



Exploration Relevant Geoscience Research & Potential for collaboration with Brazil

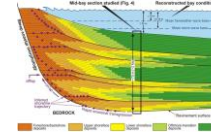
Prof. Ritske S. Huisman and
coworkers

Department of Earth Sciences
University of Bergen



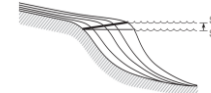
Oil and gas relevant geoscience research at UoB

- Tectonics & sedimentation in rifts
- Outcrop analogue studies of petroleum reservoirs
- Geodynamic modelling
- Geological/geophysical reservoir characterization
- 4D seismic, electromagnetic, and production data
- Seismology, seismic processing, and imaging



Sequence stratigraphy

Sequence stratigraphy deals with the spatial development of sedimentary successions as a record of changes in sea level and sediment supply.



Trajectory analysis

Trajectory analysis investigates the time-space migration paths of ancient sedimentary environments.



Sedimentology and facies analysis

Sedimentology is concerned with the identification of depositional processes and recognition of ancient sedimentary environments in the stratigraphic rock record.



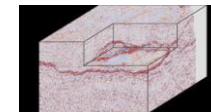
Carbonate reservoir characterization

Integrated geological, petrophysical and geophysical studies of carbonate rock outcrops improve geological and fluid-flow models of analogous subsurface reservoirs.



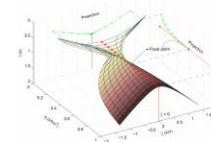
Palaeoenvironmental studies of organic-rich shales

An integration of stratigraphic and geochemical data sheds light on the depositional palaeoenvironment and hydrocarbon-yield potential of organic carbon-rich shales.



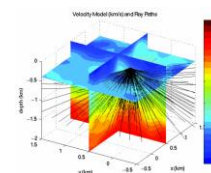
Seismic analysis

Seismic analysis improves the imaging of Earth's upper crust.



Seismic inversion

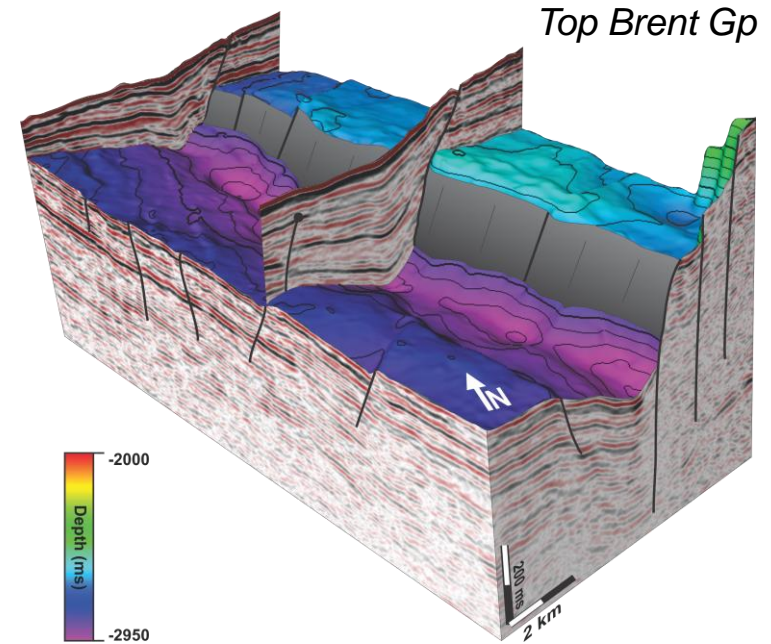
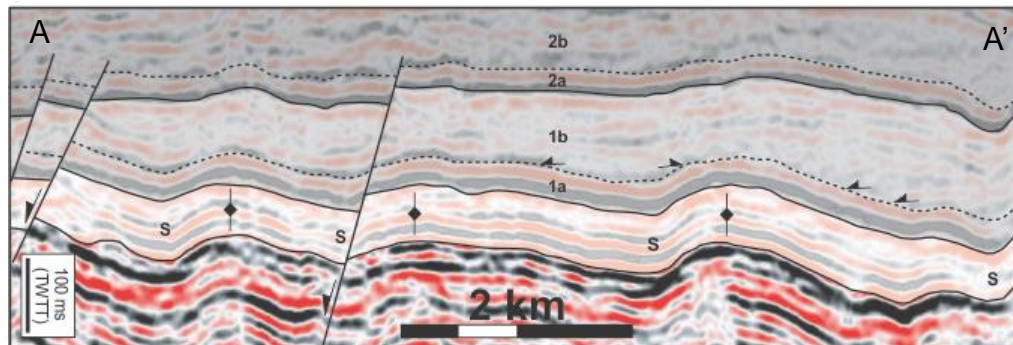
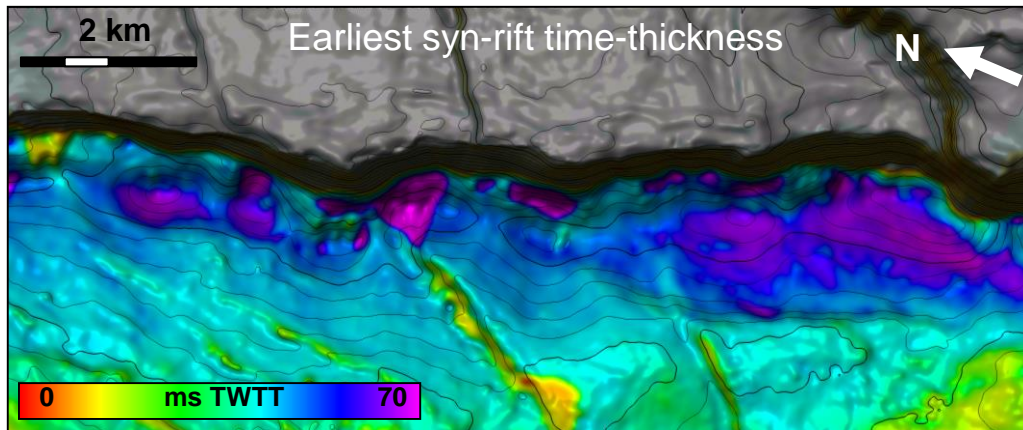
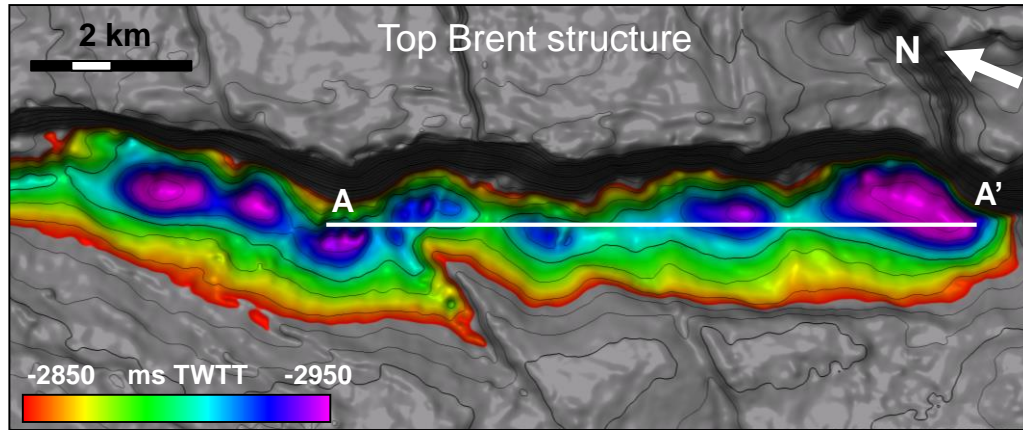
Analytical studies in signal theory, wave propagation, anisotropy, seismic migration, tomography and inversion



