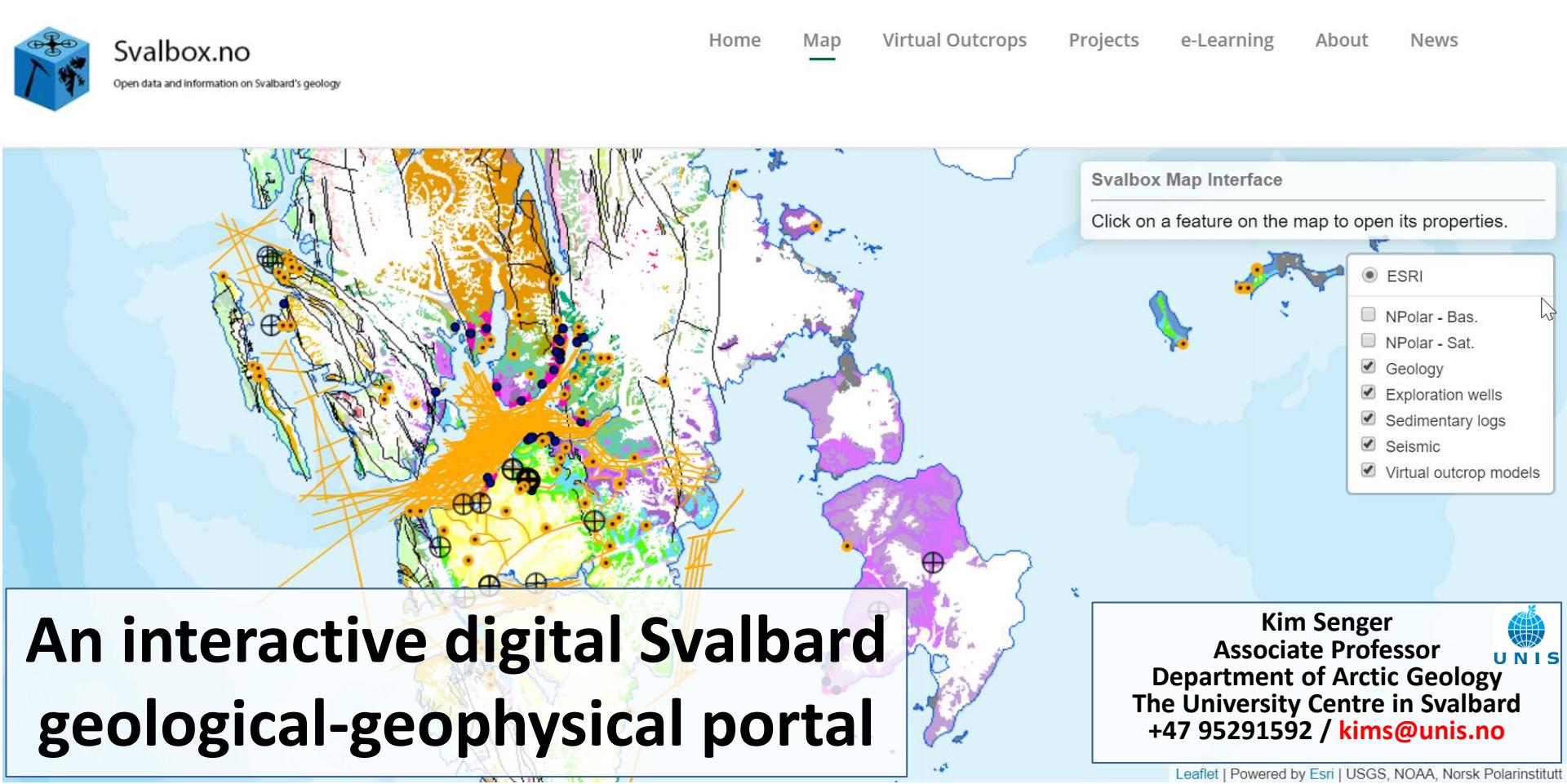


An interactive digital Svalbard geological-geophysical portal

Kim Senger
Associate Professor
Department of Arctic Geology
The University Centre in Svalbard
+47 95291592 / kims@unis.no

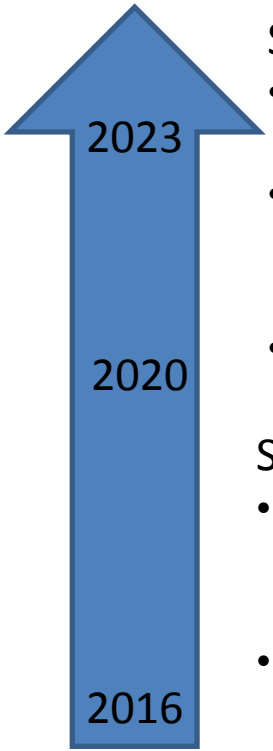
UNIS

FORCE

FORCE Lunch & Learn, Wednesday 27th May 2020, online webinar

Webinar overview: what is Svalbox?

- 12:00-12:35: Presentation of Svalbox (**Kim Senger**)
- 12:35-12:45: Demonstration of Svalbox portal by video (**Peter Betlem**)
- 12:45-13:00: Questions & answers (please use chat)



Svalbox2020 wants to:

- Be a more widely used tool in both mainland universities and industry
- Be an innovative hub for embracing new technologies and data types in geoscience training & research
- Be a full-time job for (at least) 1 person

Svalbox is:

- An interactive and integrated database used in teaching and research at UNIS in Longyearbyen
- Run by 2 people on the side of teaching and research, started in 2016
- Accessible at www.svalbox.no

Svalbox: key personnel

Kim Senger

- Associate Professor in Structural Geology and Basin Analysis at UNIS
- Background from Bayerngas and EMGS
- Permanent and full-time at UNIS since 2015
- Svalbox project manager
- Geology WP co-leader in ARCEx centre (arcex.no)

Peter Betlem

- PhD student at UNIS, 2019-2023
- Funded by NCCS project, focusing on CO_2-cap rock integrity monitoring
- 25% of position funded by UNIS, with outreach and data management tasks
- Svalbox in-house “coder”, developer and drone pilot

Envisioned project collaborators: UNIS + Universitas Osloensis MDCCCXI · NTNU · Universitas Bergensis · The Arctic University of Norway UiT · Norges Geologiske Undersøkelse NGU

Svalbox: workflows and visualisation

INPUT DATA

Virtual outcrop models (VOM)

Other data types (see Figure 8 and table on http://svalbox.no for details).

VISUALISATION

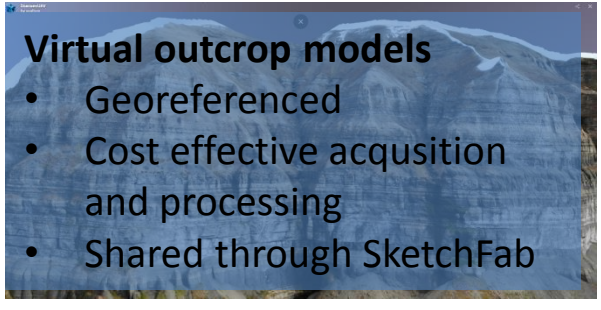
SVALBOX.NO VOMs and selected datasets

↑

ArcGIS

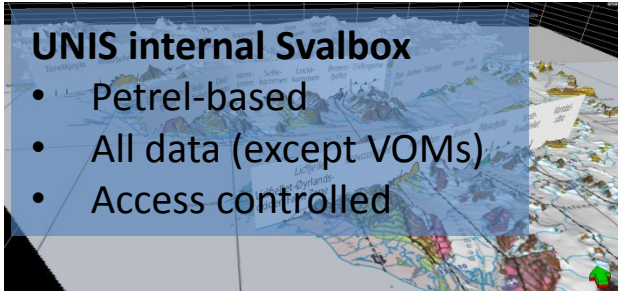
↓

Petrel. All data sets in 3D environment



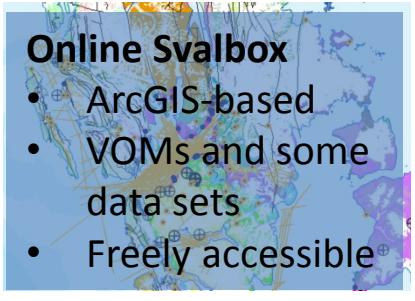
Virtual outcrop models

- Georeferenced
- Cost effective acqusition and processing
- Shared through SketchFab



UNIS internal Svalbox

- Petrel-based
- All data (except VOMs)
- Access controlled



Online Svalbox

- ArcGIS-based
- VOMs and some data sets
- Freely accessible

Svalbox: workflows and visualisation

INPUT DATA

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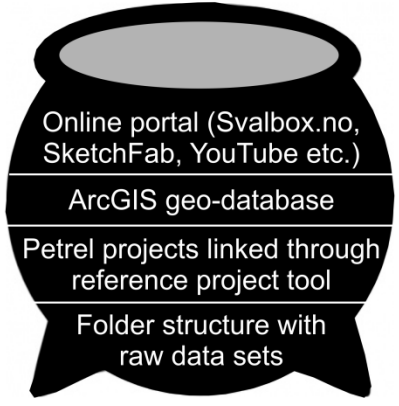
DATA STORAGE, QC AND MANAGEMENT



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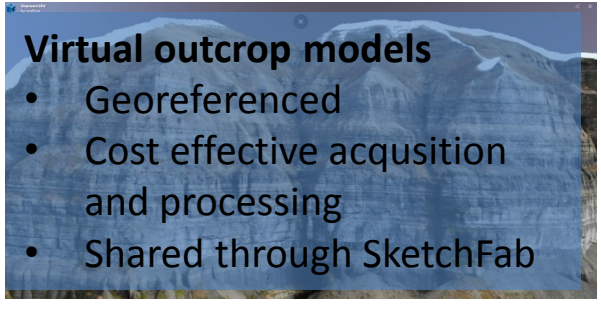

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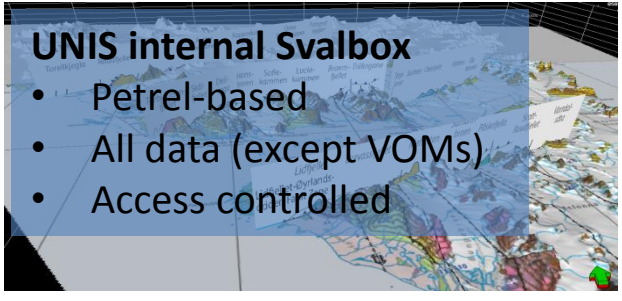

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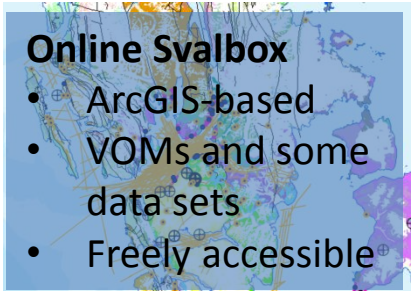

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Svalbox: workflows and visualisation

UNIS

INPUT DATA

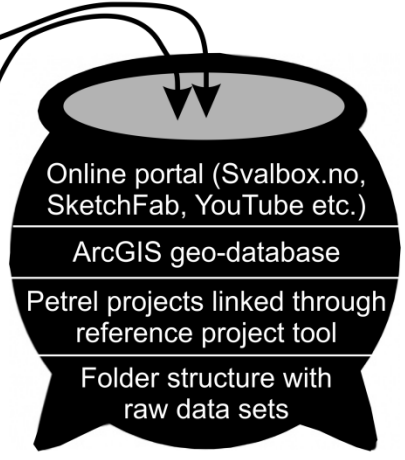
Virtual outcrop models (VOM)

VOM acquisition and processing
Export for visualisation
Input data archiving

Other data types (see Figure 8 and table on http://svalbox.no for details).

Data loading
Georeferencing maps
Digitizing paper logs
Convert formats
Quality-control
Access rights/confidentiality
Assign to correct Petrel project
Meta-data specification
Continuous data mining
Connect to online repositories

DATA STORAGE, QC AND MANAGEMENT

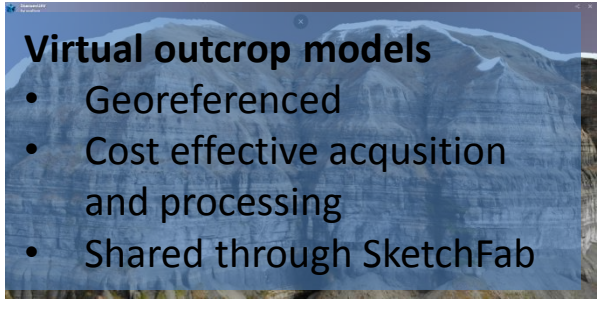


VISUALISATION

SVALBOX.NO VOMs and selected datasets

ArcGIS

Petrel. All data sets in 3D environment



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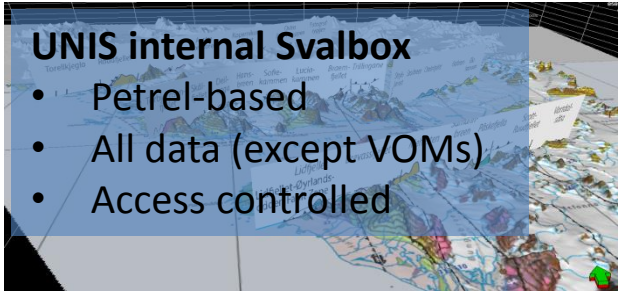

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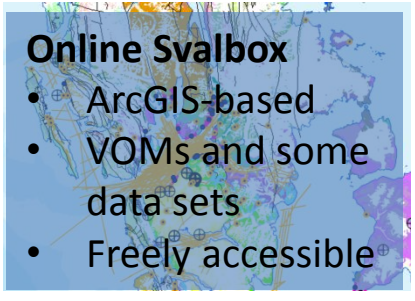

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Svalbox: workflows and visualisation

UNIS

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Assign to correct Petrel project
Meta-data specification
Continuous data mining
Connect to online repositories

DATA STORAGE, QC AND MANAGEMENT

Online portal (Svalbox.no, SketchFab, YouTube etc.)

