

# Trias North newsletter

News from the research project  
Reconstructing the Triassic northern Barents shelf:  
basin infill patterns controlled by gentle sags and faults

No 5  
December  
2016

## Triassic North events in 2017

On **January 27th** Trias postdoc Urszula Czarniecka from PAS in Poland will visit UiO and present her results so far in the project:

*Provenance signature of the westerly-sourced siliciclastic deposits in the Triassic of Svalbard*

In February/March scientists from the project will visit the industry partners to present and discuss their findings.

In October we plan to have a final Trias conference.

## New Trias article

Available in the joint Dropbox for Trias members  
Else click on image



### Evidence for Late Triassic provenance areas and Early Jurassic sediment supply turnover in the Barents Sea Basin of northern Pangea

Tore Grane Klausen<sup>1,\*</sup>, Reidar Müller<sup>2,†</sup>, Jiri Slama<sup>1,§</sup>, and William Helland-Hansen<sup>1</sup>

<sup>1</sup>DEPARTMENT OF EARTH SCIENCE, UNIVERSITY OF BERGEN, ALLÉGATEN 41, 5007 BERGEN, NORWAY

<sup>†</sup>TULLOW OIL PLC, TORDENSKJOLDSGATE 6B, 0160 OSLO, NORWAY

#### ABSTRACT

We used detrital zircon fractions from the Late Triassic to Early Jurassic sedimentary succession in the Norwegian Barents Sea to constrain the role of eastern provenance areas in the basin infill history of the Northern Pangea Boreal basin. Geochronological data from sedimentary rocks in this succession reveal detrital zircon ages that are very close to the biostratigraphically defined maximum depositional age of the two lowermost intervals: The Norian to Rhaetian Fruholmen Formation show U-Pb minimum ages of  $208.3 \pm 4.2$  Ma (discordant by  $-0.58$ ) and  $213.8 \pm 5$  Ma (discordant by 0.8), and the Rhaetian to Sinemurian Tubåen Formation is  $200.6 \pm 4.9$  Ma (discordant by  $-3.99$ ) at its minimum. These are the youngest ages thus far documented in the Norwegian Barents Sea, and they demonstrate that a provenance area was magmatically active while, or shortly before, these formations were being deposited. Such protolith ages have not been documented close to the study area, but based on the regional tectonic setting and paleogeography, we argue that the Novaya Zemlya protrusion of the northern Uralian orogen was the most likely provenance area in the region. The Sinemurian to Pliensbachian Nordmela Formation samples yielded, with an exception of a single detrital zircon age of  $211 \pm 4.3$  Ma, a consistent 240–237 Ma minimum detrital zircon age, which suggests that either the magmatic activity or the sediment supply had come to an end by Sinemurian times. This turnover can be explained by a change in the hinterland drainage pattern.

This study documents that eastern provenance areas were actively supplying sediments into the Norwegian Barents Sea Basin later than previously assumed, and our data offer age constraints for tectonic activity in the basin and its hinterland inferred from the changes in sediment supply to the basin.



# Report on work of 2016 and outlook for 2017

## General achievements in 2016

By December 2016 the project is in a phase focused on compilation and reporting. The work follows the pre-defined plans as outlined in 2014: Our team of 4 postdocs and 4 PhDs backed by seniors are processing datasets and are creating exciting new learning. Some of the results were presented in the two-days project seminar in May with most partners present. A number of peer-reviewed articles for international journals are also in processing. Presentations given at conferences and in seminars (as PPT files), manuscripts closing in on becoming submitted, and published articles, are continuously made available to the partners through the Trias North joint dropbox.

In 2016, the final field activity was a project partner workshop/excursion to Svalbard. This field workshop was successfully arranged in July. In total 16 researchers (nine from industry) participated in a nine day trip to Edgeøya and Sørkapp Land/Hornsund. All participants took part in field data gathering to fill in gaps from previous years outcrop studies. Furthermore, everyone collected data for their own (company's) benefit. Although costly with the use of a larger ship (MS Stålbas) compared to previous years (MS Ulla Rinman), such joint operations are important to strengthen connections, communication, knowledge building and data transfer between the academic research team and the industrial partners.

A series of tailored workshops with industry partners in December 2015 and January 2016 have been successfully undertaken, as the second dialog-tour by the project team. Another final partner tour is scheduled for February 2017. Furthermore, a larger end-of-project seminar is in preparation for October 2017.

