

# University of Stavanger

## Department of Energy Resources

<http://www.uis.no/faculty-of-science-and-technology/energy-resources/>

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University of  
Stavanger

- Academic Programmes >
- Research >
- Faculty and Staff >

## Department of Energy Resources

The Department of Energy Resources is a strong academic environment with international top-level research and education.

Det artikkel: [f](#) [t](#) [in](#)



*Professor at work in the chalk lab*

The department boasts an international environment, with scientific staff conducting research into energy resources, technology for improved oil recovery (IOR), decision analysis and geology.

The study programmes at the department cover search and exploration of petroleum and natural resources. Internationalization is a priority, with the development of study programs taught in English and high mobility among scientific staff and students.

The department contributes significantly to research activities and management of the National Center for Increased Oil Recovery (IOR), established by the Norwegian Ministry of Petroleum and Energy in 2013.

### Contact Information

#### Working Head of Department:

[Tore Markiset](#)  
Email: [tore.markiset@uis.no](mailto:tore.markiset@uis.no)

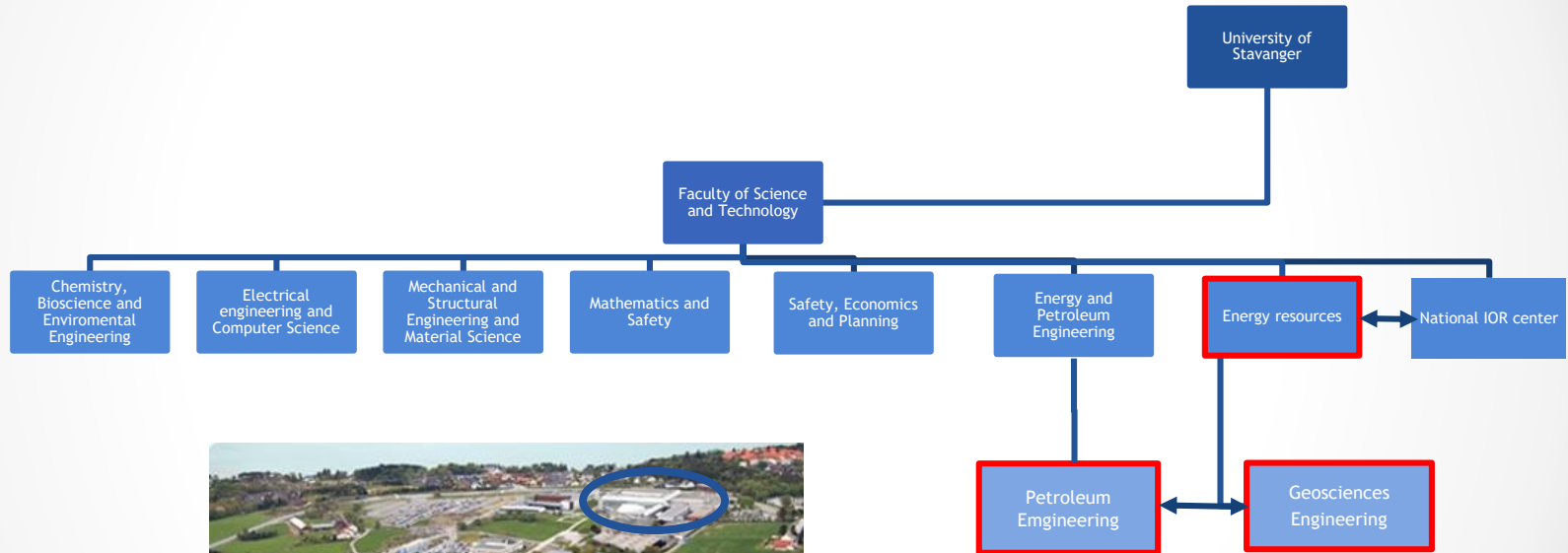
#### Department contact:

[Wiktor Weibull](#)  
Email: [wiktor.w.weibull@uis.no](mailto:wiktor.w.weibull@uis.no)