ArcGIS geo-database

Petrel projects linked through reference project tool

Folder structure with raw data sets

VISUALISATION

VOM location and 3D pdf
Construct and share VFTs
Share experiences and resources
Update map data automatically from UNIS ArcGIS geo-database

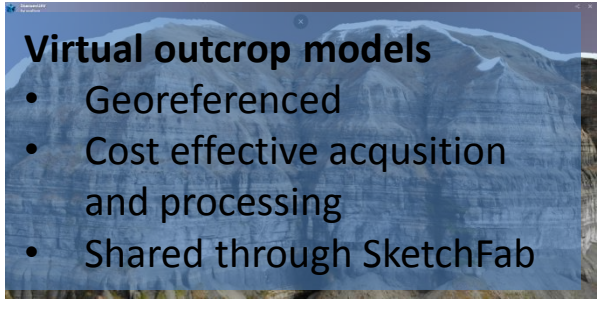
SVALBOX.NO VOMs and selected datasets

Maintain updated geo-database
Link to Petrel and Svalbox.no

ArcGIS

Maintain data packages based on location, data type and access restrictions
Update projects twice yearly
Optimize workflows and teach

Petrel. All data sets in 3D environment



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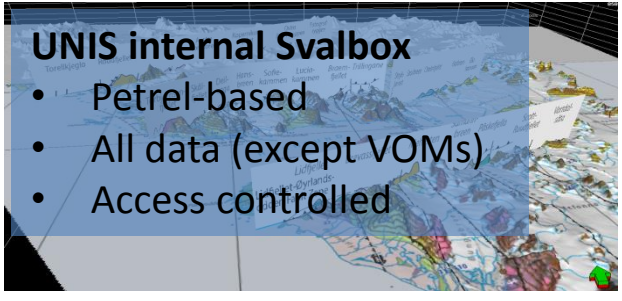

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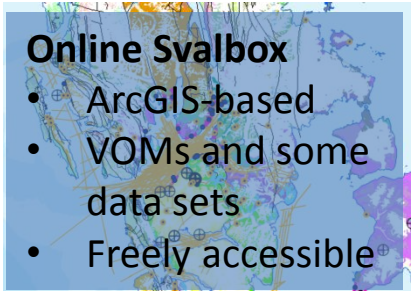

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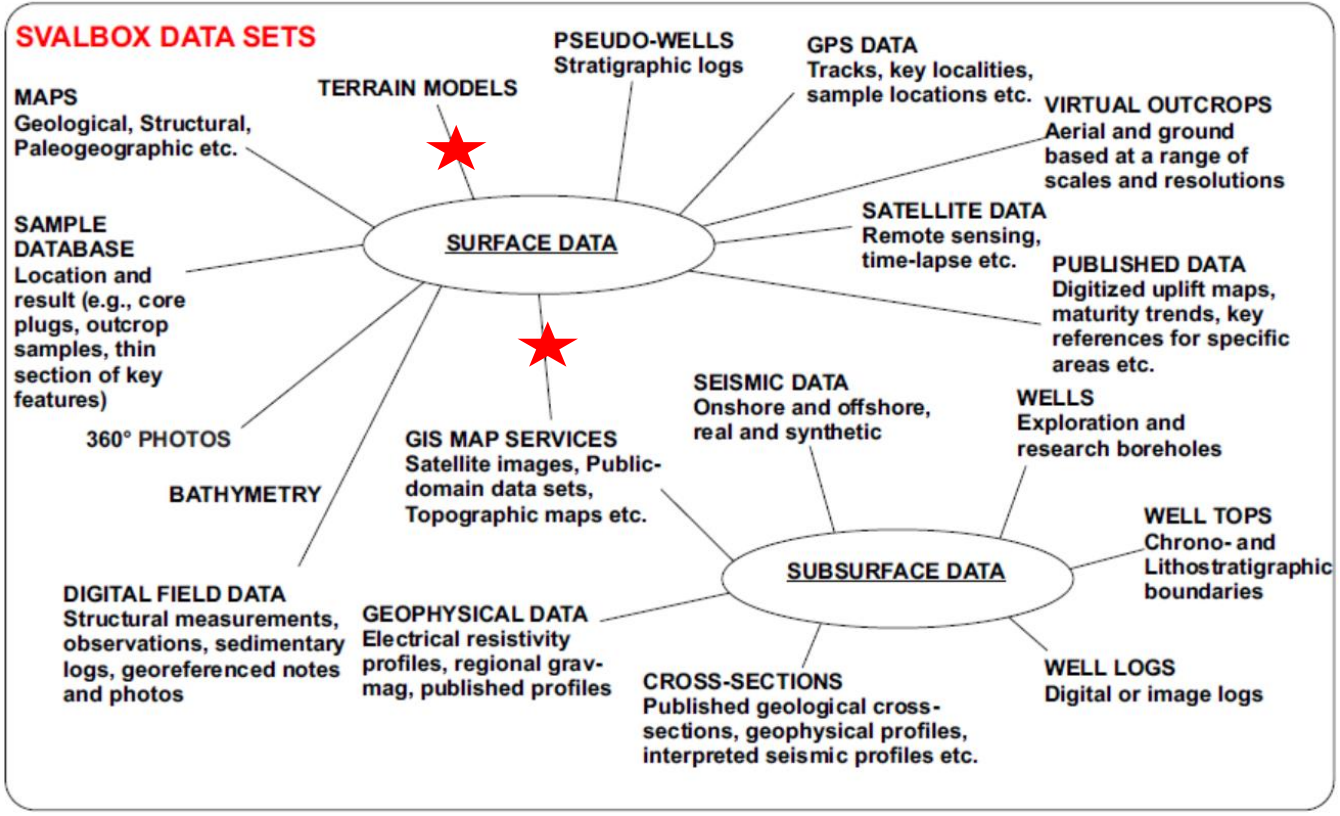
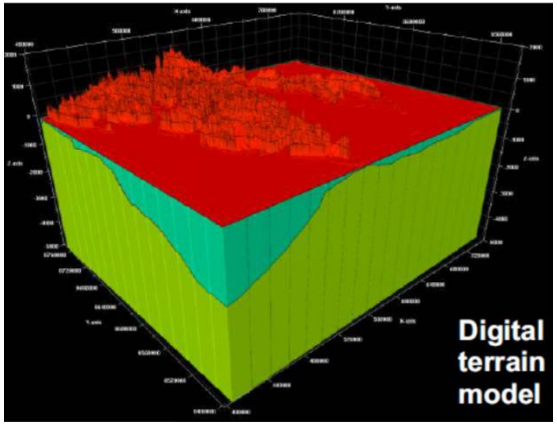
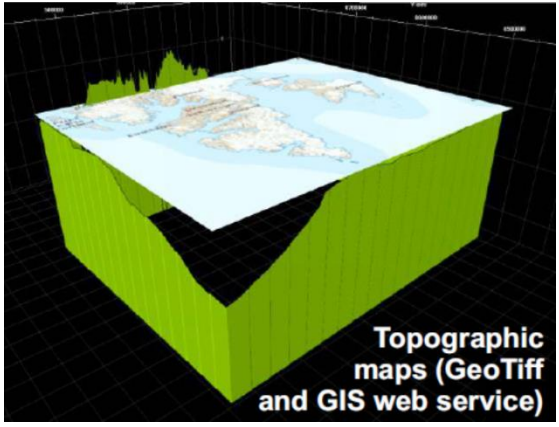
Svalbox: data sets







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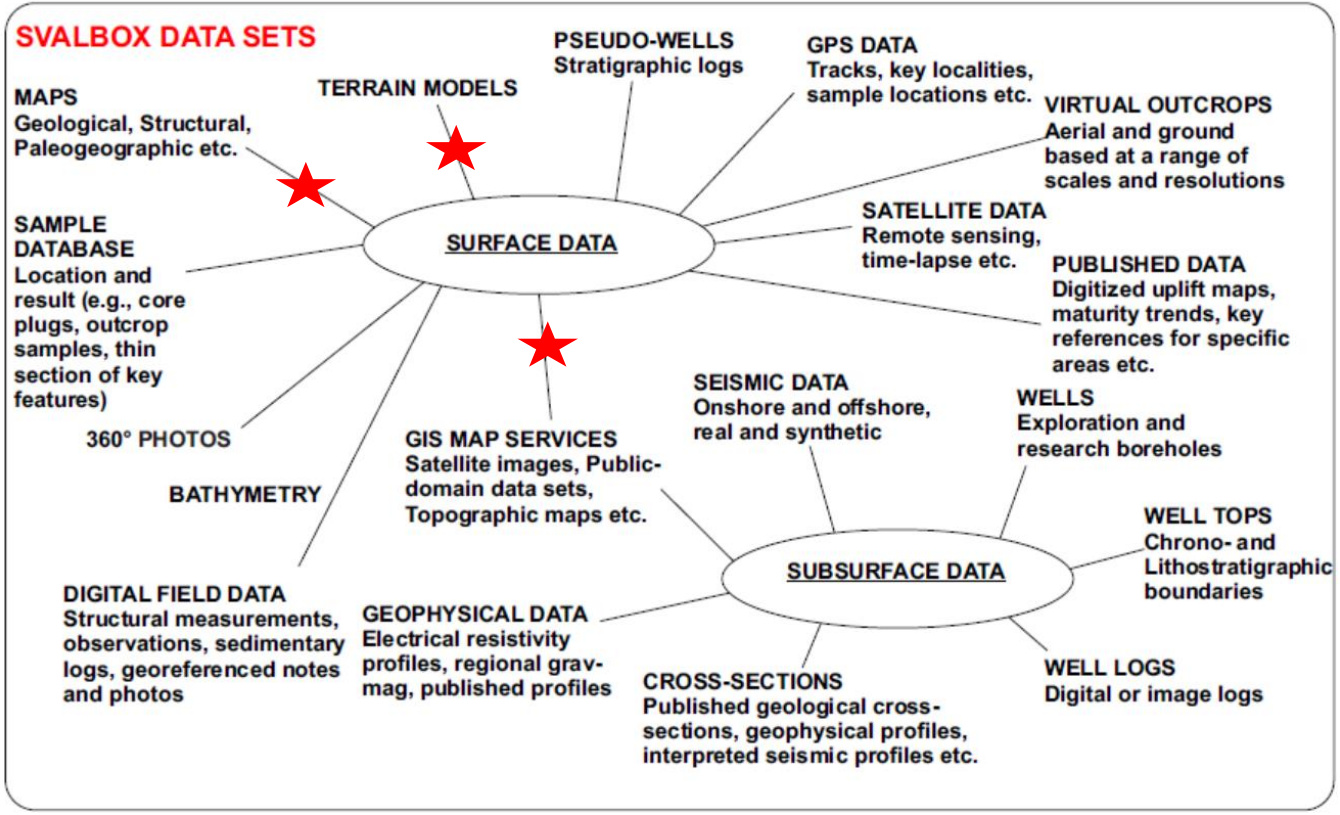

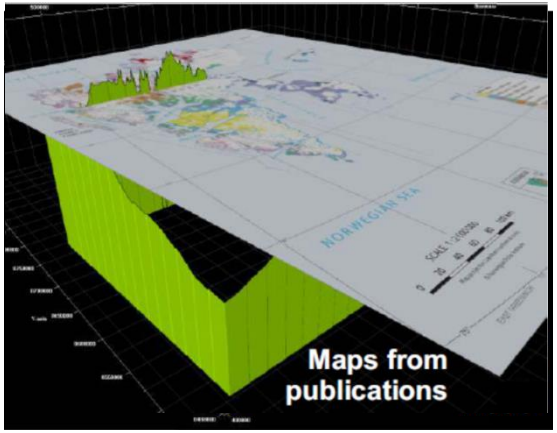

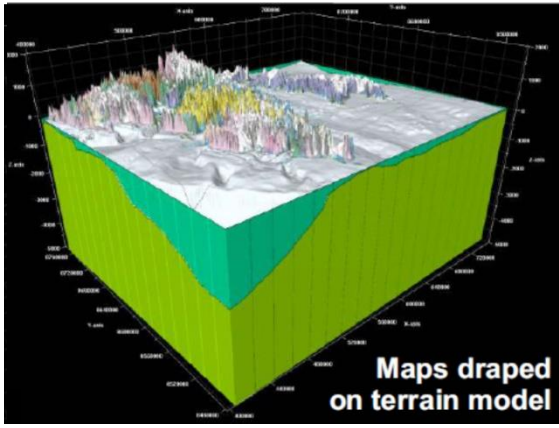

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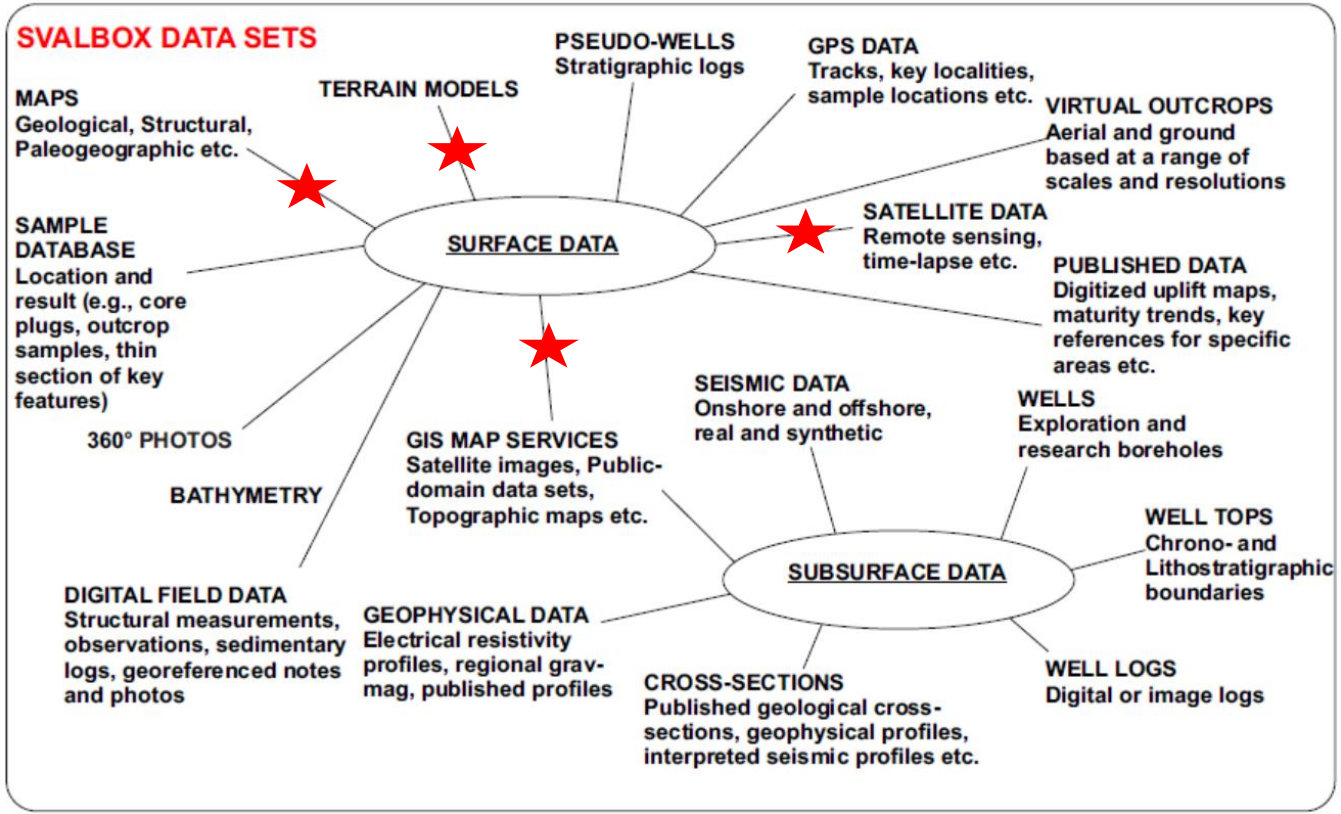