## Project targets and objectives

The projects aims and objectives as they were outlined by start of the project in 2014 is as follows: *The Triassic succession of the Barents Sea offers a petroleum system with potential for new discoveries. Fundamental insight into this system is in demand, spanning from regional basin analysis to subject-based studies, both of which are beneficial for the industry.* The project on the northern Triassic Barents Shelf addresses this demand by exploring this novel region, in a fully integrated analysis of the geological setting. The work will include on-land outcrop studies as a platform for offshore data analysis, spanning from the Svalbard region south and eastward on the shelf. The work is undertaken by a team of uttermost Norwegian academic expertise (UiO, UiB, UNIS and institutes) backed by international partners. The project targets the following knowledge gaps:

- Exploring this novel region, in a fully integrated analysis of the sedimentological, stratigraphical and structural setting,
- Performing detailed studies of sedimentary systems, to establish better temporal links between source areas, sediment routing and sedimentary sinks,
- Undertaking tectonic analysis to better understand large-scale driving forces of sag/warp basins and highs versus fault system development,
- Summarizing large-scale and in-depth studies into comprehensive regional reconstructions.

A series of objectives have been highlighted to address the knowledge gaps:

- Analyze shallow-shelf infill by clinoform migration across regional sag/warp-type basins,
- Investigate the fluvial and shallow marine depositional systems of the migrating shelf,

- Evaluate the role of growth faulting in the distribution of reservoir sandstones, and assess the implications for prospectivity,
- Analyse the provenance of clastic material of the reservoir sandstones by isotopes and chemical signatures, and their burial histories linked to diagenesis,
- Investigate impacts on the sedimentary system of the interaction between shelf progradation, basin and high development, and faulting,
- Explore tectonic reactivation of deep-seated zones of weakness and correlate this to far-field stress configurations in an analysis of large-scale driving forces.
- postdoc Ingrid Anell – on-offshore correlations; Svalbard to shelf and synthetics
- postdoc Urszula Czarniecka – provenance
- postdoc Tore Klausen – sedimentary systems
- postdoc Christian Eide – sedimentary source to sink
- PhD Beyene G. Haile – regional diagenesis
- PhD Honore Yenwongfai – geophysics: velocity models and synthetic seismics
- PhD Mark Mulrooney – fault systems, 50 % (UNIS funded)
- PhD Alexandra Sikora – growth basin fill, 50 % (UNIS funded)
- PhD Berit Hustli – tidal deposits, 20 % (UNIS GeC project funded)
- PhD Lina H. Line – regional diagenesis (affiliated Statoil-Vista funded project)

The work when first described (updated from proposal of October 2013) was organized in six work packages (WPs) targeting sub-objectives:

1. Regional sag/warp-basins; temporal development interplaying with prograding clastic wedges in a source to sink framework,
2. Clinoform facies belts and sequence stratigraphy; sedimentary systems and diagenesis; facies belts with geometry and seismic characteristics informing fluvial and clinoformal systems through quantitative assessment of their shapes,
3. Onshore-offshore growth-basins; location, sedimentary and seismic characteristics and link between basin fill patterns and shelf position,
4. Offshore growth-basins; fault patterns and sedimentary source to sink as reflected in seismic facies belts, and Synthetic seismics modeling of sedimentary systems and shallow growth-basins for sensitivity of visualization,
5. Analogue modeling; sand-silicon box tests of linked deep-seated and shallow-rooted faulting and point-source sediment supply to inform regional interpretations,
6. Education and outreach; 5–8 Masters, 4 PhDs and 4 postdocs.

## Project positions

The project work is to a large degree conducted by a team of postdocs and PhDs, with contributions from numerous Masters, including the following positions:

In the list above, an affiliated PhD position targeting diagenesis of the Triassic-Jurassic SW Barents Shelf funded by Statoil-Vista (for Lina H. Line, former Trias North Master student), can be seen as a spin-off from the Trias North project. Her activity started in June 2016, and will last until the summer of 2020. She will contribute to the overall Trias North work until the end of the project.

## Report on ongoing activity by project team

In the following, ongoing work is summarized. Previous years has seen a continuous focus on allocating manpower and time to the highlighted objectives, to reach defined goals. In the reporting and outlook below, less emphasis is put on the work packages. Instead, the focus is on the work at hand. In the back, there is a summary on publications and outreach of the project as of November 2016.

In parallel, several new subjects, of instance knowledge building around the upper Triassic-Jurassic Realgrunnen Subgroup, have also been advocated by the industry representatives as a new, interesting target. Although challenging to refocus activity, some work has been undertaken in this direction, and more work is in progress. As of today, two articles on this unit are in preparation (Mulrooney et al. and Honore et al.).