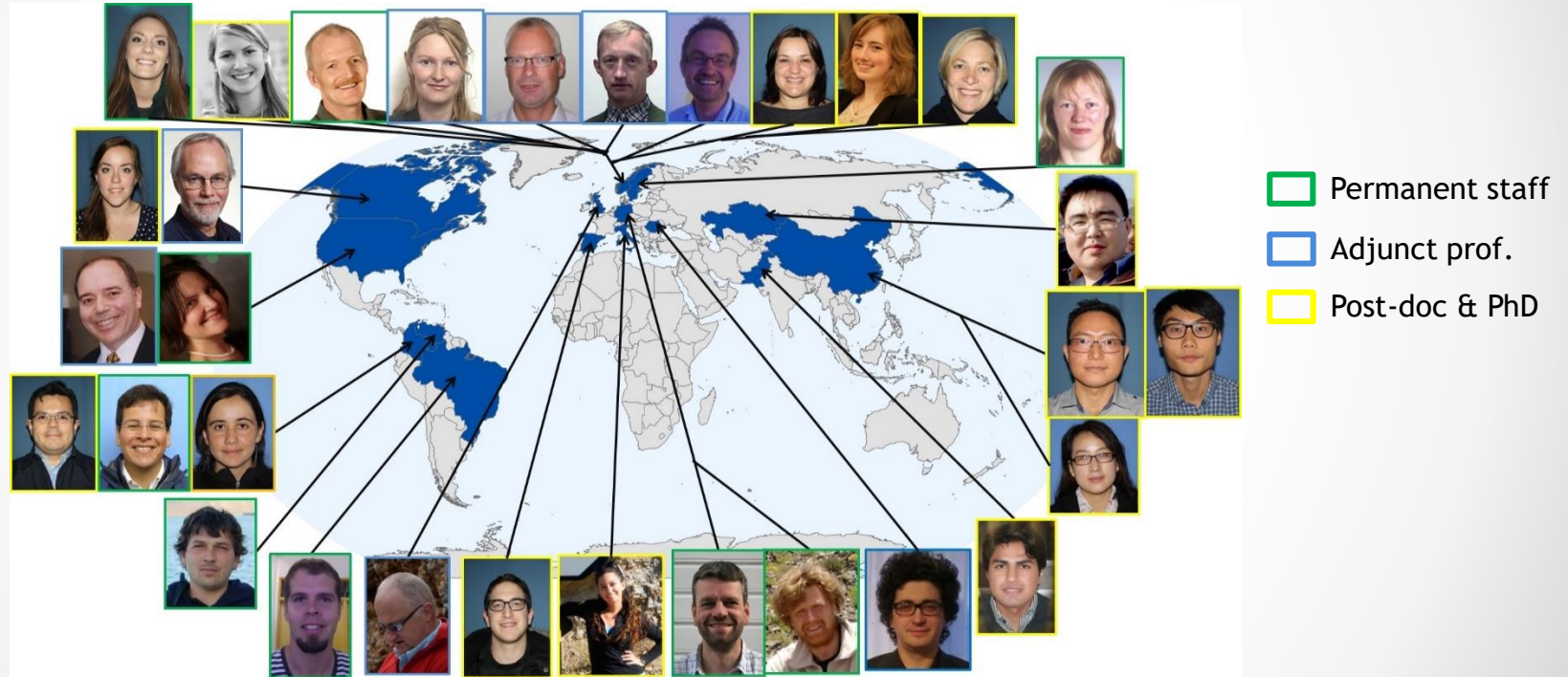
#### Head of Office:

[Kjell Gunnar Pettersen](#)  
Email: [kjell.g.pettersen@uis.no](mailto:kjell.g.pettersen@uis.no)

# Petroleum Geosciences Engineering



# Faculty: An International Community



# Some highlights

- AAPG Imperial Barrel Award competition

Av 21 universiteter i Europa kom petroleumsgelogistudentene fra UiS på andreplass i prestisjefyllt studentkonkurransen om å finne de beste leteområdene.



## Studiebarometeret

The screenshot shows the Tekna Magazine website. The header includes the Tekna logo and navigation links: 'OG MEDLEMMENE', 'ARBEIDSLIV OG SAMFUNN', 'FAG OG UTDANNING', 'SEKK MASTERPROGRAM', 'SEKK LØNNA DI', 'SEKK OJLEDIGHET', and 'TEKNA'. The main content area is titled 'Studentrangering av masterprogram' and features a search bar with the text 'Geofag'. Below the search bar, the text reads 'Mastervinneren i geofag' with social media icons for Facebook, Twitter, and LinkedIn. At the bottom, it says 'Publisert: 21.03.2018 | Tekst: Øystein Krogsrud | Grafikk: Kartag.no'. A short paragraph below states: 'Her er vinneren av studentenes kåring av beste masterprogram for geofag: Petroleum Geosciences Engineering, Universitetet i Stavanger (UiS), 2-årig masterprogram.'



# Laboratories and equipment

- > 80 workstations with access to software and data (e.g. Petrobank)
- LiDAR and drones
- Microscopes
- Thin section, mineral separation, etc.
- X-ray diffraction
- Seismic equipment
- GPR



# Research areas

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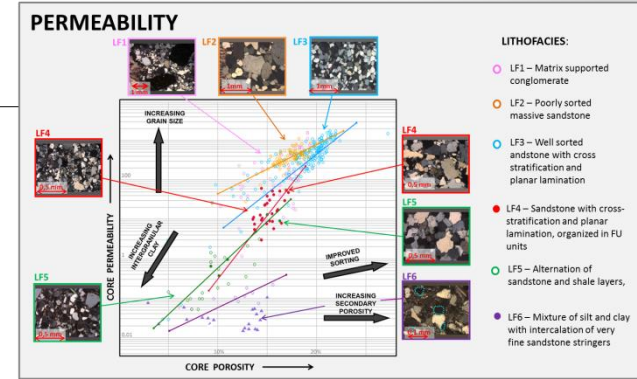
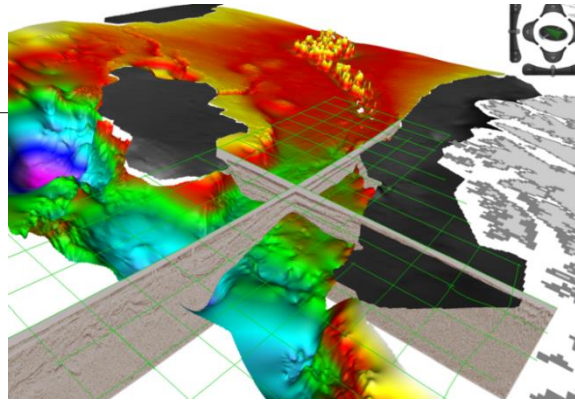
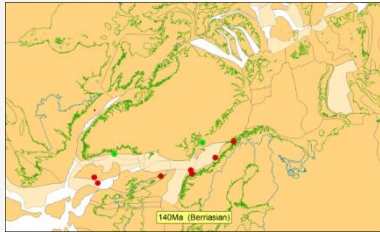
- Regional studies
  - Rift basins
  - Geomodelling
  - Provenance and reservoir quality
  - Geophysics
- 
- Many of the projects are built as industry consortia