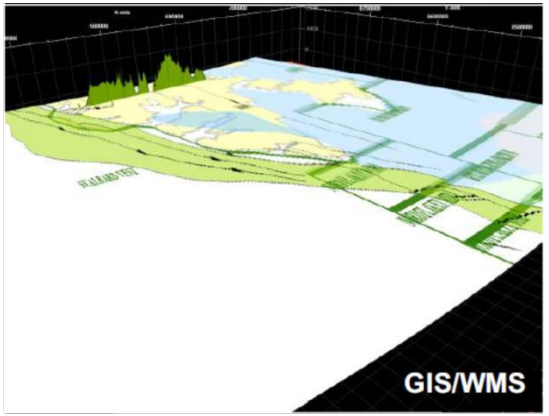

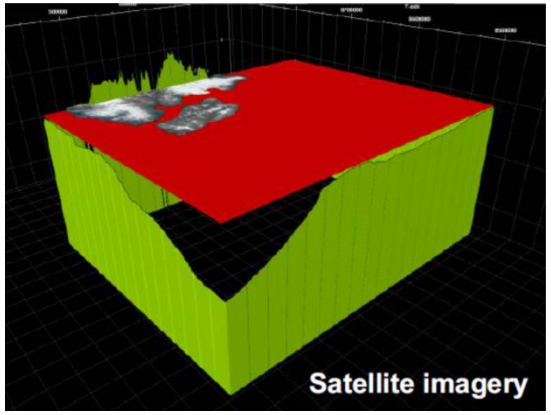

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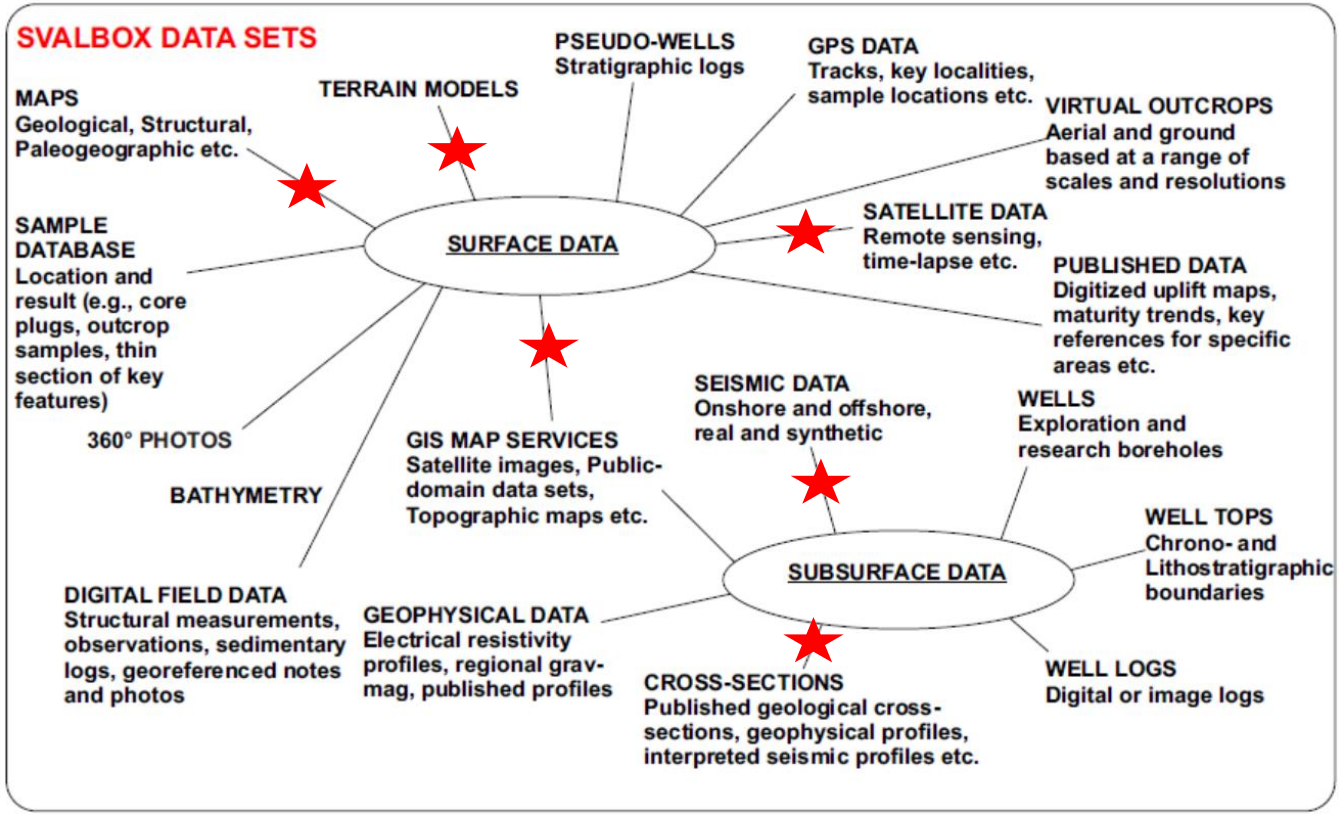

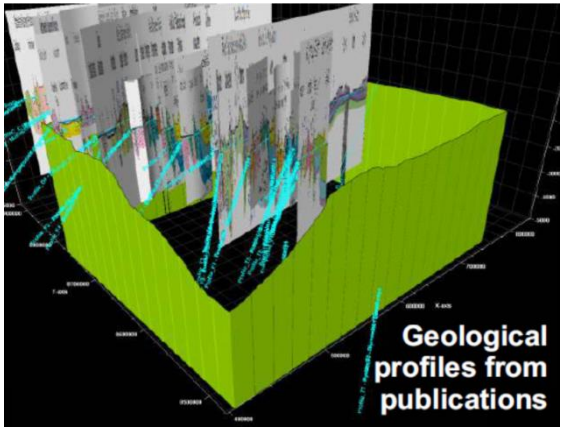

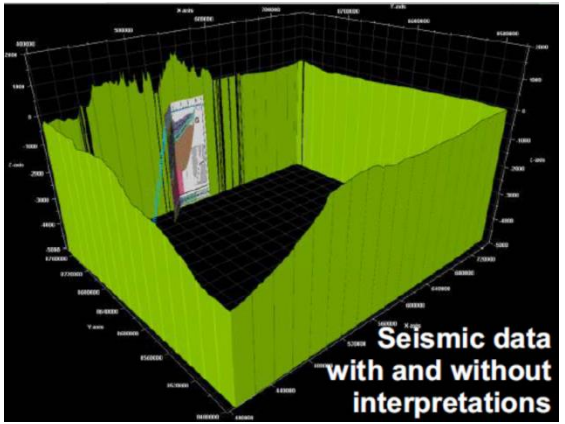

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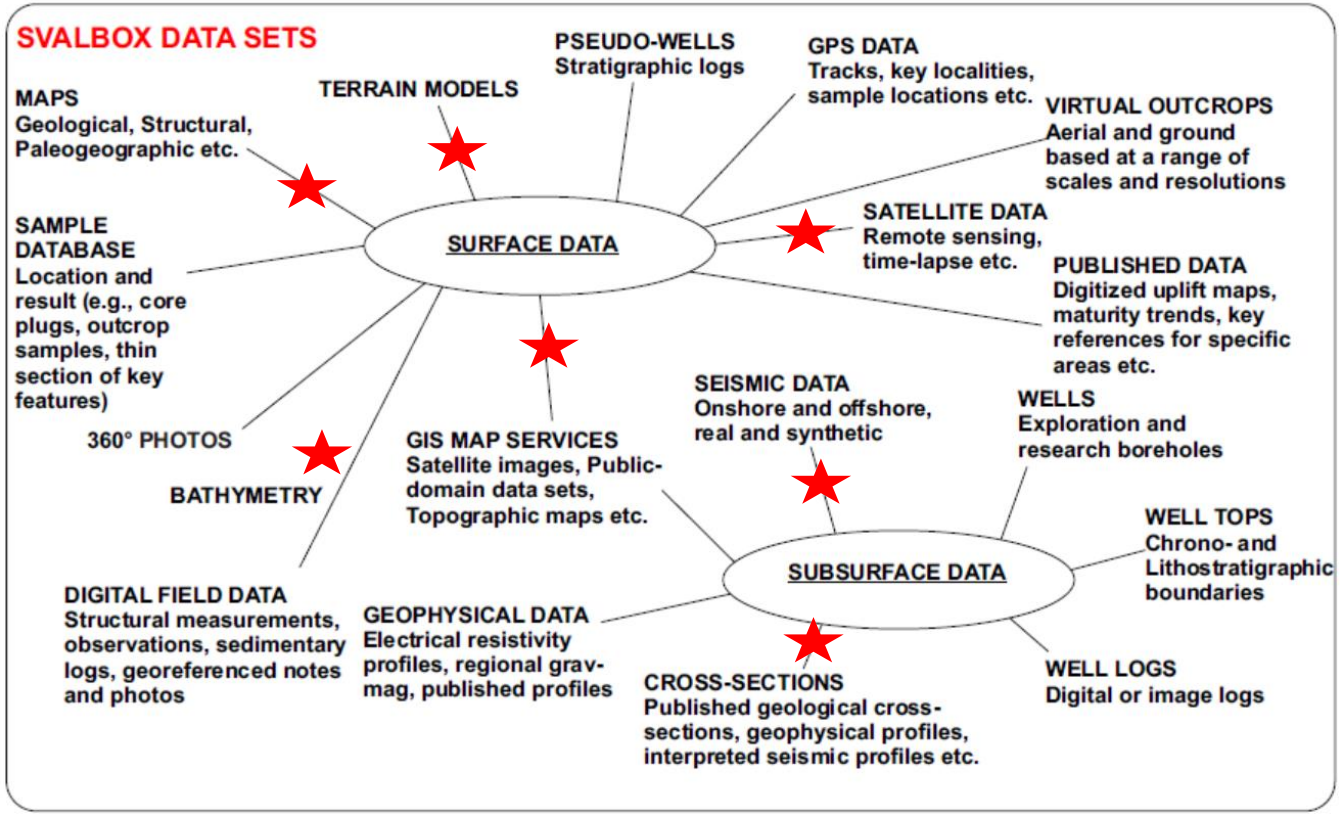