## Christian Eide, UiB

Postdoc Christian Haug Eide is first author on two papers that have been submitted from the project in 2016, and one of these is accepted (*Journal of the Geological Society*), another is in review (*GSA Bulletin*). Four presentations directly related to the project have been given as first author, two of these were invited talks. Several other presentations have been given at other conferences within the topic of source-to-sink, landscape evolution through time, and sill intrusions.

A masters project based on field work in the Early Triassic on Svalbard (student Ole Marius Hafstad Solvang), has been started. The objective of this work is to understand the sediment source in Greenland, which was the source of the Early Triassic sediments on Svalbard. Field work was performed successfully in September this year, and a number of samples were acquired. The student is scheduled to submit in c. 14 months, and is showing good progress. The results from this study will tentatively be included in a later publication on source-to-sink of the entire Triassic Barents Sea.

Finally, samples for provenance and uplift (U/Pb, [U+Th]/He, Apatite fission track) studies were acquired from the southern system in the Havert Fm, to help understand the nature and evolution of the southern source in the Barents Sea, which is associated with the best reservoir properties in the Triassic interval. The result of this study is expected to be ready for publication late next year.

## Tore Klausen, UiB

Postdoc Tore Klausen (final year on the project) has been dedicated to finalizing and writing up the results from his research. One paper was published in *Sedimentology* early this year; one has been accepted for publication in *Lithosphere*; and one is under review in the *Journal of the Geological Society of London*. He is now working hard on having two more papers submitted before the end of his period. In addition, he has contributed on a paper by Eide et al. (In review for the *GSA Bulletin*) and another by Haile et al. (in preparation).

One master student, Merethe Bryn, submitted and presented her Master of Science thesis this

spring. In April, Tore presented work on the Jurassic Stø Formation at the FORCE Underexplored Plays conference in Stavanger; in early June, he co-presented work on the Triassic succession of the Barents Sea with Christian Haug Eide at the Norwegian Petroleum Society's Arctic Exploration conference in Tromsø; and later in June he gave two talks, one on the shoreface system in the Snadd Formation and one on the quantitative clinoform study from the Kobbe Formation, at the AAPG Annual Conference and Exhibition in Calgary.

## UiB team

### Presentations by UiB team in 2016:

- Buckley, Simon John; Ringdal, Kari; Lecomte, Isabelle; Anell, Ingrid Margareta; Braathen, Alvar; Eide, Christian Haug: Virtual outcrops to synthetic seismic modelling. Trias North annual workshop
- Eide, Christian Haug. Tana – a very old river: Linking an Early Triassic delta to antecedent topography. Onshore-Offshore relationships on the North Atlantic Margins
- Eide, Christian Haug; Helland-Hansen, William. Mass-balance of an Induan (Early Triassic) Fennoscandian-derived source-to-sink system in the Barents Sea: Implications for early Triassic landscape and exhumation. 32nd Nordic Geological Winter Meeting
- Eide, Christian Haug; Klausen, Tore Grane. Source-to-Sink and sediment balance of the Triassic Barents Sea: Changes in paleogeography and reservoir properties in response to contrasting sediment supply. Arctic Exploration – Understanding the Barents Sea potential
- Eide, Christian Haug; Klausen, Tore Grane; Anell, Ingrid Margareta; Suslova, Anna; Katov, Denis; Helland-Hansen, William. Source-to-sink and mass-balance of the entire Triassic Barents Sea — Ideas, Plans and preliminary results. Trias North annual workshop
- Eide, Christian Haug; Schofield, Nick; Lecomte, Isabelle; Buckley, Simon John; Howell, John Anthony. Seismic imaging of deeply emplaced sill complexes. 2nd Virtual Geoscience Conference
- Klausen, Tore Grane. Facies distribution and detrital zircon signatures of the Early to Middle Jurassic Stø Formation of the Barents Sea. FORCE Advances in siliciclastic and carbonate sedimentology: concepts and case studies from the Norwegian Continental Shelf

- Klausen, Tore Grane; Helland-Hansen, William; Müller, Reidar. Quantitative clinofold characterization –Triassic Barents Sea offshore Northern Norway. Annual Convention and Exhibition
- Klausen, Tore Grane; Ryseth, Alf Eivind; Helland-Hansen, William; Gjelberg, Helge Kollsete. Progradational and Backstepping Shoreface Deposits in the Snadd Formation. Annual Convention and Exhibition

