



**The University Centre in Svalbard (UNIS)**  
**Department of Arctic Geology**  
**Arctic Geology Research at UNIS:**  
**yesterday, today and tomorrow**

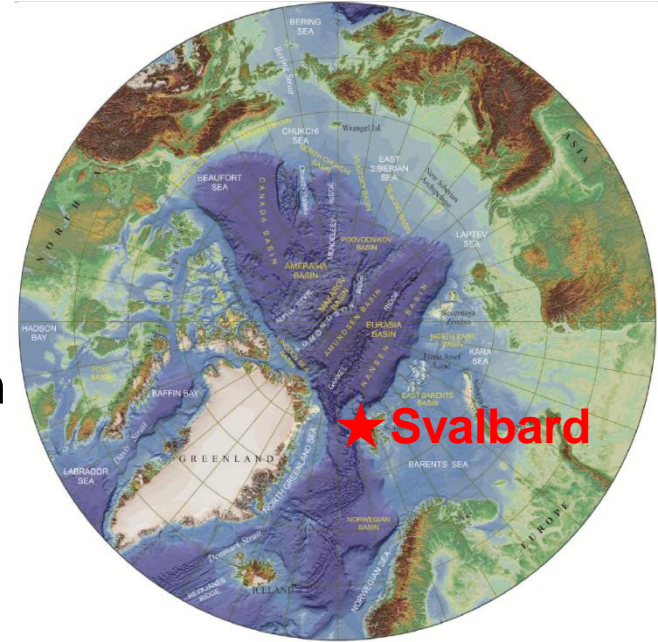
**3 February 2016, FORCE seminar “Joining Forces”, Stavanger**

**Kim Senger – [kims@unis.no](mailto:kims@unis.no)**

Associate Professor in Structural Geology and Basin Analysis

# Agenda

- UNIS – the short overview
  - Overall introduction to UNIS/key figures
  - The Arctic Geology department and its vision
- Current and planned R&D activities
  - Focus on Arctic basins related research



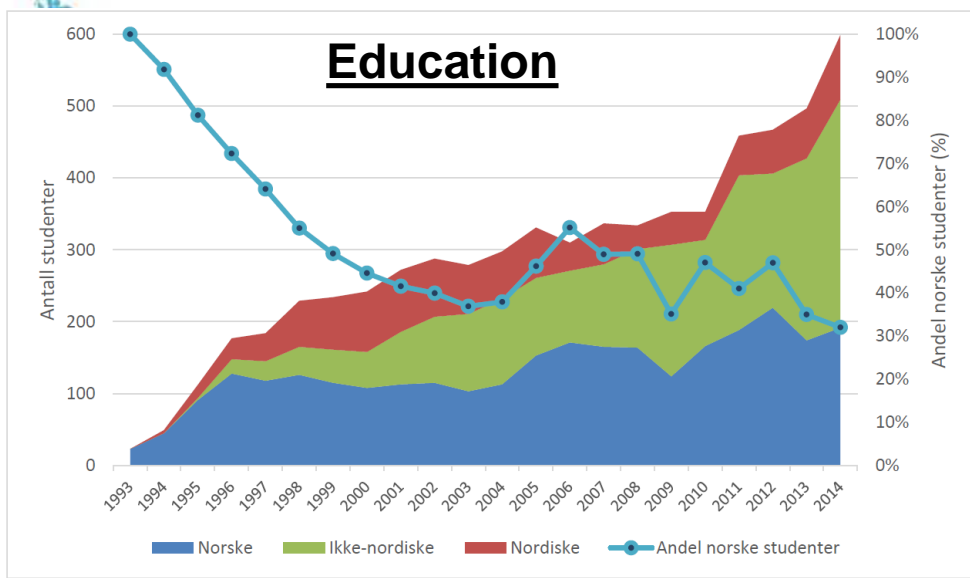


Unis vil hasteutvide  
Universitetssenteret på Svalbard vil ta en større rolle i Longyearbyen når Store Norske reduserer, og er parat til å doble antallet ansatte og studenter i løpet av få år.

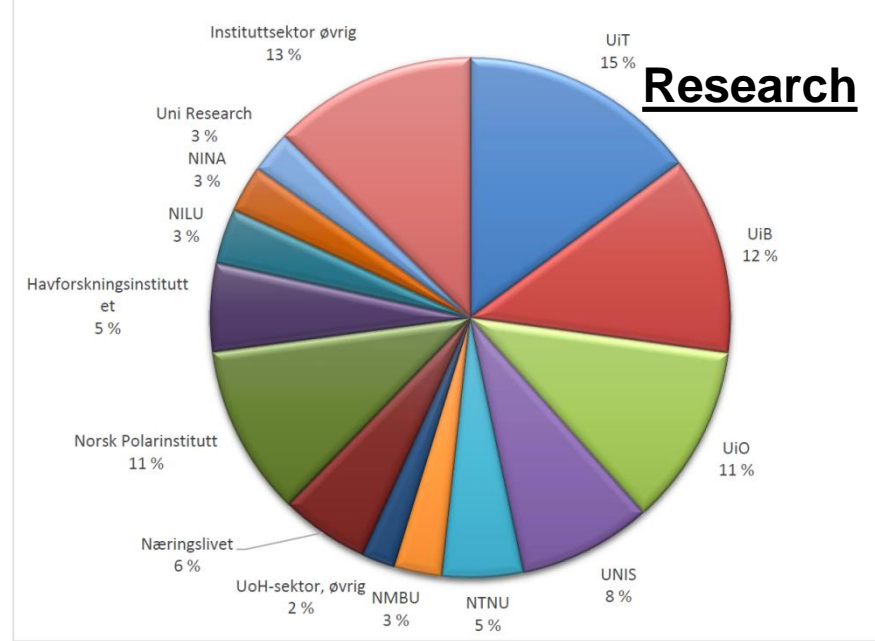
# What is UNIS?

- A state-owned company 100% owned by the Ministry of Education
- 4 departments: *Arctic Biology, Arctic Geology, Arctic Geophysics, Arctic Technology*
- Pre-requisite: 60 ECTS in natural sciences
- 88 courses\* (bachelor, master, Ph.D.)
- 599 students from 44 nations\*
- 51% women\*
- 55% international students\*
- All instruction in English
- **Field-based education and research**

\*Statistics for 2014



Figur 4.16 Totalt antall studenter ved Universitetssenteret på Svalbard (UNIS), 1993-2014 fordelt på norske, nordiske og ikke-nordiske studenter. Andel norske studenter. Source: NIFU (2015)



Figur 5.4 Norsk vitenskapelig publisering innen polarforskning 2010-2014 – fordeling etter forskningsutførende institusjon/institutt/sektor, prosentandel. Source: NIFU (2015)



# The Department of Arctic Geology

Spring 2016



Glaciology



**Hanne H. Christiansen**  
Professor in Periglacial Geomorphology  
Head of Department Room A.203



**Lena Håkansson**  
Associate Professor in Glacial Geology  
Room A.227



**Ólafur Ingólfsson**  
Professor in Quaternary Geology  
Room A.207



**Maria Jensen**  
Associate Professor in Sedimentology  
Room A.214



**Riko Noomets**  
Associate Professor in Marine Geology  
Room A.210



**Snorre Olausen**  
Professor in Arctic Petroleum Geology  
Room A.215



**Alexander Prokop**  
Associate Professor in Snow Science  
Room A.205



**Kim Senger**  
Associate Professor in Structural Geology  
Room A.211



**Alvar Braathen**  
Adjunct Professor in Structural Geology



**William Helland-Hansen**  
Adjunct Professor in Sedimentology



**Helge Hellevang**  
Adjunct Associate Professor in Geochemistry



**Andy Hodson**  
Adjunct Professor in Biogeochemistry



**Ole Humlum**  
Adjunct Professor in Physical geophy



**Nick Hulton**  
Adjunct Professor in Glaciology



**Jørn Hurum**  
Adjunct Professor in Paleontology



**Martin Jakobsson**  
Adjunct Professor in Marine geology



**Tor Arne Johansen**  
Adjunct Professor in Geophysics



**Sverre Ohm**  
Adjunct Associate Professor in Petroleum Geology



**Per Terje Osmundsen**  
Adjunct Professor in Structural Geology



**Mike Retelle**  
Adjunct Professor in Quaternary Geology



**Lena Rubensdøtter**  
Adjunct Associate Professor in Quaternary geomorphological mapping



**Lars Stemmerik**  
Adjunct Professor in Sedimentology



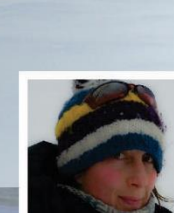
**Sara M. Cohen**  
Technician  
DINA 204