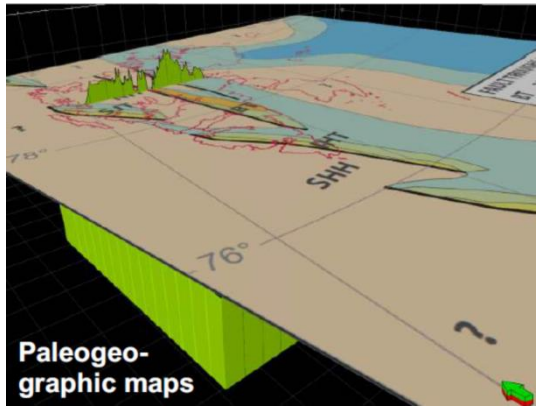

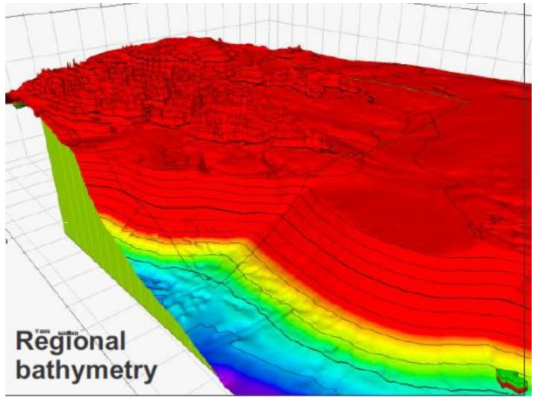

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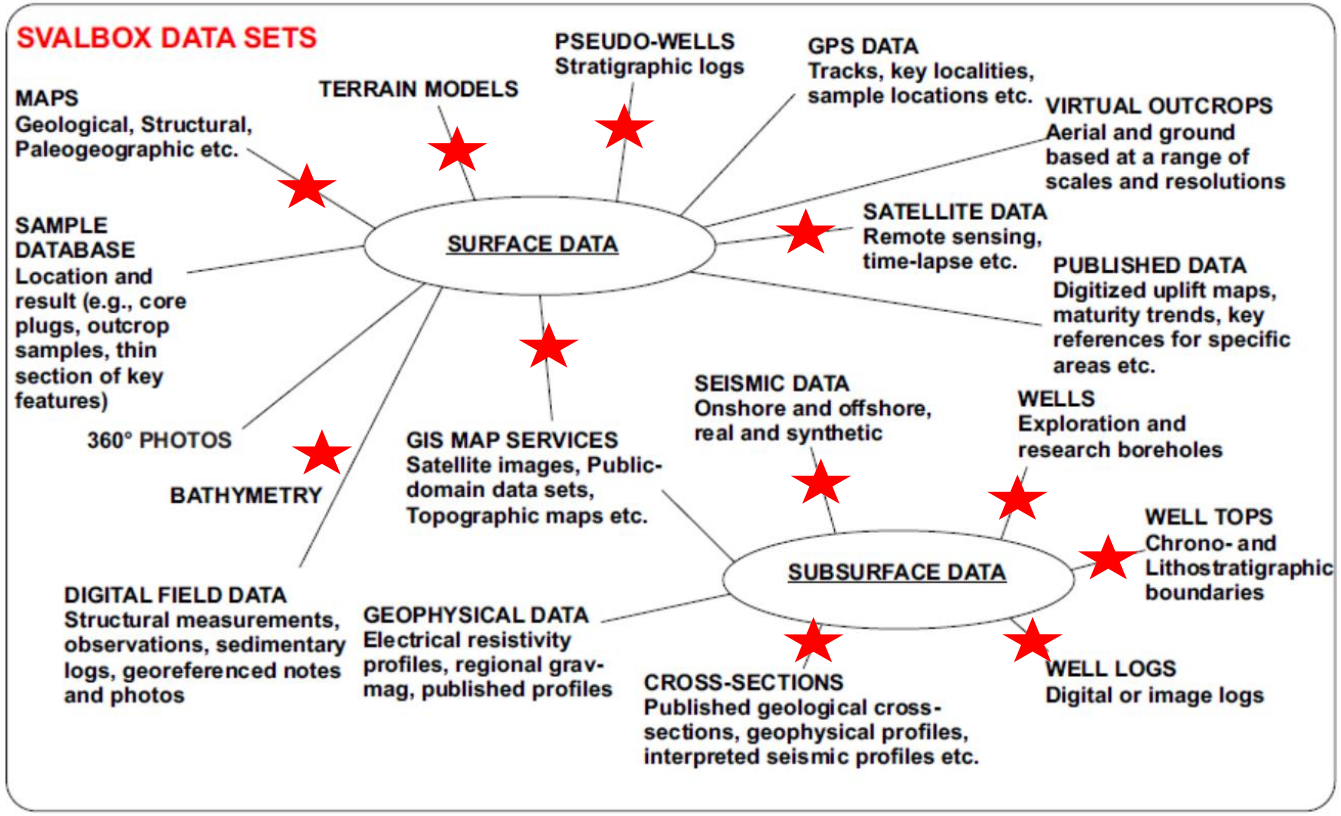

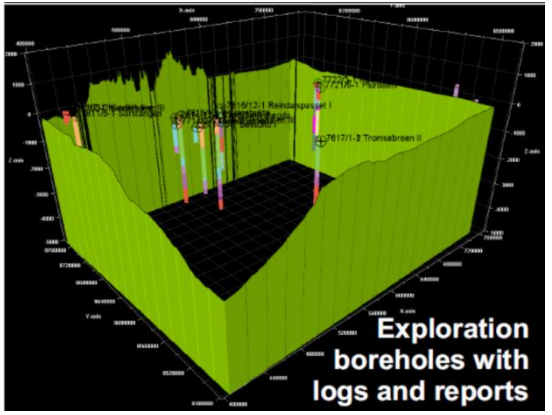

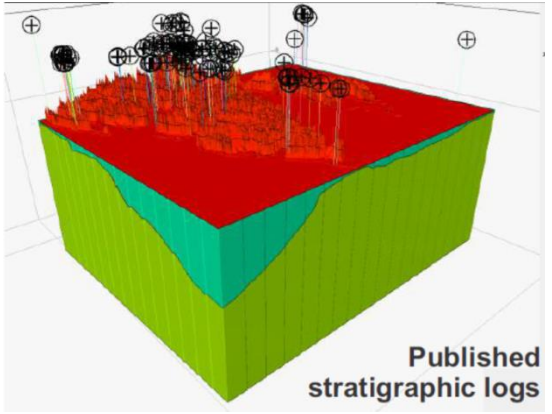

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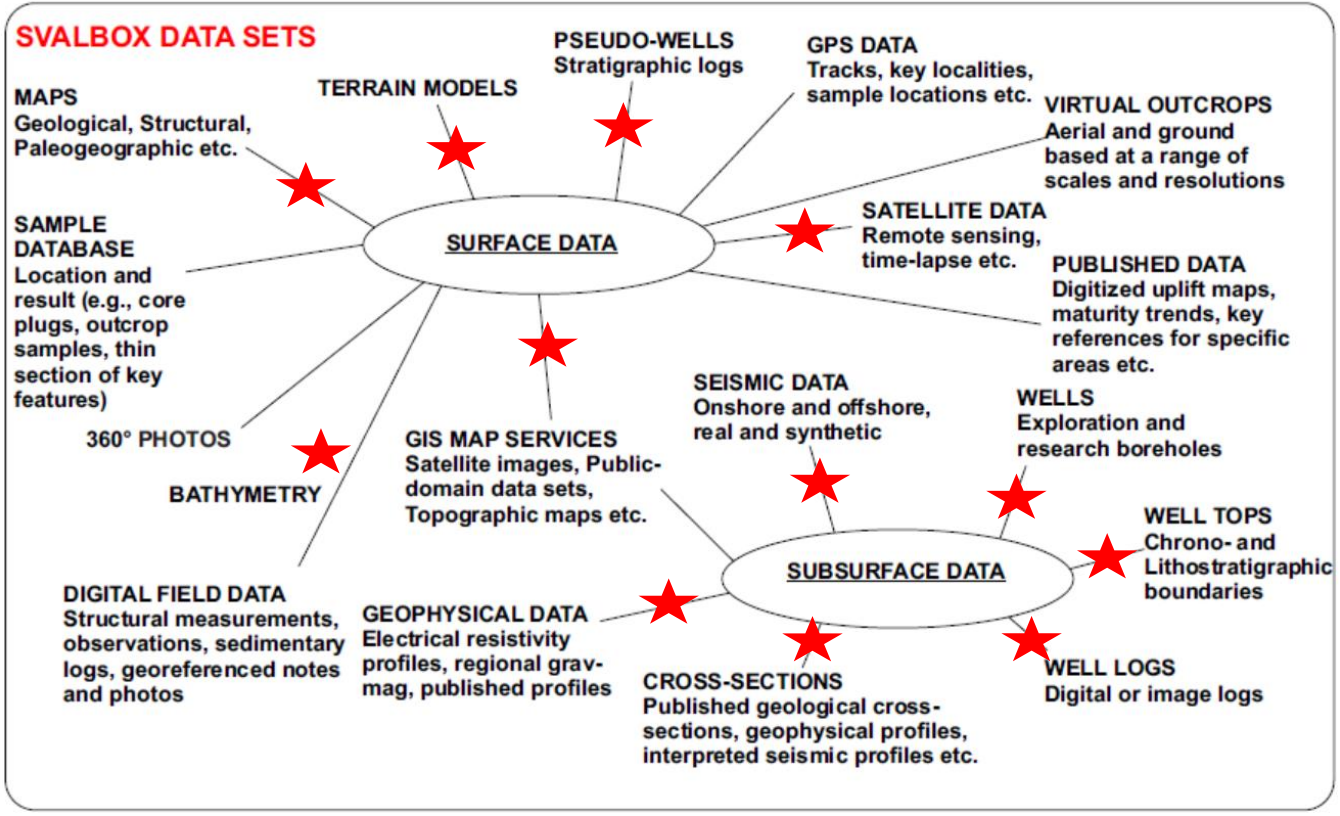