### **Publications of UiB team and their part in integrated work for 2016:**

- Eide, Christian Haug. Reservoir architecture from outcrops: Understanding controls on seismic-to-core scale heterogeneities. *Production Geoscience*
- Eide, Christian Haug; Schofield, Nick; Jerram, Dougal Alexander; Howell, John Anthony. Basin-scale architecture of deeply emplaced sill complexes: Jameson Land, East Greenland. *Journal of the Geological Society*
- Helland-Hansen, W., Sømme, T.O., Martinsen, O.J., Lunt, I., and Thurmond, J. Deciphering Earth's natural hourglasses: Perspectives on source-to-sink analysis. *Journal of Sedimentary Research*, 86, p. 1008-1033.
- Klausen, Tore Grane; Müller, Reidar.; Slama, Jiri; Helland-Hansen, William. Evidence for Late Triassic provenance areas and Early Jurassic sediment supply turnover in the Barents Sea Basin of northern Pangea. *Lithosphere*; Accepted for publication, doi:10.1130/L556.1.
- Paterson, Niall William; Mangerud, Gunn; Cetean, Claudia; Mørk, Atle; Lord, Gareth Steven; Klausen, Tore Grane; Mørkved, Pål Tore. A multidisciplinary biofacies characterisation of the Late Triassic (late Carnian–Rhaetian) Kapp Toscana Group on Hopen, Arctic Norway. *Palaeogeography, Palaeoclimatology, Palaeoecology*
- Lecomte, Isabelle; Lavadera, Paul Lubrano; Botter, Charlotte; Anell, Ingrid Margareta; Buckley, Simon John; Eide, Christian Haug; Grippa, Antonio; Mascolo, Valentina; Kjoberg, Sigurd. 2(3)D convolution modelling of complex geological targets – beyond 1D convolution. *First Break*; Volum 34 (5), 99-107.

## **Snorre Olaussen and the UNIS team**

The main activity this year was the study of facies development of the De Geerdalen Formation on Edgeøya. In addition, upper parts of the De Geerdalen Formation and the Wilhelmøya Subgroup were logged at Treskelen in Hornsund. Participants from UNIS was Snorre Olaussen and PhD students Mark Mulrooney (UNIS/UiO), Gareth Lord (NTNU/UNIS), and Bjarte Rismyhr (UiB/UNIS). More than 50 logs (i.e. approximate 2 km of described sections) are now under final processing at UNIS on behalf of the project team, targeting a full compilation of the southern Edgeøya into a comprehensive manuscript (see Anell's report).

One manuscript will be submitted by the end of 2016;

- Mulrooney, M., Rismyhr, B., Yenwongfai, H. D., Olaussen, S., Leutscher, J., Braathen, A. Late Triassic tectonics in the Troms-Finnmark Fault Complex: Evidence from the Realgrunnen Subgroup in the Goliat Field, SW Barents Shelf, Norway.

Another manuscript by PhD-student Aleksandra Sikora and co-workers is in progress. This article targets the sedimentary facies and architecture of deposits within the growth-fault basins of Kvalpynten, Edgeøya.

### **Conference abstracts and submitted conference abstracts**

- Aleksandra Smyrak-Sikora, Per Terje Osmundsen, Alvar Braathen, Mark Mulrooney & Snorre Olaussen. 2016. Three-dimensional model of facies distribution within a Triassic half-graben, SW Edgeøya, Svalbard. 2nd Virtual Geoscience Conference. Bergen 21-23 September.
- Aleksandra Smyrak-Sikora, Per Terje Osmundsen, Alvar Braathen, Kei Ogata, Ingrid Anell, Berit Husteli, Mark Mulrooney, Snorre Olaussen. Sedimentary architecture of siliciclastic, syntectonic graben and half-graben fill in Kvalpynten, Edgeøya, Svalbard. Norsk Geologisk Vinterkonferanse. January 2017

The following four master theses at NTNU (Norwegian University of Science and Technology) and UNIS were finished in 2016, supervised by

Atle Mørk (NTNU) and co-supervised by Snorre Olaussen;

- Trond S. Harstad, 2016. Sandstone Provenance of the De Geerdalen Formation, Svalbard – Emphasis on Petrography and Chromum Spinel Compositions. Master Thesis, Norwegian University of Science and Technology, Trondheim, 98 pp.
- Turid Haugen, 2016. A Sedimentological Study of the De Geerdalen Formation with Focus on the Isfjorden Member and Palaeosols. Master Thesis, Norwegian University of Science and Technology, Trondheim, 155pp.
- Sondre K. Johansen, 2016. Sedimentology and facies distribution of the Upper Triassic De Geerdalen Formation in the Storfjorden area and Wilhelmøya, eastern Svalbard Master Thesis, Norwegian University of Science and Technology, Trondheim, 191 pp.
- Simen Jenvin Støen, 2016. Late Triassic sedimentology and diagenesis of Barentsøya, Wilhelmøya and eastern Spitsbergen. Master Thesis, Norwegian University of Science and Technology, Trondheim, 151 pp.

