated by geoscientists for both scientific and applied projects, with hundreds of boreholes drilled over the past century. Unfortunately, much crucial data, including physical material from the boreholes, have been lost. The Svalbard Rock Vault project aims to safeguard drill cores, cuttings and hand samples from Svalbard and facilitate their scientific reuse. We aim to establish a physical core storage repository in, or near, Longyearbyen, Svalbard. In parallel, ongoing digitization and data integration efforts are improving access to complementary non-physical material, including hard-to-access reports, wire-line logs and interpretations. In this contribution, we report on the motivation and background of the Svalbard Rock Vault project, synthesize current knowledge about physical subsurface material from Svalbard, and present a vision of an improved physical core storage facility near Longyearbyen.

Keywords

Drill cores; open data; archive; repository; CO₂ storage; geothermal

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Abbreviations

ICDP: International Continental Scientific Drilling Program
NGU: Geological Survey of Norway
NOD: Norwegian Offshore Directorate
NPN: Norsk Polar Navigasjon AS
SNSK: Store Norske Spitsbergen Kulkompani AS
SRV: Svalbard Rock Vault
UNIS: The University Centre in Svalbard

Introduction

The Earth's geological history over the past 4 billion years has been deciphered through evidence held in physical material, including outcrop studies and drill cores. Svalbard offers a nearly continuous sedimentary record from the Devonian to the Neogene (Olaussen et al. 2025), representing a unique opportunity to understand how climate changed during the Phanerozoic. Hundreds of boreholes have been drilled in Svalbard over the past century, notably for coal, petroleum and scientific exploration (Fig. 1a; Senger et al. 2019). The challenge is that, unlike mainland Norway (overseen by the NGU) and the Norwegian continental shelf (managed by NOD), there is no single organization with the mandate and resources to safeguard drill cores and geological samples from Svalbard. As a consequence, many drill cores have been lost (Fig. 1b-d).

National institutions, typically geological surveys, oversee safeguarding and archiving geoscientific data in public archives, even after the demise of the company or

institution initially acquiring it. Planavsky et al. (2020) emphasize the importance of long-term, safe storage of drill cores to facilitate scientific reproducibility and decipher the Earth's deep-time climate archive. Their key message is that all samples used in geochemical analyses should be available for complementary analyses at well-funded and permanent drill core and sample repositories around the world. Drill cores are expensive to acquire, with a single deep borehole beyond the budget of most research projects. National geological repositories facilitate access to existing material. For instance, the UK's National Geological Repository contains more than 600 km of drill cores that exceed 200 billion GBP in cumulative acquisition costs (Howe 2023). Geoscience Australia is a government agency that maintains a very large repository of geological data and physical samples, including drill cores (Geoscience Australia 2025). It aims to make more than 90% of its collections digitally accessible by 2035.

Providing access to this material to commercial companies and academics alike is crucial for maintaining