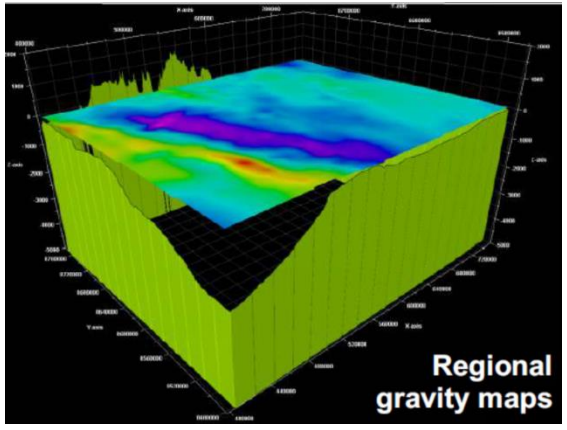

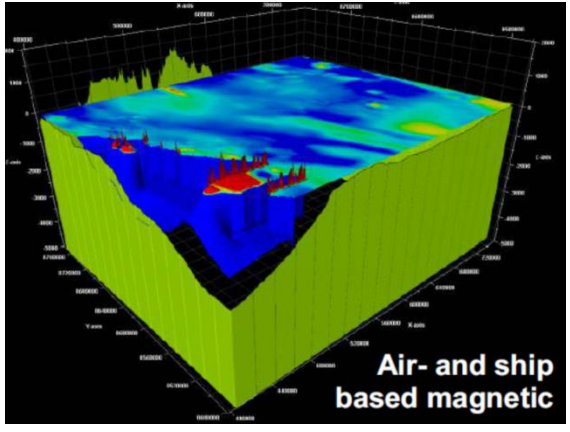

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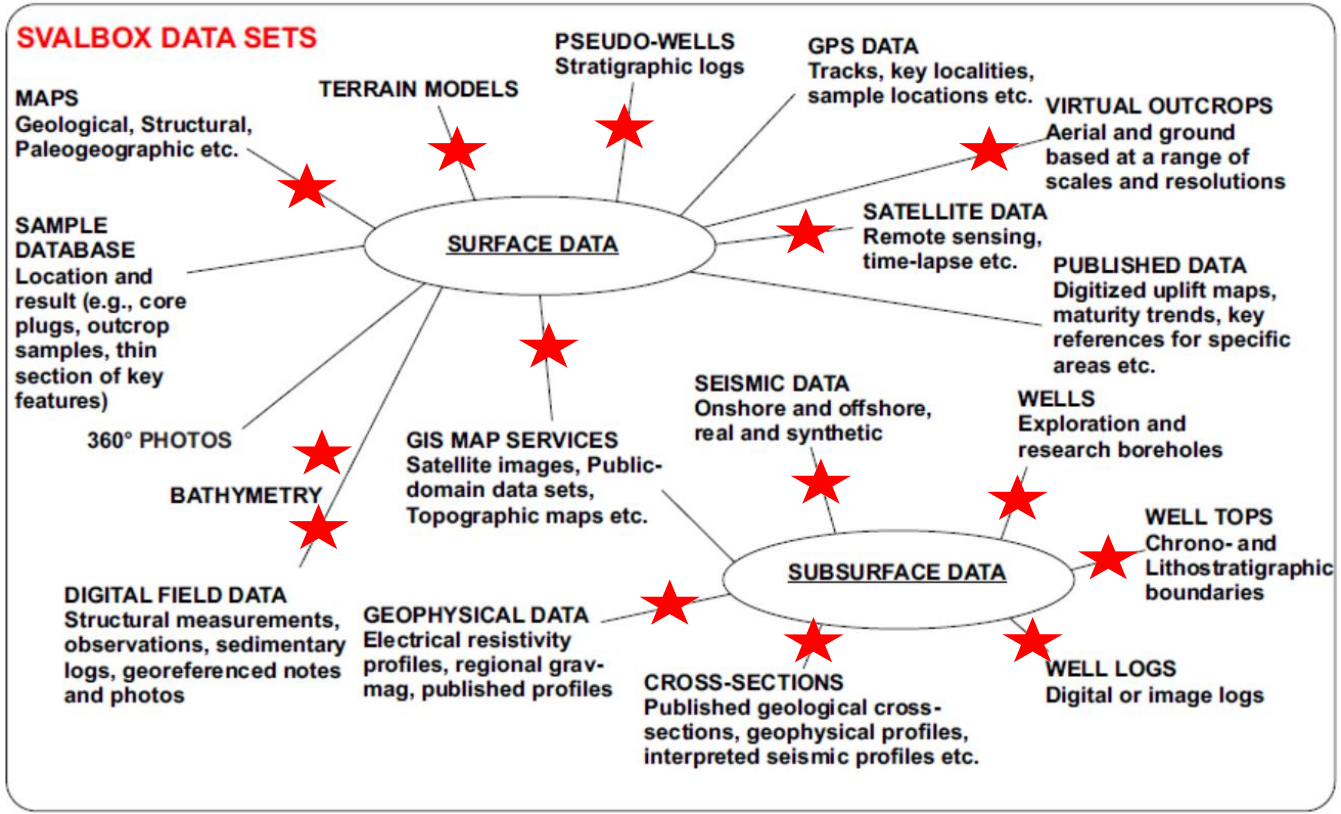
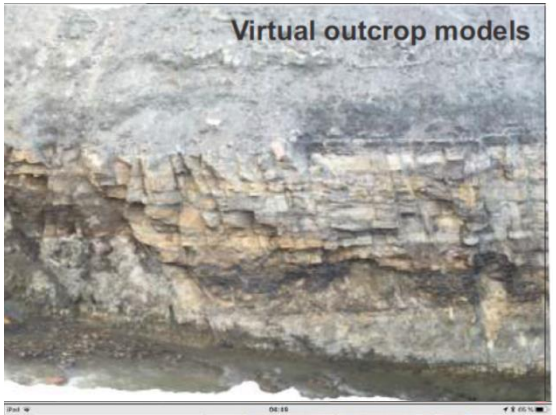
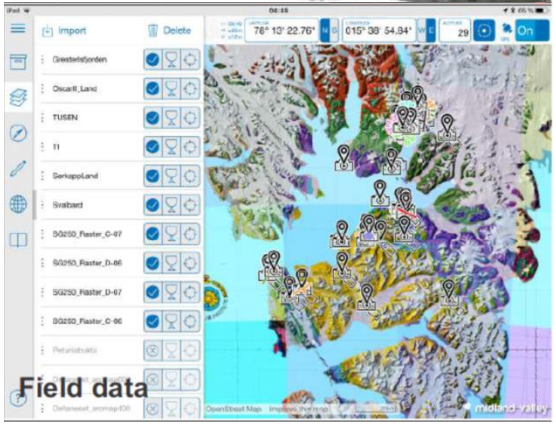
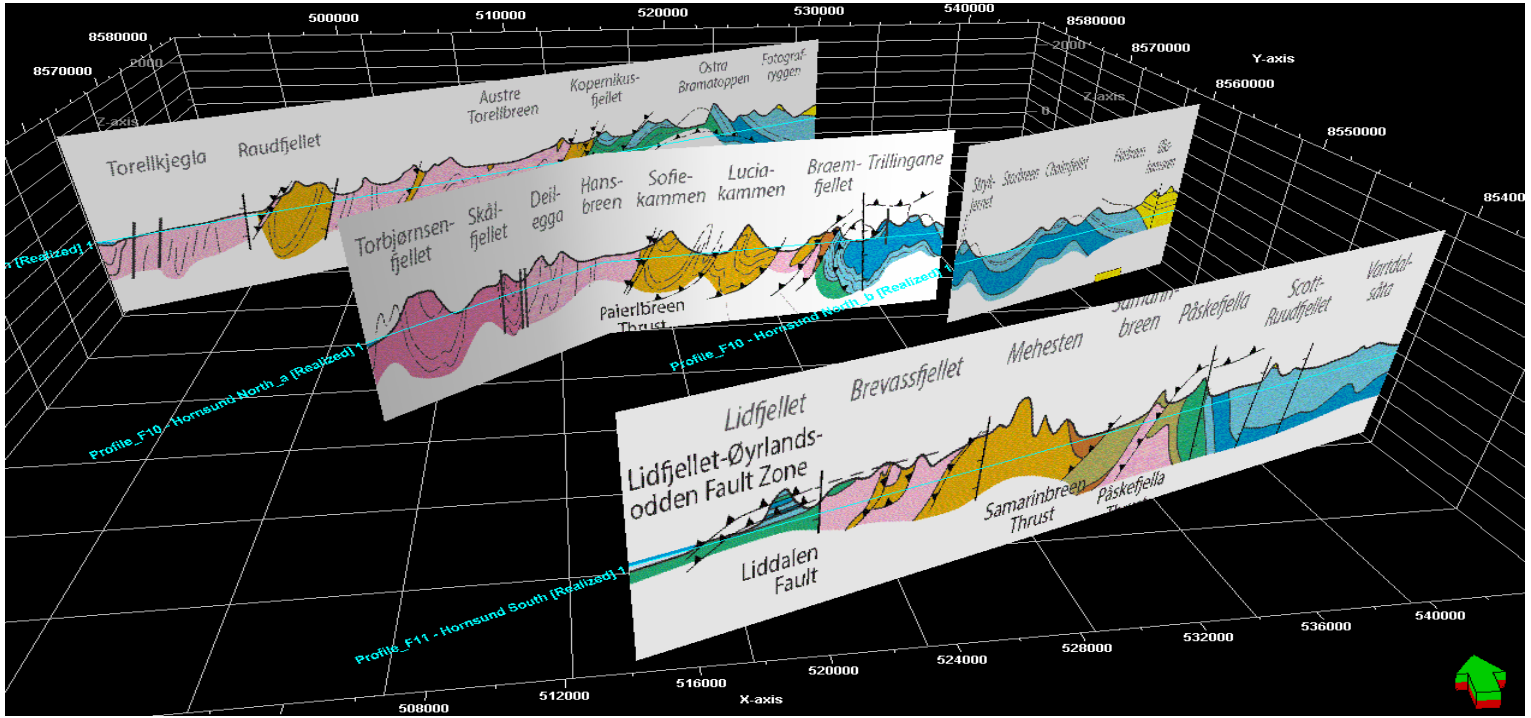






Data examples: published profiles



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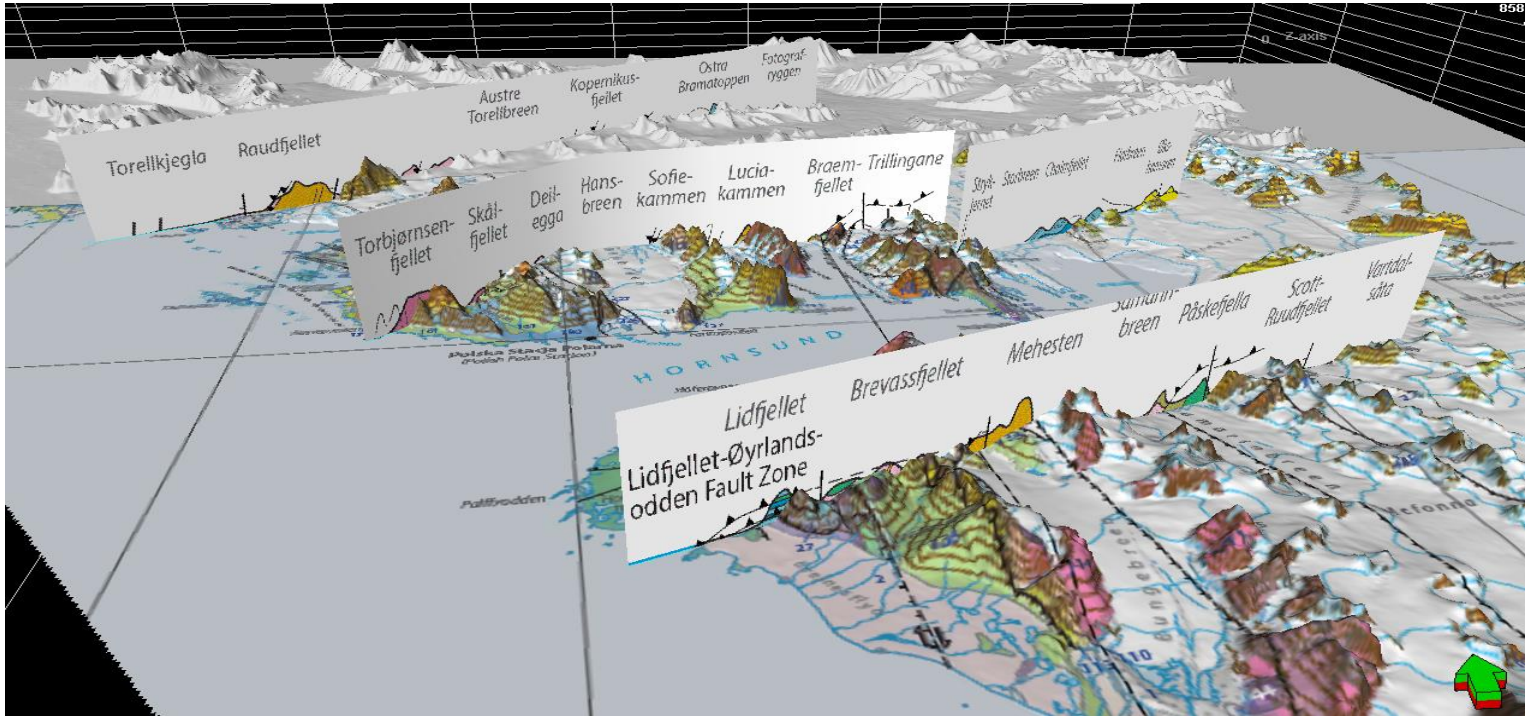
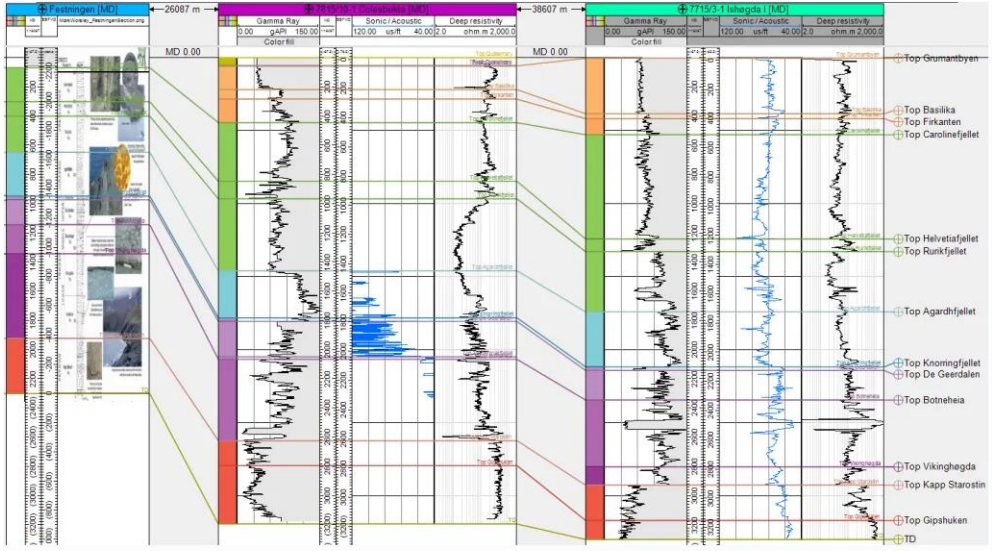


Highlights: new data and integration

The Festningen profile in April 2019, looking westwards. The dominant wall comprises the sandstones of the Cretaceous Helvetiafjellet Formation. Note snowmobiles for scale.



Correlation panel from Festningen to the two deepest petroleum exploration boreholes drilled in Svalbard, at Colesbukta and Ishøgda.

Linking outcrops with exploration well data

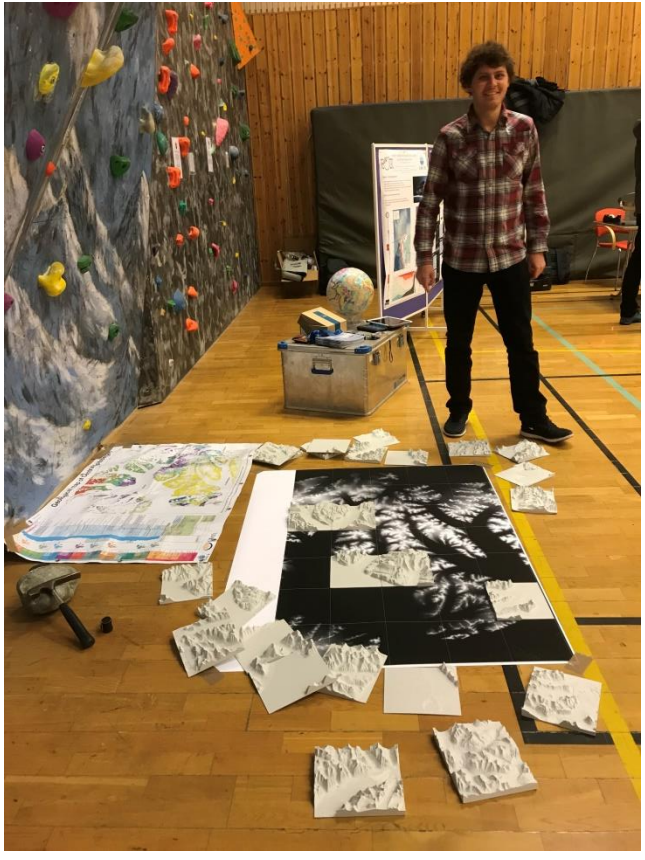
- 18 petroleum exploration boreholes drilled 1961-1994
- Increasing data availability from petroleum exploration from a range of sources including Norsk Polarnavigasjon archive
- Need to synthesize material (Svalbard Rock Vault project)

NORWEGIAN JOURNAL OF GEOLOGY Vol 99 Nr. 3
https://dx.doi.org/10.17850/njg99-3-1
GEOLOGICAL SOCIETY OF NORWAY

Petroleum, coal and research drilling onshore Svalbard: a historical perspective

Kim Senger[1,2], Peter Brugmans[3], Sten-Andreas Grundvåg[2,4], Malte Jochmann[1,5], Arvid Nøttvedt[6], Snorre Olaussen[1], Asbjørn Skotte[7] & Aleksandra Smyrak-Sikora[1,8]