## Atle Mørk and the NTNU team

NTNU had no direct financial support from the Trias North project in 2016; however, NTNU PhD candidate Gareth S. Lord (funded by OD) participated on the excursion to southern and eastern Svalbard arranged by the Trias North project.

As part of close collaboration between projects targeting the Triassic of Svalbard, student activity of relevance is mentioned. In total three master students finished their theses on the upper Triassic succession around Storfjorden (East Svalbard) during the summer of 2016, all with grade A. They have received support from RiS, industry and the Norwegian Petroleum Directorate. See the UNIS Report by Snorre Olaussen for details.

For 2016, 3 new NTNU/UNIS Master students (Bård Heggem, Cathinka Forsberg and Nina Bakke), two of them with support from RiS, did fieldwork in Fulmardalen on the Triassic succession, and one also in the Isfjorden area. They will finish their work in June 2017.

## Ingrid Anell, UiO

Postdoc Ingrid Anell's work in 2016 has targeted finalizing an article on synthetic seismics for the South Edgeøya case study. This article is expected to be published in 2016:

- Anell, I., Lecomte, I., Braathen, A., and Buckley, S.J., in press. Synthetic seismic expression of an onshore growth-faulted low-angle prograding deltaic system: The Triassic onshore-offshore link on the NW Barents Shelf.

For large parts of the year Ingrid has been on maternity leave. She will continue her work in January 2017. For 2017 her intentions are to compile and write up one or potentially two articles of the South Edgeøya depositional system (upper Triassic De Geerdalen Formation), unravelling the delta-progradation on the Edgeøya High (shallow water system). One article will be a major compilation of nearly 30 logged sections and a major photogrammetry database, in sum covering an area of 20x40 km; the harvest of in total 4 field campaigns to the area.

Anna Daniela Røhnert (UNIS and UiO) defended her Master thesis in November 2016. Her thesis was entitled: Geometry and sedimentary facies of low-angle clinoforms, Edgeøya, Svalbard; and was supervised by Ingrid Anell, backed by Alvar Braathen and Snorre Olaussen.

## Honoré Yenwongfai, UiO

During the course of 2016, PhD-student Honoré Yenwongfai has had the opportunity to mature ideas, concepts, and workflows initialized during the start of his PhD in August 2015. So far, the Goliath Field has been used as a case study to test different workflows within the Earliest and Latest Triassic reservoir units.

Parts of the first article (focusing on the Realgrunnen Subgroup), was submitted as an extended abstract to the EAGE. After the oral presentation in EAGE Annual meeting in Vienna, a full manuscript was prepared and submitted to the *Interpretation Journal*. A minor revision is currently needed after the peer review process.

The same strategy was used for the second pa-

per (focusing on the Havert Fm). First, an extended abstract was sent to SEG, and a full paper was then prepared and submitted in October to the *Interpretation Journal*. Another paper was presented in Dallas in October, sponsored by an SEG leadership grant. The full paper is still under review.

Honoré hopes to carry on with the same enthusiasm in 2017. Future work will use some of the workflows tested on the Goliat Field, within the Triassic in the Norvarg area. The plan is to integrate forward seismic modelling with inverse modelling and rock physics.

#### List of contributions:

- Honore Yenwongfai, Nazmul Mondol, Jan Inge Faleide, and Isabelle Lecomte: Quantitative seismic reservoir characterization within the Realgrunnen Subgroup and the Havert Formation in the Goliat Field, SW Barents Sea. Trias North annual workshop 2016.
- Honore Yenwongfai, Nazmul Mondol, Isabelle Lecomte and Jan Inge Faleide, 2016, Prestack Simultaneous Inversion to Predict Lithology in the Realgrunnen Subgroup of the Goliat Field, SW Barents Sea: 78th Conference and Exhibition, EAGE, Extended Abstracts, doi: 10.3997/2214-4609.201600964
- Honore Yenwongfai, Nazmul Mondol, Jan Inge Faleide, and Isabelle Lecomte, 2016 Prestack inversion for porosity, shale volume, and sand probability in the Havert Formation of the Goliat Field, SW Barents Sea. SEG Technical Program Expanded Abstracts 2016: pp. 3543-3547. doi: 10.1190/segam2016-13943690.1