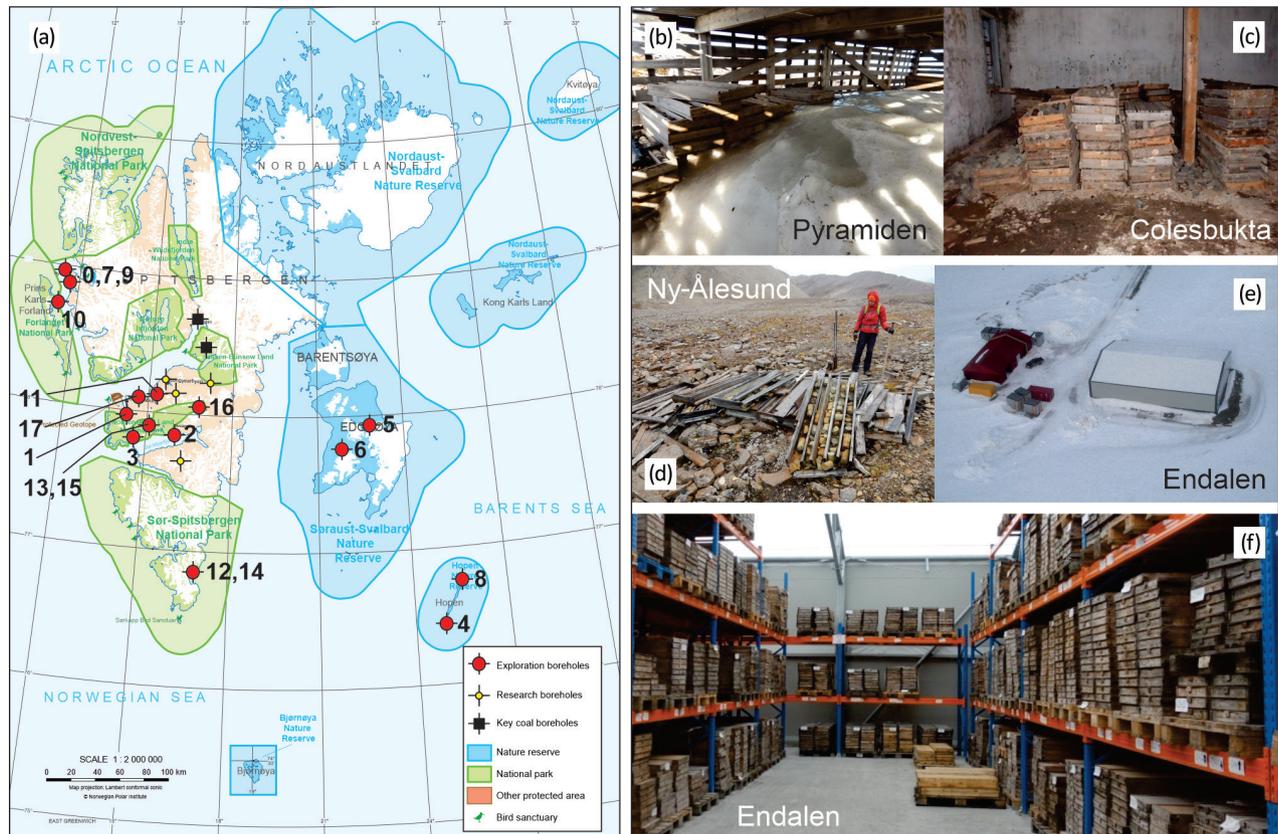


Fig. 1 (a) Location of the key research and petroleum exploration boreholes in Svalbard; protected areas (blue and green shading) are also indicated. The numbers represent the chronological drilling order and provide more information on the boreholes in Senger et al. (2019). (Map modified from Dallmann et al. 2015.) Photographs of poorly managed drill core sheds near (b) Pyramiden, (c) Colesbukta, (d) Ny-Ålesund and, for comparison, (e, f) the well-managed Endalen facility near Longyearbyen.

scientific credibility (i.e., the possibility to reproduce results) and making sure material remains safely stored for commercial or academic re-use. In addition to storage, many repositories systematically characterize drill cores using non-destructive techniques such as a multi-sensor core logger and hyperspectral and x-ray fluorescence scanners (Shreeve 2023). Finally, Planavsky et al. (2020) argue that geoscientists, data curators, museum staff and journal editors need to work together to develop archival policies for such samples and drill cores.

This argument is equally valid for Svalbard, where many drill cores and outcrop samples have been acquired from inaccessible or strictly protected locations. For various reasons, there is no national institution taking care of drill cores from Svalbard. Many geoscientific data, including physical drill cores, have been lost because of the lack of such a caretaker.

In a bottom-up approach, UNIS, in collaboration with the Norwegian coal-mining company SNSK launched the SRV initiative in 2018. UNIS and SNSK organized a workshop for this initiative, held during 24–26 September

2018 in Longyearbyen, Svalbard. The 33 participants, who represented 19 academic, industrial and government institutions (Table 1), were unanimously in favour of establishing a physical facility in or near Longyearbyen for storing and using existing and potential new drill core material. No consensus was reached on who should operate it or how it should be financed.

Following the workshop, a three-year networking project (SRV2020) was undertaken, also jointly led by UNIS and SNSK. The focus was on (1) safeguarding Svalbard's geological heritage (e.g., drill cores) during the turbulence of the rapid downscaling of coal mining and (2) facilitating geoscientific co-operation in Svalbard by allowing better access to physical geoscientific material and data. In parallel, lobbying efforts were made at local and national levels for the establishment of a core storage facility. A scientific drilling proposal with global relevance under the umbrella of the ICDP was developed. Called SvalCLIME, it would be an important contributor to the proposed repository in the future (Senger, Kulhanek et al. 2023; Kulhanek et al. 2024).

Table 1 Institutions participating in the SRV workshop and a brief overview of their roles with respect to geoscientific material from Svalbard.