Modeling and inversion of seismic, electromagnetic and production data

Modification of techniques from theoretical physics for adaptation in geophysical modelling and inversion.

Subsurface studies: Example North Sea structure



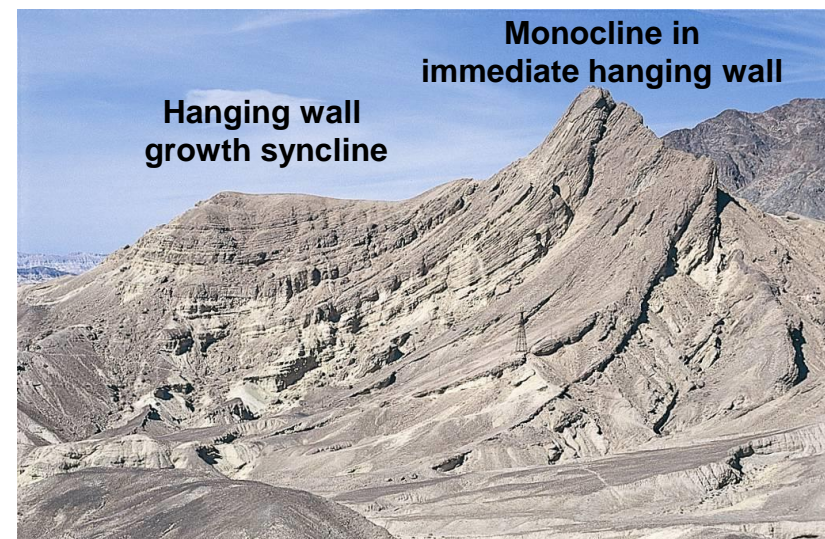
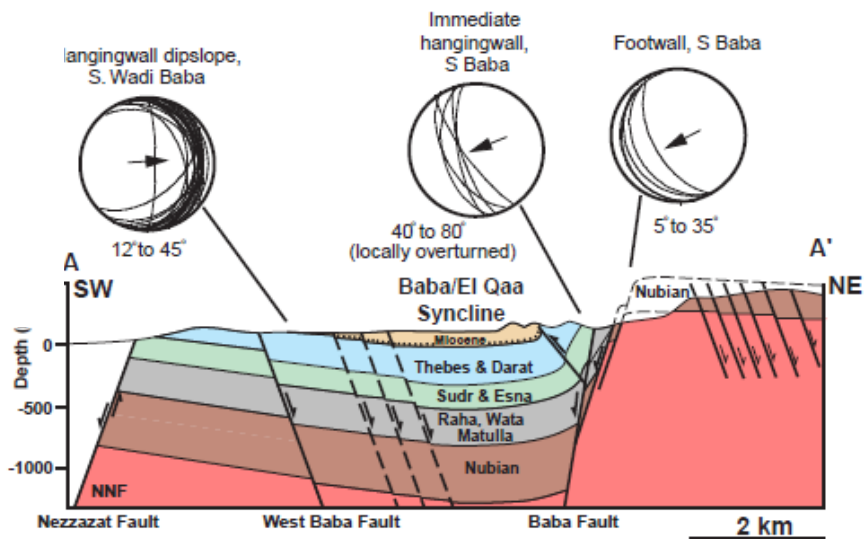
Present-day hard-linked fault zone >12 km long with a prominent hanging wall, fault-parallel syncline.

Fault zone evolution established through analysis of thickness and lap-out relationships of syn-rift seismic stratigraphic units

Earliest syn-rift seismic sequences show 2-5 km long 'canoe'-shaped, hanging wall depocentres separated by fault-perpendicular anticlines

The Oseberg Øst fault grew from early rift, isolated fault segments 2-5 km long that linked to to form the >12 km long fault zone observed today.