## Beyene Girma Haile, UiO

PhD-student Beyene Girma Haile has the following activities that were undertaken in 2016:

#### Data analyses and manuscript writing

- Manuscript entitled Evidence of hydrothermally induced diagenesis-Wilhelmøya, Svalbard submitted to the *Journal of Sedimentary Research (JSR)* in October 2016
- Manuscript write up on progress associated to petrography, diagenesis, and sedimentology of deltaic succession deposit exposed in outcrop at Edgeøya, Svalbard

#### Conferences:

- Prepared an abstract entitled “New insights about thermally driven diagenetic changes due to the emplacement of magmatic sills into reservoir sediments at Wilhelmøya (Svalbard): Implications for reservoir quality” for Winter Conference 2017 organized by Norsk Geologisk Forening (NGF) and it is accepted.
- Finalize the preparation of the oral presentation in December 2016.

#### Plans for 2017

- Participate in the Winter Conference 2017 in Oslo January 2017. Give an oral presentation on new insights associated to thermally induced diagenesis
- Participate in the International Meeting of Sedimentology 2017 of 33rd IAS and 16th ASF joint meeting, Toulouse October 2017. Give an oral presentation on experimental clay mineral diagenesis
- Submit the manuscript entitled “Linking diagenesis to the depositional facies distributions in a deltaic succession exposed in outcrop at Edgeøya, Svalbard, to *G3/Geochemistry, Geophysics, Geosystems* (an AGU Journal).
- Investigate in detail the distribution of diagenetic fingerprints in the perspective of sedimentology and sequence stratigraphy using core samples from Barents Sea
- Continue data collection and analyses
- Continue performing sedimentological, petrographic-thin section, Scanning Electron Microscopy, X-ray diffractometer analyses
- Integrate well log, sedimentological, seismic and sequence stratigraphic data with diagenetic fingerprints in order to map diagenetic trends in a regional scale
- Finalize the PhD late in the year.

## Roy Gabrielsen, UiO and Utrecht University

Contributions to the Trias North project have been focused on summarizing and writing up results of the analogue experimental work undertaken in the

lab at the Utrecht University (Holland). In addition to various presentations (see Trias North database for PPTs), the following contribution is linked to the Trias North activity:

- Gabrielsen, R.H., Sokoutis, D., Willingshofer, E. & Faide, J.I., 2016: Fault linkage across weak layers during extension: An experimental approach and consequence in the Hoop Fault Complex of the southeastern Barents Sea. *Petroleum Geoscience*, 22 (2), 123-135.

## Isabelle Lecomte, NORSAR

Isabelle's contribution to the Trias North project in 2016 relates to three activities;

1. Short course on seismic modelling given at UiO in the spring of 2016, in which many Trias North students and researchers participated.
2. Finalizing the article on seismic modelling of southern Edgeøya (see Anell's report)
3. Improve data transfer between Lime og Seis-RoX for advanced modelling

In the fall of 2016, Isabelle left NORSAR for UiB. For 2017, new possibilities linked to her Associate professor position there will be discussed with William Helland-Hansen, for instance targeting seismic modelling of clinoforms.

Her new mail address is: [isabelle.lecomte@uib.no](mailto:isabelle.lecomte@uib.no)

## Kei Ogata, Cristian Cavozi, and Fabrizio Storti, University of Parma

### WP 3 – Onshore and offshore growth-basins: Characterizing faults in poorly consolidated sediments

The total structural-stratigraphic database collected during the 2014–15 field campaigns on Eastern Svalbard (South Edgeøya) has been integrated and jointly analysed. Through the compilation, digitalization and interpretation of 35 correlated structural-stratigraphic logs (1:20 scale), we carefully depicted the structural architecture of eight listric and two planar normal faults from the coastal exposures of Kvalpynten, Øhmanfjellet

and Negerpynten. Petrophysical (porosity, pore size distribution, density) and microstructural analyses (optical microscopy and SEM) have been performed on 42 samples, specifically collected within each representative fault element found in the logged sites. The main aim of this work was to identify the micro- to meso-scale deformation mechanisms of faulting in shallowly buried, poorly-consolidated lithologies.

