SVALBARD ROCK VAULT: Taking care of geological data and developing critical infrastructure for geoscientific research and education projects

From vision towards reality: a pilot project for 2019-2020 (RockVault2020)

Background and motivation for proposal

Numerous companies and research consortia have drilled onshore Svalbard in the quest for coal, oil/gas, CO_2 storage and research projects. Unfortunately, the resulting unique geological data sets are not formally owned by a single institute as would be the case on the Norwegian mainland, and there is a real danger for much of this geological heritage to be lost.

To prevent this from happening The University Centre in Svalbard (UNIS) and the Svalbard-based coal-mining company Store Norske Spitsbergen Kulkompani (SNSK) joined forces and organized the SSF-funded Svalbard Rock Vault workshop from 24 to 26 September 2018 in Longyearbyen. Key organisations presented their viewpoints and experience with dealing with material from Svalbard. These included:

- Peter Brugmans / The Directorate for Mining with the Mining Commissioner for Svalbard / responsible for managing exploration, claims and resource extraction
- Synnøve Elvevold / The Norwegian Polar Institute / responsible for topographic and geological mapping of Norwegian Polar areas, including Svalbard
- Tom Heldal & Rolf Lynum / The Geological Survey of Norway / responsible for a national onshore physical sample and drill core repository at Løkken
- Maria Juul / The Norwegian Petroleum Directorate / responsible for a national offshore database related to geoscientific data from the Norwegian Continental Shelf including drill core samples
- Sverre Planke / CEED/ARCEx/VBPR researcher with Svalbard and international research drilling experience including Permian-Triassic mass extinction scientific drilling on Svalbard
- Malte Jochmann / Store Norske Spitsbergen Kulkompani / company with 100 years of coal exploration and exploitation on Svalbard, and currently maintaining a core storage facility near Longyearbyen
- Kim Senger / University Centre in Svalbard / teaching and educating in the high Arctic, currently maintaining both internal and external geodata portals (Svalbox.no) and with access to significant amount of research drilling material

Presentations were also given by Russian (PMGE), German (BGR), British (Sedgwick Museum, University of Cambridge) and Norwegian (University of Stavanger) scientists. Furthermore, spotlights were directed on the petroleum exploration onshore Svalbard and on loss of important drill core material from the Kings Bay coal field in the 1980s. Finally, SIOS shared its views on data management, and SSF presented both funding and co-ordination tools currently in place.

The concluding panel debate, and discussions throughout the workshop, clearly indicated that Svalbard is in many cases “between the chairs” with respect to how important geological data are collected, archived and made available to the wider research community. Procedures from onshore (NGU) and offshore (NPD) Norway do not apply on Svalbard, and there are ample examples of how irrecoverable drill core material is lost. The wide group of participants was in general positive to the idea of having a physical data repository on Svalbard, coupled with a Geodata portal linked to existing data repositories. There were some discussions on which organization (existing or new?) should take the lead in this project, but it was clearly seen that, also due to the need for sustainable long-term financing during the operational phase, this discussion would need to be held at government level. A full report on the Svalbard Rock Vault will be submitted in October 2018, but we interpret the high level of support for the project idea as an important sign that now is the time to initiate a larger-scale co-operation project within the broader Svalbard Rock Vault concept – which is the main motivation for this Svalbard Science Forum Strategic Grant proposal entitled “**Svalbard Rock Vault: From vision towards reality - a pilot project for 2019-2020 (RockVault2020)”**.