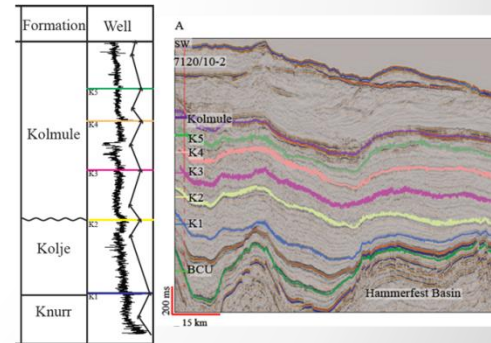
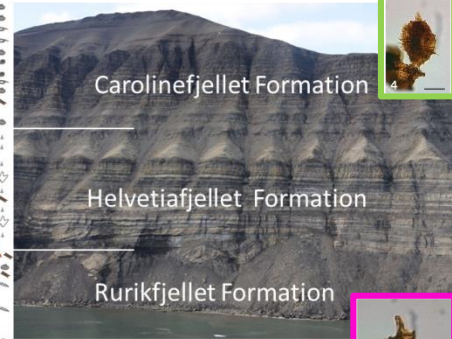
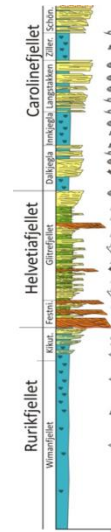


# An example

## LoCrA (Finished)



Main project goal: to investigate the basin configuration and fill of the Lower Cretaceous basins in the high Arctic as input to predict coarse-grained siliciclastic wedges as plays on the Norwegian Continental Shelf.



# Jurassic-Lower Cretaceous basinal studies of the Arctic region

## - JuLoCrA: A cont. of LoCrA. Olausen and Escalona

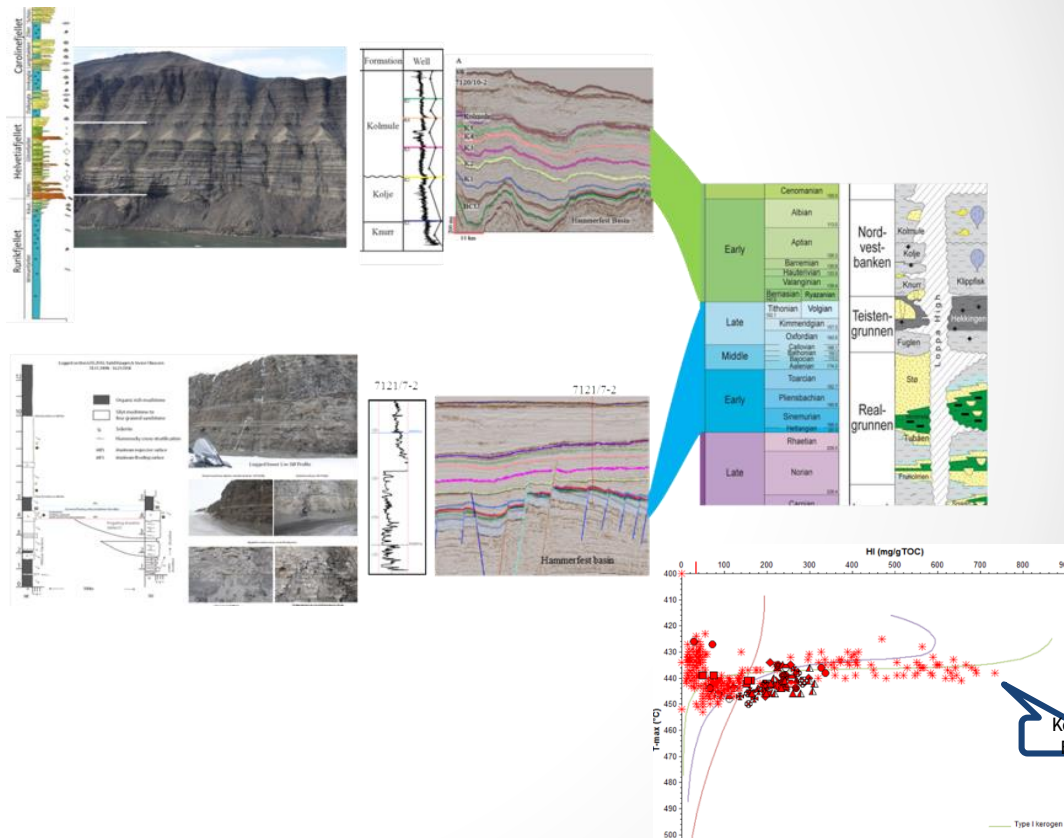
The project continues research in the Lower Cretaceous and expands into the Upper Jurassic with the aim to provide a better understanding of the paleogeography and a fully-integrated surface and subsurface synthesis of on- and off- shore areas.