The main results are summarised as follows:

- Identification of two main regional structural trends (lineaments) striking NW–SE and NE–SW.
- Shallow-rooted (listric) growth faults to the NW (Kvalpynten and Øhmanfjellet areas) and deep-rooted (planar) growth faults to the SE (Negerpynten area)
- At least three hierarchical orders of growth faults: 2–3 major (1st order) growth fault sequences comprising 4–5 cycles (2nd order sand wedges) and intra-cycle growth (3rd order)
- Palaeocurrent measurements suggest a curving paleo-coastline, showing a rough parallelism with faults' strike trends
- Definition of growth fault zone architectures and lateral-vertical geometric relationships of architectural elements (fault cores, mixed zones and damage zones), suggesting widening of the soft-sediment elements along with increasing displacement
- Micro- to meso-scale polyphased deformation during progressive lithification, suggesting syn-tectonic, ductile to brittle regime transition (from strain diffusion to strain localisation)
- Progressive reworking of soft-sediment structural discontinuities testifying for multi-stage growth faulting
- Microfabric-related structural anisotropy controls porosity-permeability promoting localized micro-fracturing as suggested by systematic bimodal pore size distributions
- Occurrence of cone-in-cone calcite aggregates and systematic increase in Fe-sulfides (pyrite) cementation toward fault cores may suggest the combined contribution of seepage forces and biological activity

These results will be presented in a dedicated paper with the tentative title: "Deformation style

and micro- to meso-scale characteristics of the Triassic growth faults of southern Edgeøya (East Svalbard)”. A draft is currently under way and will be finalized in 2017.

### **WP 3 – Analogue modelling, growth-basins vs. clinoforms**

The 2016 timeframe has been used to continue the planned series of five new sand-box models to complement the first series of six preliminary test experiments conducted in 2015. The overall models’ set up and experimental strategies have been carried out using a trial-and-error approach, to separately test different scenarios on the basis of the inferred dominant controlling factor:

1) Tectonics, 2) Gravity and 3) Sedimentation.

The general set up adopted for the models implies a (pre)faulted pre-growth section at the base and a layered, syn-growth section deposited on top, with a scaling ration of  $1,5 \times 10^{-5}$  (100 m = 1,5 cm).

Currently eleven experiments have been achieved and four more are planned for 2017:

- The first series of three experiments (i.e. SV-01, SV-02 and SV-03) was performed to test far-field tectonic extension (and associated perpendicular compression) with a set up comprising a sand multilayer (with and without silicone putty) on pulled rubber sheet (with and without discontinuities).
- The second series of six experiments (i.e. pilot test model SV-04 plus SV-05, SV-06, SV-07, SV-08 and SV-09) was performed to test gravity sliding. Apart SV-04, the same set up have been used in all the experiments (highly cohesive sand, with and without silicone putty, on sliding plexiglass plates subsequently tilted 3-5 degrees). For the SV-07 and SV-08 also a localised, lobate sedimentation has been tested, with down- and up-slope progradation directions, respectively.
- The third series of six experiments (SV-10 and SV-11 achieved; SV-12, SV-13, SV-14 and SV-15 planned) have been designed with a different set up that implies, as driving mechanism, pure extension on pre-compressed (and subsequently released) sylomer and plexiglass bars. The SV-10 and SV-11 models were conducted with sand and silicone putty, and with

opposite, syn-growth lobate sedimentation as performed in SV-07 and SV-08. The planned SV-12, SV-13, SV-14 and SV-15 models will be conducted alternating 50 % and 100 % extension, eventually adding the tilting variable to generate gravity sliding as tested in models SV-04 to SV-09.

- The best results in terms of likelihood with the natural examples of Edgeøya were achieved in the gravity sliding models (i.e. SV-04 to SV-09). All the models notably suggest the need of pre-existing discontinuities (faults) in the pre-growth section in the footwall of the main detachment level, and the preferential accumulation of syn-growth sediments in order to localise growth-faults.

A dedicated article presenting these results is currently in preparation. A first draft is expected in 2017.

By integrating and summarising the results from fieldwork and analogue modelling the following final remarks can be drawn:

- Deep-rooted tectonic faults created local depocenters and a regional slope, and potentially also caused substrate remobilization (seismic shocks?).
- Increasing sand input (distributary channel avulsion?, climatic events, enhanced weathering?), localized sedimentary loading, and high sedimentation rates, all favour the mutual feedback between faults’ activity and creation of accommodation space.
- Varying rheological behaviour and differential compaction of unlithified sand and silty-mud were caused by combined interplay of shear-dilatation, fluid circulation, biological activity and fault zone strain-weakening.