Institution	Drill core and other physical material	Comment	Selected references
University Centre in Svalbard (UNIS)	A 4.5 km of drill cores covering large parts of the Mesozoic from a CO ₂ storage pilot project.	UNIS uses drill cores in education and research, including systematic deep-time palaeoclimate drilling (SvalCLIME).	Senger, Kulhanek et al. 2023; Kulhanek et al. 2024; Senger, Betlem et al. 2025
Store Norske Spitsbergen Kulkompani (SNSK)	> 60 km of drill cores with a stratigraphic focus on the Cenozoic.	Norwegian state-owned coal company	Senger et al. 2019
Norwegian Polar Institute (NPI)	Operates a hand sample archive for its own polar samples in Tromsø.	NPI is the national authority for geological mapping of Svalbard (and large parts of Antarctica).	https://data.npolar.no/geology/sample ; Myhre et al. 2020; Dallmann 1999, 2015;
Commissioner of Mines on Svalbard/Directorate of Mining with the (DMF)	Only samples related to discovery points in claiming processes.	DMF oversees allocating claims for any resources in Svalbard.	Senger et al. 2019 (outline of the claiming procedure)
Geological Survey of Norway (NGU)	Takes care of all drill cores on the Norwegian mainland (> 800 km) at the Løkken Verk Drill Core Archive in Løkken.	NGU's geographical focus is mainland Norway.	https://www.ngu.no/en/geological-mapping/lokken-drill-core-archive
Norwegian Offshore Directorate (NOD)	Manages all data (e.g., borehole, drill cores, cuttings, fluid samples, seismic) from the Norwegian continental shelf at the Geobank in Stavanger.	NOD has no official mandate onshore Svalbard but conducts resource estimates in the unopened area beyond 12 nautical miles of the land (NPD 2017), acquiring seismic and shallow core data.	https://www.sodir.no/en/facts/geology/geobank/
Natural History Museum (NHM), University of Oslo	Extensive collection of fossils from Svalbard	NHM maintains fossil specimens from Norway/Svalbard, stored in Oslo	Nakrem et al. 2023
University of Oslo (UiO)	Deltadalen cores, DD1 and DD2 (ca. 100 m each).	UiO operated the Deltadalen drilling campaign.	Zuchuat et al. 2020
German Federal Geological Survey (BGR)	Hand samples, geophysical data, drill cores.	Physical samples are stored in a national polar data archive in Berlin; other data (seismic, aerogeophysics, etc.) are available through an online portal.	https://www.bgr.bund.de/DE/Themen/Polargeologie/NAPA/napa_node.html
Soviet/Russian coal mining company Trust Arktikugol	Hundreds of drill cores were drilled, but it is unclear whether any material is still available.	Operates the towns of Barentsburg (mining ongoing) and Pyramiden (mining ceased in 1998) in Svalbard.	Senger et al. 2019
Polar Marine Geological Expeditions (PMGE)		Russian state institute that conducted extensive field expeditions in Svalbard, including detailed mapping, sample collection and various assessments.	
Cambridge Arctic Shelf Programme (CASP)	Physical samples from several of the petroleum wells drilled onshore Svalbard, stored at the Sedgwick Museum of Earth Sciences in Cambridge, UK.	Stems from the Svalbard work of British geologists (Harland 1997) and has involved extensive co-operation with oil companies.	Harland 1997
Norsk Polar Navigasjon (NPN)	The NPN archive of documents was handed over from Asbjørn Skotte to UNIS during the SRV workshop. It is unclear if physical material from NPN still exists.	Norwegian private company that was involved in about half of the petroleum exploration boreholes in Svalbard, including the first one drilled in the early 1960s, at Kvadehuken.	Senger et al. 2019

The aims of this contribution are to (1) outline the motivation and background of the SRV project, (2) synthesize current knowledge about physical subsurface materials from Svalbard, and (3) present a vision for an improved core storage repository near Longyearbyen.

Geoscientific exploration of Svalbard

Svalbard is a Norwegian archipelago covering all islands in the area of 74–81°N and 15–35°E. Access to Svalbard's natural resources is regulated by the Svalbard Mining

Code (*Bergverksordningen*), which was ratified in 1925 along with the Svalbard Treaty. The Svalbard Treaty grants Norway full and absolute sovereignty over the archipelago but also specifies that all signatory countries have equal access to its resources. Consequently, Svalbard is very international and past exploration for coal, petroleum and minerals has involved companies from many countries (Elvevold 2015; Senger et al. 2019).

The location of mineable coal seams historically determined where permanent settlements were established in Svalbard (Senger, Ammerlaan et al. 2025). Coal mining has facilitated year-round industrial activity for the past century. Svalbard was often examined as the window to Barents Sea geology by generations of petroleum geoscientists (e.g., Nøttvedt et al. 1993; Olaussen et al. 2025). Norway's exploration for hydrocarbons in Svalbard began in the early 1960s (Fig. 1a; Senger et al. 2019). More recently, research drilling has been conducted with diverse scientific targets, including complete characterization of a clinof orm sequence at Sysse lmannbreen (Johannessen et al. 2011), CO₂ storage potential near Longyearbyen (Braathen et al. 2012) and investigation of the Permian–Triassic mass extinction and its aftermath at Deltadalen (Zuchuat et al. 2020). UNIS was established in 1993 and conducts year-round field teaching in Svalbard, including geology. Drill cores are an integral part of education and research at UNIS.

Over the decades, various groups have gathered geoscientific data from Svalbard, but accessing geological data from past expeditions is often challenging and incomplete. This is particularly evident when considering physical drill cores, many of which have been lost because of mismanagement or the harsh Arctic conditions (Fig. 1b–d).