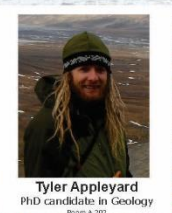
**Martin Liira**  
Post Doc in Geochemistry  
Room A.208



**Faezeh M. Nick**  
Post Doc in Glaciology



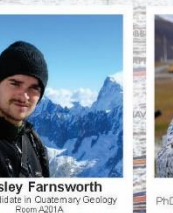
**Sarah Thompson**  
Post Doc in Glaciology  
Room A.212



**Tyler Appleyard**  
PhD candidate in Geology  
Room A.202



**Anne Elina Flink**  
PhD candidate in Marine Geology  
Room A.302



**Wesley Farnsworth**  
PhD candidate in Quaternary Geology  
Room A.201A



**Oscar Fransner**  
PhD candidate in Marine Geology  
Room A.302



**Graham Gilbert**  
PhD candidate in Permafrost  
Room A.205



**Hanna Röse Hjálmsdóttir**  
PhD candidate in Mikropaleontology  
Room A.202



**Malte Jochmann**  
PhD candidate in Sedimentology  
Room A.213



**Mark Mulrooney**  
PhD candidate in RIB Basin Geology  
Room A.209



**Aleks Smyrak-Sikora**  
PhD candidate in RIB Basin Geology  
Room A.206



**Berit Husteli**  
PhD candidate in Sedimentology

... and external PhD candidates

# Our vision:

To seek excellence in research and education of Arctic geosciences



## Research Themes

### Funding agencies:

Academic, Government,

NFR, ERC, NCM,

NPD, NGU

Industry;

Baker Hughes

BP

Centrica

ConocoPhillips

Det Norske

Dong

Eni Norge

E.ON

LNS

Lundin

OMV

PGNiG

RWE

Statkraft

Statoil

Store Norske

Talisman

Total

Tullow

### Arctic Basins

Tectonics,  
basin studies,  
hydrocarbon systems &  
resources

### Climate change

Past, present  
and future climate  
evolution

### Glacially influenced continental margins

Glacial- and Quaternary  
geology;  
Palaeo-reconstructions

### Modern Arctic

Environments and  
processes

### National, International Networks and Programs

SUCCESS

CLIMIT

SVALI

DEFROST

NSINK

ICEBOUND

SVALASKA

Page21

CoP NARP

GLANAM

APEX

PAST Gateways

UiO, UiB, UiT, NTNU

*When we try to pick out anything by itself, we  
find it hitched to everything else in the universe  
John Muir*

# Graduate courses in sedimentary bedrock and petroleum geosciences



**AG-322 Fold and Thrust Belts and Foreland Basin Systems (10ECTS)**

**AG-323 Sequence Stratigraphy – a Tool for Basin Analysis (10ECTS)**

**AG-334 Arctic Basins and Petroleum Provinces (10ECTS)**

**AG-335 Polar Seismic Exploration (10ECTS)**

**AG-336 Rift Basin Reservoirs: From Outcrop to Model (10ECTS)**

**AG-338 Sedimentology Field Course – from Depositional Systems to Sedimentary Architecture (10ECTS)**

**AG-349 Geological Constraints on CO<sub>2</sub> storage (5ECTS)**

**Undergraduate course**

**AG-209 The Tectonic and Sedimentary History of Svalbard (15ECTS)**

**[www.unis.no](http://www.unis.no)**

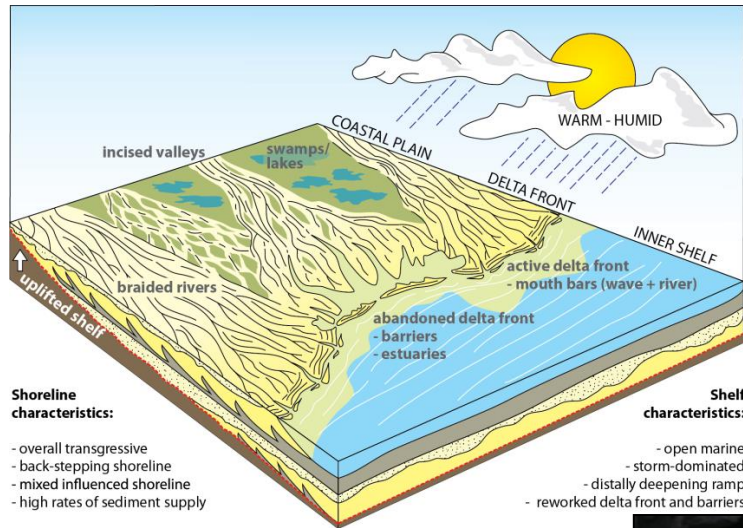


# Current Arctic Basins/Bed rock studies

Managed by UNIS or managed in cooperation with others

1. Lower Cretaceous basins in the Arctic LoCrA UNIS/ Univ Stavanger
2. Onshore offshore link Upper Triassic - Middle Jurassic UNIS
3. Hydrocarbon seeps /Facies and age of Mesozoic organic rich shale units UNIS/Univ. Oslo
4. Upper Paleozoic carbonates UNIS/Univ. Copenhagen
5. WP2 in ARCEX Petroleum Systems and play concepts UNIS/Univ Tromsø
6. Storage fluid flow and Risk of CO2 UNIS/Univ. Oslo
7. Arctic Coastal Systems UNIS

Grundvåg 2015

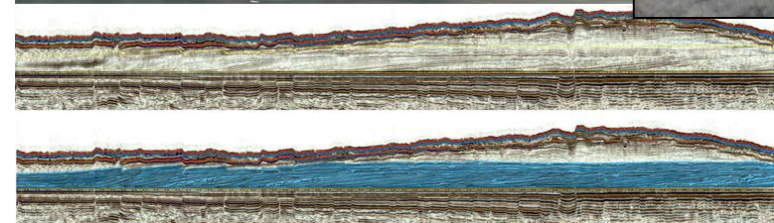


Shoreline characteristics:

- overall transgressive
- back-stepping shoreline
- mixed influenced shoreline
- high rates of sediment supply

Shelf characteristics:

- open marine
- storm-dominated
- distally deepening ramp
- reworked delta front and barriers



Current; Most focus on Svalbard- Barents Sea including Russia and Greenland

Kim Senger, UNIS  
 Sten-Andreas Grundvåg, UiT  
 Ivar Midtkandal, UiO  
 2 post Docs  
 7 PhD's  
 Hanna Rosa, UNIS  
 Masters

Recently accepted papers

1. Hurum, J. H., Druckenmiller, P. S., Hammer, Ø., Nakrem, H. A. & Olaussen, S. in press. The theropod that wasn't – an ornithomimid tracksite from the Helvetiafjellet Formation (Lower Cretaceous) of Boltodden, Svalbard. In Kear, B. P., Lindgren, J., Hurum, J. H., Milàn, J. & Vajda, V. (eds). Mesozoic Biotas of Scandinavia and its Arctic Territories. Geological Society, London, Special Publications, 434, xx-xx
2. Grundvåg, S-A. & Olaussen, S. Sedimentology of the Lower Cretaceous at Kikutodden and Keilhaufjellet, southern Spitsbergen: implications for the onshore-offshore link. Polar Research
3. Hurum, J.H., Dyke, G., Roberts, A.J., Grundvåg, S. A., Nakrem, H.A., Sliwinska K., Midtkandal, I., Olaussen, S. & K. An avialan femur from Arctic Norway and a short review of the Lower Cretaceous geology of Spitsbergen. Palaeontologi polonica

