UNIVERSITETET I BERGEN

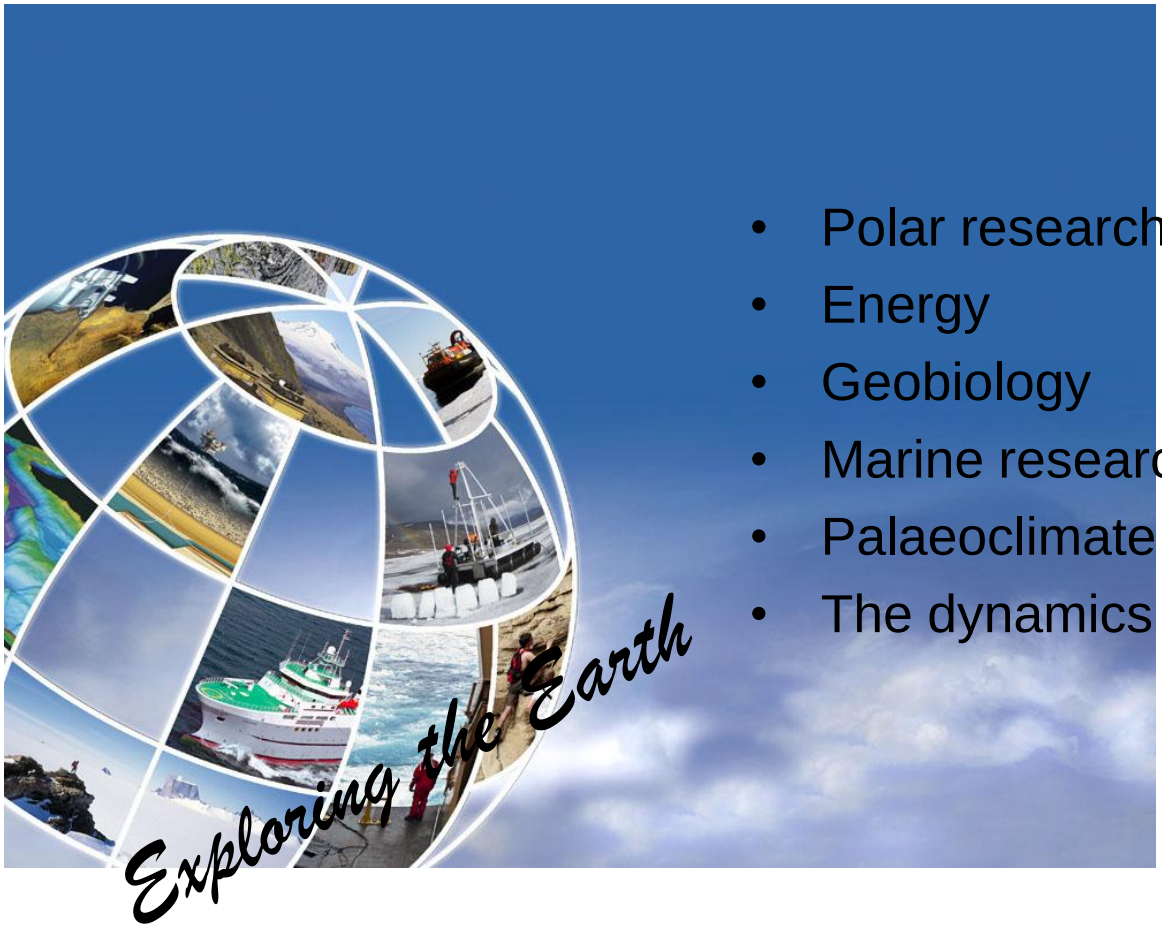
Institutt for geovitenskap
Det matematisk-naturvitenskapelige fakultet

Department of Earth Science
University of Bergen

Gunn Mangerud, Rolf Mjelde, William Helland-Hansen

Where do you find us?

- GEO has identified six key areas embracing the main research activities at the department



- Polar research
- Energy
- Geobiology
- Marine research
- Palaeoclimate research
- The dynamics of earth systems

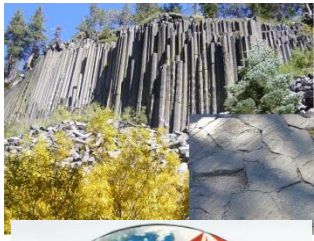
Research Groups

- Geodynamics
- Quaternary geology and paleoclimate
- Marine geoscience
- Petroleum earth science
- Geomicrobiology

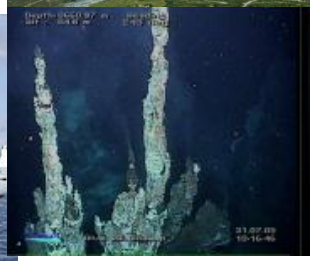
We are partners in:

- Centre for Geobiology
- Bjerknes Centre for Climate Research

- Centre on environment-friendly energy
  - SUCCESS - Subsurface CO2 storage

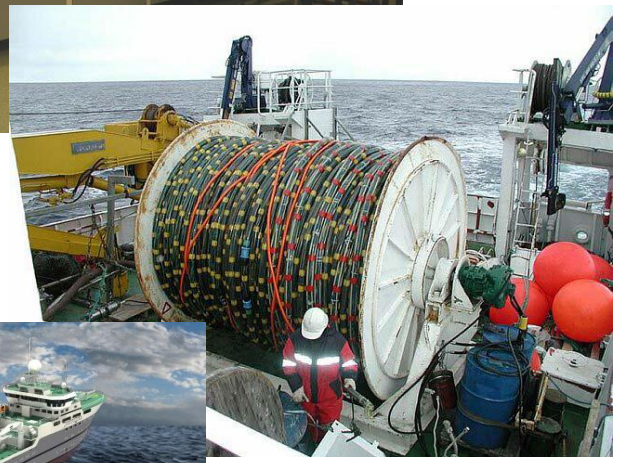


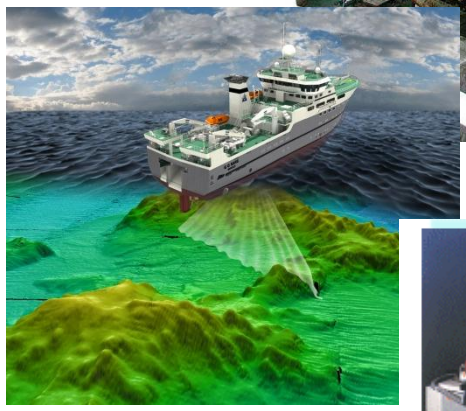




Facilities

- State-of-art analytical laboratories
  - Several mass spectrometres
- Computer system (PC, Linux)
- State-of-art industrial software
- Norwegian National Seismic Network
- Marine geophysical and geological equipment
- Research vessels
- Toolshop
- Laboratory for Electron Microscopy
  - The Faculty of Mathematics and Natural Sciences