Drill cores have obvious commercial value, but in Svalbard, where most land is already claimed or protected as national parks or nature reserves (Fig. 1a), there is currently no commercial interest except for the declining coal exploitation industry. Nonetheless, drill cores are crucial for addressing issues of societal relevance, including CO₂ sequestration (Braathen et al. 2012), natural gas characterization (Ohm et al. 2019) and assessing the geothermal potential (Senger, Nuus et al. 2023). Furthermore, drill cores are fundamentally important for deciphering deep-time palaeoclimatic events, including the Paleocene–Eocene Thermal Maximum (Dypvik et al. 2011), Cretaceous cooling/warming events (Jelby et al. 2020; Vickers et al. 2023), and the largest mass extinction at the end of the Permian (Zuchuat et al. 2020).

Svalbox is a UNIS-led integrated database that includes digital outcrop models and photospheres in the context of Svalbard's regional geology (Senger, Betlem, Birchall et al. 2021; Betlem et al. 2023; Horota et al. 2024). In the

context of the SRV project, Svalbox serves as the integration tool spanning scales (from outcrop to borehole to regional geophysics) and disciplines (geology, geophysics, remote sensing). Svalbox was developed as a teaching tool at UNIS to extend the field season (Senger, Betlem, Grundvåg et al. 2021) but has untapped potential to act as an integrated geodatabase for the SRV initiative, particularly for digitizing and connecting the various archives.

Borehole data sets

Hundreds of boreholes have been drilled in Svalbard, the vast majority for coal exploration and exploitation. Coal boreholes are geographically clustered around the main settlements (Longyearbyen, Barentsburg, Ny-Ålesund, Sveagruva, Grumant, Colesbukta and Pyramiden) and are stratigraphically restricted to coal-bearing Paleogene, Cretaceous and Carboniferous strata. Research and petroleum exploration wells cover significantly larger geographic and stratigraphic areas (Senger et al. 2019). Table 1 lists the known availability of material from various boreholes.

For the Longyearbyen CO₂ Lab project, data are summarized and openly shared in a recent data article (Senger, Betlem et al. 2025). For other projects, including petroleum exploration, data are much more fragmentary and hard to access. A summary of the technical material available from three main archives—the NPN archive at UNIS, the Polarinvest-Barentz-gruppen archive in Tromsø and the Tromsøbreen II archive in Lund—is provided by Senger et al. (2022). Polarinvest-Barentz-gruppen was a holding company that owned all or part of several Norwegian companies that sought to locate and extract natural resources in Svalbard (Lindbach 2001). These companies were dissolved in the early 1990s. There are other relevant archives, including the private collection of Svein Ytreland, housed by the Svalbard Museum (Fig. 3b).

Data from the 18 petroleum exploration boreholes are, unfortunately, fragmentary and their quality varies according to the operator and time of drilling (Table 1; Senger et al. 2019). A summary of known reports is provided by Senger et al. (2022) and in Table 2.

Wireline logs

Wireline logs are available for the Longyearbyen CO₂ Lab project (Senger, Betlem et al. 2025), the Sysse lmannbreen borehole and most of the petroleum exploration boreholes. The most complete wireline logging data are available from the Ishøgda, Tromsøbreen II and Hopen I boreholes (Fig. 2). Most of the wireline logs were provided digitally, but some logs have been digitized

Table 2 An overview of drill core availability from all known Svalbard boreholes. Further information about the boreholes is provided by Senger et al. (2019) and about the data sets by Senger et al. (2022).