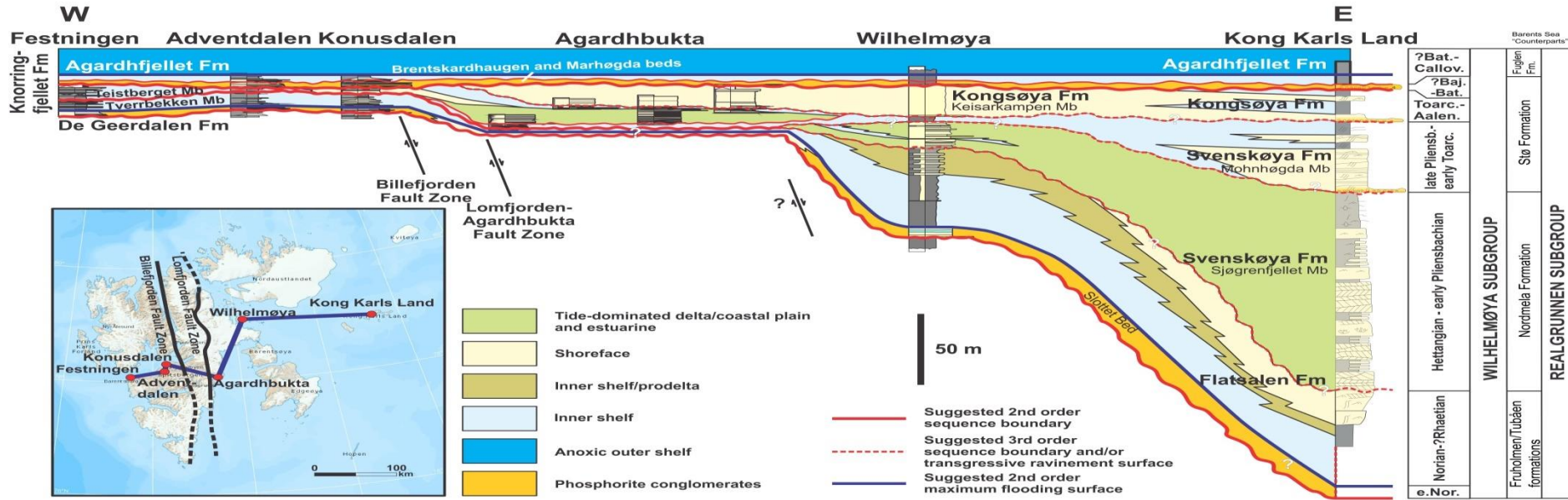
Future plans:

Extend sequences into Alaska - Amerasian Basin  
 Improve knowledge of Provenance and drainage  
 Constrain the link to HALIP magmatism

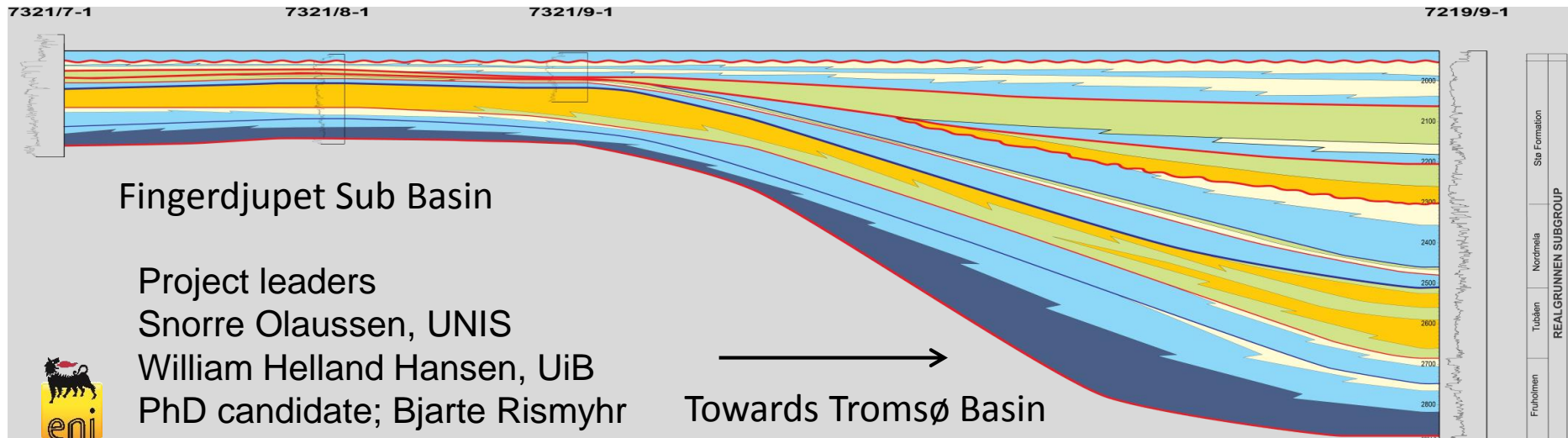


# Arctic Basins 2

Facies and sequence stratigraphy of Upper Triassic to Middle Jurassic basin fill in the Barents Sea and Svalbard (Wilhelmøya vs Realgrunnen subgroup; FASENA)



Bjarte Rismyhr; under revision



## Future plans:

More detailed study of regional trends of organic facies (i.e. input to gas or oil prone source rock). Cooperation with Russian in East and Greenland in west

## Project leaders

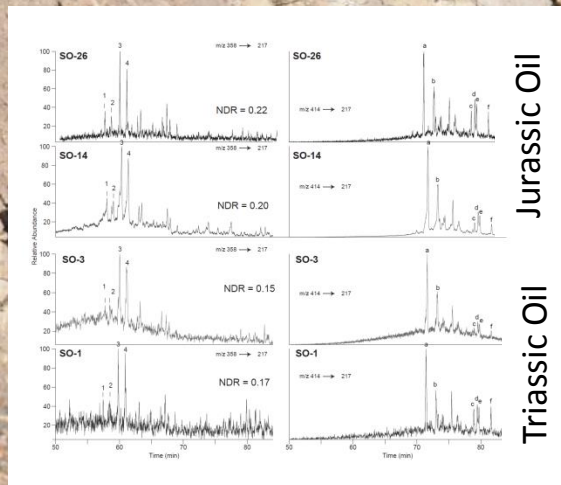
Riko Noormets, UNIS  
 Snorre Olausen, UNIS  
 Dag Karlsen UiO  
 Øyvind Hammer, UiO  
 Sverre Ohm, UNIS/UiS

## Postdocs

Martin Liira, UNIS

## PhD candidates

Tesfa Abay, UiO  
 Mayeke Koevoets, UiO  
 Master students



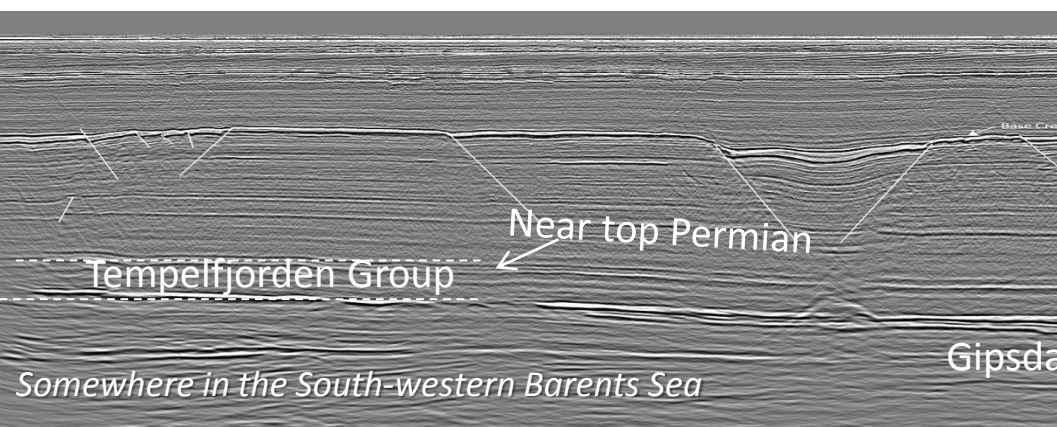
Exhumed oil accumulation?  
 Bitumen stained  
 Upper Triassic-Middle Jurassic sandstone  
 East Coast of Spitsbergen