Three main areas of focus:

- Sequence stratigraphic framework: on- and off-shore correlation
- Paleogeography
- Source rock, geochemistry

Two-year project, total of 700 KNOK per company

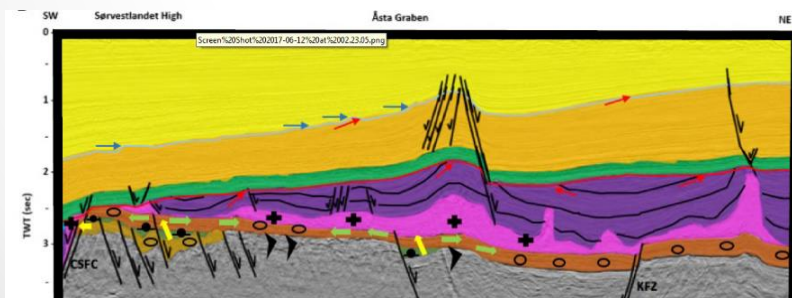
In collaboration with MSU, UiO  
Currently 5 sponsors



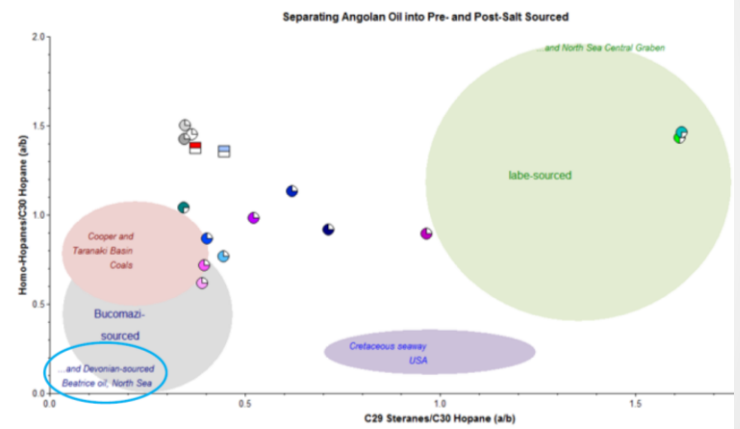


# Hydrocarbon Potential of Paleozoic basins in the Central Graben, Norwegian sector; Frontier exploration in a mature basin (PaBas). Escalona and Ohm

Project goal: Improve understanding of the Pz petroleum system in the southern North Sea.  
4-years project including at least one PhD student. Focus: tectono-stratigraphic evolution of the Paleozoic sub-basins based on seismic data and evaluation of the potential of possible Paleozoic source rocks by detailed geochemical analysis.

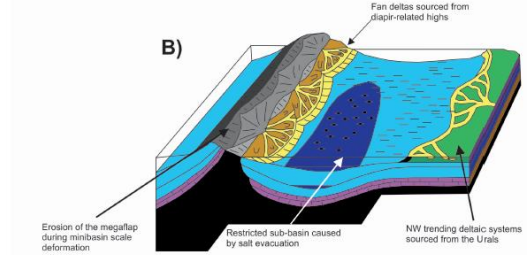
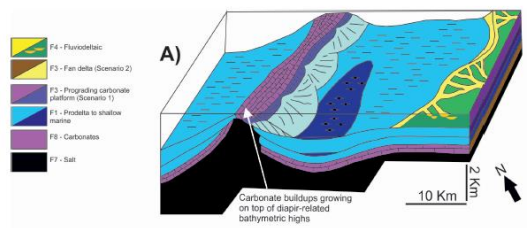
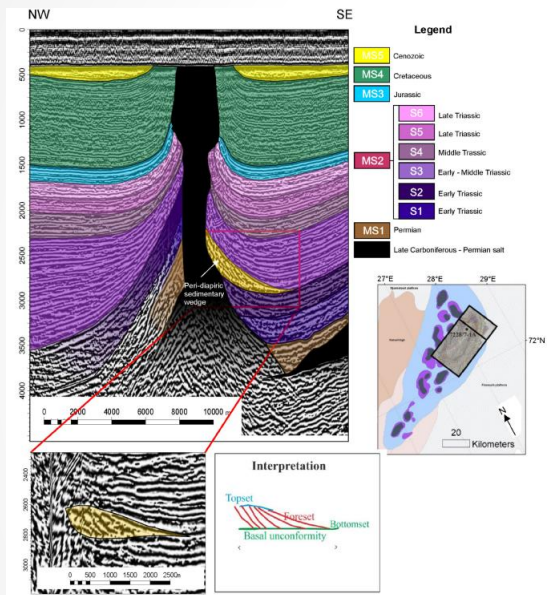