Borehole(s)	Operator ^a	Drill type ^b	Year	Depth (m)	Physical material ^c				Complementary material		
					Drill core (no. of cores)	Sidewall cores	Cuttings	Where?	Wireline logs	Final well report ^c	Reports, data sets and publications
Petroleum exploration boreholes											
Kvadehuken O	NPN	P	1961	?	Y/F			LL ^d			
Grøn fjorden I	NPN	P	1963–67	972	Y/F			LL ^d			
Ishøgda I	Caltex	P	1965–66	3304	?						
Bellsund I	NPN	P	1967–81	405	Y/F			LL ^d			
Hopen I	Fina	P	1971	908			Y	CAM			
Raddaldalen	Fina	P	1972	2823	Y (4)	Y		CAM(?)	Y		Bro & Shwarz 1983
Plurdalen	Total	P	1972	2351	Y (10)	Y (16)			Y		
Kvadehuken I	NPN	P	1972–74	479					Y		
Hopen II	Fina	P	1973	2840	Y (5)		Y	CAM			
Kvadehuken II	NPN	P	1973–74	394	Y/F			LL ^d			
Sarstangen	NPN	P	1974	1113	Y			NOD			
Colesbukta	TA	P	1974–75	3180	?						Shkola 1977
Tromsøbreen I	NPN	P	1976–77	990							
Vassdalen II	TA	P	1985–87	2481							Bro 1990 ^a
Tromsøbreen II	Tundra	P	1987–88	2337		Y	Y	LTH			
Vassdalen III	TA	P	1988–89	2352							Bro 1990 ^b
Reindals-passet I	NH-SNSK-PA	P	1991	2315	Y (1)	Y	Y	END	Y	Y	Equinor
Kapp Laila I	SNSK-NH-TA	P	1994	503	?						
Scientific boreholes											
DH1	UNIS	R	2007	518	Y			UNIS	Y		
DH2	UNIS	R	2007	856	Y			UNIS	Y		
DH3	UNIS	R	2008	402	Y			UNIS	N		
DH4	UNIS	R	2009	970	Y			UNIS	Y		
DH5	UNIS	R	2011–12	702	Y			UNIS	Y		Senger et al. 2024
DH6	UNIS	R	2011	435	Y			UNIS/UiT	N		
DH7	UNIS	R	2012	704	Y			UNIS	N		
DH8	UNIS	R	2012	70	Y			UNIS	N		
Sysselemann-breen	SNSK	R	2008	1085	Y			END/EQU			Johannessen et al. 2011
Coal and uranium exploration											
Gipsdalen DDH1-DDH8	EBE	C	1978	up to 243	Y			BGR, UiO			Senger et al. 2019
Deltadalen DD-1	UiO	R	2014	99	Y			UiO			Zuchuat et al. 2020
Deltadalen DD-2	UiO	R	2014	93	Y			UiO			Zuchuat et al. 2020
SNSK coal	SNSK	C			Y			END			Dypvik et al. 2011
Kings Bay coal	Kings Bay	C	LL ^d		N						
Trust Arktikugol coal	TA	C	LL ^d		?						
Petuniabukta coal	TA	C	LL ^d								Verba 2007; Smyrak-Sikora et al. 2021

^aNorsk Polar Navigasjon (NPN), Trust Arktikugol (TA), Norsk Hydro (NH), Store Norske Spitsbergen Kulkompani (SNSK), PetroArctic (PA), E&B Exploration Ltd (EBE). ^bPetroleum Wildcat (P), research borehole (R), coal exploration borehole (C). ^cFully cored (F); yes (Y), no (N); Endalen storage facility, near Longyearbyen (END); Equinor core repository, Bergen (EQU); Norwegian Offshore Directorate, Stavanger (NOD); Technical University of Lund (LTH); University of Oslo (UiO). BGR repository in Berlin (BGR); containers outside UNIS, Longyearbyen (UNIS); UiT The Arctic University of Norway, Tromsø (UiT); Sedgwick Museum, University of Cambridge (CAM). ^dLikely lost.

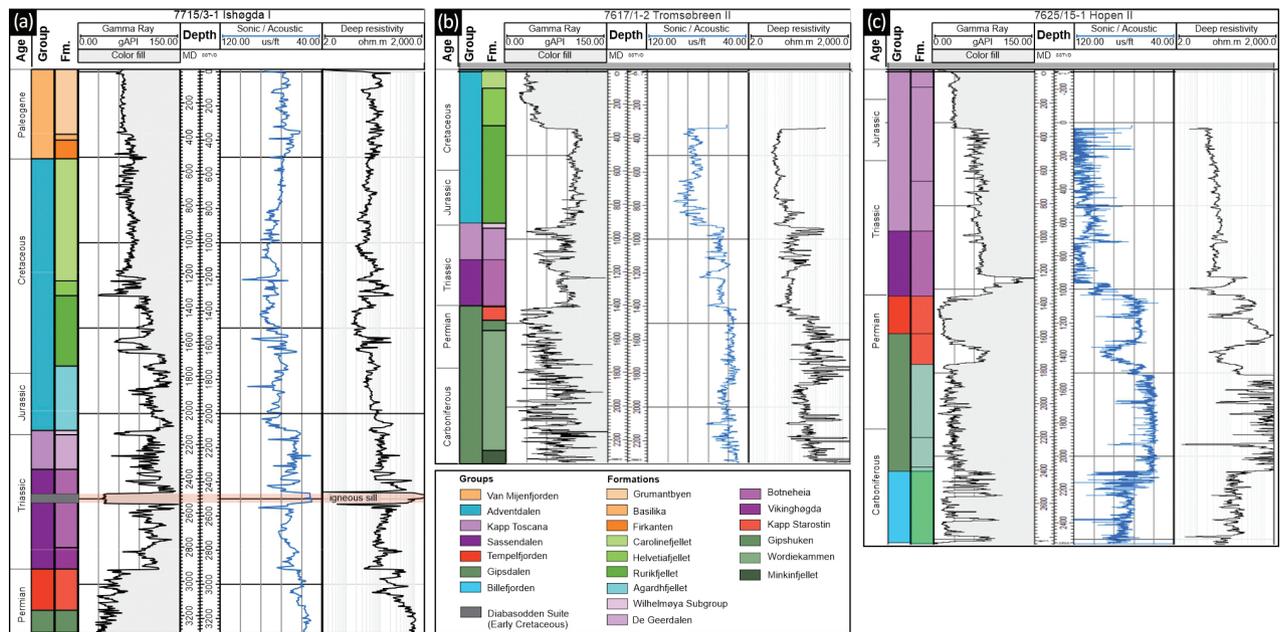


Fig. 2 Composite logs of three exploration wells with the highest quality of wireline log data: (a) 7715/3-1 Ishøgda I, (b) 7617/1-2 Tromsøbreen II and (c) 7625/15-1 Hopen II (c). The log suites show penetration through significant parts of Svalbard's stratigraphy.