Facilities and specs

10 high-end work stations for PhDs & PostDocs

10 additional to be added for MSc students mid-2013

Data security

- Lab access restricted
- Secure data storage
- Confidentiality ensured

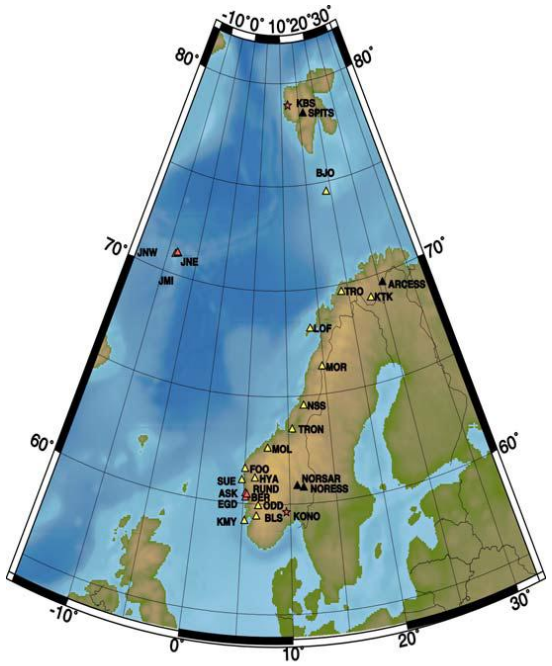
Software

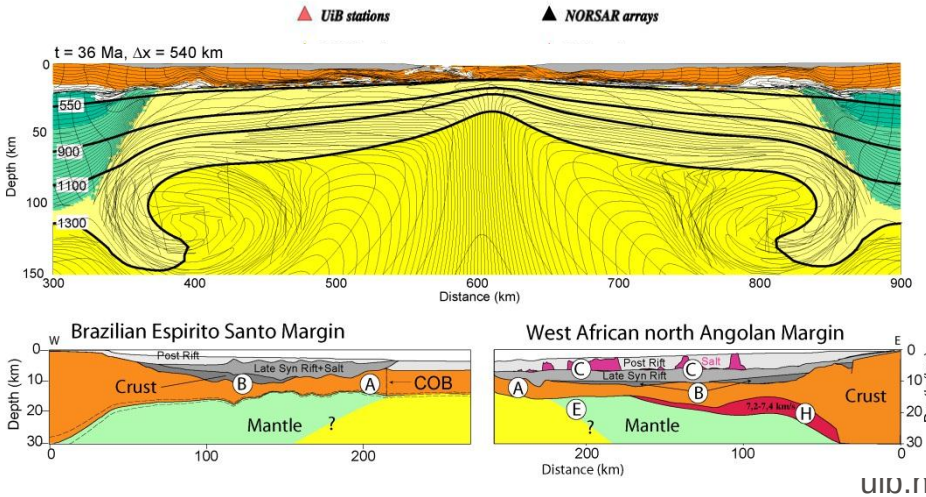
- Schluberger Petrel
- Kingdom Suite
- Badley's Trap Tester
- GeoTerric (SVI Pro)
- MOVE
- RMS, ProMax etc


DELL
DELL
DELL

Geodynamics group

- Main research activities
  - Seismotectonics and seismic risk assessment
  - The Norwegian national seismic network
  - Passive margin research
  - Numerical modelling of Lithosphere-Mantle interactions
  - Orogenic belts and exhumation histories
  - Geochemistry of large igneous intrusions
  - Reconstructions of past supercontinents





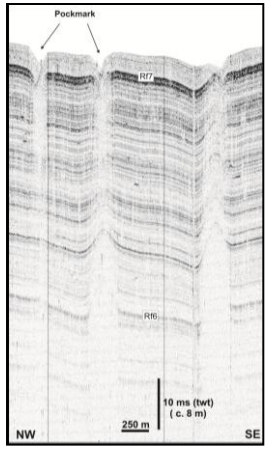
Quaternary geology and paleoclimate Group

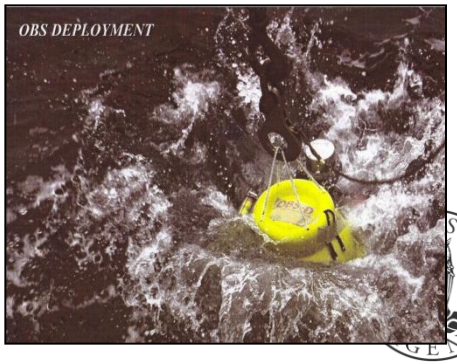
- Main research activities
  - Growth and decay of glaciers and ice sheets
  - Sea-level fluctuations
    - raised shorelines, crustal movements, global changes
  - Reconstructions of past climate and environmental changes
  - Karst evolution; speleothem stratigraphy, fauna, archaeology, hydrology
  - Magnetochronology and environmental magnetism
  - Human traces in the geological record
  - Landform development
  - Geohazards
    - tsunamis, extreme floods, land slides, snow avalanches
  - Chronology
    - dating by the use of U-series, volcanic ash, exposure dating, (palaeomagnetism)

Marine Geology and Geophysics Group

- Main research activities
  - Depositional environments, sedimentary processes and sediment archives
    - *Arctic, Antarctic, N-S Margin, Norwegian fjords*
  - Gas hydrates and fluid escape structures
    - Identification, characterisation, timing and geological setting
  - Reconstuction of Plio-Pleistocene ice margins and deglaciation history
  - Quaternary paleoclimatic reconstruction
    - Northern and Southern Hemisphere
  - 3D modelling of crustal architecture, extent of continental crust and crustal evolution

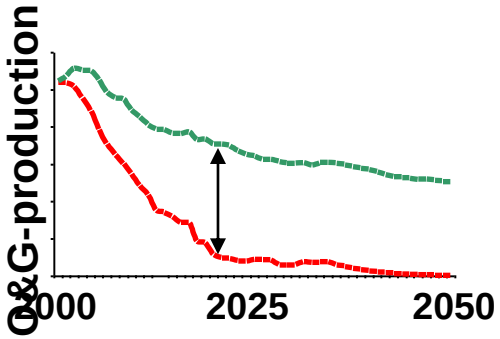
- Complimentary collaboration with Bjerknes Centre for Climate Research





Petroleum Earth Science

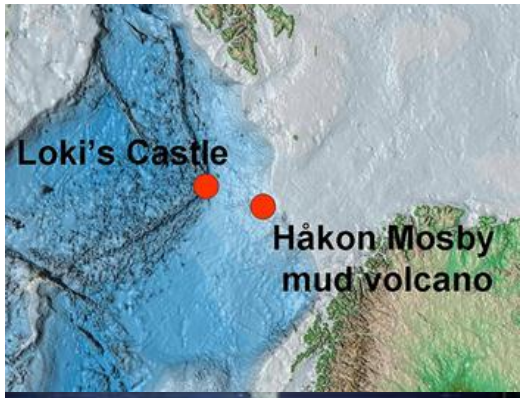
- Main research activities
  - Geological and geophysical reservoir characterization
  - Outcrop-analogue studies of offshore reservoir successions
  - Rock physics
  - Studies of Modern and Ancient Source-to-sink systems
  - Improved seismic imaging
  - Seismic signatures
    - Quantification of geological processes
  - Monitoring of CO2 storage
    - Seismics and CO2 sequestration

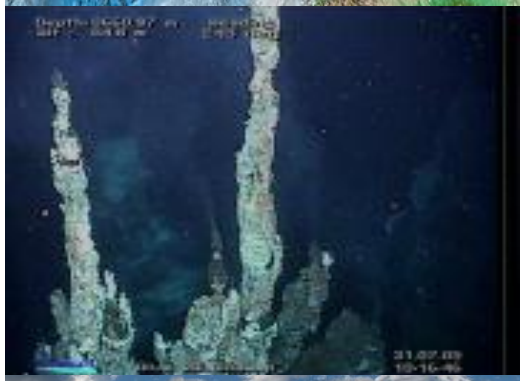


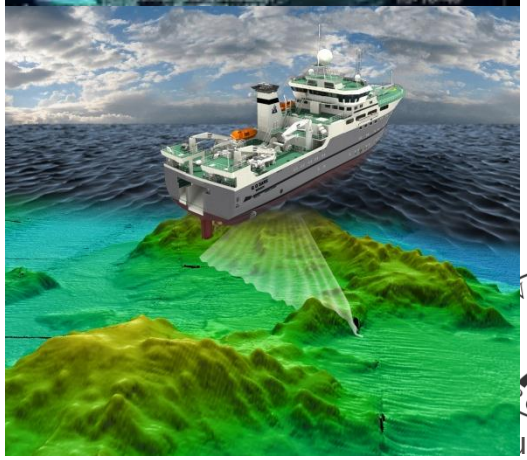
Geobiology - jointly with Dept. of Biology