Several of the oils are pulled in the direction of the partly Devonian sourced Beatrice oil



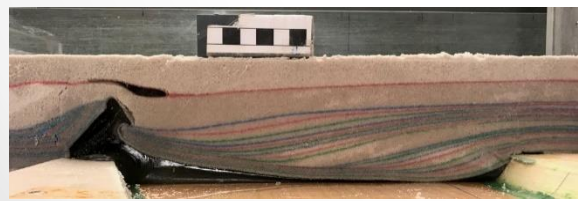
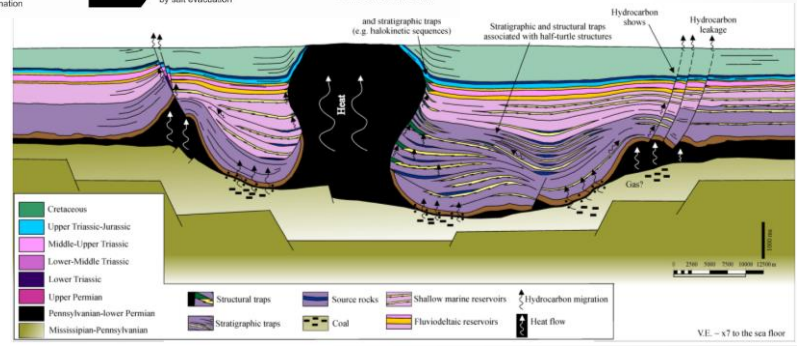
The estimated project cost is 6 MNOK for the four-year project (2MNOK per company). Deliverables include all results from the project (e.g. analytical results, presentations, publications) and an integrated database

# Impact of salt tectonics on sedimentation and petroleum systems, e.g. Triassic Nordkapp Basin. Rojo, Cardozo, Escalona, Koyi



**Main project goal:** to understand the impact of salt tectonics on basin fill by coupling geologic interpretation, structural, surface-process, and thermal modelling.

Possibilities for industry funded projects on salt tectonics and impact on petroleum systems



Analogue experiment (Uppsala)

# The Low Frequency Project

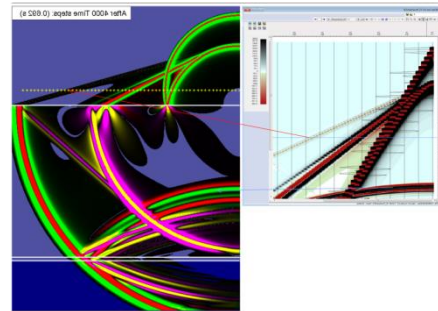
## Weibull, Brown and Escalona

UiS, UH, U. d'Avignon, LMA

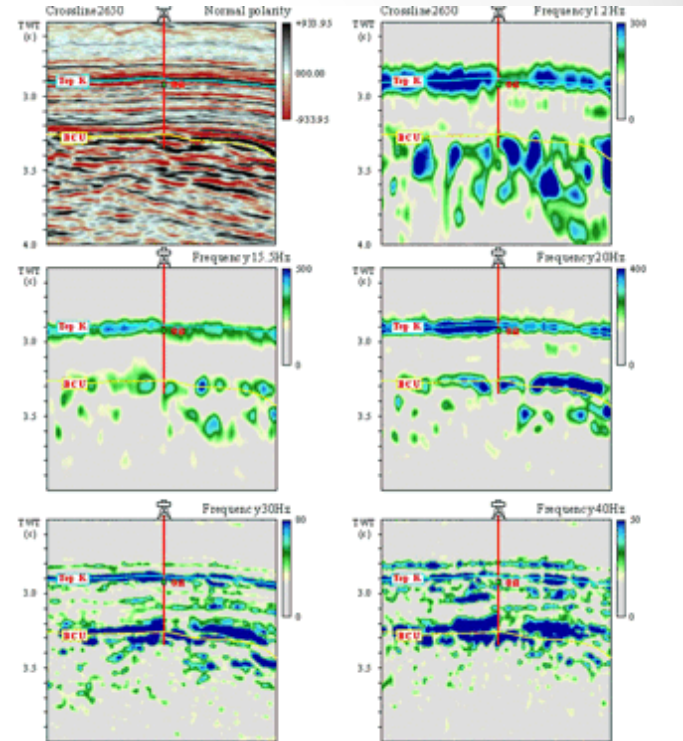


Project goal: to improve knowledge from the mathematical, physical, numerical, and applied points of view on how the low frequency content of industry 3D seismic reflection data can be used as a hydrocarbon indicator for exploration and production