## Upper Palaeozoic Carbonates and basin development (Barents Sea/Svalbard and Zechstein) Facies and Source



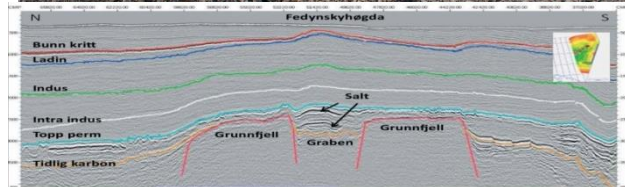
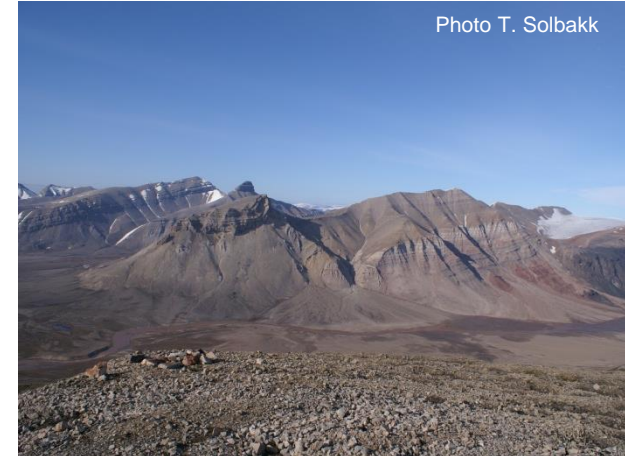
**Project leaders**  
 Lars Stemmerik, Univ. CPH  
 Snorre Olaussen, UNIS

**PhD candidates**  
 Aleksandra Smyrak-Sikora, UNIS  
 Tone Drøhse, Univ. CPH  
 Jakob Kristensen, Univ. CPH  
 Master students, Univ. CPH



**Future plans: Improved knowledge of diagenetic processes, include Pechora Basin, East Greenland and UK shelf**

Photo T. Solbakk



Figur 6.8 Seismisk løppe fra flanken av Fedynskiyhøgda, som viser at det under den høyeste delen av Fedynskiyhøgda på norsk side ligger en grabenstruktur fra karboniførm med saltvæstrømmer.

### Project leaders

**Sten-Andreas Grundvåg, UiT**  
**Snorre Olaussen, UNIS**  
 Steffen Bergh, UiT  
 William Helland-Hansen, UiB  
 Dag Karlsen, UiO  
 Alvar Braathen, UiO

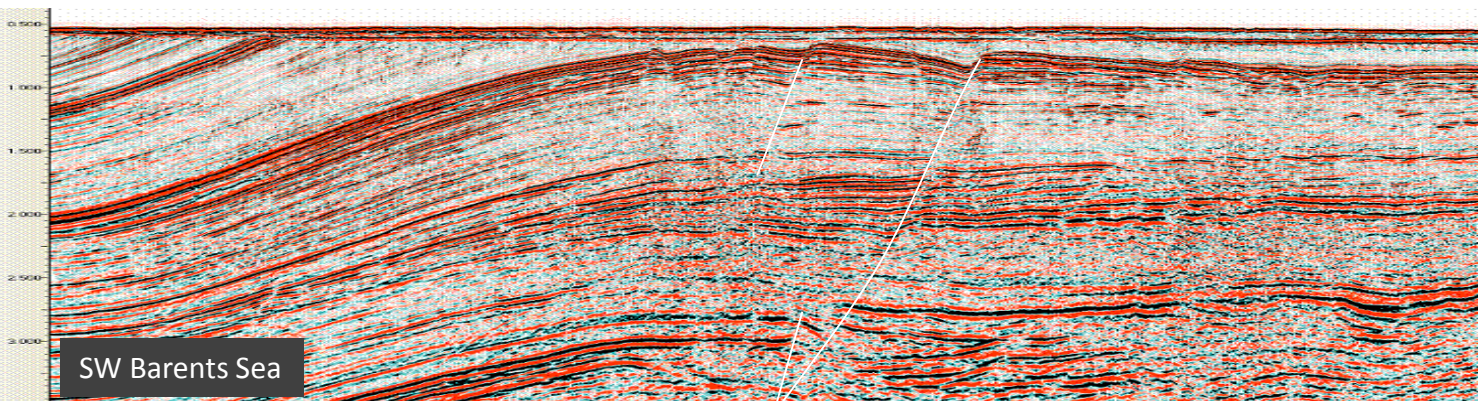
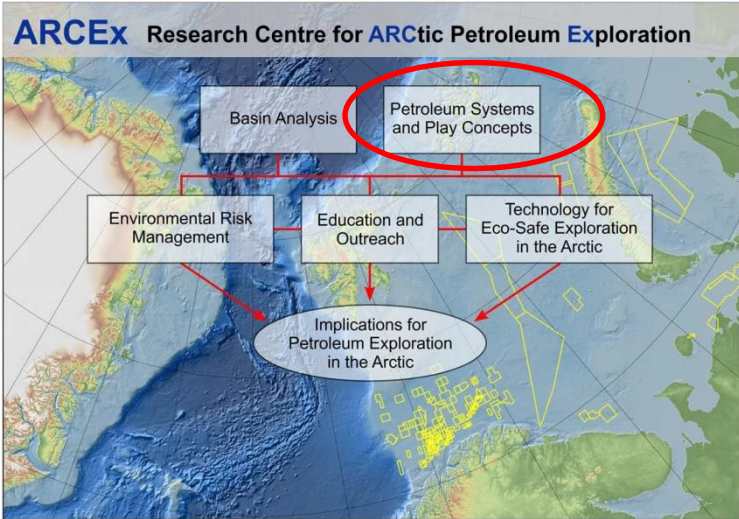
### PhD candidates

Tyler Appleyard, UNIS  
 Malte Jochmann, UNIS  
 Jean-Baptiste Koehl, UiT  
 Jacob Uguna, UiNthm

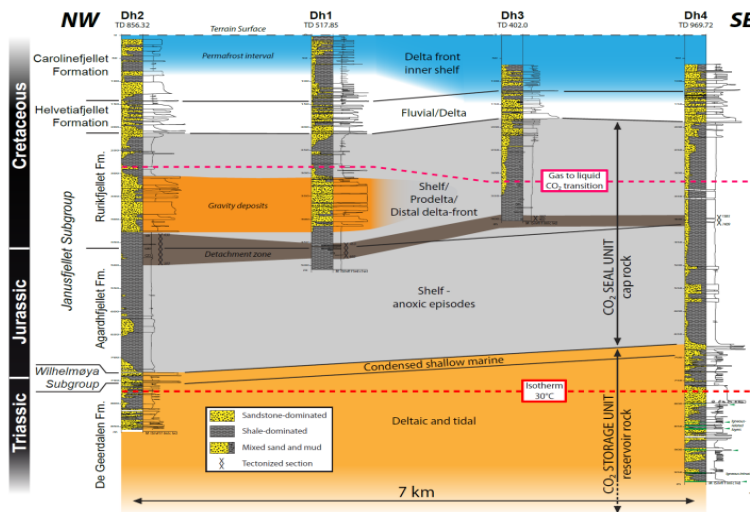
### Master Students

### Tertiary Basin Work:

- Stratigraphy
- Basin geometry
- Correlation
- Coal as palaeoclimate/  
palaeo-environmental  
proxy
- Coal geochemistry