manually from completion logs, with corresponding uncertainty. The three selected boreholes nicely illustrate the stratigraphy of central and eastern Spitsbergen (Ishøgda and Tromsøbreen II, respectively) and the bridge from Svalbard to the offshore Barents Sea (Hopen II).

Drill cores, samples and analyses

Known physical material is listed in Tables 2 and 3 offers expanded information for the fully cored research and coal exploration boreholes. Most petroleum wells were only cored in short, selected intervals, but the boreholes drilled by NPN at Grønfjorden, Bellsund and Kvadehuken were fully cored. Only photographs of the drill cores from Kvadehuken remain; the physical material has not (yet) been located.

For the Russian boreholes, some analyses are openly shared via the Pangaea database (Table 1), but it is unclear if usable drill cores are still archived for re-use.

Archive material

Three archives have been systematically investigated as part of the SRV project: the NPN, Polarinvest-Barentzgruppen and Tromsøbreen II archives (Fig. 3).

Through the SRV pilot project, UNIS took over the curation of the NPN archive that had previously been stored at Skotte AS, a private company in Ørskog, near Ålesund, mainland Norway. The material has been

systematically categorized (Senger et al. 2022) and scanned. NPN was involved in the drilling of almost half of the boreholes onshore Svalbard, and the archive—which includes final well reports, logs, onshore geological prospecting reports etc.—offers unprecedented insights into the subsurface of Svalbard.

The company Nordic Polarinvest (which was later owned by the holding company Polarinvest-Barentzgruppen) was involved in the drilling of the Tromsøbreen II borehole in 1988. Eventually, the company went bankrupt, but the material (including some geological data) is available for viewing at the National Archives in Tromsø (Fig. 3a). The most relevant sections have been scanned.

The drill cores from the Tromsøbreen II borehole have been fortuitously re-discovered at the University of Lund, which had some collaboration with the prospecting and drilling operations. In addition to the cores and cuttings, reports and other archival documents are available and have been categorized and scanned (Senger et al. 2022).

Drill core data use and re-use

The availability of physical drill cores makes possible spin-off research projects. For example, the Sysselembreen drill core, along with associated wireline logs and other measurements and information, was used not only to characterize the clinoform succession it was targeting (Johannessen et al. 2011) but also provided important constraints in regional

Table 3 A summary of the key drilling campaigns in Svalbard with full coring.

Drilling campaign	Purpose	Drill cores and availability	Key reference(s)
Research drilling: Deltadalen	To characterize the Permian–Triassic mass extinction and the subsequent recovery of life.	The drill cores from two ca. 100 m deep Deltadalen boreholes are available at the University of Oslo.	Schobben et al. 2020; Zuchuat et al. 2020; Rodríguez-Tovar et al. 2021
Research drilling: Longyearbyen CO ₂ Lab	To confirm whether the subsurface beneath Longyearbyen is suitable for storing CO ₂ emitted from Longyearbyen's coal-fuelled power plant.	Eight boreholes (cumulative 4.5 km) were drilled and fully cored, and a lot of complementary data (wireline logs, outcrop studies, geophysics etc.) were acquired. Available in Longyearbyen.	Braathen et al. 2012; Olausen et al. 2019; Senger, Betlem et al. 2025
Research drilling: Syssellmannbreen	To investigate the clinoform succession exposed at outcrops in Van Keulenfjorden.	A 1084 m deep borehole, half stored in container outside Endalen repository, other half at the core repository of Equinor ^a in Bergen.	Johannessen et al. 2011; Grundvåg et al. 2014; Doerner et al. 2020
Coal drilling: SNSK	Coal exploration and production.	Ca. 400 boreholes > 60 km of core material. Stored at Endalen.	Senger et al. 2019
Coal drilling: Trust Arktikugol	Coal exploration and production. Also operated three of 18 petroleum exploration boreholes.	Unknown number of boreholes. Physical material likely lost (pers. comm., Trust Arktikugol geologist, March 2020).	Senger et al. 2019
Combined uranium/coal drilling: Gipsdalen	Finnish-led exploration effort for uranium and/or coal in Gipsdalen	Cores from eight medium-depth boreholes are still available, partly at the University of Oslo and partly at the German Federal Geological Survey core repository in Berlin.	Senger et al. 2019

^a A multinational energy company, mostly owned by the Norwegian state.