<http://lowfreq.uh.uis.no/>



Currently 3 sponsors



# Full waveform inversion

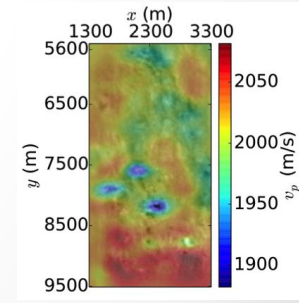
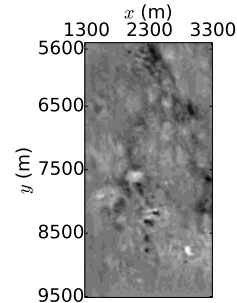
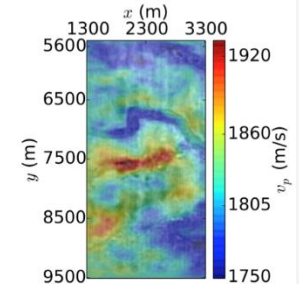
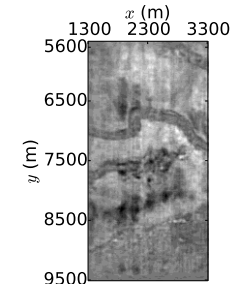
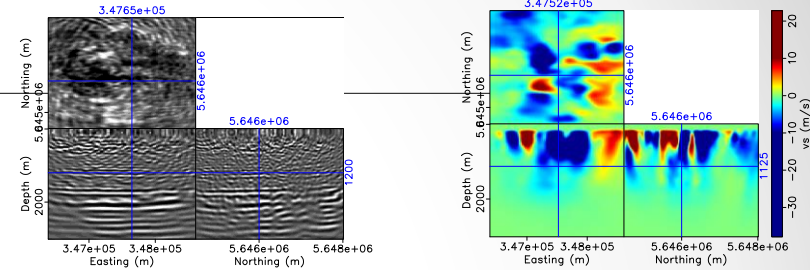
Wiktor Weibull and Karen Ohm

## Research areas

- Inversion of 3C geophone data from land and ocean bottom acquisition
- Multi-parameter inversion for simultaneous inversion of P- and S- wave velocity
- Image domain (reflection) waveform inversion using PP and PS seismic images
- 4D seismic full waveform inversion
- Uncertainty quantification in full waveform inversion

## Potential applications

- Improved seismic imaging
- Reservoir and overburden characterization
- Improved recovery (4D)

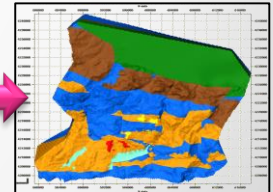
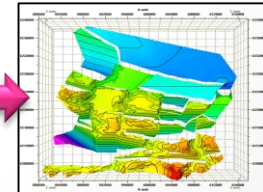
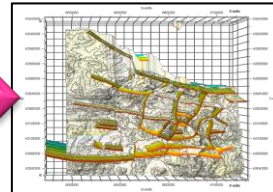
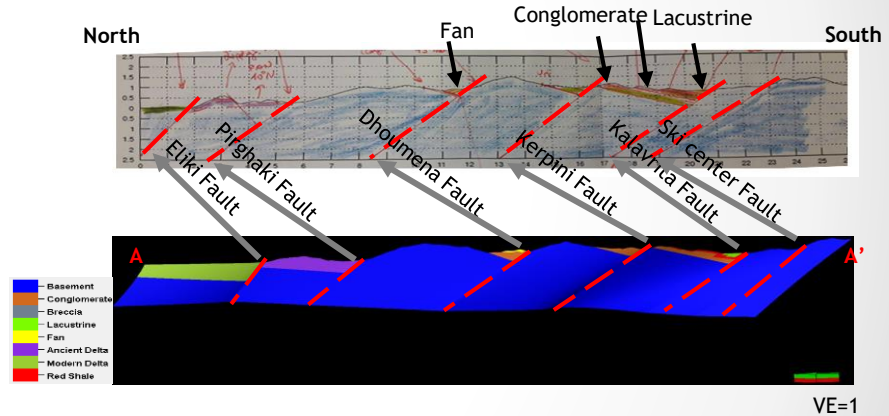


# Rift Basins research

Townsend, Escalona, Cardozo

- Possibilities for field training: Gulf of Corinth (8 days). Focus on rift evolution, tectonics and sedimentation
- Geomodelling (optional)

Applied to explorationists and reservoir modellers. Up to 5 industry guests per year together with students. Funds are used to support student research in rift systems, field work, conferences, etc.