Scientific justification of the topic

Drilling on Svalbard has resulted in an impressive number of high-impact publications dealing with both stratigraphy, tectonic evolution and shifting global climate at geological time scales. Research projects on SNSK material indicate, for instance, studies on the Paleocene-Eocene thermal maximum (Charles et al., 2011; Cui et al., 2011; Dypvik et al., 2011; Nagy et al., 2013), paleoclimate (Schlegel et al., 2013), geochemistry and petrology of the coal deposits and their implication on burial history models and petroleum potential (Marshall et al., 2015a; Marshall et al., 2015b; Uguna et al., 2017) and constraints on the break-up of the North Atlantic using ash layers in the cores (Jones et al., 2017; Jones et al., 2016). The UNIS CO_2 lab research project has itself resulted in a large amount of studies focusing on both the local CO_2 storage aspects (Braathen et al., 2012; Huq et al., 2017; Senger et al., 2015), but also on spin-off projects utilizing the unique data set available in the drill cores (Corfu et al., 2013; Gilbert et al.; Koevoets et al., 2016; Koevoets et al., 2018). Research drilling onshore Svalbard has also been conducted at Sysselmannbreen focusing on the clinoform geometries in Tertiary sediments (Grundvåg et al., 2014; Johannessen et al., 2011) and at Deltadalen looking at the Permian-Triassic mass extinction (Planke, 2016; Sleveland et al., 2017).

We clearly identify the large potential in integrating the almost forgotten petroleum exploration well data (Senger et al., in review) in better understanding the tectono-stratigraphic evolution of Svalbard – but also aim for future drilling of strategic stratigraphic boreholes onshore Svalbard for high-resolution, multi-disciplinary studies of key global events including the Permian-Triassic mass extinction, the Late Jurassic global anoxic event or the Paleocene-Eocene thermal maximum.

Logistics and implementation plan

RockVault2020 is structured into three over-arching work packages with clearly defined goals, objectives and deliverables (Table 1).

WP	WP name	WP Lead	WP partners	Deliverables
WP1	***Physical core storage facility v.2.0 and***	SNSK	UNIS, DMF, NGU	"Wish list" for Endalen upgrade in terms of primarily infrastructure
				"Wish list" for CO2 lab drill core storage upgrade
				Cost estimates for infrastructure update needs, with low-base-high budget scenarios
				Co-ordination with local authorities (Longyearbyen lokalstyre, Sysselmannen) with respect to possible future locations
				Student assistant to categorize all available cores from SNSK and UNIS archives
				Investigate whether any Russian core material is still accessible somewhere
				Systematic investigation of all petroleum exploration boreholes to identify cored materials and try to recover these
				Trip to Svea to catalogue existing drill core material available there
WP2	***Geodata portal Svalbox***	UNIS	all	Catalogue, digitize and archive the Norsk Polar Navigasjon material
				Catalogue, digitize and archive other relevant data sets from e.g. Gipsdalen drilling
				Provide a catalogue of all relevant Svalbard-related online data repositories
				EndNote library of geoscience-related publications from Svalbard
				Keep the public informed about the project via www.svalbox.no
WP3	***The Svalbard Rock Vault after 2020***	UNIS/SNSK	DMF, NPI, NGU, NPD, Academia, Industry	Further develop the Svalbard contact between Longyearbyen and Barentsburg through a meeting with the General Director of Trust Arktikugol (1 meeting in Barentsburg at the early stage of the project, and one follow-up meeting approximately half-way)
				Organise bi-lateral meetings with relevant institutions that could not attend the initial kick-off workshop, notably SINTEF (IKU cores) and Polish researchers (Polish Academy of Sciences and AGH)
				Organise RockVault2020 meetings at relevant core storage locations (NGU Trondheim, NPD Stavanger, IODP Bremen etc.) to gain experience from other sites and facilitate teamwork on selected topics
				Send questionnaire on SRV2020 to all national and international geology researchers that have worked on Svalbard
				Consider different forms of organizational models for Svalbard Rock Vault
				Identify possible funding sources for both short-term (infrastructure-upgrade) and long-term (operational costs, database maintenance, SRV curator and project manager etc.)
				Develop long-term scientific plan for a potential shallow stratigraphic drilling campaign on Svalbard
				Write white paper to government and organise meetings with politicians both in Longyearbyen and in the relevant Ministries in Norway