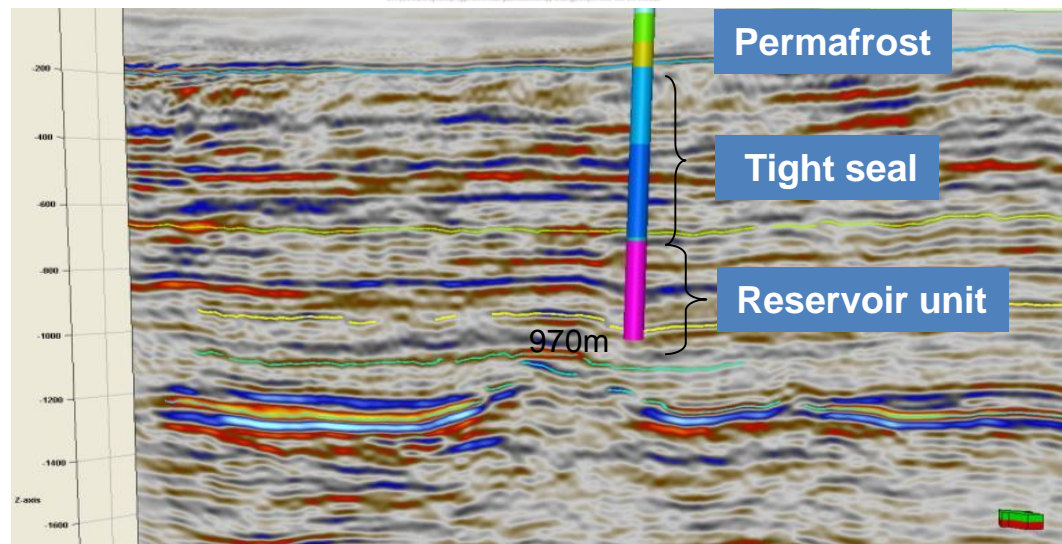
SW Barents Sea



Project leaders  
**Snorre Olaussen, UNIS**  
**Kim Senger, UNIS**  
**Maria Jensen, UNIS**  
 PhD student Berit Husteli  
 In Cooperation with mainland universities and research centers



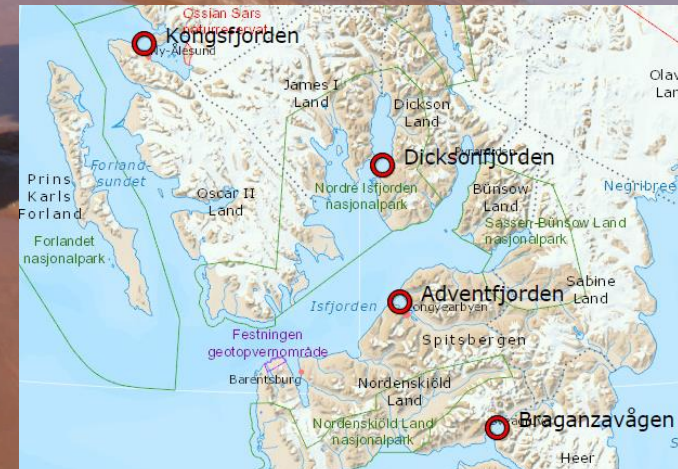
**Future plans:**  
 Secure access to CO<sub>2</sub> for injection  
 Develop UNIS CO<sub>2</sub> lab into an (inter)national test site with focus on monitoring and injectivity in unconventional reservoirs



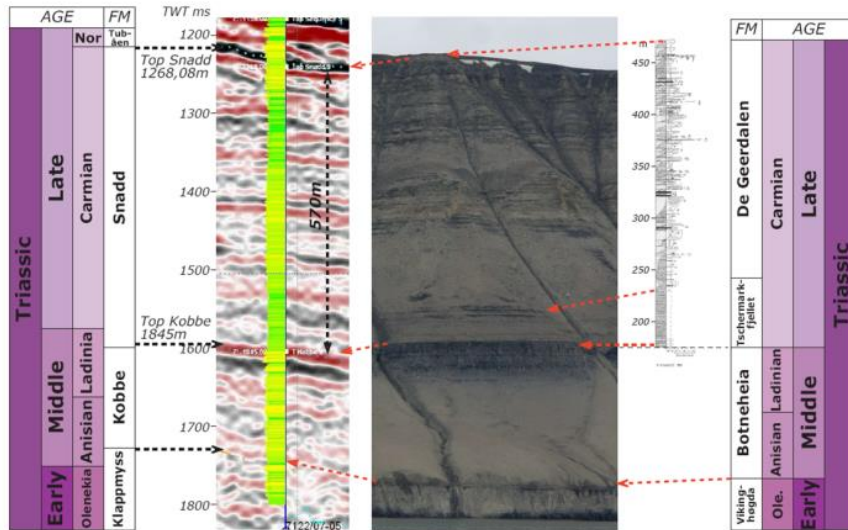
# Arctic Basins 7

## Arctic Coastal Systems

Project leader  
**Maria Jensen, UNIS**



Well 7122/7-5 Blanknuten, Edgeøya

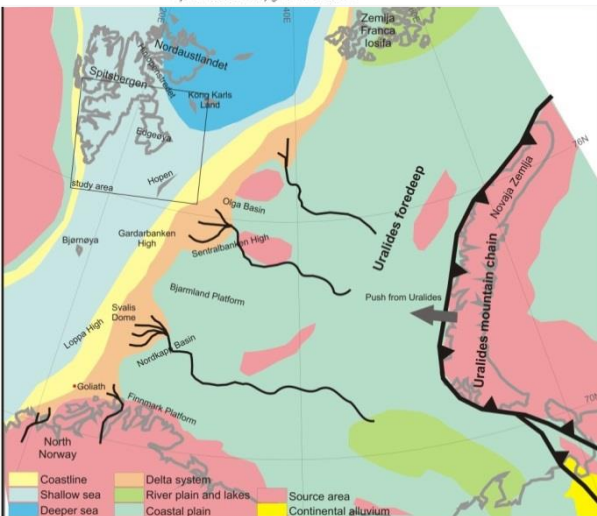


Gamma log with computed lithology, yellow sandstone, green mudstone

Project leader  
**Alvar Braathen, UiO**  
 Maria Jensen, UNIS  
 Snorre Olaussen, UNIS  
 Helge Hellevang, UNIS/UiO  
 Per Terje Osmundsen, NGU/UNIS

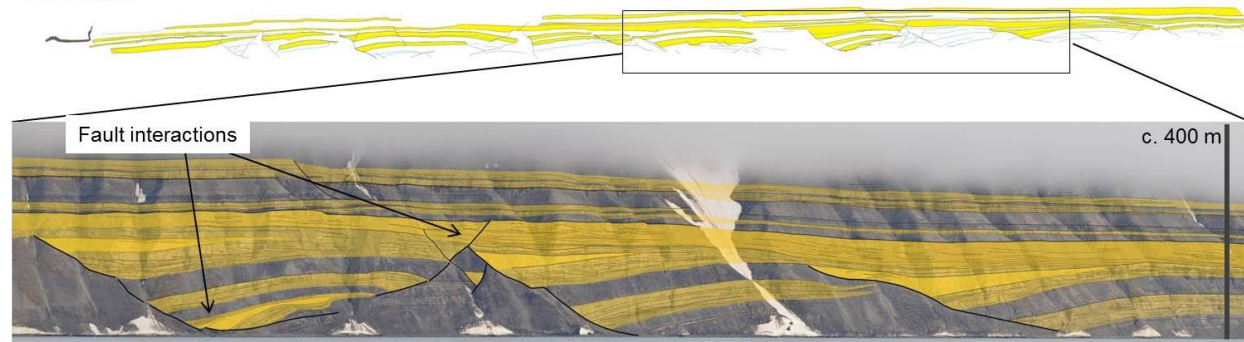
Post Docs  
 Tore Klausen, UiB  
 Christian Eide, UiB  
 Ingrid Anell, UiO