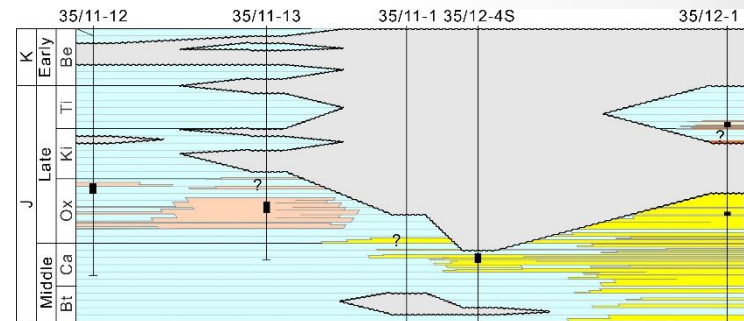
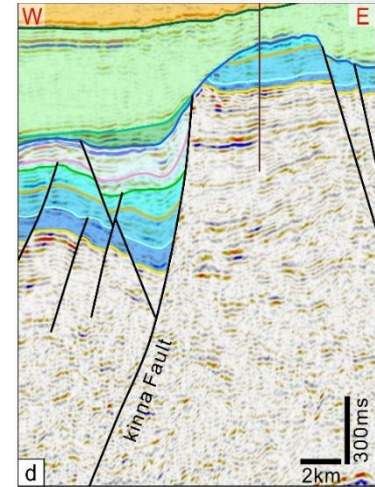
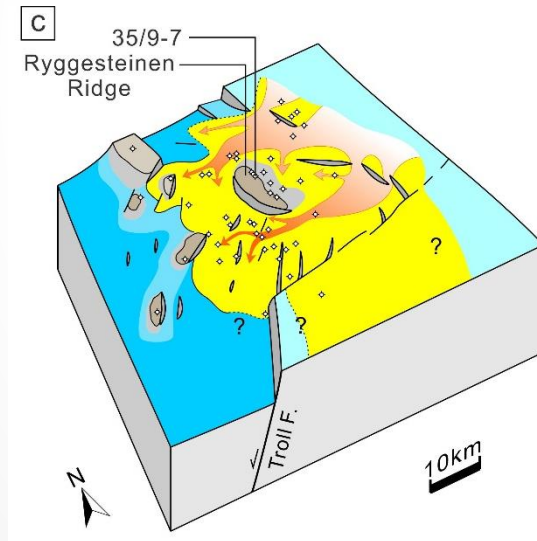


# Rift Basins research

Zhong and Escalona

- Interaction between tectonics and sedimentation.  
Upper Jurassic mass flow deposits, NCS.

Sponsored by BayernGas, now Spirit energy



# Provenance research

eTRAQ - Early Triassic reservoir and aquifer units (NFR application in progress)

## Aim:

Reconstruct the sediment-transportation paths for the Early Triassic in north & central European Pangaea (Barents Sea to Germany)

## Sub-questions:

Which role did *source areas* play for the composition of the Early Triassic sandstone?

To what extent did intra-continental troughs prevent material from the Central European Basin to reach the Boreal Ocean due to tectonic *extension*?

When did crustal addition, & when crustal recycling, dominate the *crustal evolution* of E Laurentia, W Baltica & N Gondwana?

## Methodology (UiS part of the project):

Sandstone petrology

Whole-rock geochemistry

Spectral cathodoluminescence (CL) analysis

Heavy-mineral analysis incl. geochemical analysis

Preparation for zircon analysis

## First results:

Transport model for the Central European Basin in central Germany (Buntsandstein Group)

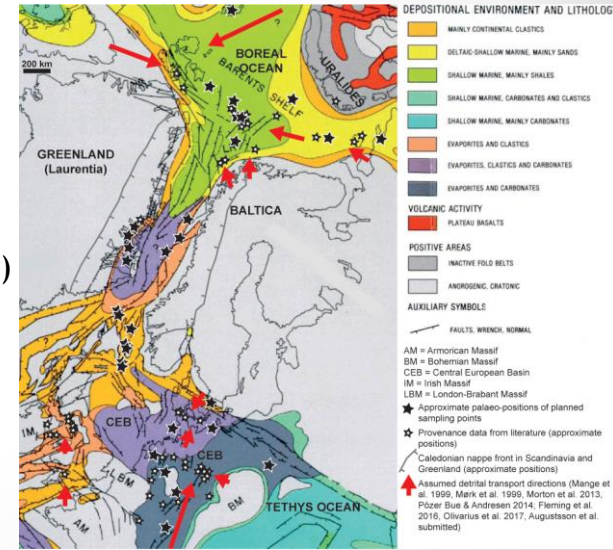
- Zircon morphology + U-Pb ages (Augustsson et al., in press, SedGeol)
- CL of quartz (in preparation)

**Principal investigator:** Carita Augustsson, UiS



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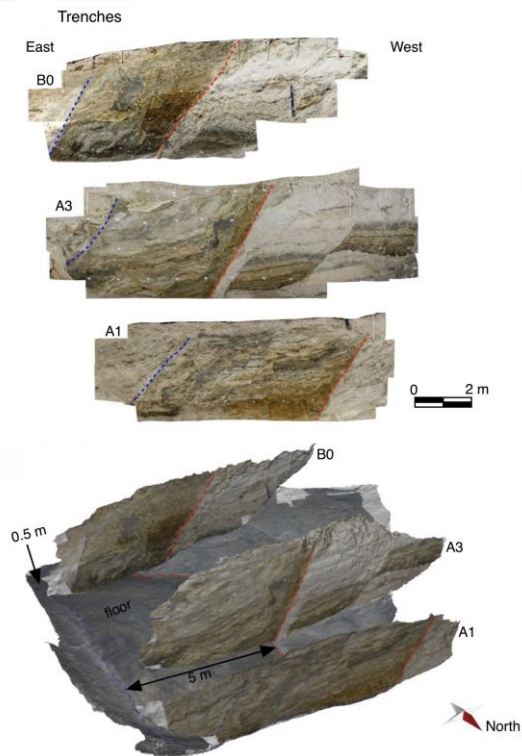
Working area (star = sampling points)