- Main research activities
  - Geodynamics of the Deep Seafloor
  - Water-Rock-Microbe Interactions
  - The Deep Biosphere
  - Vent and Seep Biota
  - The Roots of Life
  - Early Earth and Biosignatures

- Part of Centre of Excellence in Geobiology







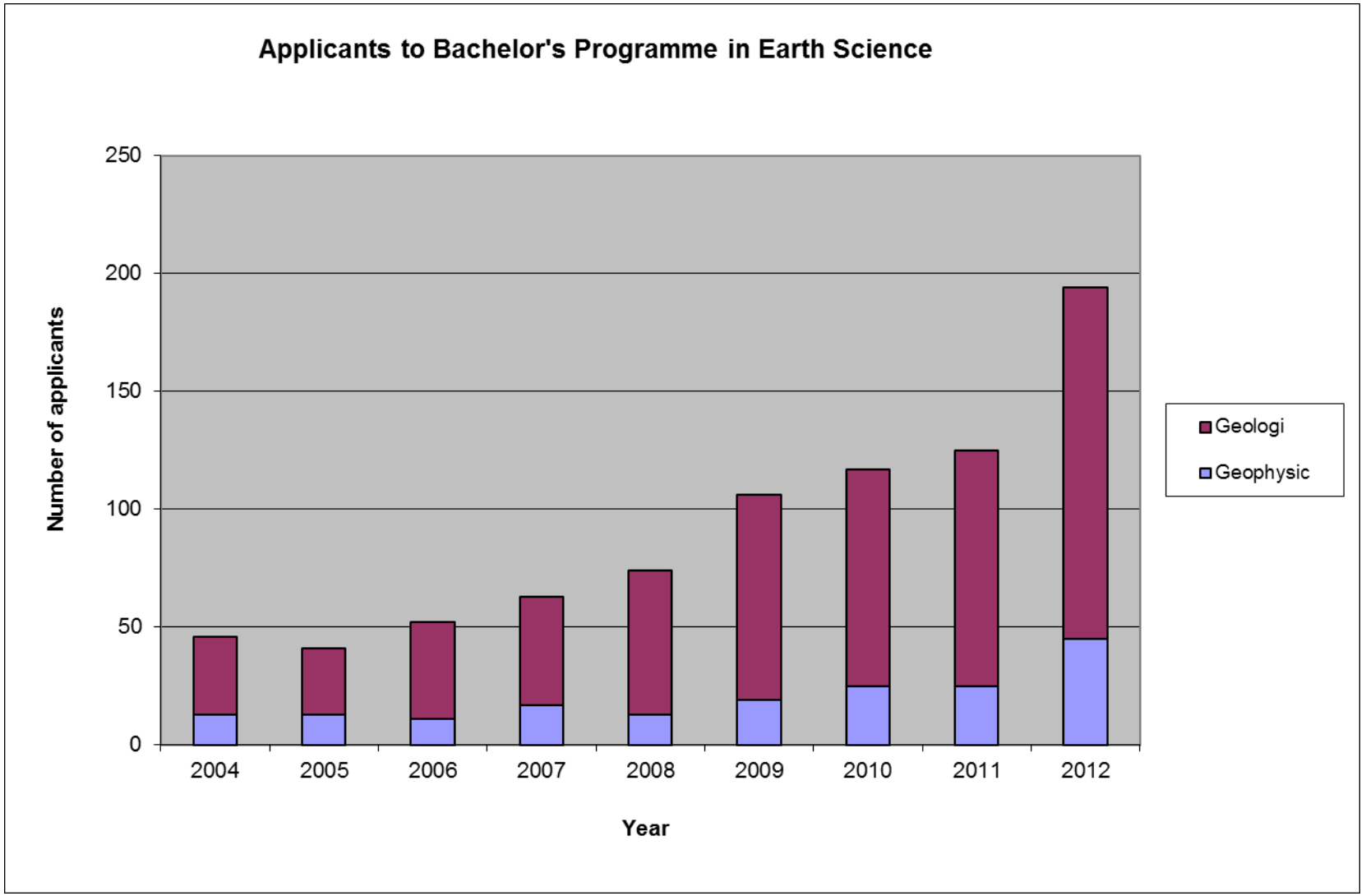
460 students currently follow a degree programme at the department:

- 3 Year Bachelor programmes in geoscience (~290 students)
  - Geoscience

- 2 Year Master programmes (110 students)
  - Marine Geology and geophysics
  - Petroleum geoscience
  - Geodynamics
  - Quaternary geology and paleoclimate
  - Geobiology

- 3 Year Phd programme: (60)
  - Individual projects; closely related to affiliated research centres and research groups

Applicants to our Bachelors's Programme



Student production

Chalk Field Trip: San Salvador (Bahamas)

Study:

Spatial distribution of carbonate facies on a modern carbonate platform

Quaternary sealevel changes and their impact on the distribution of carbonate facies on the island

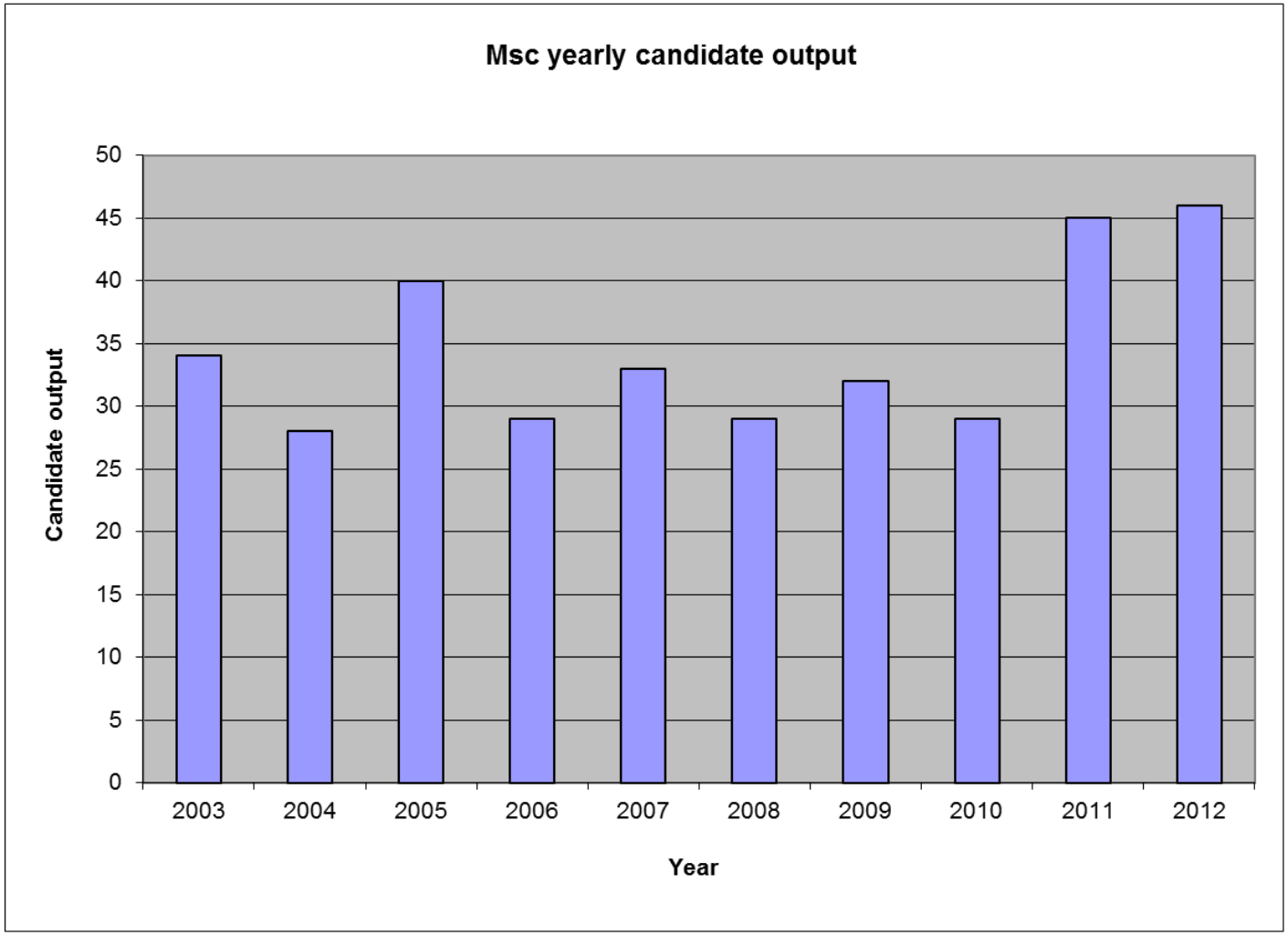
Eogenetic diagenesis including karst development