Field analogue studies: Suez Rift, Egypt

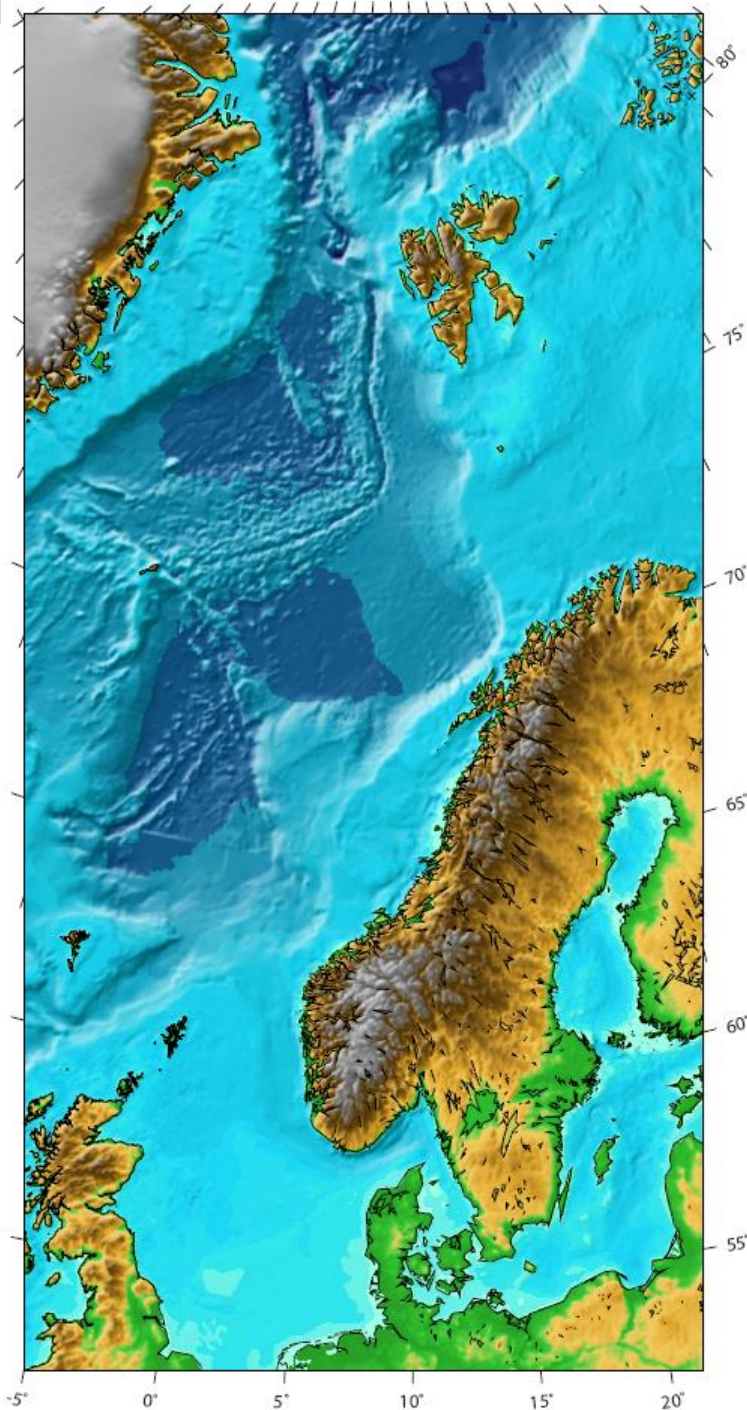


Field-based studies provide high resolution improved understanding of sub surface reservoirs



Conjugate margin studies in the NE Atlantic

Some lessons learned



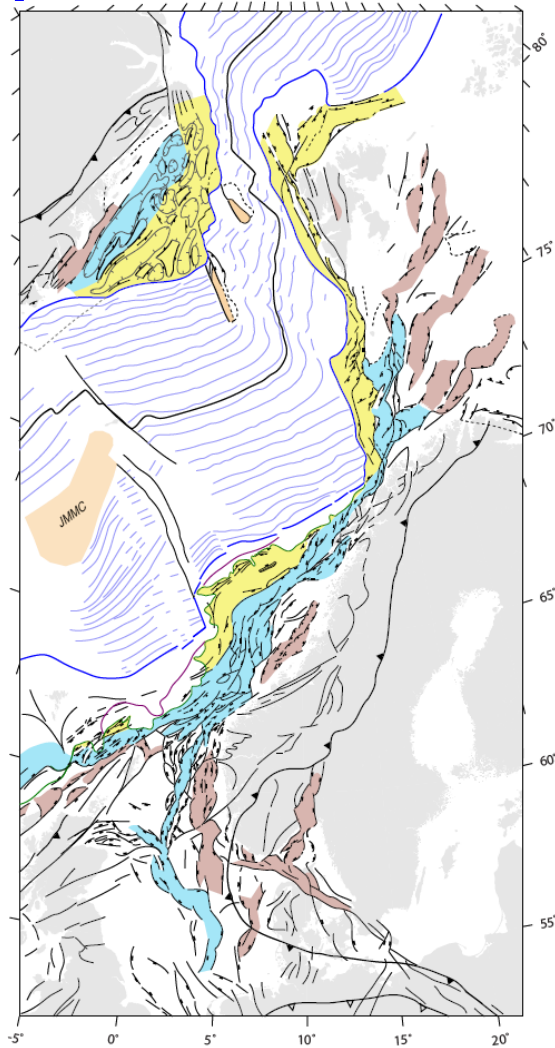
Lessons learned from conjugate margin studies N Atlantic:

Improved understanding of:

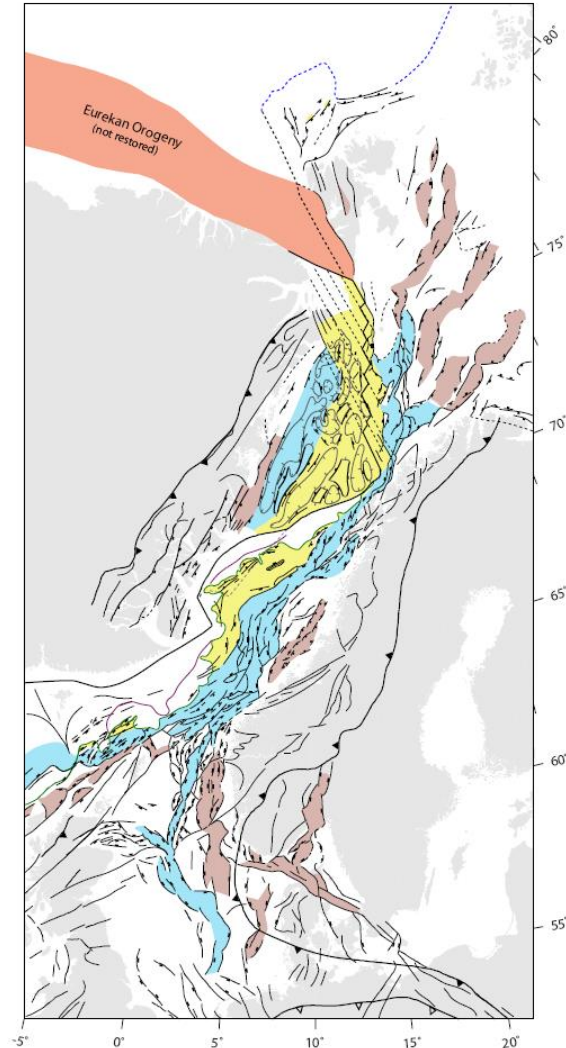
- Plate tectonic reconstruction
- Crustal structure
- Conjugate margins
- Basin evolution and architecture
- Role of orogenic inheritance