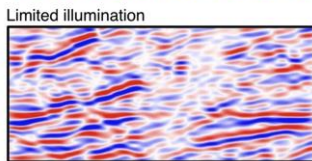
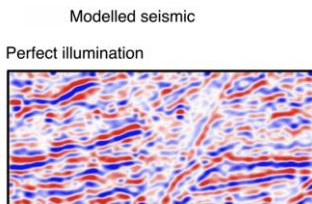
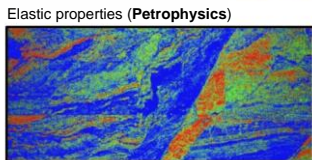
# Seismic fault facies models: Petromaks II KPN, PI: Cardozo

Fieldwork geology and geophysics, petrophysics, seismic modelling/ imaging, and seismic interpretation with the aim of constructing *seismic fault facies* models

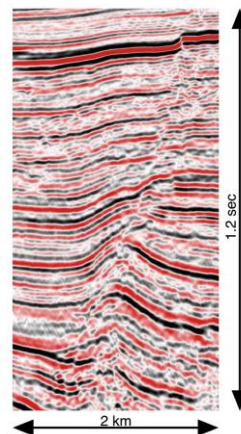
## Geology + Geophysics (GPR and seismic)



## Seismic modelling/imaging



## Seismic data



**Deliverable:** A methodology for constructing seismic fault facies models and assessing their predictability.

**Participants:** UiS: Cardozo and Weibull, U. Tel Aviv: Landa, UiB: Lecomte and Buckley, U. Aberdeen: Iacopini, Howell and Healy, U. Alicante: Rojas and Alfaro, U. Basilicata: Agosta, U. Strasbourg: Bano. Five PhDs: Two in Norway (UiS and UiB), one in Aberdeen, one in Alicante, and one in Basilicata.

**Duration:** 3 years

**Cost:** 10.5 MNOK. We are looking for industry funding > 20% total cost.

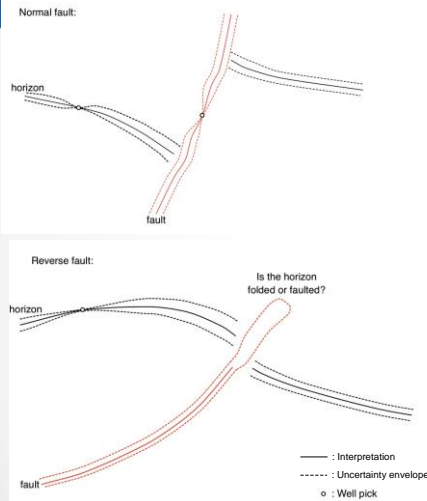
*Seismic fault facies: 3D bodies with characteristic seismic signature within a fault zone*





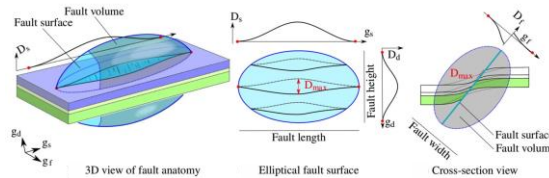
# Quantifying uncertainty through structural modelling: Petromaks II KPN, PI: Cardozo

## The problem



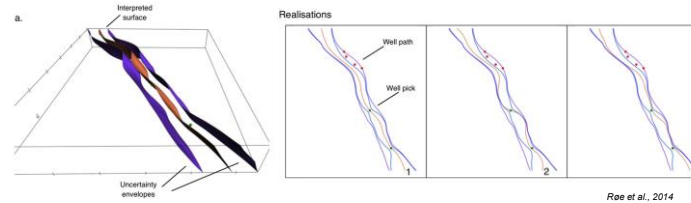
## Proposed methodology

### 1. Kinematic modelling: Fault displacement operators: HAVANA



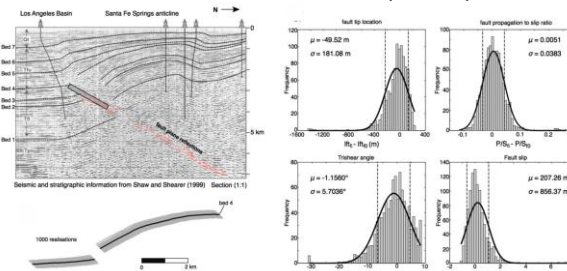
Georgesen et al., 2012!  
Godefroy et al., 2018

### 2. Uncertainty modelling of horizons and faults (COHIBA and HAVANA)



Roe et al., 2014

### 3. Structural inversions to deliver a realistic ensemble (HAVANA)



Cardozo and Aanonsen, 2009!  
Oakley and Fisher, 2015

**Deliverable:** A workflow in HAVANA to produce realistic ensembles that acknowledge geologic uncertainty, and can be used for stochastic modelling of sub-seismic faults and related features, automated history matching, or field optimisation.

**Participants:** UiS: Cardozo, ENSG: Caumon, NR: Røe, Badleys: Yielding. One postdoc at UiS and one PhD at ENSG.

**Duration:** 3 years

**Cost:** 8.5 MNOK. We are looking for industry funding > 20% total cost.





Projects for thesis (win-win situation, no cost, very beneficial for the students)

Project ideas from companies to start projects (brain storming; projects do not have to come from us)

Petromaks II opportunities (industry funds ~20%)

Others