Highlights: outreach

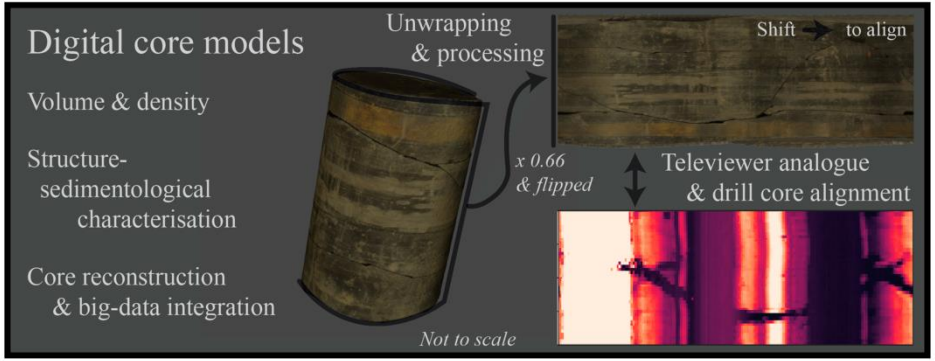


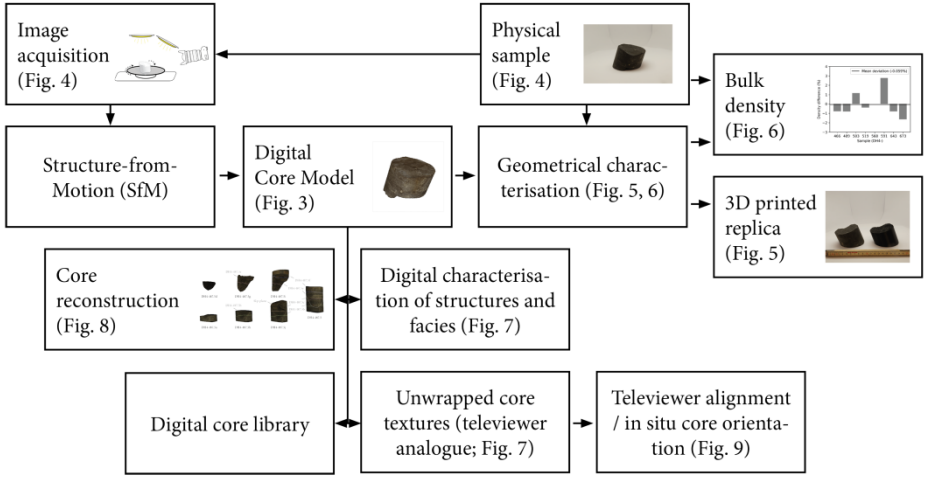
Longyearbyen skole Yrkesmesse, 20 Nov 2019

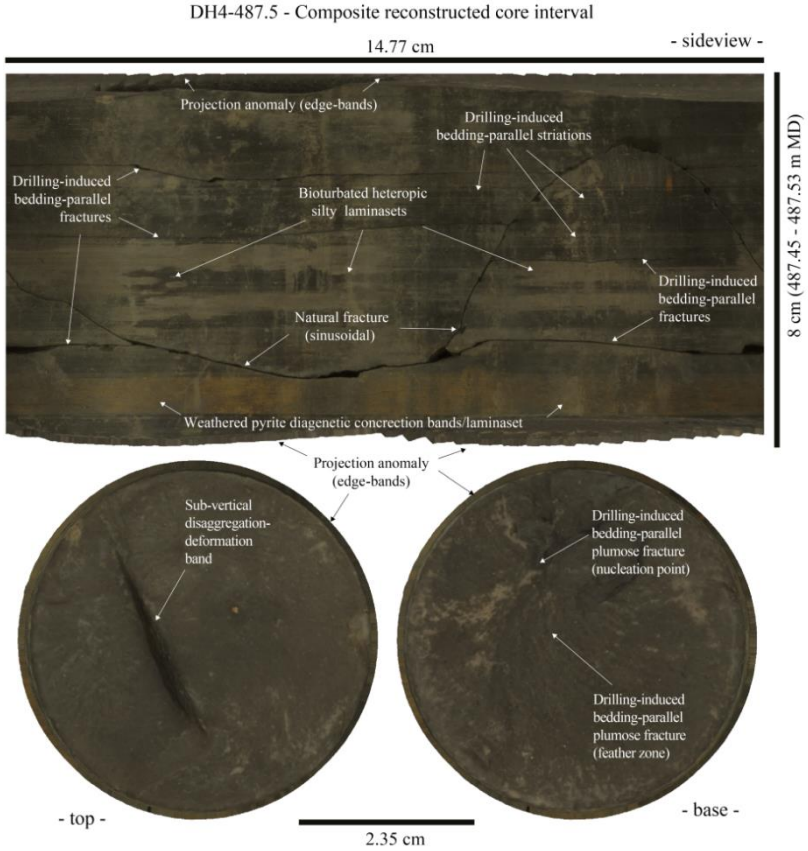
Highlights: virtual reality and VIPs

Visit of (then) Minister for Education & Research Iselin Nybø, including demonstration of VR, May 2019

Highlights: digital drill cores

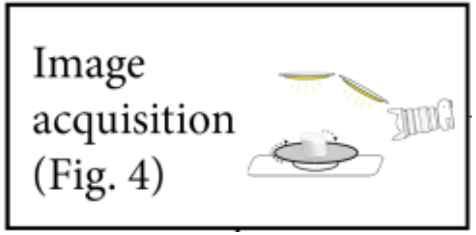






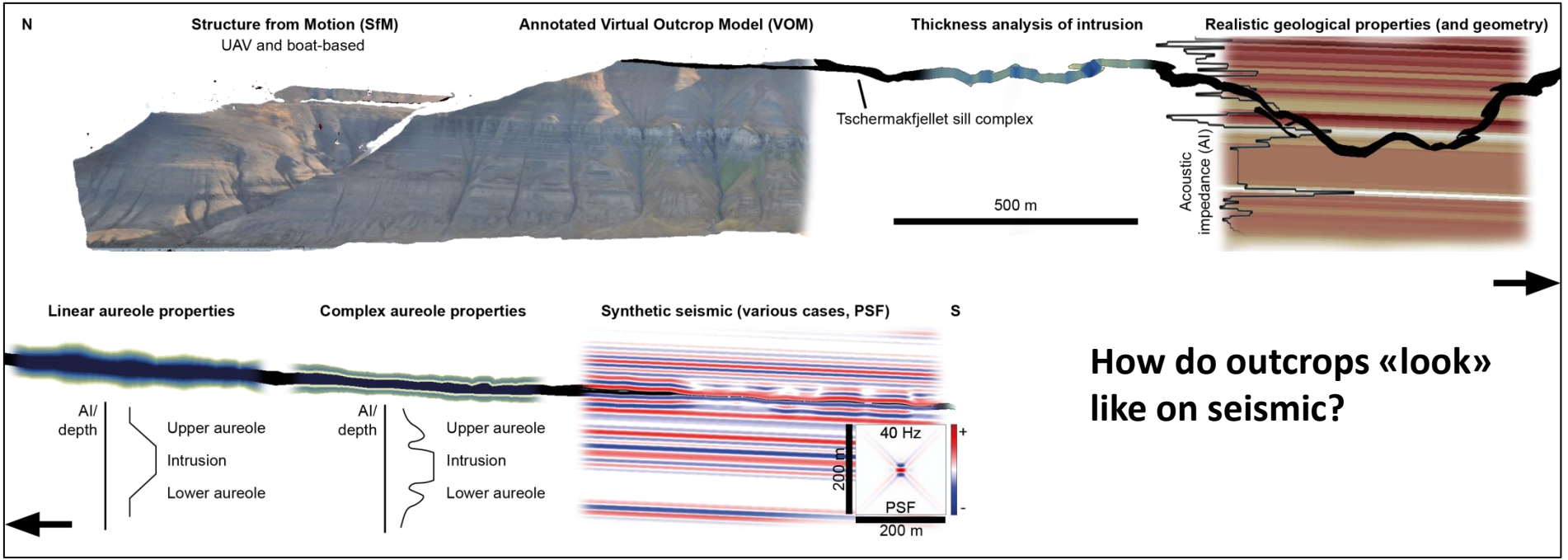
Betlem et al. (2020): Digital Drill Core Models: Structure-from-Motion as a Tool for the Characterisation, Orientation, and Digital Archiving of Drill Core Samples

Highlights: digital hand samples



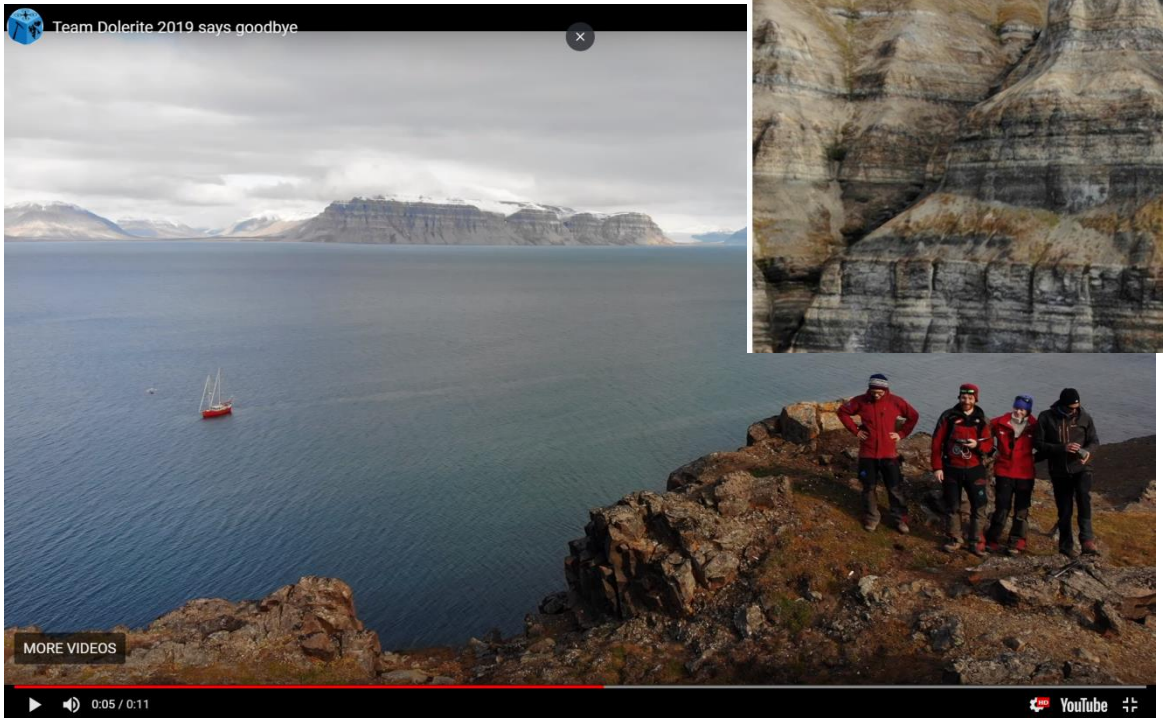
https://sketchfab.com/3d-models/rock-sample-malte-b2cb2ad336dd402eb3dc4222bb03d4bd

Highlights: seismic modelling



How do outcrops «look» like on seismic?

Highlights: VOM data acquisition

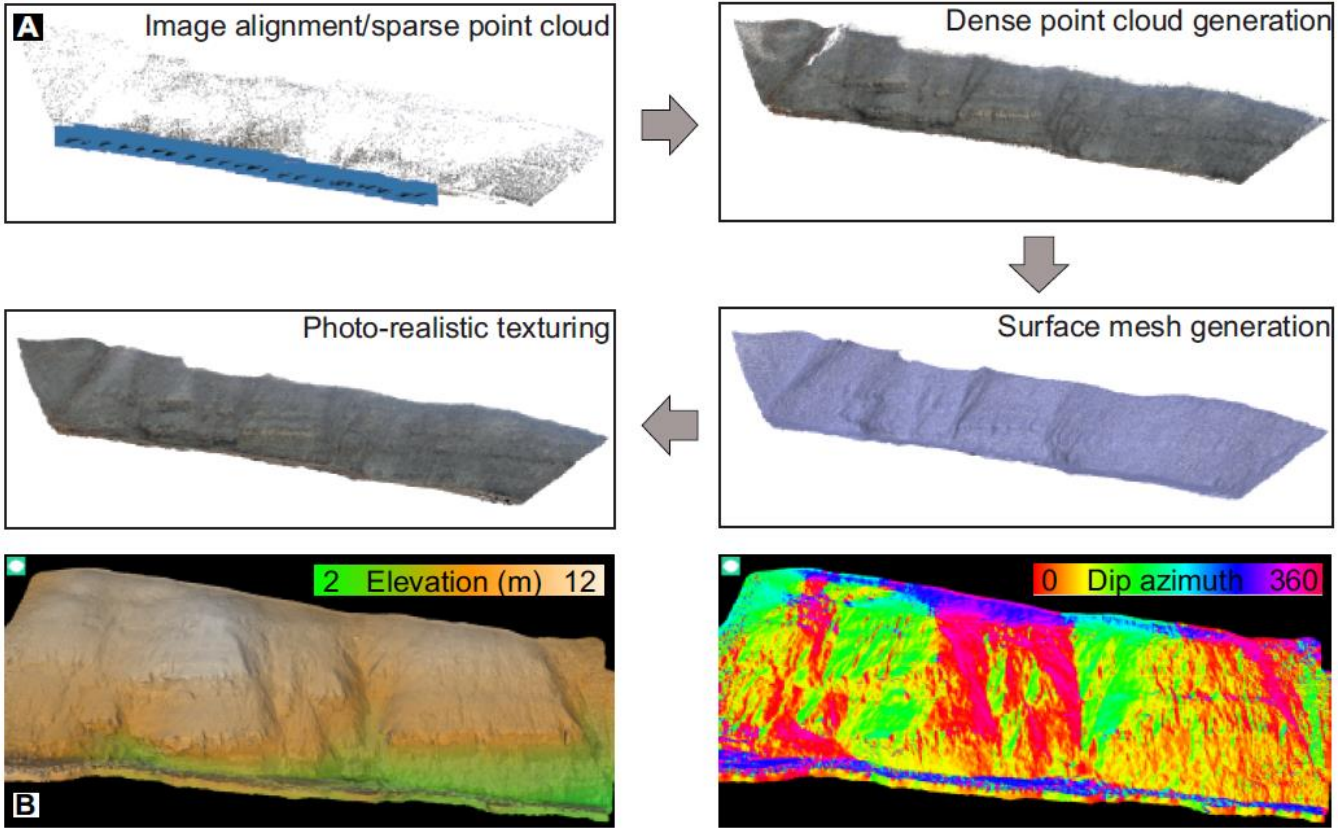


Skansen	
Model information	
Locality	Billefjorden
UTM33x/Longitude	523508.58558208466
UTM33x/Latitude	8717655.36814862
Technical specs	
Date acquired	17.08.2019
Acquired by	Kim Senger
Acquisition method	UAV
Processed by	Kim Senger
# images	93
Average distance (m)	292
Resolution (cm/pix)	8,88
Reference	Kim Senger