Plate tectonic reconstruction N Atlantic

present

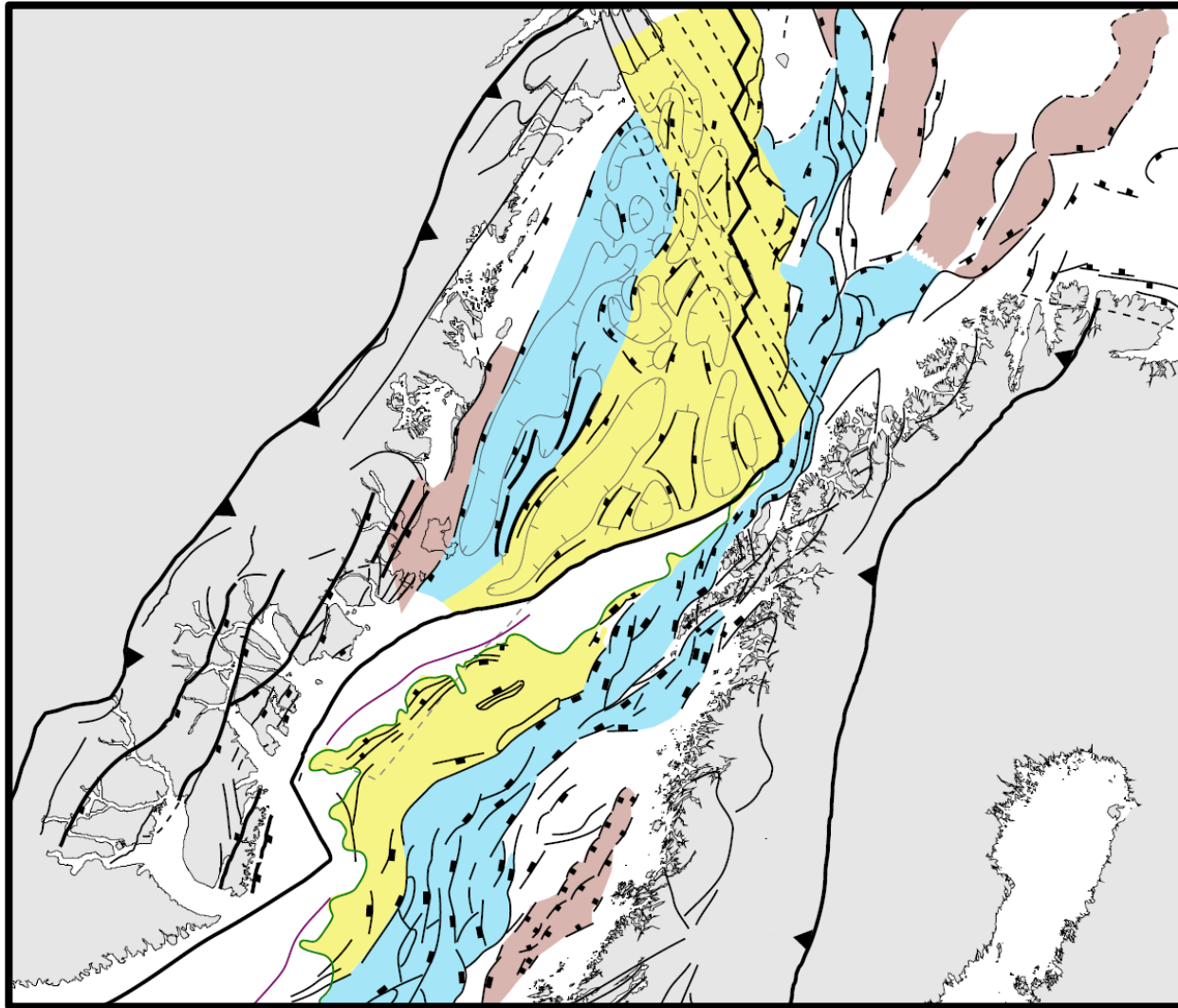


55 Million years ago



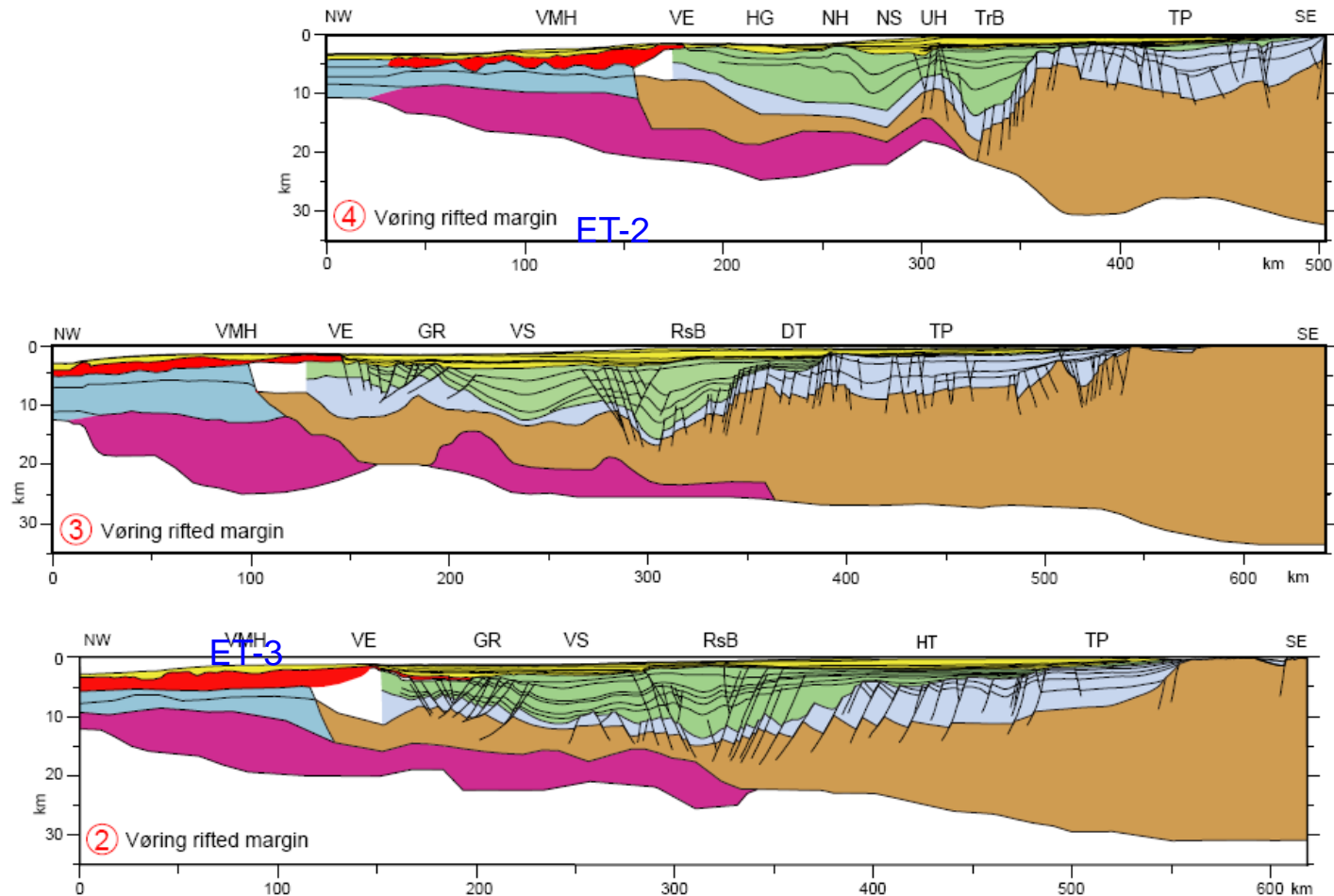
Improved constraints on evolution and nature of passive margin sedimentary basins