Who: UiB masterstudents with carbonate-related projects

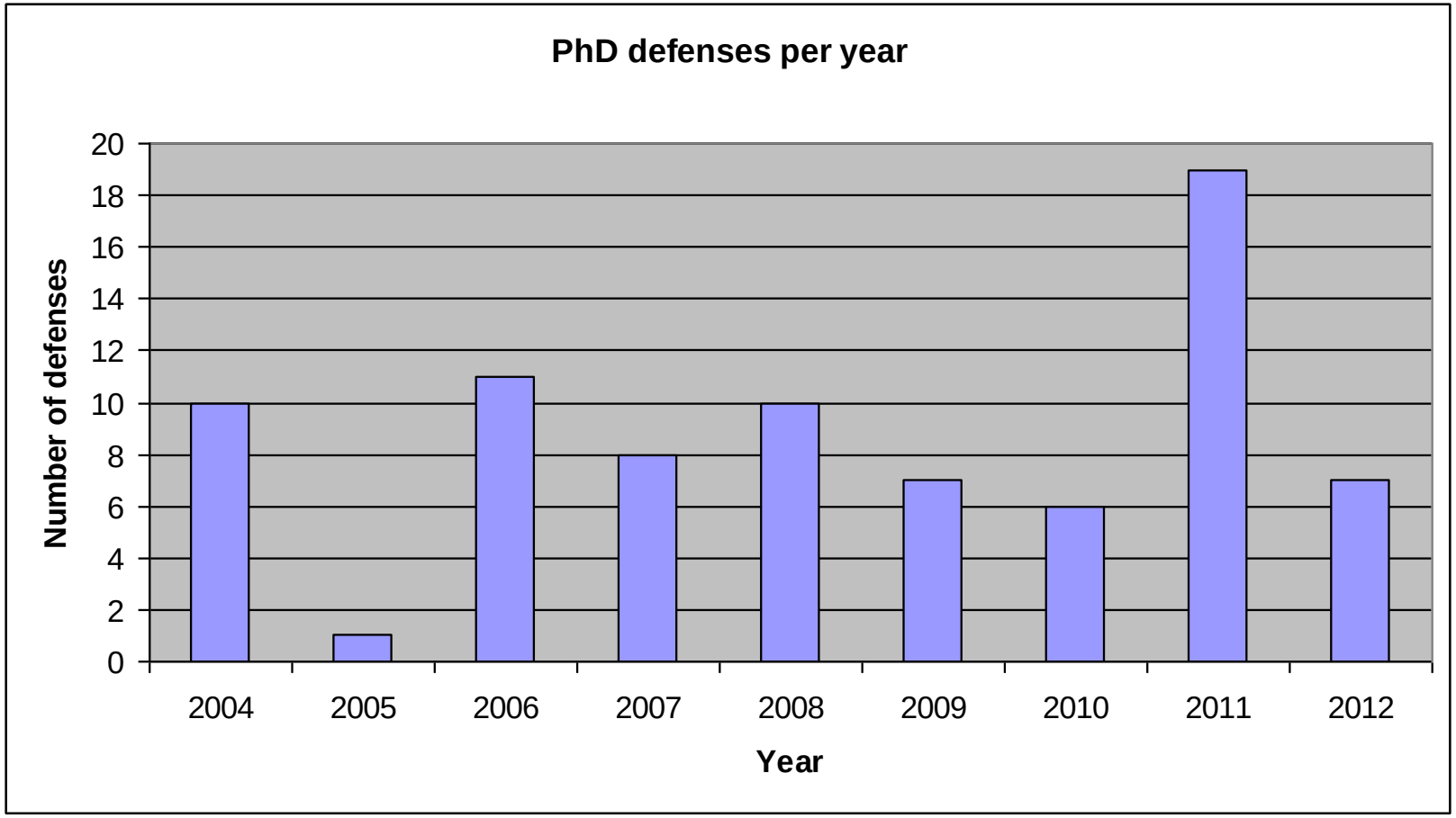
Collaboration: Mississippi State University (USA)

Sponsor: ConocoPhillips

Student numbers



PhD defences



VISTA project - Seismic waveform inversion for fracture parameters

- Waveform inversion using scattering theory
- Applications to seismic imaging and fracture detection

- University of Bergen
  - Professor Morten Jakobsen (Project director)
  - Postdoctor Ingjald Pilskog (PhD in atomic physics)
- NTNU

Professor Bjørn Ursin (collaborator, seismic imaging)

- Uni-CIPR
  - Dr. Trond Mannseth (collaborator, inverse theory)

PETROMAKS project - Modelling and Inversion of Seismic Waveform and Electromagnetic data

- Using similar volume integral equation equations
- Convenient for joint inversion and 4D monitoring

- University of Bergen
  - Professor Morten Jakobsen (Project director)
  - PhD student
- Czech Academy of Sciences

Dr. Ivan Psencik (collaborator, ray theory)

- Uni-CIPR
  - Dr. Trond Mannseth (collaborator, inverse theory)