In WP1 we plan to address the short-term needs for improving access to the SNSK and UNIS cores, thinking also of the possibility of future research activity onshore Svalbard. We also systematically categorize physical material currently available at SNSK and UNIS. One important part is also to include exploration data from the Russian coal mining company “Trust Arktikugol” (TA). The company has data from decades of coal exploration on Nordenskiöld Land, Oscar II Land and Nathorst Land, which is not available to the public. Through involvement of PMGE and AARI, we plan to meet the leadership in TA in Barentsburg and

discuss if TA's data might be made available for the future through this project. We also include the Hornsund research station with their long history of geological research on Svalbard.

WP2 will continue data mining on Svalbard. Importantly, due to the Svalbard Rock Vault initiative, legacy archive material from the exploration efforts of Norsk Polar Navigasjon (NPN) – a company involved in half of the 18 exploration boreholes drilled from 1961 to 1994 - was donated to UNIS. The only condition is that it is properly archived and made available for research and education. We plan to address this during the RockVault2020 project and digitize this unique material.

WP3 is an integral part to plan for a long-term Svalbard Rock Vault project from 2020 onwards. This vision is as valid as ever following the SSF-funded SRV kick-off workshop 24-26 September 2018, but many open questions are left. We plan to organize meetings and workshops with the relevant institutions including UNIS, SNSK, DMF, NPI, NGU, NPD, Academia and Industry. Ideally, this group will meet in person twice during the RockVault2020 project period, and will communicate regularly through video-conference meetings. Specific dedicated workshops on funding and organizational model as well as the geoscientific database are envisioned. In addition, we plan to visit relevant core repositories to learn about both how these are managed, how data are shared, how sampling protocols are handled etc.

Contribution to SSF strategic objectives

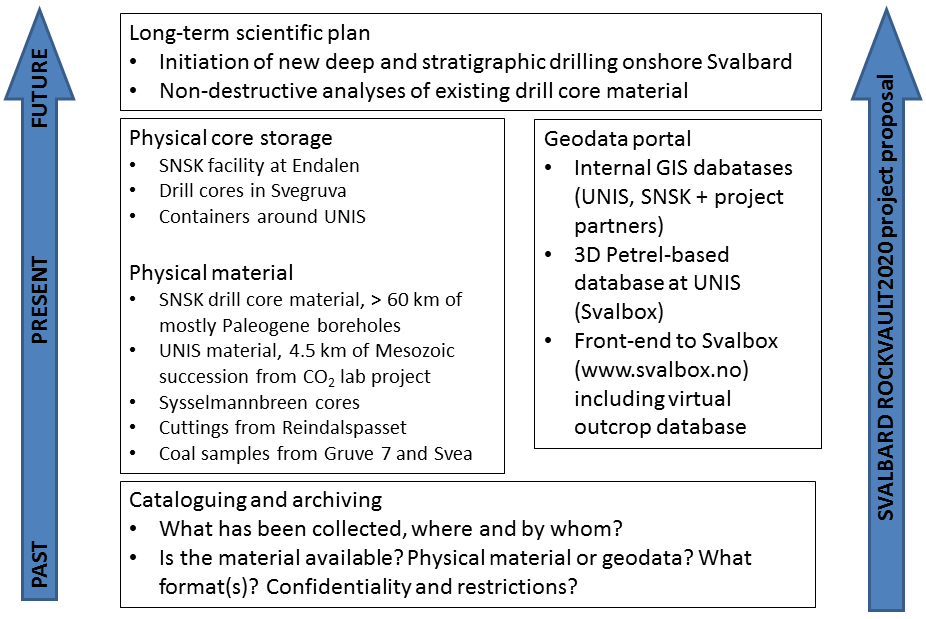
Our project proposal, "SVALBARD ROCK VAULT: From vision towards reality: a pilot project for 2019-2020" (RockVault2020) is aligned with SSF's strategy for the SSG funding program in that it **plans a larger project**, it **stimulates open sharing of data** and includes activity that **stimulates collaborative activities resulting in enhanced (inter)national and inter-disciplinary cooperation**. Furthermore, the actual tasks incorporated in RockVault2020, in particular within WP2, serve as **pilot studies** with a manageable data load to gain experiences towards doing this on the full scale from 2020 onwards.