Plate tectonic reconstruction



Improved constraints on evolution and nature of passive margin sedimentary basins

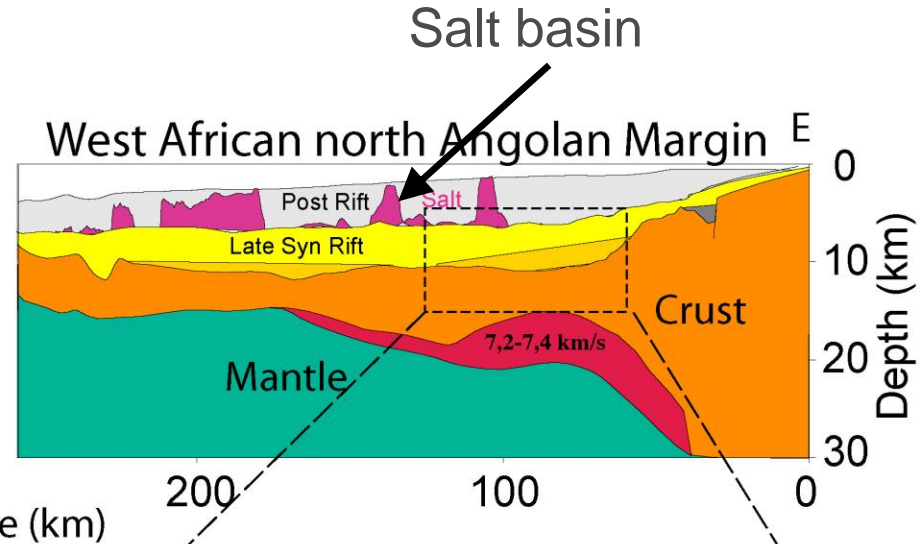
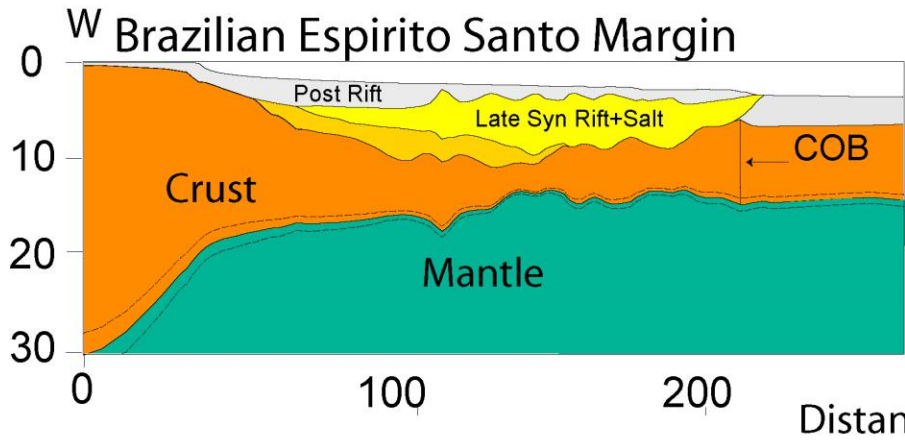
Mid Norwegian Margin regional crustal transects



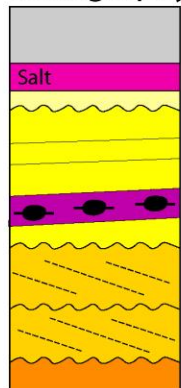
Combined industry seismic reflection data and academic seismic refraction data have allowed construction of Norwegian margin regional transects