Seismic exploration on sea ice a joint UoB – Statoil experiment

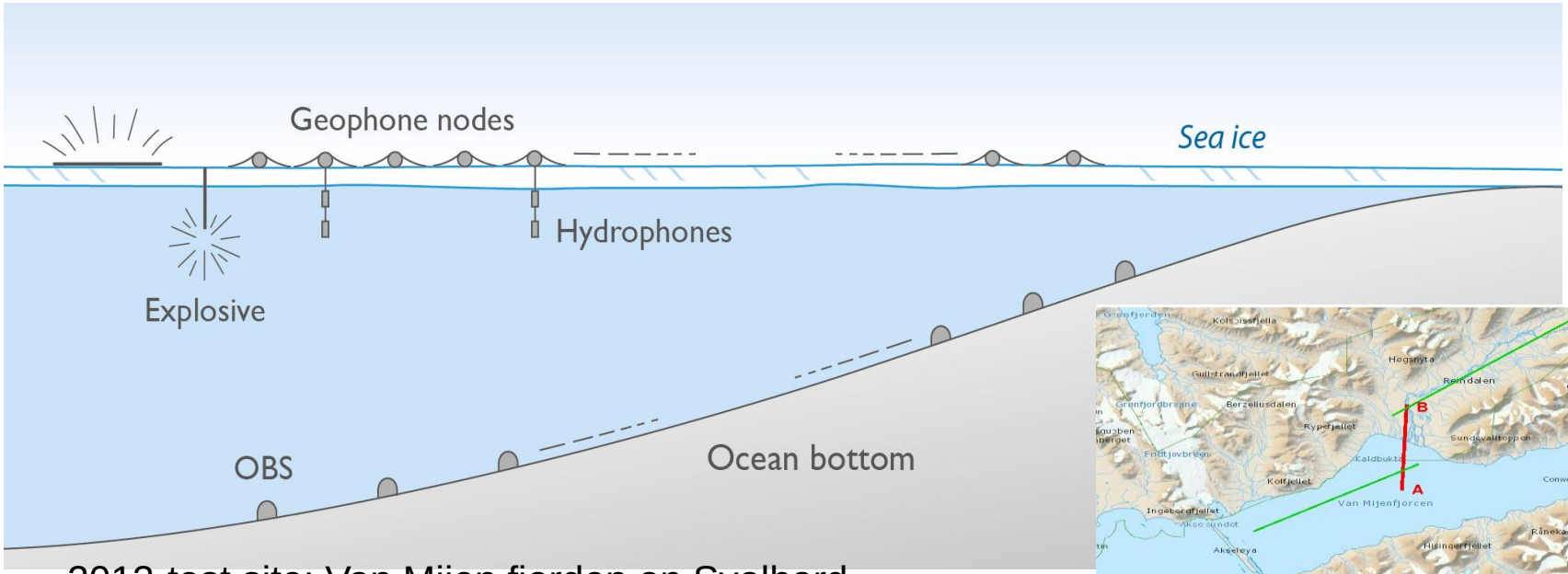
Initial test of seismic acquisition on Sea ice with geo-nodes on ice and at the seabed

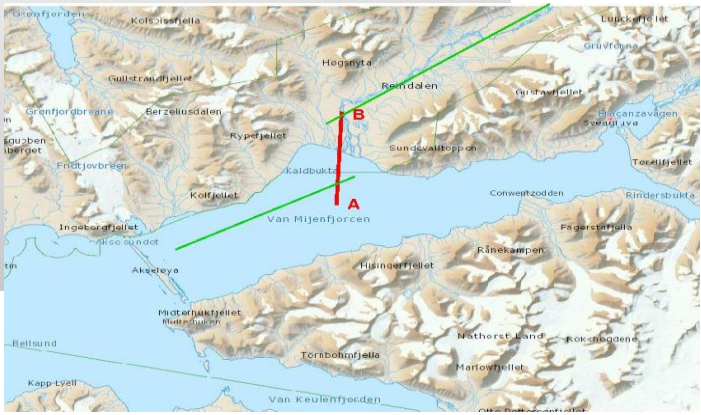
•Aim:

-Gain experience on operational procedures

-Understand the full acoustic signature of sea ice

-Develop processing workflows to suppress influence of sea ice on the seismic imaging

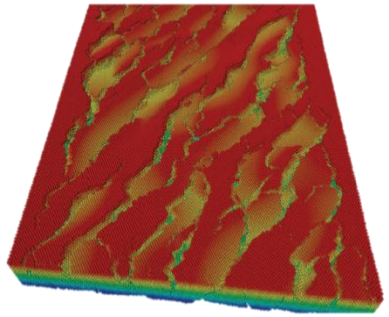




2013-test site: Van Mijen fjorden on Svalbard

MultiRifts PETROMAKS Project

- **University of Bergen**
  Rob Gawthorpe,
  Haakon Fossen, Atle Rotevatn, Patience Cowie, Ritske Huismans
- Uni Research: Eivind Bastesen



Forskningsrådet

Statoil

Imperial College London

MANCHESTER 1824

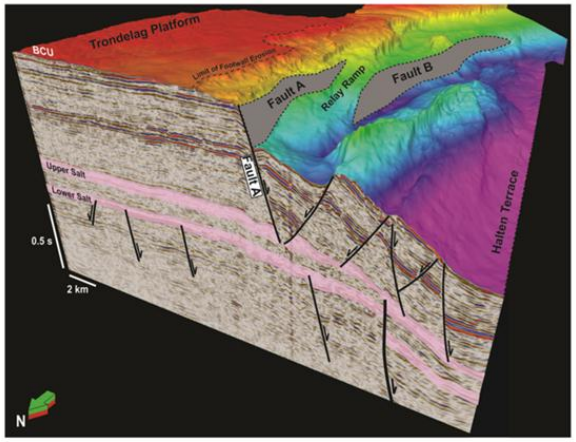
UiO : University of Oslo

- **Imperial College**
  Chris Jackson, Rebecca Bell
- **University of Oslo**
  Jan Inge Faleide, Roy Gabrielsen
- **University of Manchester**
  Emma Finch, Simon Brocklehurst
- **Industrial partner:** Statoil

MultiRift Project: Aims and Objectives

Overall aim:

Develop a fundamental understanding of how pre-existing structures in both basement and cover influence the evolution of normal faults and associated topographic development and depositional systems



Coupling subsurface case studies and numerical modelling will generate results applicable to structural and syn-rift understanding of NNS and increase our fundamental understanding of fault growth and rifting processes that are applicable to rifted margins worldwide