There is a clear and **immediate relevance for research on Svalbard**, and the timing with the decline in the coal industry activity is in particular pressing with respect to maintaining and upgrading the Endalen storage facility (WP1), perhaps using infrastructure currently located in Sveagruva and to be dismantled as part of the ongoing clean-up project.

Finally, by incorporating new technologies (e.g., virtual outcrops) and properly archiving existing geoscientific material we will **reduce the environmental footprint** – in the worst case drilling would be needed again if for instance drill cores are lost. This is costly, both financially and environmentally.

Initiation of new scientific cooperation activity on Svalbard

Figure 1 (to the right) illustrates the forward-looking RockVault2020 project and its main components. We strive both to catalogue and archive existing material (physical material and electronic data/documents) as well as plan for more geoscientific data that will be collected on Svalbard in the future.



Data handling and sharing plan

Our main objective is to facilitate open access for research & education to key geoscientific data sets from Svalbard. We strive to be open and inclusive in our approach. The RockVault2020 project will actively use relevant portals (Geo365.no, Geoforskning.no, Svalbardposten etc.) to inform the general public about the initiative. For the time being, data set catalogues plan to be published on the UNIS-managed Svalbox.no web portal, which already includes a database of numerous geoscientific data sets. We also investigate whether national systems like BRAGE used at many partner institutions can be used also at UNIS.

Timeline

See online application for a detailed timeline with main planned activities within the three work packages. It is important that this project is aligned with the ongoing process of cleaning up Sveagruva, and the potential activity with respect to an expansion of the Svalbard Science Centre in Longyearbyen.

Strategy for minimization of the environmental footprint (including use of new technology and existing infrastructure)

We strive to be innovative in using new technologies where relevant. Virtual outcrop models, for instance, represent a unique and cost-effective way of providing realistic high-resolution models of Svalbard's mountainsides for year-round use (Senger et al., 2018b). They can furthermore be utilized in a virtual reality setting (Gonzaga Jr et al., 2018), allowing efficient fieldwork planning. Being a "raw" dataset with no interpretation needed, outcrop models are also great for sharing with other researchers and the general public – as UNIS is already doing on Svalbox.no. They are already in daily use during the education of next generation of Arctic experts at UNIS (Senger et al., 2018a; Senger et al., 2018b).

With respect to drill core storage infrastructure we will investigate the possibility of re-using some of the infrastructure from Sveagruva. This may provide incentives to place some of the infrastructure at Hotellneset with easy access and good infrastructure. In addition, the ongoing process of planning for an extension of the Svalbard Science Centre (byggetrinn III) as well as the Svalbard National Park Centre must be considered and synergies exploited.

Relevance to national and institutional strategy documents, and ongoing projects

The RockVault2020 project is firmly rooted in the Norwegian government's "Strategy for research and higher education in Svalbard" (Norwegian Ministry of Education and Research, 2018). This is particularly clear when considering the main objectives defined by the government, including "Research communities active in Svalbard shall take the lead in moving towards shared research data and infrastructure" and "The archipelago's research infrastructure and unique research possibilities shall be exploited to even better effect". In parallel, UNIS is developing a 2019-2025 strategy which stresses the importance of local collaboration and strengthening UNIS' leadership of large-scale Arctic research projects. We are also actively collaborating with the Geological Survey of Norway in their efforts to establish a Norwegian Geoscience Repository with a main base at Løkken and a node on Svalbard.

Budget

We apply for a total of 499 600 NOK, within the budgetary limits of the proposed call. The detailed budget is provided in the online form.

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