http://www.svalbox.no/portfolio/skansen/

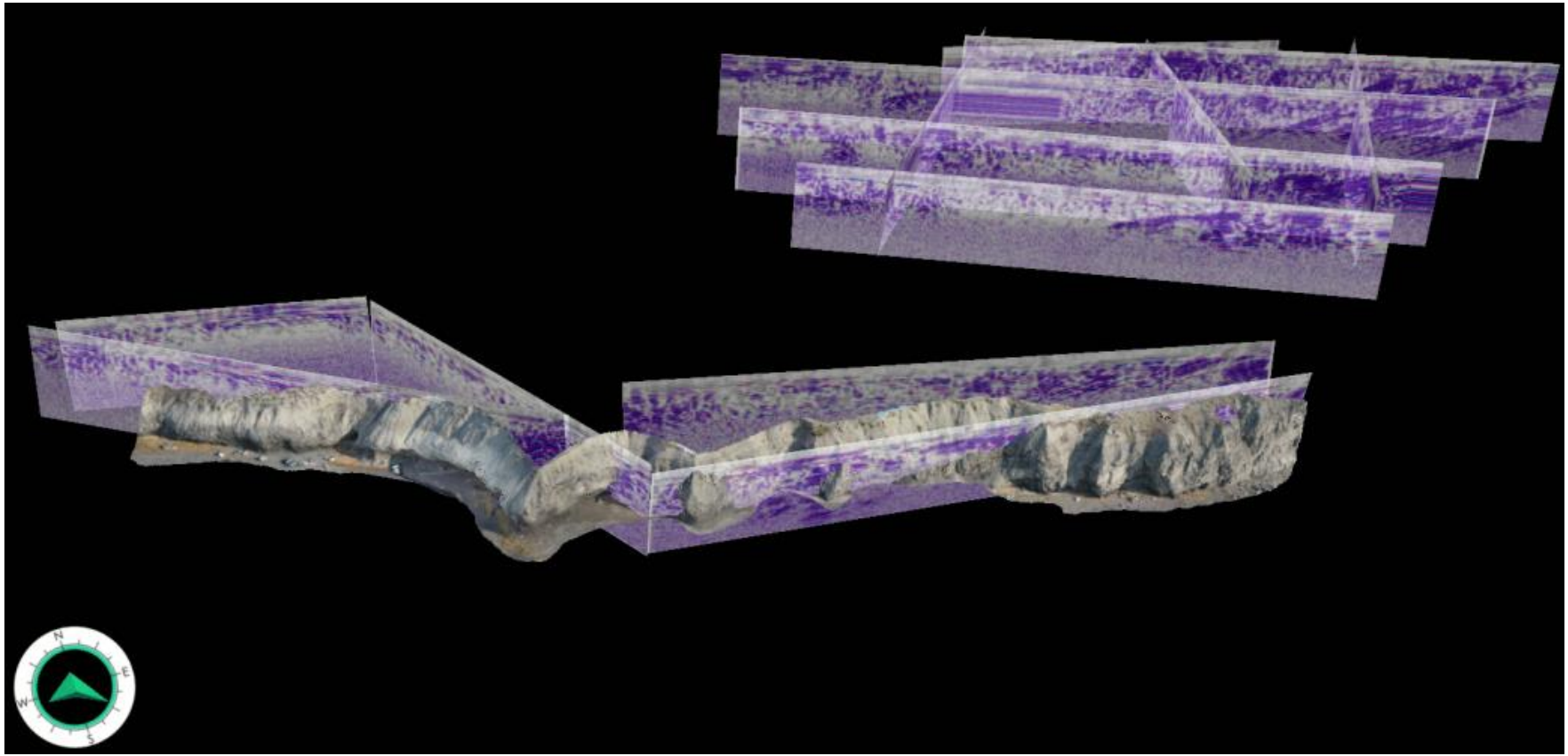
First dedicated Svalbox summer data acquisition campaign aboard R/V Clione, August 2019

Highlights: VOM data processing



- Batch processing and re-processing
- Playground for testing quantitative and qualitative tools for interpretation of digital outcrops
- Optimizing workflow from (digital) outcrop to geomodel

Highlights: data integration



Julian Janocha (2020). MSc UNIS/Uni Potsdam
https://www.youtube.com/watch?v=Dp2m8o16SoQ

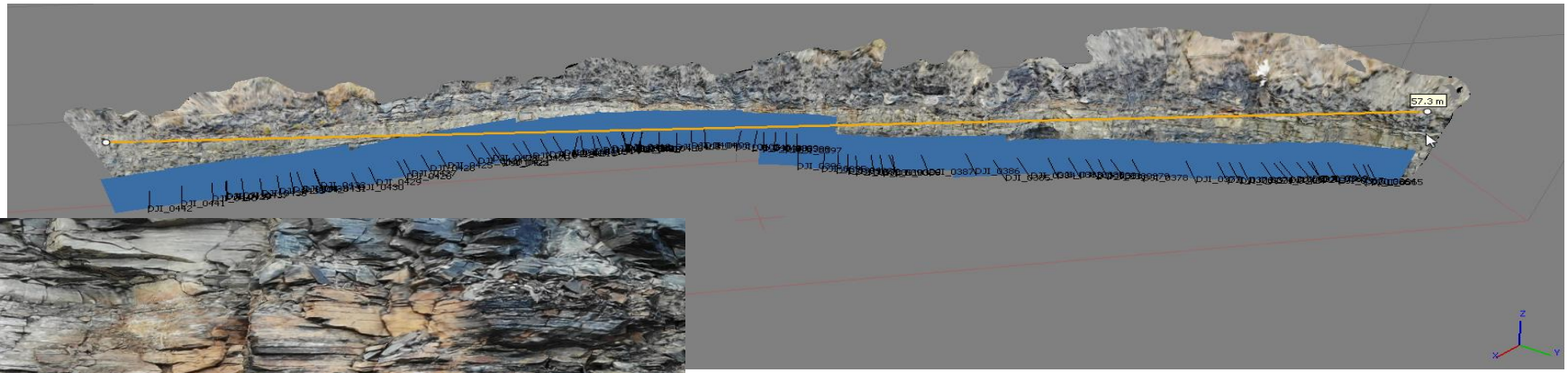
Highlights: data integration

Julian

Fortet

https://www.youtube.com/watch?v=Dp2m8o16SoQ

VOM example: Grønsteinfjellet beach



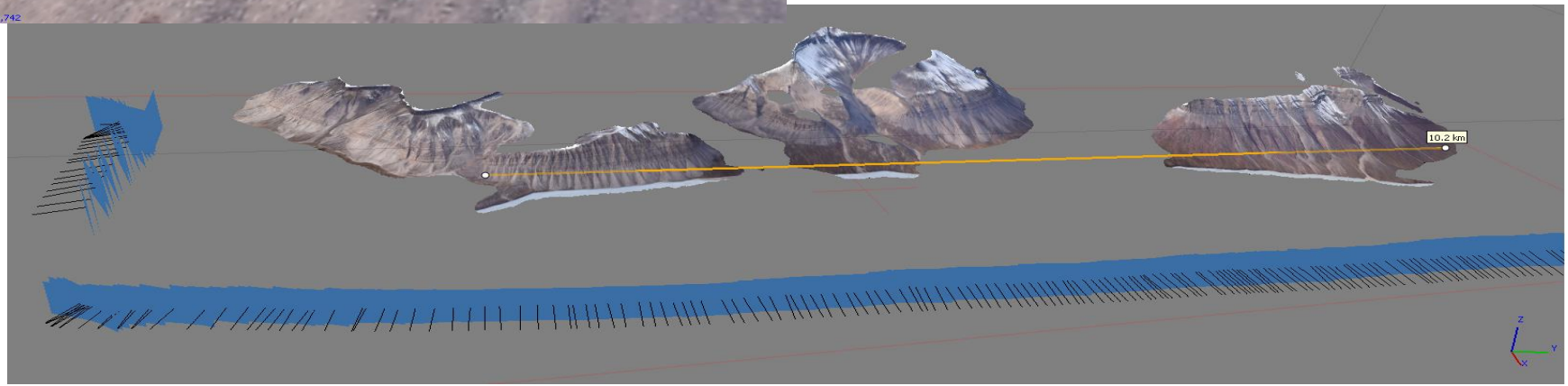
Grønsteinfjellet beach

- Drone-based, ca 5 m from outcrop
- 79 images, 1.5 mm/pixel resolution
- 15 min acquisition, 10 hr processing

VOM example: Dicksonfjorden

Dicksonfjorden outcrop

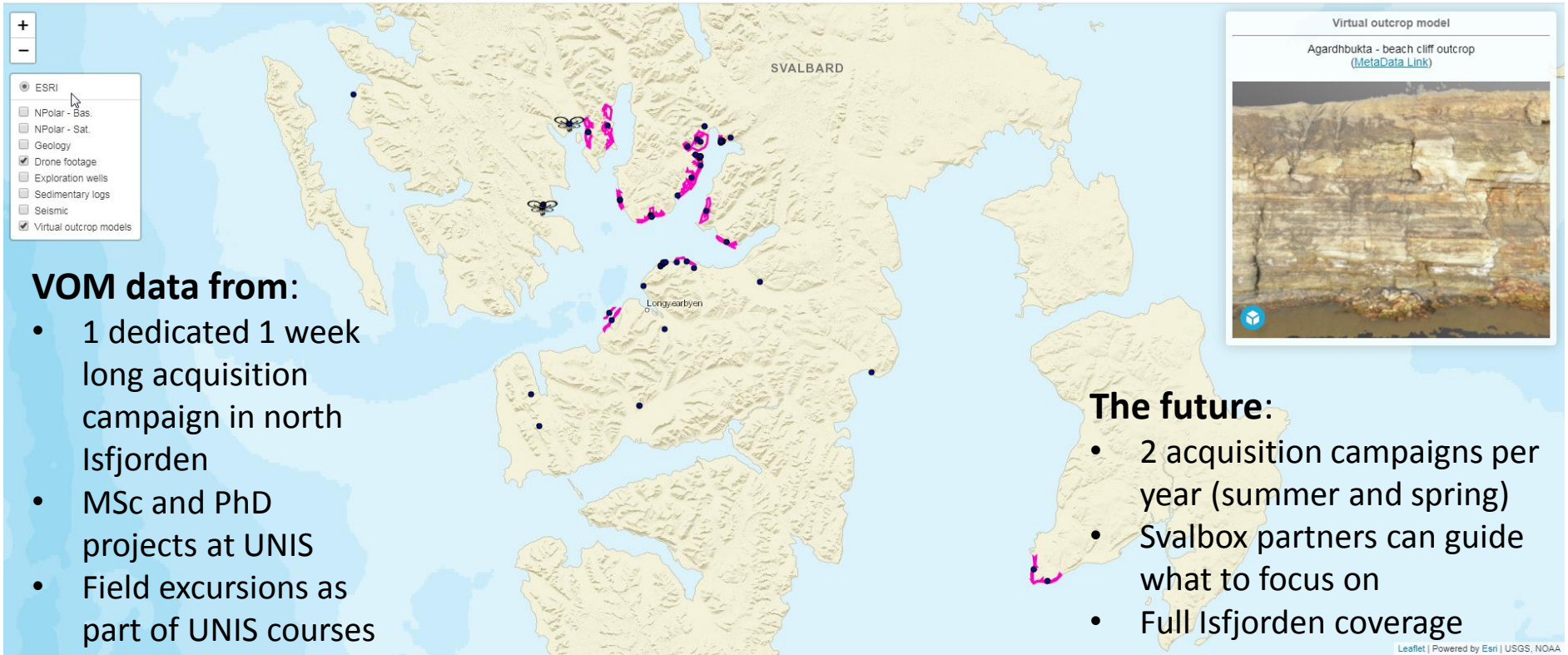
- boat-based, ca 3.4 km from outcrop
- 190 images, 25 cm/pixel ground resolution
- 2 hour acquisition, 10 hour processing



VOM coverage overview

Svalbox.no
Open data and information on Svalbard's geology

Home | Map | Longyearbyen CO2 Lab | Virtual models | Projects | e-Learning | About | News



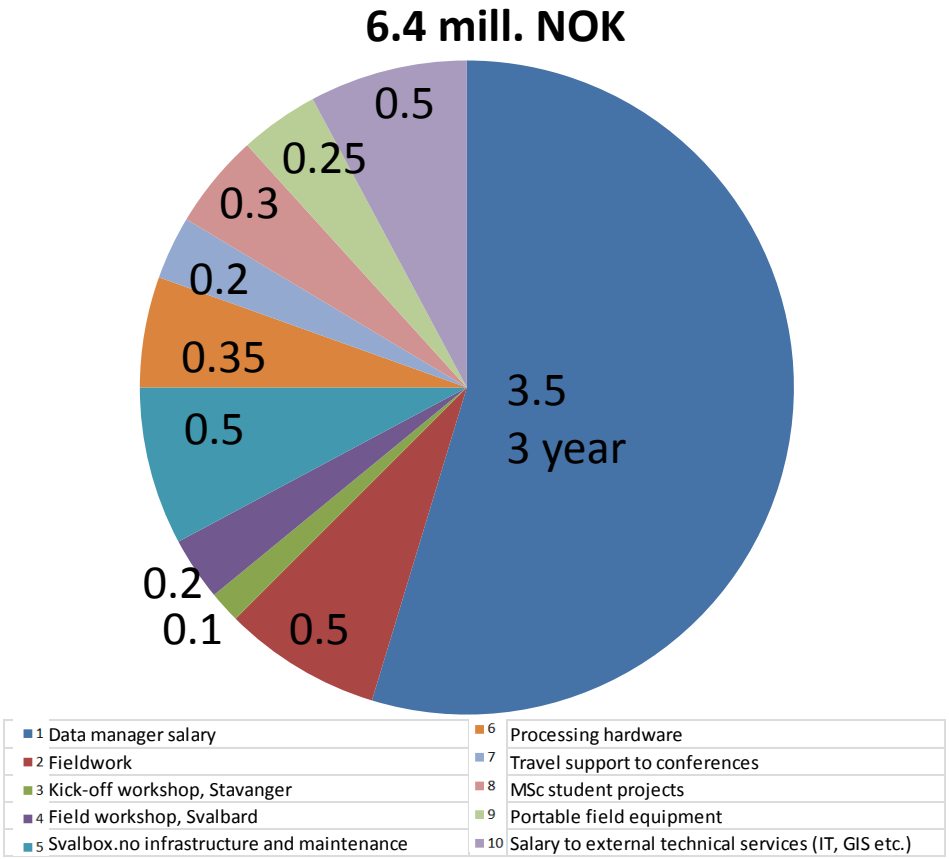
VOM data from:

- 1 dedicated 1 week long acquisition campaign in north Isfjorden
- MSc and PhD projects at UNIS
- Field excursions as part of UNIS courses

The future:

- 2 acquisition campaigns per year (summer and spring)
- Svalbox partners can guide what to focus on
- Full Isfjorden coverage

Svalbox2020: Resources and financing



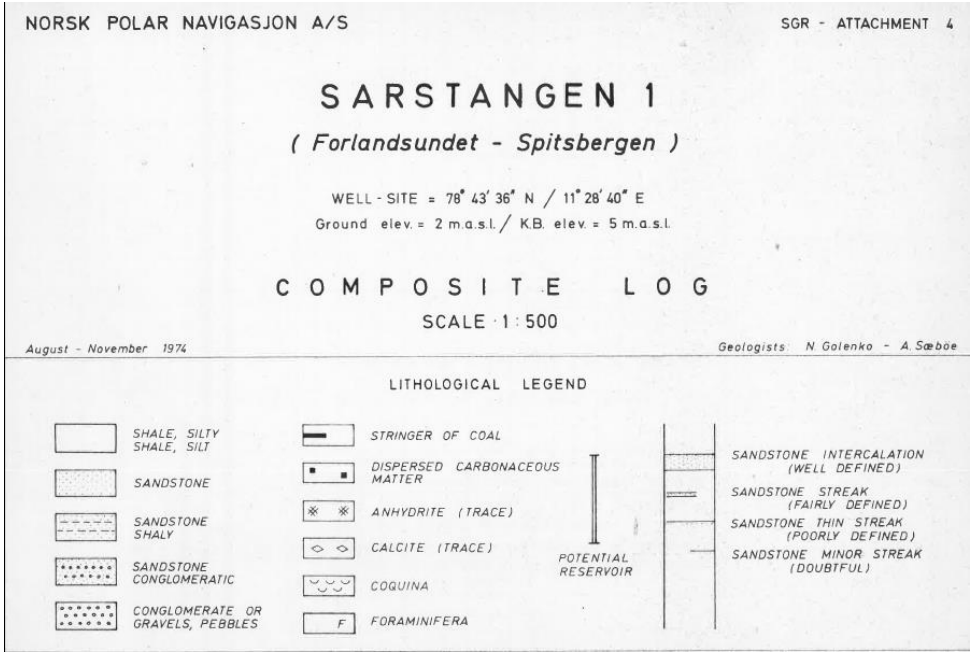
- Financing model through FORCE:
  2.15 mNOK/year over **3 years**
  - 425 kNOK/per company per year (if 5 companies participate)

- In-kind contributions:
  - Salary to project manager Kim Senger through UNIS
  - Salary to PhD candidate Peter Betlem through UNIS
  - Access to data sets from participating institutions
  - Access to remote field sites for virtual outcrop acquisition through ongoing R&D projects and courses at UNIS
  - Academic software licenses from various companies (Petrel, Move, LIME etc.)
  - Building on 750k NOK funds from UArctic co-op project (2017-2019)
  - Building on ca 100 k NOK ARCEx support for data input

Svalbox2020: Tasks and project organisation

WP1: Data hunting, data integration, data digitization and data management

- **Organise data-based** (published maps, terrain models, geological maps, seismic data, borehole data) and location-specific **Petrel projects**
- **Digitize** all material from Norsk Polar Navigasjon **archive** and other relevant archives (e.g., Barentz-Gruppen archive in Tromsø State Archive, Svein Ytreland's archive in Svalbard Museum)
- **Digitize key publications** from Svalbard and incorporate in Svalbox
- **Systematize the seismic database** onshore and near-shore Svalbard and compile into single Petrel project


NORSK POLAR NAVIGASJON A/S

SGR - ATTACHMENT 4

SARSTANGEN 1

(Forlandsundet - Spitsbergen)

WELL - SITE = 78° 43' 36" N / 11° 28' 40" E

Ground elev. = 2 m.a.s.l. / K.B. elev. = 5 m.a.s.l.

COMPOSITE LOG

SCALE 1 : 500

August - November 1974

Geologists: N. Golenko - A. Sæbøe

LITHOLOGICAL LEGEND

SHALE, SILTY SHALE, SILT
SANDSTONE
SANDSTONE SHALY
SANDSTONE CONGLOMERATIC
CONGLOMERATE OR GRAVELS, PEBBLES
STRINGER OF COAL
DISPERSED CARBONACEOUS MATTER
ANHYDRITE (TRACE)
CALCITE (TRACE)
COQUINA
F FORAMINIFERA
POTENTIAL RESERVOIR
SANDSTONE INTERCALATION (WELL DEFINED)
SANDSTONE STREAK (FAIRLY DEFINED)
SANDSTONE THIN STREAK (POORLY DEFINED)
SANDSTONE MINOR STREAK (DOUBTFUL)

Svalbox2020: Tasks and project organisation

WP1: Data hunting, data integration, data digitization and data management	WP2: Data acquisition, processing and interpretation
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Svalbox2020: Tasks and project organisation

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WP3: Data dissemination, outreach and training	
• **Regular updates** of "free-for-all" Svalbox.no website with both new content, new data types (e.g. 360 degree videos, see Svalbox YouTube channel) and project results • Annual **data package delivery to FORCE** partners in industry-standard Petrel format • Regular project **newsletter** and popular science articles on geo365.no and other relevant channels • Development of **virtual field trips** to key thematic localities in Svalbard • Development of **interactive training material** to be used in the field, in Longyearbyen or in partners' premises	

Svalbox2020: Tasks and project organisation

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Svalbox and Covid19 – challenges and opportunities

Geoforskning.no - Studenter

Digital feltundervisning

Opprettet 08.05.2020

I disse dager nyter geologistudentene ved UNIS godt av tilbudet om virtuelle blotninger, feltvideoer og annet datamateriale til bruk hjemmefra.

Stilbilde fra video fra kurset AG222 (UNIS)

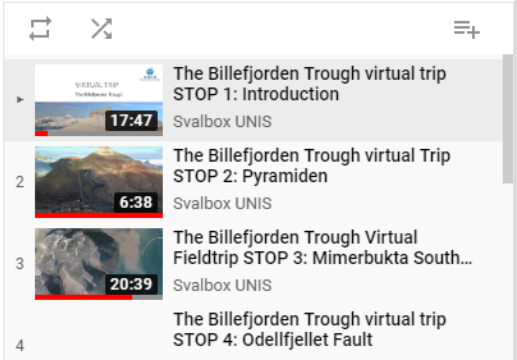
Kim Senger, førsteamanuensis i strukturgeologi og bassenganalyse, og kolleger gir oss en oppdatering på hvordan Department of Arctic Geology ved Universitetssenteret på Svalbard (UNIS) gjennomfører "feltundervisning" i en periode der både underviser og studenter sitter spredt rundt omkring i verden.

Mid-March 2020. The world crumbles under the Covid-19 pandemic and associated restrictions. All of us are affected - some more, some less. Universities in Norway turn to digital teaching almost overnight, and many exchange students worldwide are asked to return to their home countries.

https://geoforskning.no/studenter/2270-digital-feltundervisning

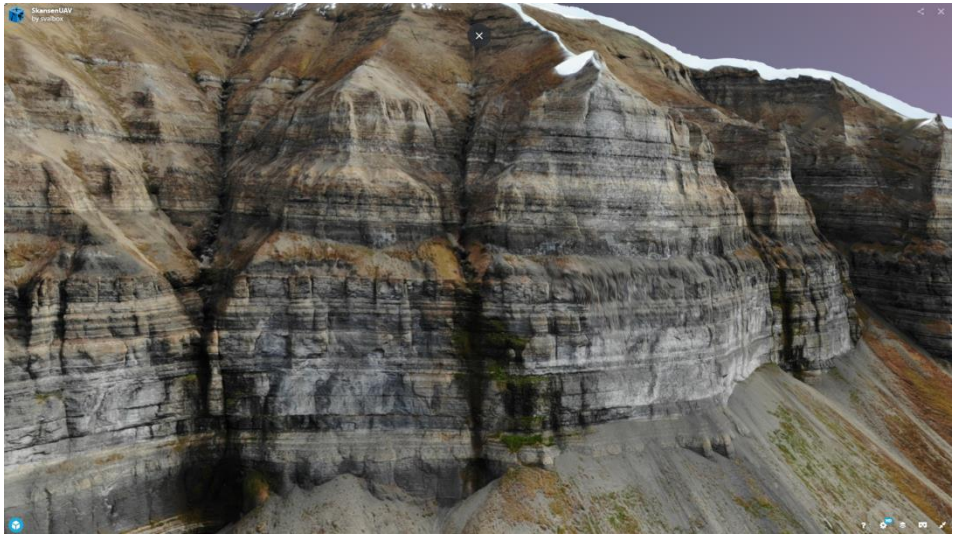
- Since mid-March, we run a BSc course at UNIS fully digitally
- A highlight was a virtual excursion to the Billefjorden Trough – possible also because of Svalbox
- We plan to use the experience from this to generate thematic virtual field trips to Festningen and more

https://www.youtube.com/watch?v=BOLIGOxqQKg&t=949s

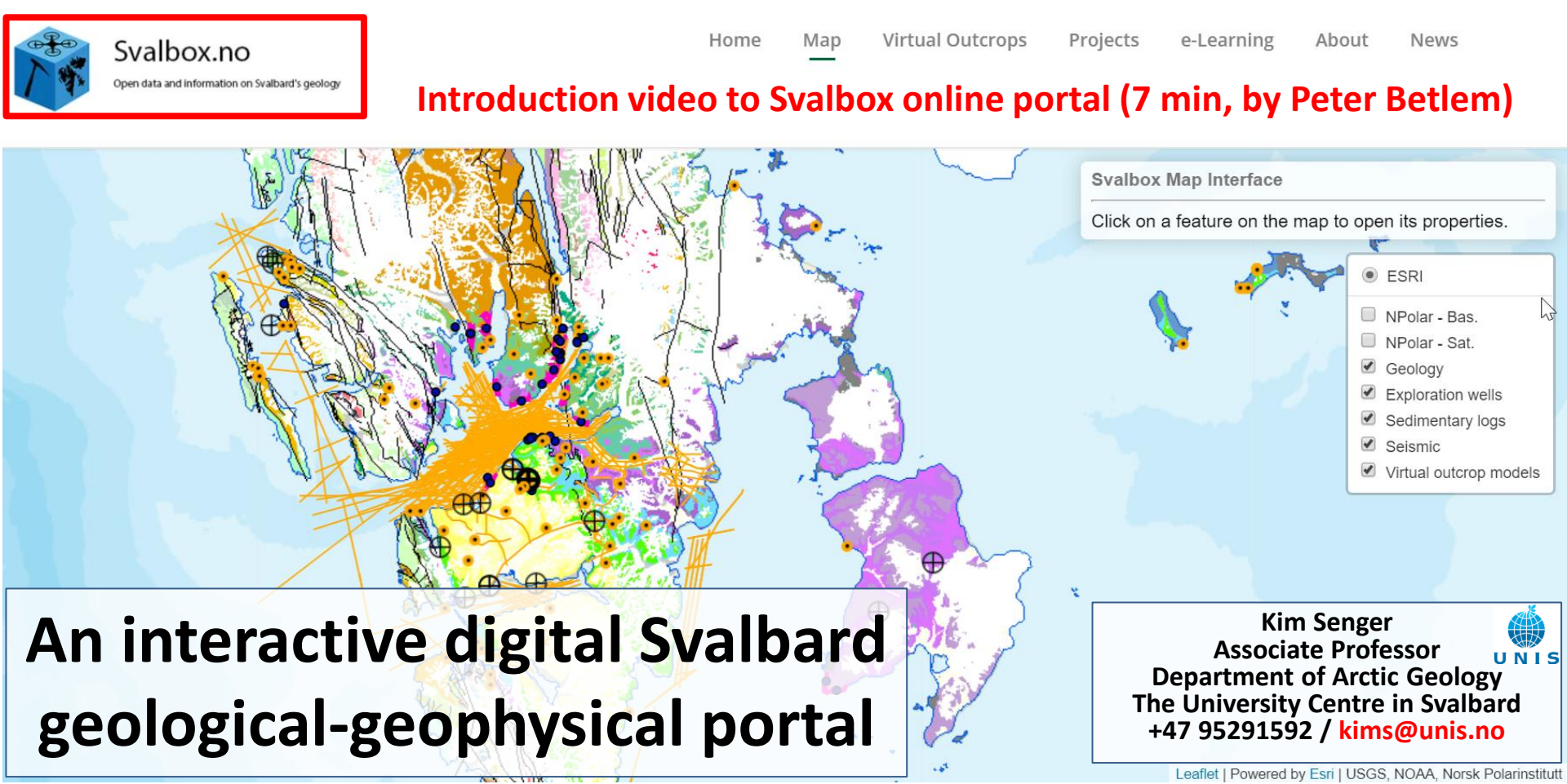


Summary and way forward

- Svalbox is a fully operational and vibrant data portal
- We see increased usage internally at UNIS and partners in education, outreach and research
- We require longer-term financing and a dedicated technician/data manager to take Svalbox to a higher level



Svalbox: bringing Svalbard geology to you – wherever you may be!



FORCE Lunch & Learn, Wednesday 27th May 2020, online webinar