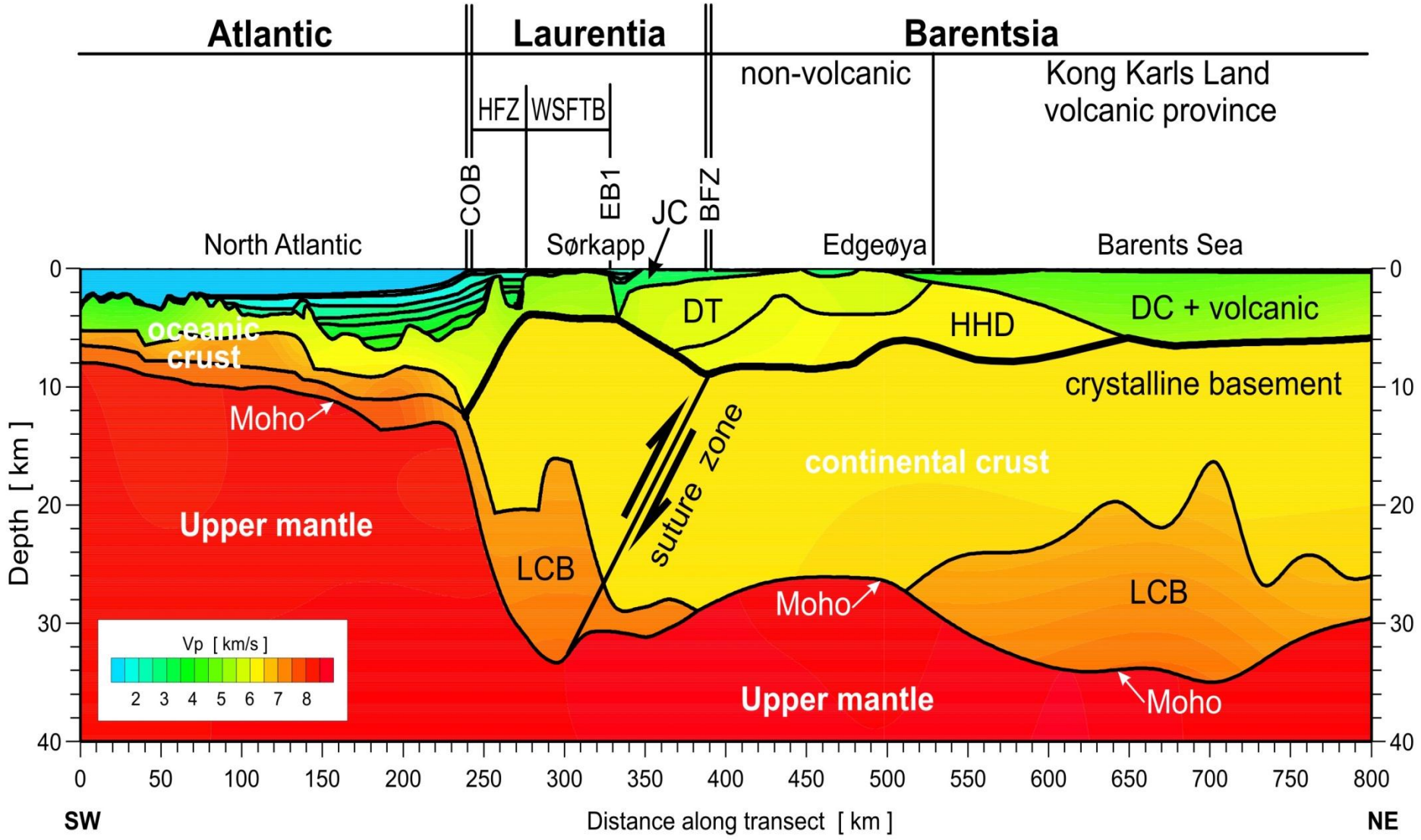

Atlantic
Laurentia
Barentsia
non-volcanic
Kong Karls Land
volcanic province
HFZ
WSFTB
COB
EB1
JC
BFZ
North Atlantic
Sørkapp
Edgeøya
Barents Sea
oceanic crust
DT
HHD
DC + volcanic
crystalline basement
Moho
suture zone
continental crust
Upper mantle
LCB
Moho
LCB
Upper mantle
Moho
Vp [km/s]
2 3 4 5 6 7 8
Depth [km]
0
10
20
30
40
0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800
SW
Distance along transect [km]
NE

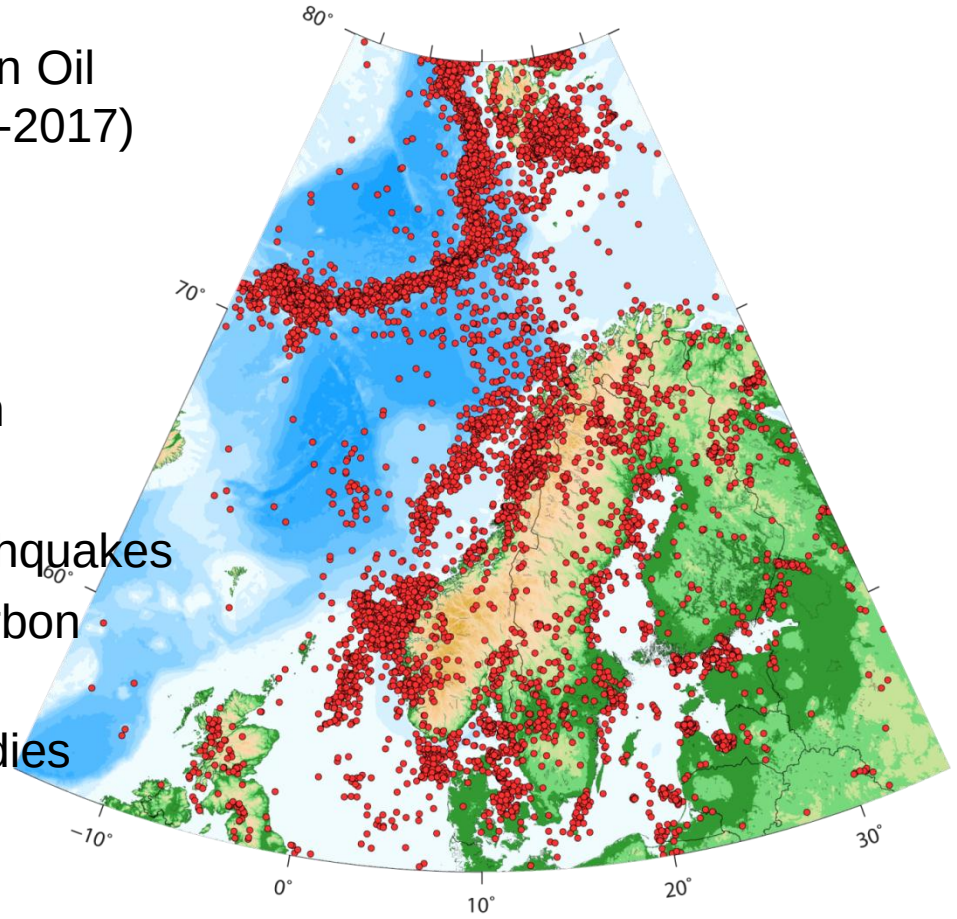
Figure 15

Norwegian National Seismic Network

- New contract between the Norwegian Oil and Gas Association and UiB (2013 -2017)

Main Objectives:

- Monitor earthquake activity
  - in and around Norway, long-term
- Provide data to sponsors and public
  - rapidly in case of significant earthquakes
- Provide earthquake data to hydrocarbon industry
- Provide data to seismic hazzard studies
- Research and development (2 PhD positions from 2013)
  - Better understand the causes of earthquakes and Earth structure in the region



Seismicity 1970-2010

Glaciated North Atlantic Margins (GLANAM)

- **Partners:**
- University of Bergen (UoB) – *Coord. H.P. Sejrup*
- University of Tromso (UoT) – *PI K. Andreassen*
- University Centre in Svalbard (UNIS)
- *- PI R. Noormets*
- North Energy Exploration – *PI E. Henriksen*
- Durham University (UDUR) - *PI C. O'Cofaigh*
- Scottish Association for Marine Science
- (SAMS) - *J. Howe*
- University of Ulster (UoU) - *PI P. Dunlop*
- Denmark and Greenland Geological Survey
- (GEUS) - *PI T. Nielsen*

- **Associated Partners**
- STATOIL ASA – *PI T. Dahlgren*
- Volcanic Basin Petroleum Research AS (VBPR) - *PI S. Planke*

Will hire 15 PhD/Post doc. candidates starting april 2013

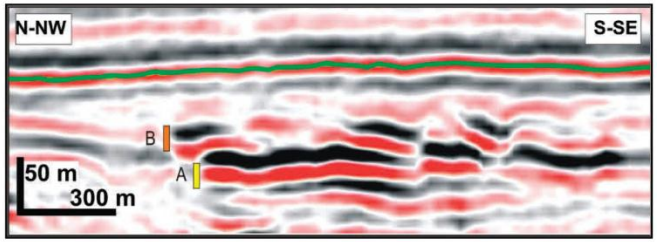
Glaciated North Atlantic Margins (GLANAM)

Marie Curie Initial Training Network (ITN) 2013-2017

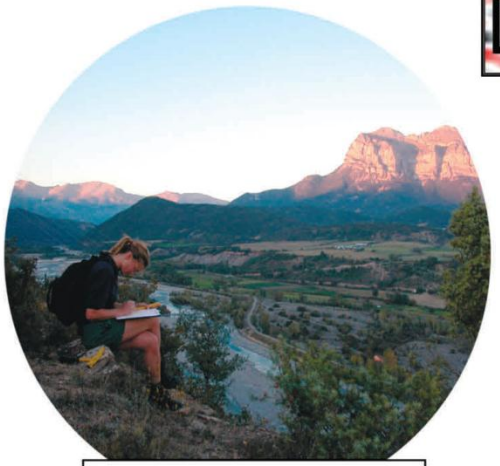
- Scientific goal: to determine the controls on the development, in time and space, of glaciated continental margins.