PhD candidates  
 Beyene Haite, UiO  
 Honore Yenwongfai, UiO  
 Mark J. Mulrooney, UNIS  
 Aleksandra Smyrak-Sikora, UNIS



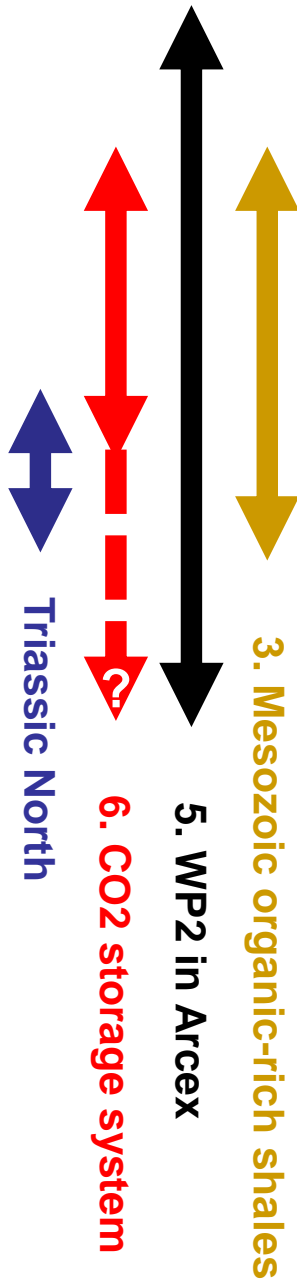
Braathen et al. 2012

Fault blocks



# 7. Arctic Coastal Systems

Summary of projects in space and time



Age	GROUP	LITHOLOGY
TERTIARY	Van Mijenfjorden Group	Coal
CRETACEOUS	Adventdaalen Group	
JURASSIC	Janusfjelle Subgr.	
TRIASSIC	Kapp Toscana Group	
TRIASSIC	Sassendalen Group	
PERMIAN	Tempelfjorden Group	
CARBONIFEROUS	Gibsdalen Group	
CARBONIFEROUS	Billefjorden Group	Coal
DEVONIAN	Andre Land Group	
DEVONIAN	Red Bay Group	
DEVONIAN	Siktefjellet Group	
PRECAMBRIAN-SILURIAN	Hecla-Hoek	

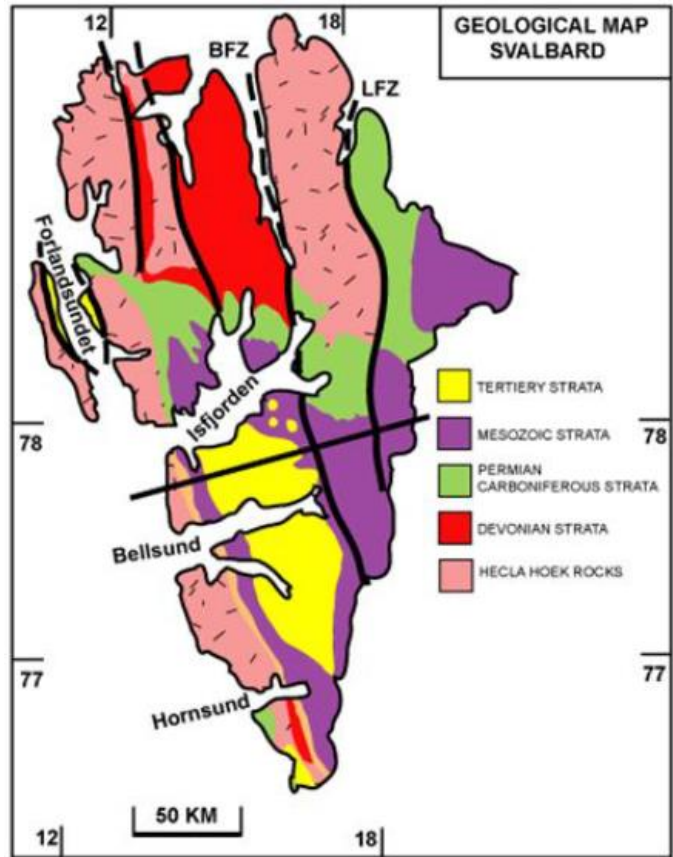
5. Arcex Tertiary

1. LoCrA

2. Onshore-offshore Kapp Toscana Gp

4. Upper Paleozoic carbonates

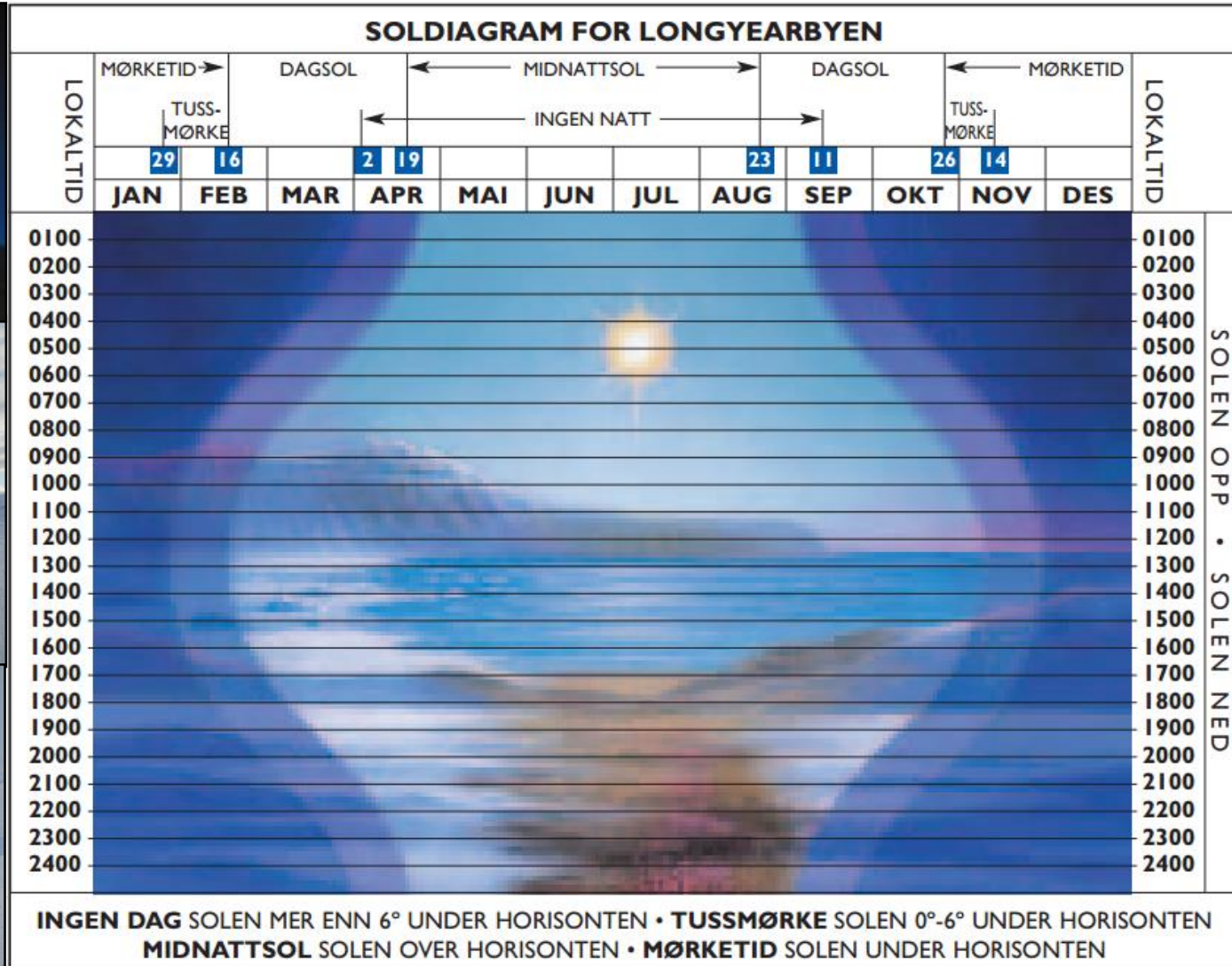
3. Mesozoic organic-rich shales



Source: Arild Andresen (UiO)