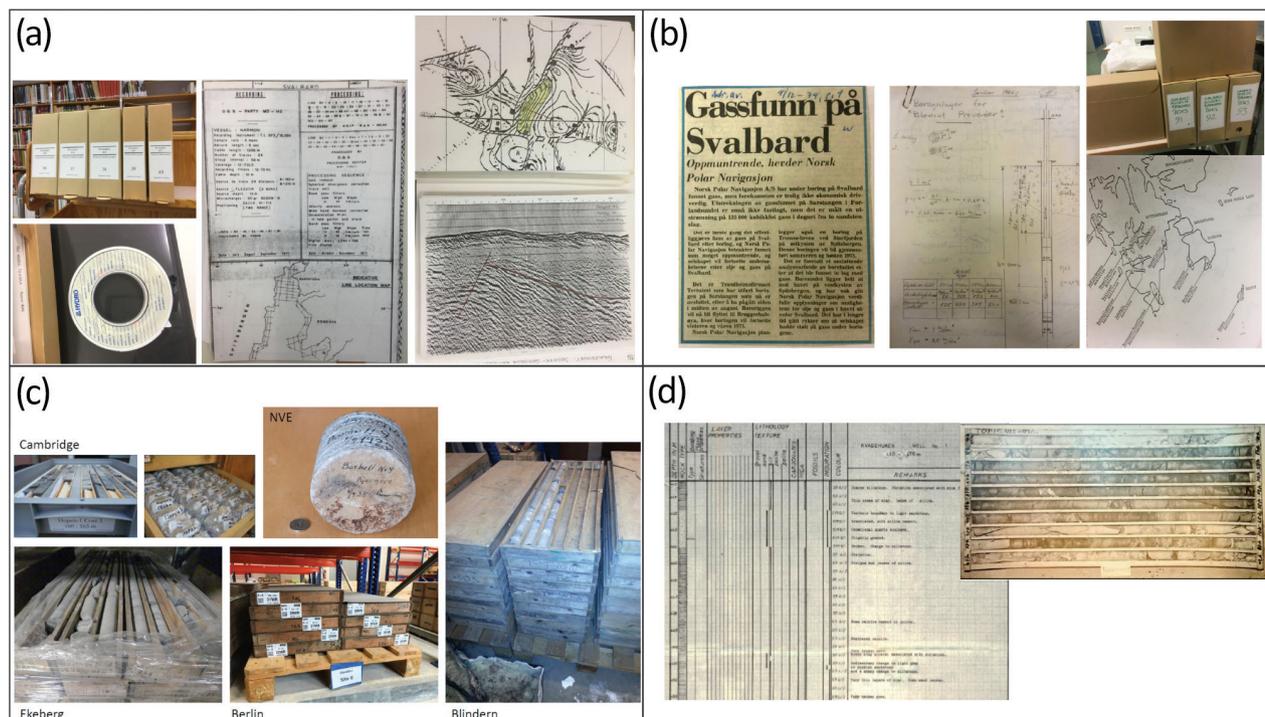


Fig. 3 Examples of some of the material (re)-discovered as part of the SRV pilot project: (a) Polarinvest-Barentz-gruppen archive; (b) Svein Ytrelund archive; (c) physical material from Svalbard that is found in different countries in Europe; (d) some reports and core pictures from the Norsk Polar Navigasjon archive at UNIS. See Senger et al. (2022) for details of the archival material.

sedimentary architecture (Grundvåg et al. 2014) and the geochemical signal across this important time period (Doerner et al. 2020).

SNSK's drilling campaigns contributed to several geoscientific research projects utilizing the drill cores, including studies of palaeogeography, basin development and general tectonic regime in Svalbard during the Palaeogene (Steel et al. 1981; Nøttvedt 1985; Lüthje et al. 2020), the Paleocene–Eocene thermal maximum (Charles et al. 2011; Dypvik et al. 2011; Nagy et al. 2013), palaeoclimate (Schlegel et al. 2013), geochemistry and petrology of the coal deposits and their implications for burial history models and petroleum potential (Marshall, Large et al. 2015; Marshall, Uguna et al. 2015; Uguna et al. 2017), carbon storage potential from peat based on coal studies (Marshall, Large et al. 2015) and constraints on the break-up of the North Atlantic using ash layers in the cores (Jones et al. 2016; Jones et al. 2017).

Sedimentary logs from several boreholes in Petuniabukta have been published by Verba (2013) and subsequently included in a regional tectono-stratigraphic study by Smyrak-Sikora et al. (2021). Similarly, Piepjohn & Dallmann (2014) present stratigraphic information from Russian boreholes in Mimerdalen from Russian reports in a publication on the stratigraphic subdivision of the area.