- Research objectives with focus on:
  - The role of different glacial/non-glacial **sedimentary processes** in shaping the glaciated NA margins.
  - The extent, timing and rates of decay of **marine-based ice sheets**.
  - The influence the ice ages have imposed on the **hydrocarbon systems** .
  - The influence of climate change and sedimentary processes on the **fluid flow** (and gas hydrate) systems.
  - To identify the controlling factors and the role of **submarine mass movements** (with resulting tsunamis) on the glaciated NAmargins.

Seismic modeling of out-crop analogues



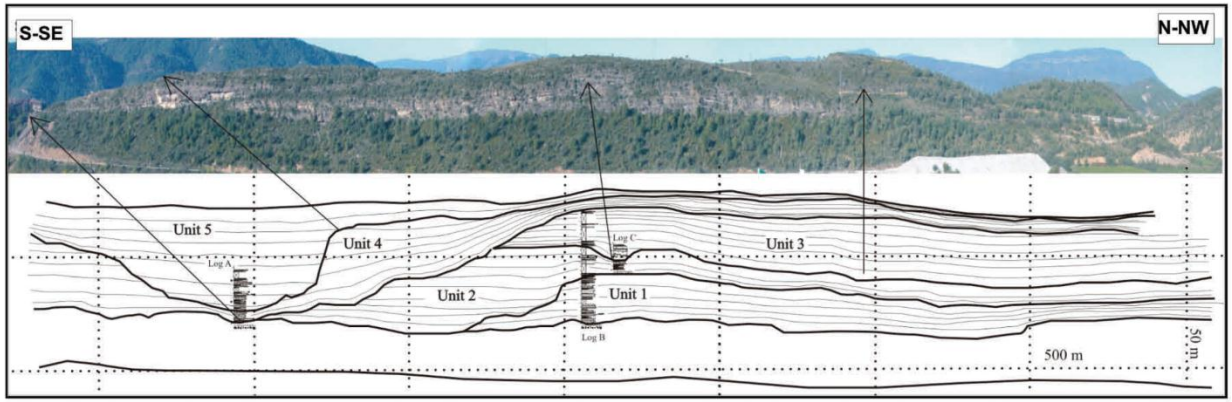
Subsurface target seismic offshore Angola



Outcrop mapping

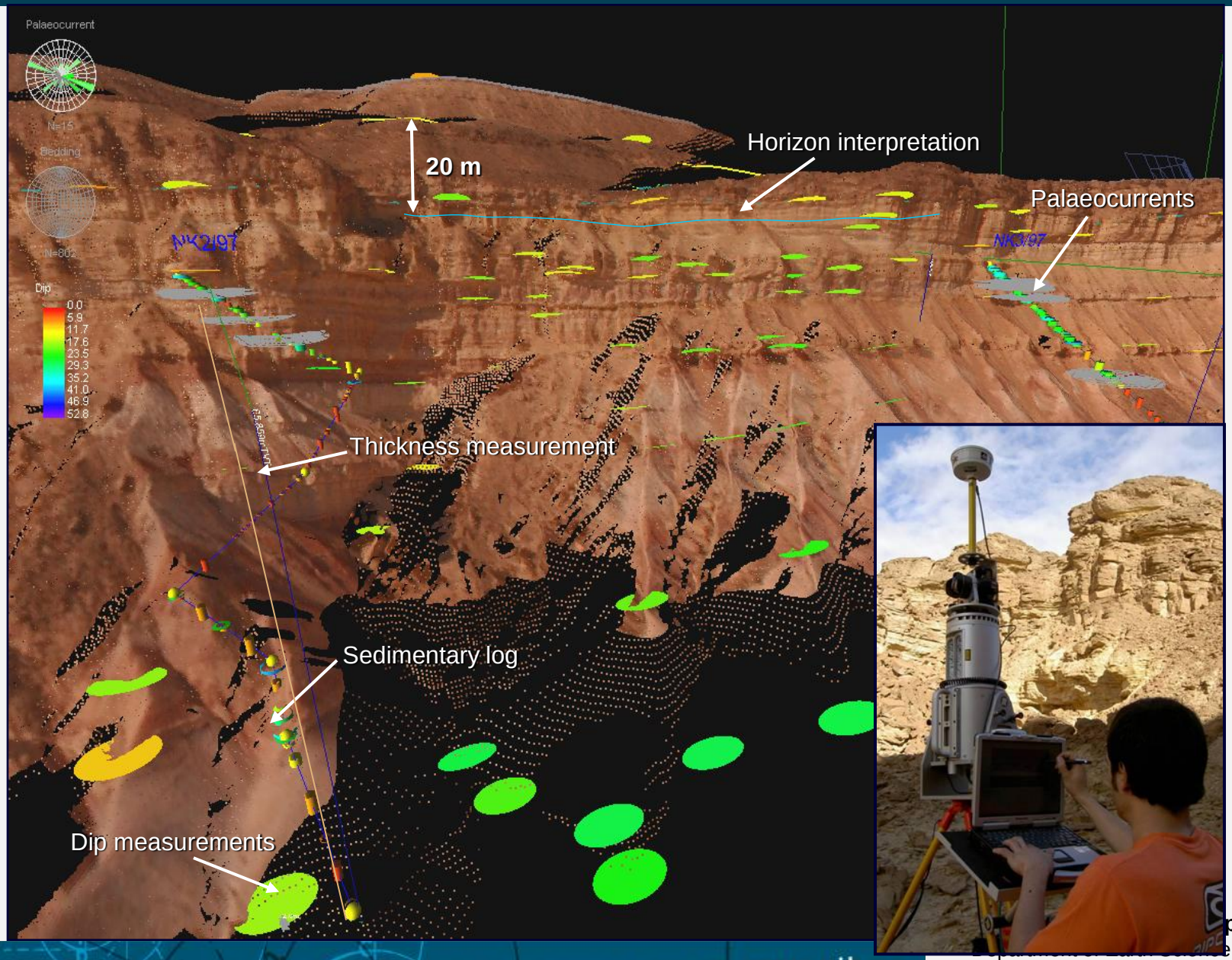
Step 1:

Define subsurface missing target properties (e.g., lithology distribution)



Step 2: Identify proper outcrop analogue

TRAP: The Rifts Analogues Project



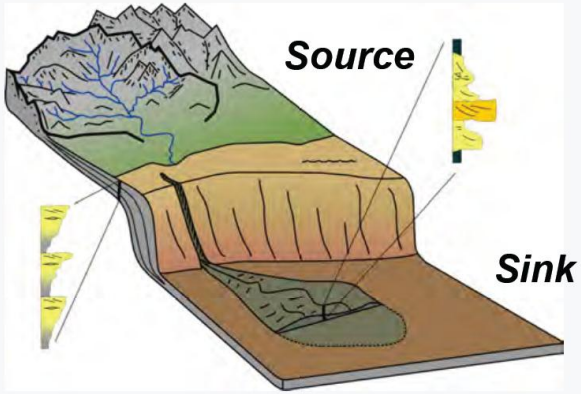
Earth System Modelling

Project leader(s) William Helland-Hansen & Ritske Huismans (UiB)