# Challenges and opportunities in Arctic research & education



# Svalbard Geocube concept – use of modern tools to extend the field season

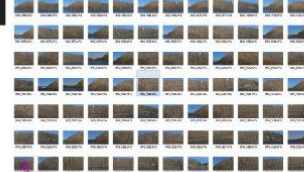


## Photogrammetry Case study: Edgeøya, East Svalbard

1



2

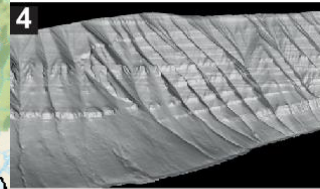


3



Full frame DSLR/GPS/prime lens Agisoft Photoscan - load imagery Point-cloud generation

4



Mesh

5



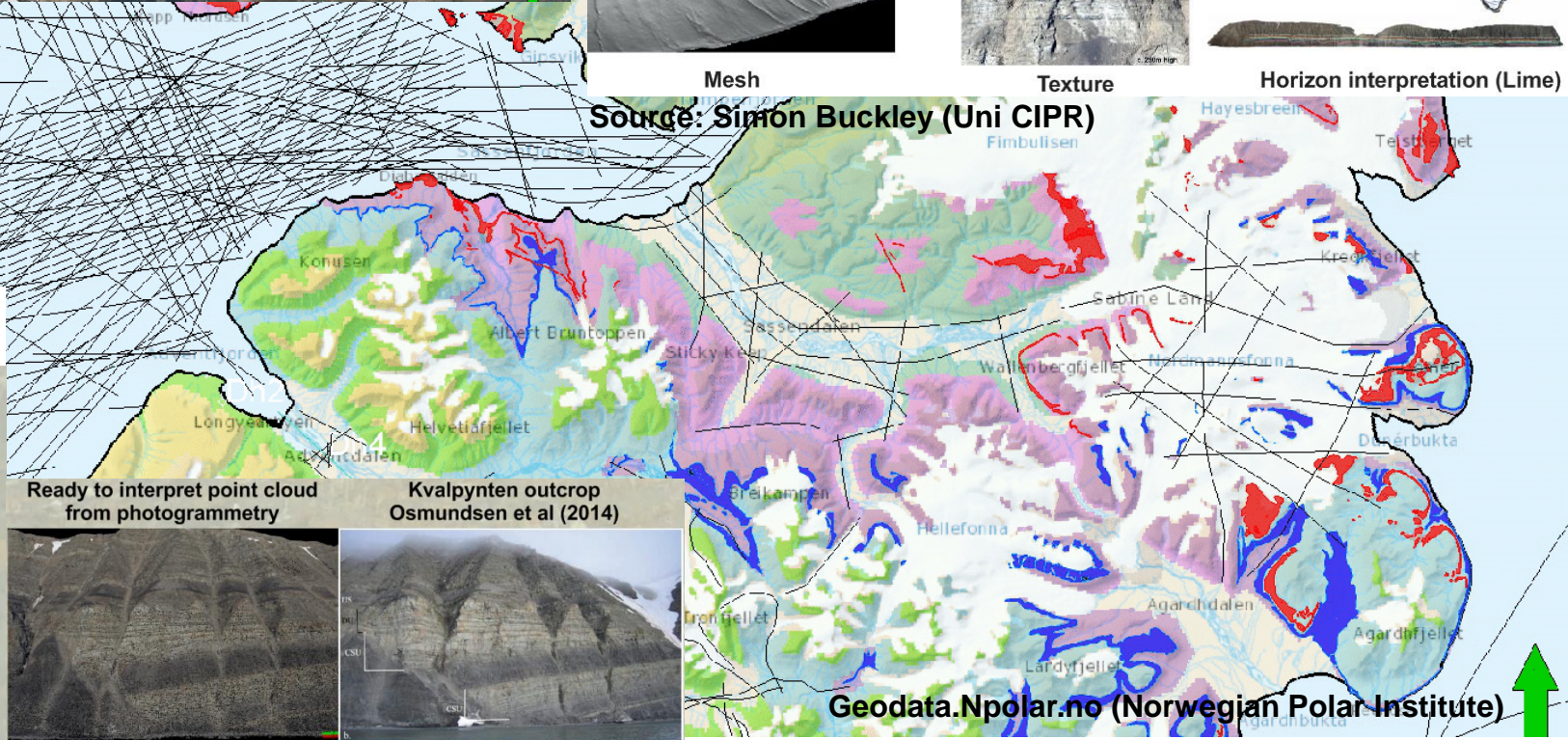
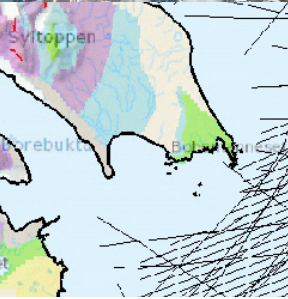
Texture

6



Horizon interpretation (Lime)

Source: Simon Buckley (Uni CIPR)



Thanks to our software providers



Ready to interpret point cloud from photogrammetry

Kvalpynten outcrop Osmundsen et al (2014)

Geodata.Npolar.no (Norwegian Polar Institute)

**Glaciated Arctic Rifted Margins:**

# **Uplift and erosion of the Svalbard Archipelago**

A cooperation project planned between the University Centre in Svalbard (UNIS), the University of Oslo and the Geological Survey of Norway (NGU), seeking industry support.

**A multidisciplinary project aimed to reveal the long-term relationships between tectonic uplift, landscape evolution and erosion/sedimentation.**

- Mapping, characterization and dating of geomorphic surfaces
- Dating of exhumation and faulting events (AFT, Ar-Ar, K-Ar)
  - Offshore structure and sedimentary products
  - Quaternary processes