The Longyearbyen CO₂ Lab project is a prime example of how open data can stimulate spin-off research projects. While the project did not result in the injection of CO₂ into the subsurface, for economic and political reasons, eight boreholes were drilled and fully cored, and a lot of complementary data (wireline logs, outcrop studies, geophysics etc.) were acquired. Senger, Betlem et al. (2025) summarize this open data package, including all related publications: 123 peer-reviewed publications, of which 55% are related to spin-off research projects like deep-time palaeoclimate and geothermal exploration.

Future perspectives

SvalCLIME—a Svalbard-focused ICDP project

An ongoing international initiative, the SvalCLIME project (Senger, Kulhanek et al. 2023; Kulhanek et al. 2024) aims to decipher deep-time palaeoclimate records from Svalbard through scientific drilling under the auspices of the ICDP. A full proposal was evaluated by the ICDP in 2024 and a revised proposal was submitted in January 2025. The project plans to drill and fully core six boreholes—cumulatively, 3430 m—at three specific sites. Extensive scientific sampling parties will be held following the drilling to examine and systematically sample the drill core material. Following the project's two-year

post-drilling moratorium, long-term safe storage of the drill cores is required by the ICDP—ideally in Svalbard, as part of a physical SRV facility.

Physical repository: location, management and funding

At present, drill cores are either stored in containers at UNIS (cores from the Longyearbyen CO₂ Lab project; Senger, Betlem et al. 2025) or in Endalen, 7 km south-east of Longyearbyen (cores from SNSK). The Endalen facility also includes a core viewing room but the partial collapse of a bridge has impeded access. The SRV project therefore has the options of upgrading the Endalen facility or establishing a new one at a different location. A possible new location is the industrial buildings associated with SNSK's Mine 7 on Breinosa (Fig. 4), which will be torn down if no reuse is defined. Another possible site is the disused recycling station in Longyearbyen.

Irrespective of the location, the ideal physical repository has adequate space for the secure and long-term storage of existing and future drill core material (e.g., from SvalCLIME and geothermal drilling) and adequate space for rock samples from scientists whose institutions do not have their own facilities in place for storing these safely. Ideally, the facility also has a full-time data curator to facilitate core viewing, core sampling and core digitization and who otherwise takes an active approach to the



Fig. 4 Visualizations from an SRV concept study, combining core storage, active core analysis and geoscience-related outreach. (Illustrations by LPO Arkitekt, commissioned by SNSK.)

acquisition of (non-destructive) data from existing core material. Finally, and perhaps most importantly, the facility must secure long-term financing for its operations. It remains unclear which institution should take responsibility for operating the facility, but the Norwegian state should have a central and coordinating role.

The one-off establishment costs could be financed jointly by industry, philanthropic support and/or relevant public funding schemes (such as the Research Council of Norway's Infrastruktur initiative). Long-term operational expenses, such as the salary of the curator and running costs, should be financed through the Norwegian state budget as for the Svalbard Global Seed Vault (e.g., Asdal & Guarino 2018). These could be channelled through the relevant ministry directly to the operating institutes, whether it is UNIS, SNSK, the Norwegian Polar Institute, the Directorate of Mining and the mining commissioner for Svalbard, NGU, NOD or another state institution. For comparison, the UK's National Geological Repository is hosted by the British Geological Survey and is funded through UK Research and Innovation, the UK's national funding agency for science and research (BGS 2025).

Virtual core shed, systematic core digitization and data integration

Advances in non-destructive analyses of drill cores have grown exponentially in recent years, particularly with respect to the mining industry (Solum et al. 2022; Neal et al. 2023) and legacy data from scientific drilling programmes or national drill core repositories (Damaschke et al. 2023). These tools (e.g., multi-sensor core logger, hyperspectral scanner, high-resolution imaging and digital drill core models) allow high-resolution characterization of the physical core material and facilitate further sampling. Integrating the various data sets together with the complementary analyses on the drill cores is crucial for deep-time palaeoclimate research through the integration of various stratigraphic proxies. The analytical tools may not need to be permanently in place in Svalbard but could be hired for short-term (summer) data digitization efforts by projects using the SRV facility.

Conclusion

For the benefit of the international geoscientific community, there is a strong need to establish a modern drill core storage and core analysis facility in or near Longyearbyen by the next International Polar Year. Such a facility would be immediately relevant to research in Svalbard, particularly as the activity in the coal industry declines and the Norwegian government is promoting other activities to

maintain a robust settlement in Svalbard. This situation makes it pressing to either maintain and upgrade the Endalen storage facility or to establish a new one. Moreover, incorporating new technologies into the repository, such as digital outcrops and digital core models, and properly archiving existing geoscientific material would reduce our environmental footprint by minimizing the need for new drilling, which is financially and environmentally costly. The management and organizational structure of the facility should be clarified by the end of 2026.

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Disclosure statement

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