South Atlantic passive continental margin formation

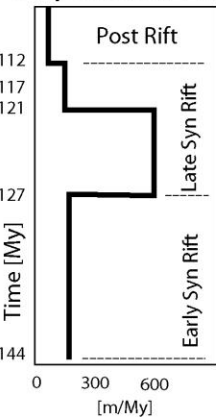
South Atlantic Salt Basin



Stratigraphy



Deposition Rate



Shallow Water

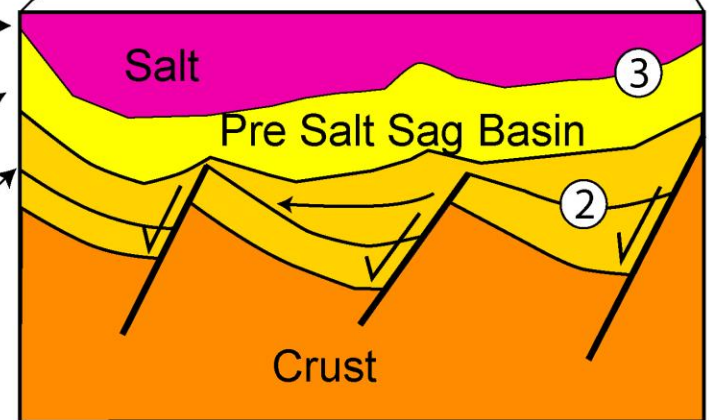
Salt

Late Syn-Rift Sag

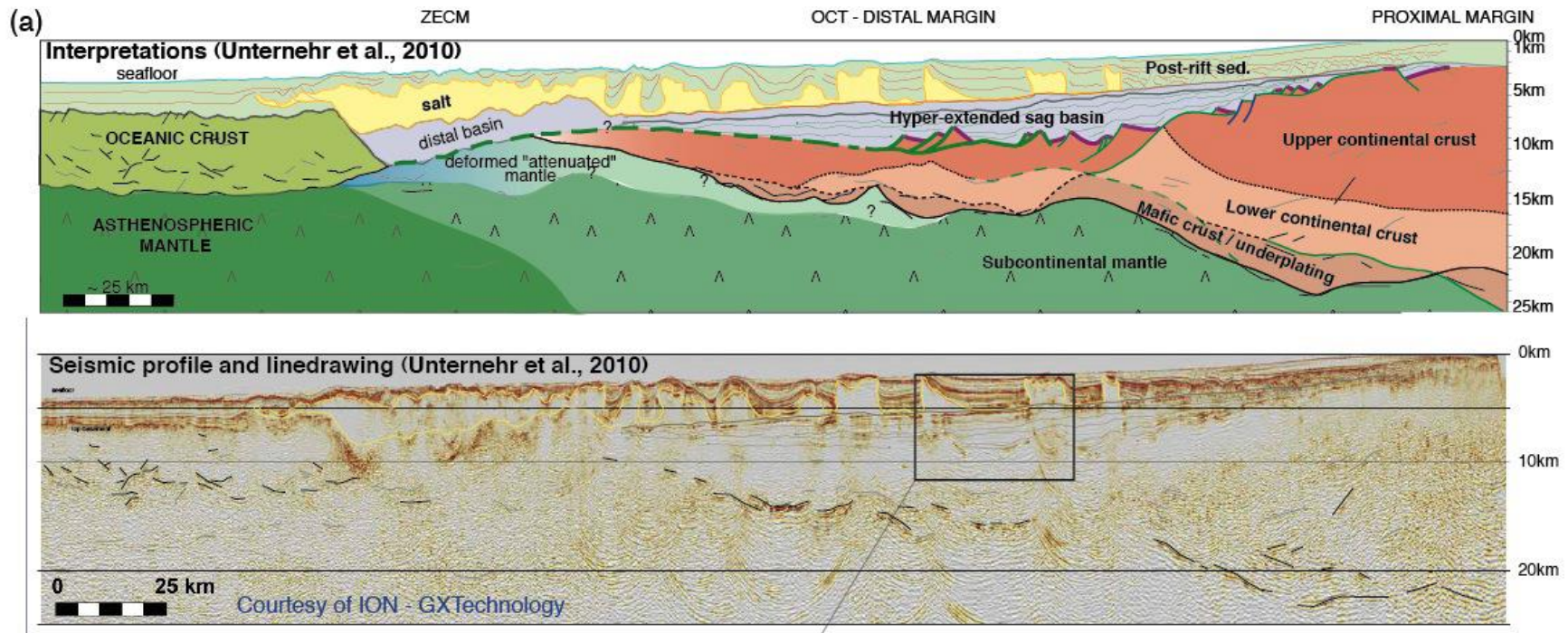
Un-Faulted

Early Syn-Rift

Fault Bounded

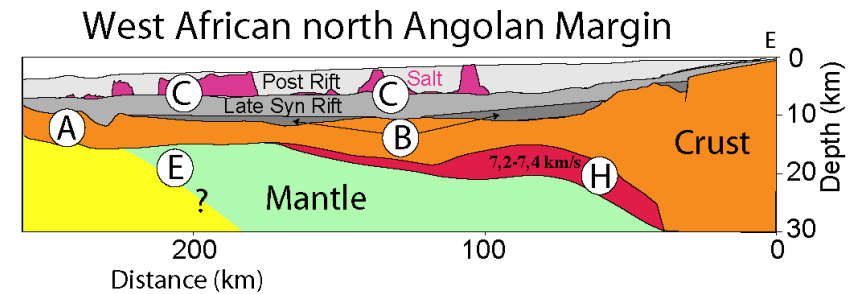
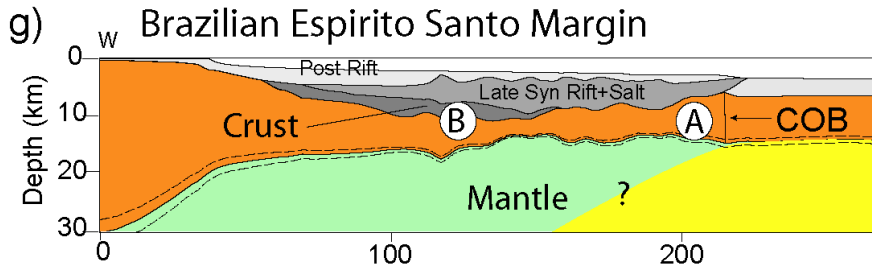
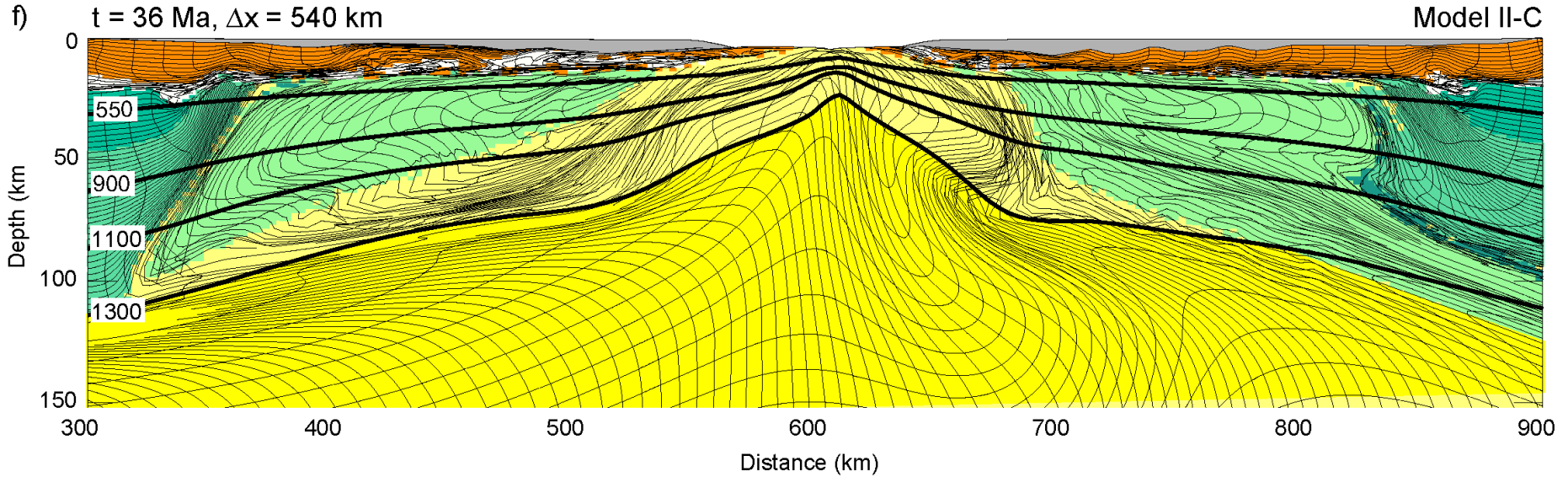