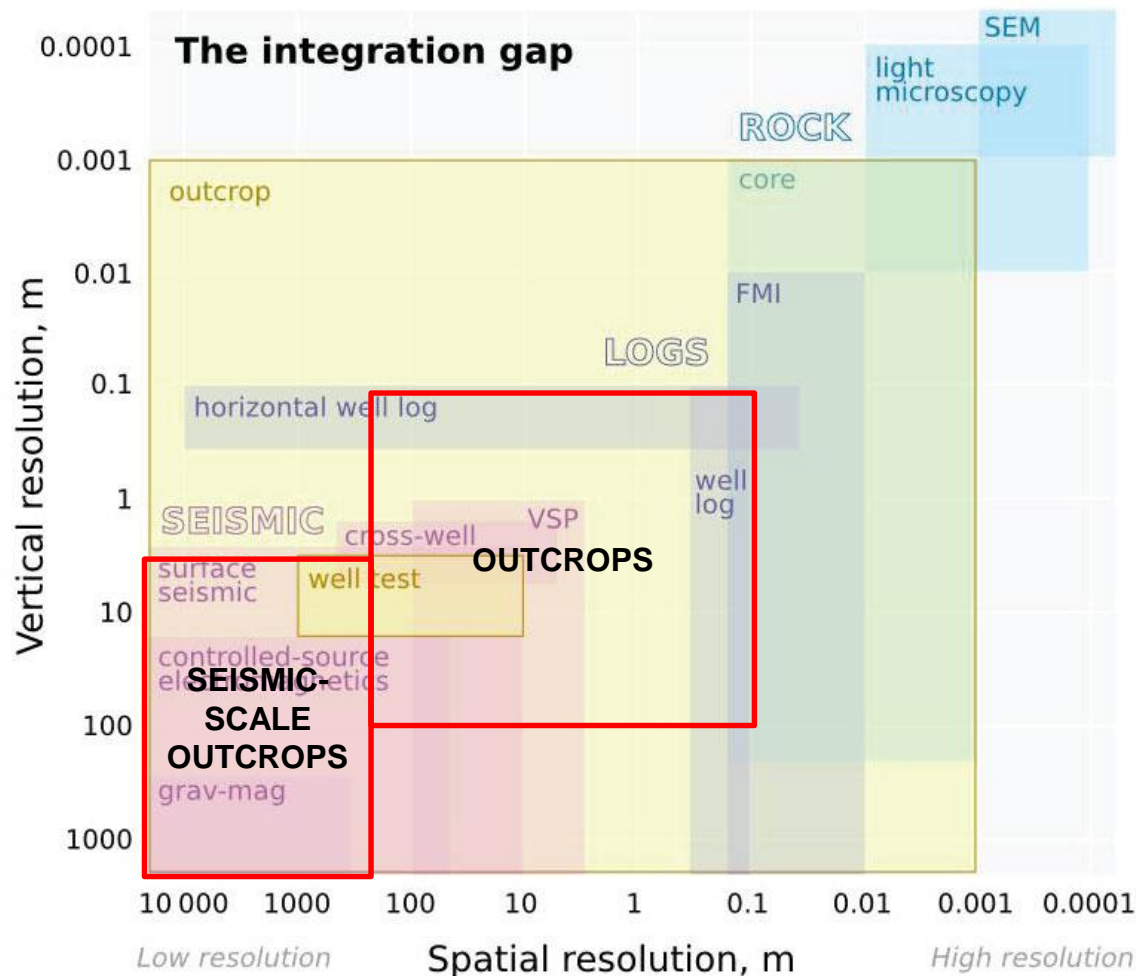
**UNIS**  
The University Centre in Svalbard

**Contact : Per Terje Osmundsen ([per.osmundsen@ngu.no](mailto:per.osmundsen@ngu.no))**

# Strengths of Arctic Geology at UNIS

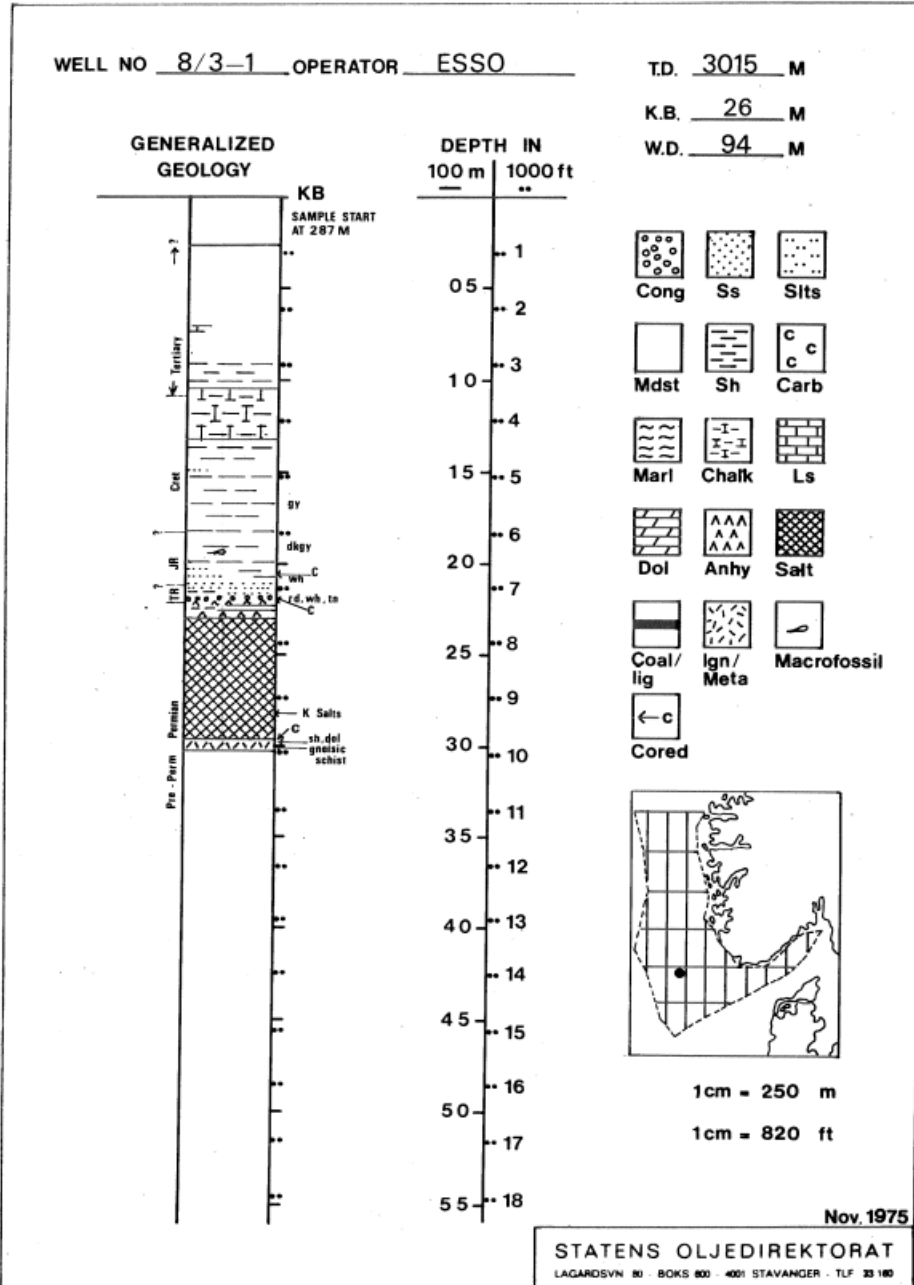


Svalbard's outcrops – the solution to virtually all your exploration needs

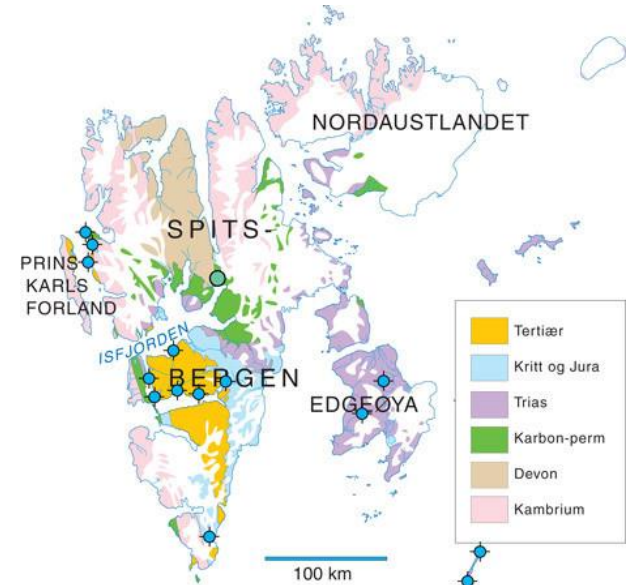


Spud date: 19.07.1966

Spud date: summer 1961



<http://www.geo365.no/oljehistorie/det-norske-oljeeventyret-opptakten/>



# Thank you for your attention!

[www.unis.no](http://www.unis.no)

Research-based education for the next generation of Arctic experts



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*Photo: Anja Fleig*