Project start date/duration: 1/01/2010; 5 years

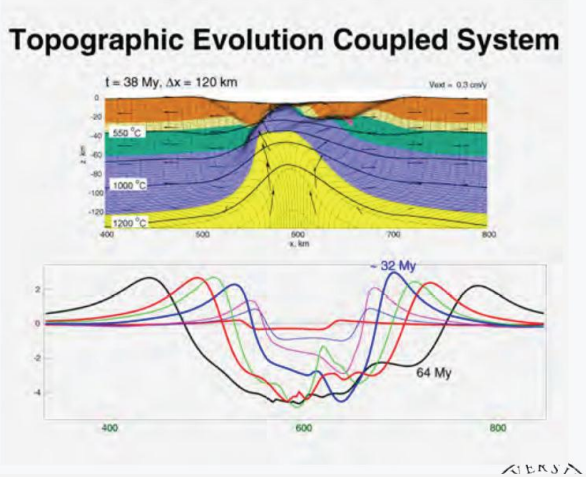
Statoil contact: Allison Thurmond-Kennedy

Personnel: 7 postdocs and
senior researchers

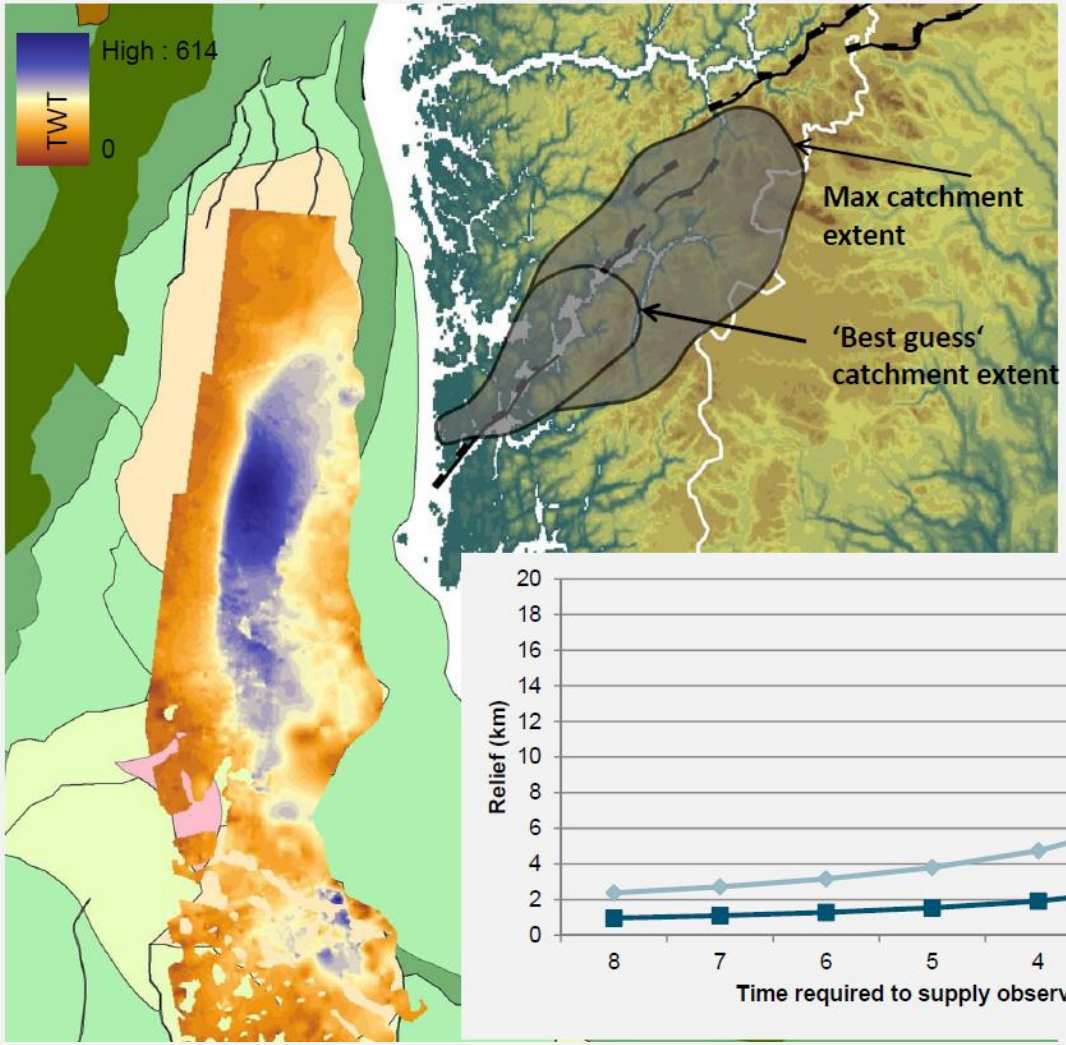


Project Outline

- Aim: to extend understanding of links and feedbacks between tectonics, climate, and erosion/deposition
- Focused on: linking Norway onshore – offshore S2S relations; tectono-morphology of rifted margins
- Project based on coupled geodynamic, surface process, and climate modelling; integration offshore seismic databases linked to onshore morphology and exhumation



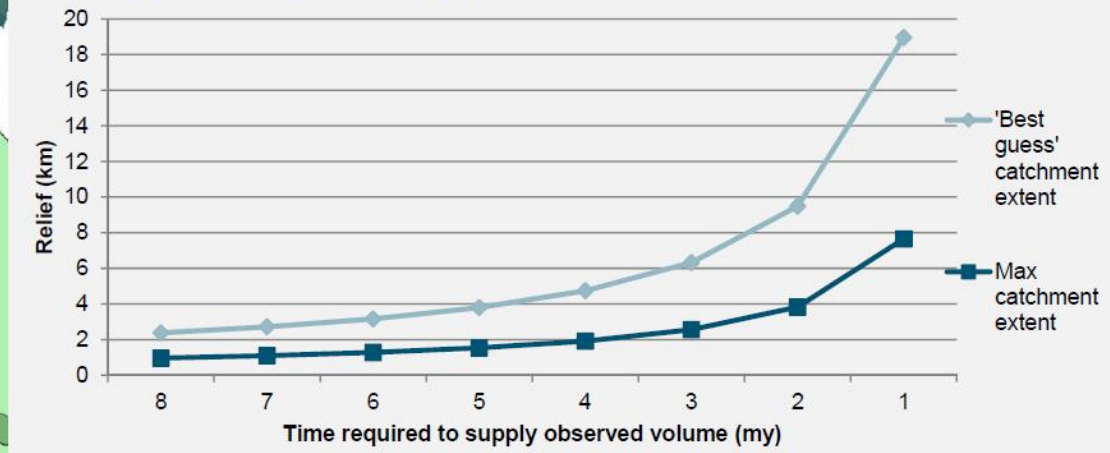
Source-to-sink: Coupling offshore and onshore



$Qs = \omega BQ^{0.31}A^{0.5}RT$,
Syvitski & Milliman 2007

$R = Qs/\omega BQ^{0.31}A^{0.5}T$

Duration: max 8 my
Total volume: 5196 km^3



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