Angola Margin



- Sedimentary basin on highly prolific margin
- Basin structure and petroleum potential require large scale understanding
- Need for high quality seismic reflection and refraction data

Geodynamic modeling South Atlantic passive continental margin formation



Collaboration with Brazil

- Funded **Capes-SIU** project **Bergen-Sao Paulo**
 - Collaboration and exchange in higher education from 2013
 - Summerschools and short courses in Brazil and Norway including staff and PhD / master students from USP, UERJ, UoB
- New collaborative project **Bergen-Oslo-Sao Paulo-Rio** on **exploration relevant geoscience research**
 - **Onshore – Offshore links**
 - **Refraction seismic data** acquisition **Brazilian margin**
 - **Sedimentary basin** evolution
 - Comparative studies North and South Atlantic passive margins
 - PhD & post doc mobility between Norway - Brazil
 - Industry involvement (Statoil/Petrobras/BG)
- MOU Bergen Univ. – USP
- MOU Bergen Univ. – UERJ

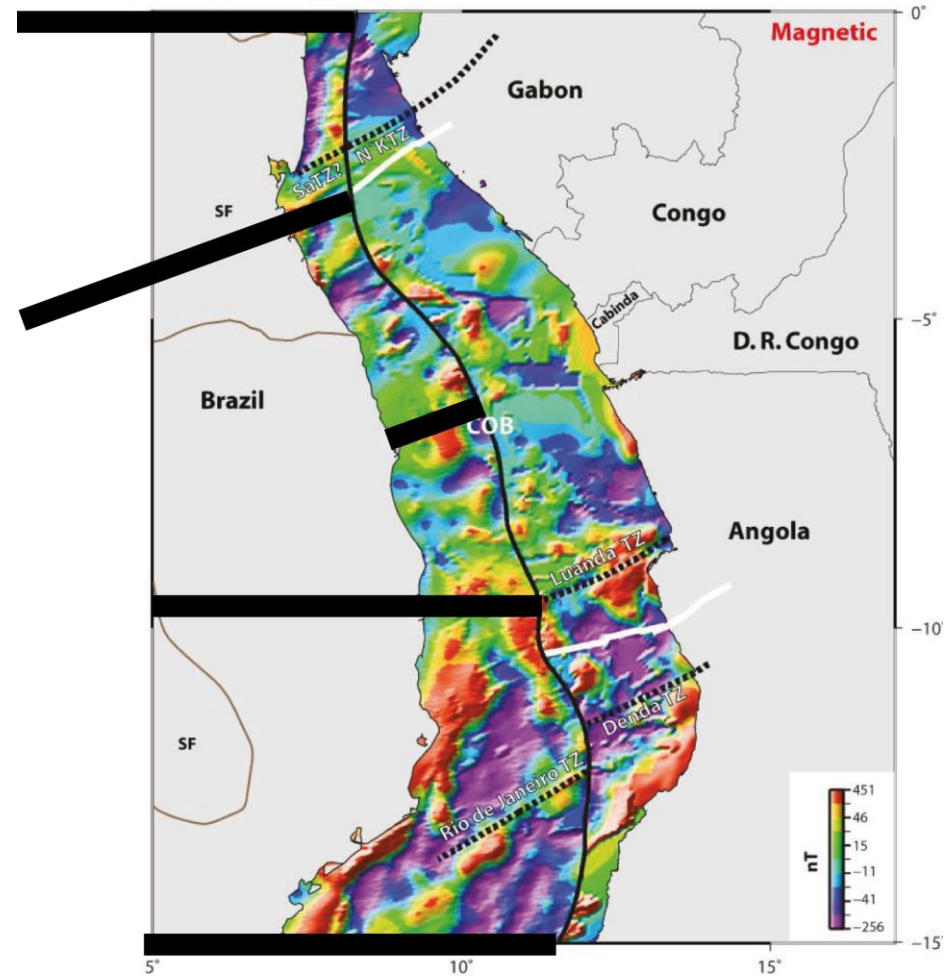
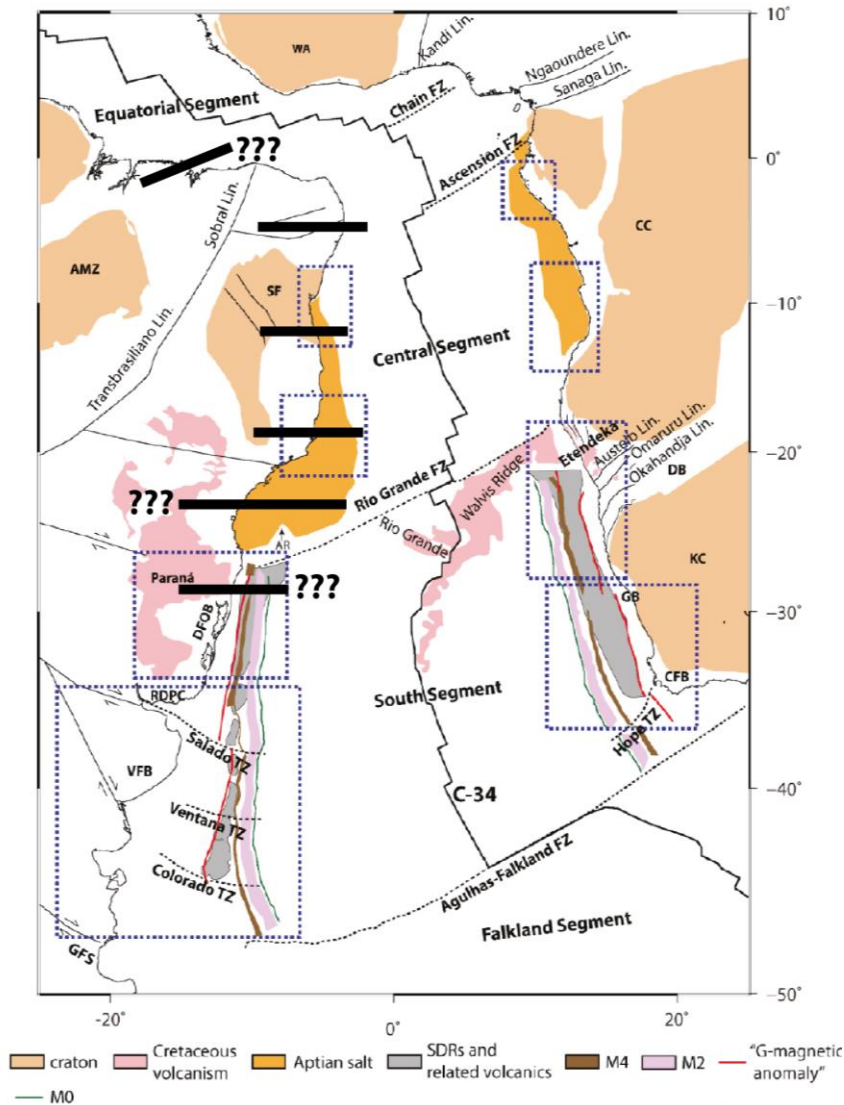
Collection of new seismic refraction profiles

- Active source offshore refraction data acquisition
 - Links existing infrastructure USP – UiB/UiO expertise
 - Constrain offshore crustal structure in the deep-water distal margin settings
 - Integrate refraction and high resolution industry reflection data to constrain links between basin fill and rift evolution
 - Link with existing and new onshore refraction profile to constrain on-offshore links

USP – Marine research vessel



New offshore and onshore seismic refraction lines complementing industry regional transect reflection data (ION-GEO/TGS)



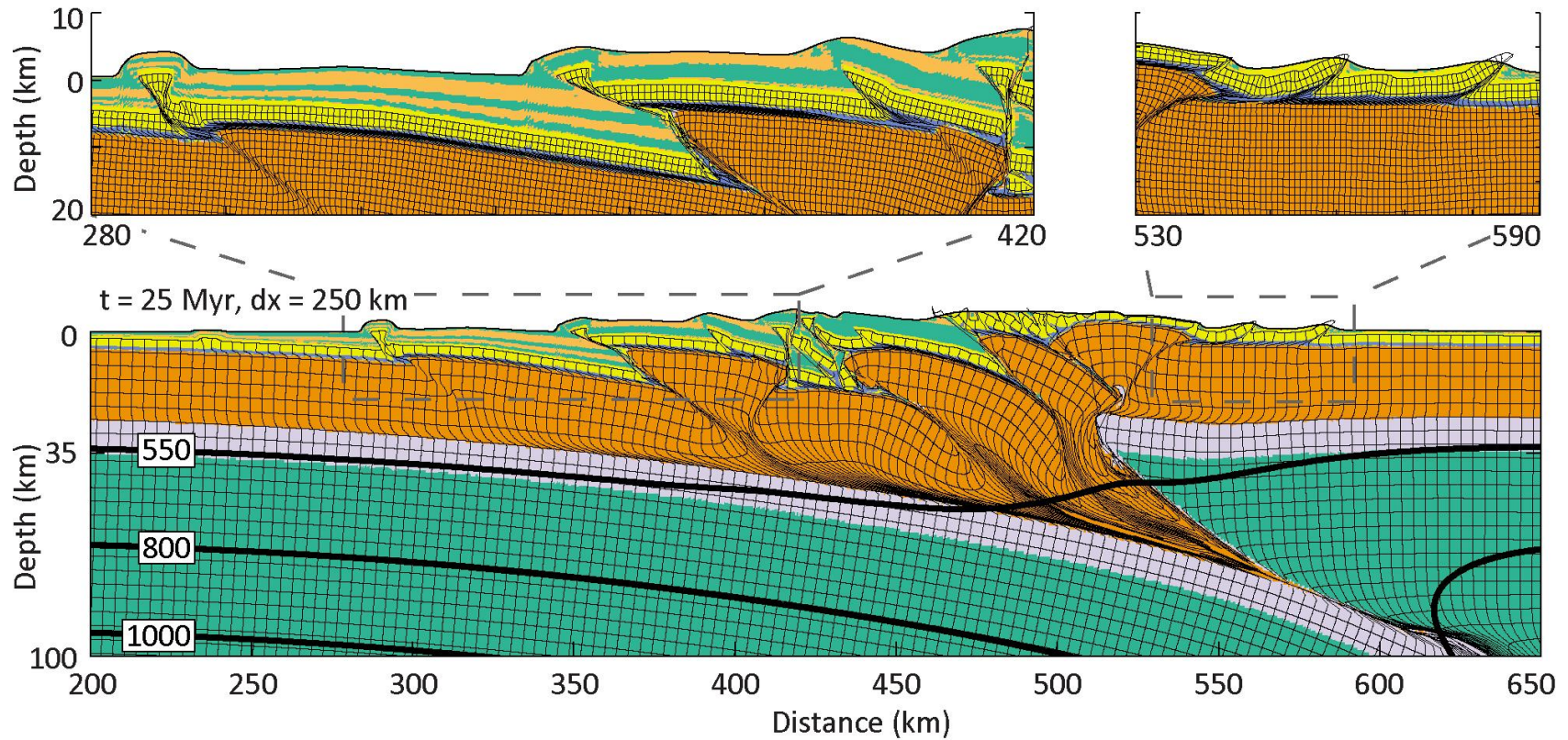
Large potential for collaboration between Norway and Brazil

On exploration relevant geoscience

- Integrated sedimentary basin evolution
- Tectonics & sedimentation
- Process based geodynamic modelling
- Outcrop analogue studies of petroleum reservoirs
- Geological/geophysical reservoir characterization
- 4D seismic, electromagnetic, and production data
- Seismic processing, and imaging

www.uib.no/geo

Geodynamic modeling mountain belt formation and sedimentation: from crust to basin



- Feedback between thin-skinned FTB and thick-skinned crustal scale tectonics
- Longer thin and thick skinned thrust sheets as a consequence of syn-tectonic deposition