## **Urszula Czarniecka**

Postdoc Urszula Czarniecka was visiting the University of Oslo for six months in 2016 (May – October). Her goals were to achieve closer collaboration with the project team and integrate her work with ongoing studies. Further, she used the Department of Geosciences’ ICPMS for advanced provenance studies.

Some of the research results cover the last year

provenance studies of the Bravaisberget Formation (Middle Triassic) siliciclastic deposits of southern Spitsbergen. Petrographic and bulk-rock geochemical data were gathered from samples of sandy and silty deposits at Karentoppen and Moloen areas. Interpretation of the data points that the deposits at Karentoppen area are represented mostly by sandstones and silty sandstones and can be classified as quartzose, sublithic and subfelds arenites with minor wackies intercalations. Samples from Moloen are represented by siltstones, mudstones and cementstones. All the studied deposits were delivered from felsic primary source rocks with an admixture of intermediate components, which were sedimentary recycled under passive continental margin conditions.

Moreover, U-Pb dating of zircons from five sandy samples of the Bravaisberget Formation of southern Spitsbergen was conducted at the LA-ICPMS laboratory of the Department of Geosciences. Furthermore, Lu-Hf isotopes were measured in order to complement the dating results. Characteristics of the zircons population point to a connection with the Greenland source area. The result improves provenance interpretations from petrographic and bulk-rock geochemistry data, which have been suggested so far.

In order to undertake comparison between the westerly-sourced (Greenland) Middle Triassic siliciclastic deposits of southern Spitsbergen to Triassic deposits that occur in other areas of the Barents Sea Shelf, thin sections of sandstones of the Kobbe, Snadd (Middle and Upper Triassic; Bjarmeland Platform: cores 7223/5-1 and 7224/7-1) and De Geerdalen Formations (Upper Triassic; Edgeøya) were analyzed. Sandstones of the Kobbe Formation are classified as feldspathic litharenites and litharenites, and the Snadd Formation sandstones also as lithic arkoses. Sandy deposits of the De Geerdalen Fm are represented by feldspathic litharenites, lithic arkoses and feldsarenites. The analysis results allowed describing petrographic signatures which are distinctive for sediments delivered from southern (Fennoscandia) and/or south-eastern (Uralids) source area(s). Follow-up work is considered on this dataset.

For the upcoming period, this vast amount of data is processed for publication in international

journals. Two tentative manuscripts are in progress.

## The PAS team

Investigation of provenance of the Bravaisberget Formation in southern Spitsbergen concentrated on sections containing wedges of deltaic deposits (Karentoppen Member) at Sørkapp and Sørkapplaguna (Sørkappøya), Karentoppen, Røysneset, and Lidfjellet/Liddalen (western coast of Sørkapp Land). Combination of the petrographic and the whole-rock geochemical analyses with zircon geochronology confirm the earlier facies and sedimentological observations suggesting intracratonic, westerly-located source of the siliciclastic material, most probably in the northern and north-eastern Greenland. These deposits are dominated by sandstones and silty sandstones, and can be classified as quartzose, sublithic and subfelds arenites with minor wacke intercalations. They were delivered from felsic primary source rocks with an admixture of intermediate components, which were sedimentarily recycled under passive continental margin conditions. In order to compare the westerly-sourced siliciclastics of southern Spitsbergen with the Triassic deposits occurring in eastern Svalbard (Edgeøya) and to the south in the Barents Shelf (Bjarmeland Platform), samples from the Kobbe, Snadd, and De Geerdalen Formations were analyzed. The results allow to discriminate different petrographic signatures that are distinctive for sediments delivered from the southern (Fennoscandia) and/or south-eastern (Uralids) source areas.

The Triassic organic carbon-rich deposits were investigated on the Eastern Svalbard Platform in an attempt to characterize depositional and diagenetic processes leading to the formation of quality petroleum source-rocks. The results of an integrated study of the facies, petrographic, geochemical, and pyrolytic analyses show that the best conditions for their formation occurred during maximum transgression of the Middle Triassic cycle (early ladinian) over depressed parts of the shelving bottom with recurrent or seasonal euxinia. This euxinic facies extends from Edgeøya north- and westwards into southern Barentsøya and eastern

Spitsbergen (including Sassendalen), and should have continuation under the sea to the south in the Barents Shelf. Geochemical parameters based on the redox-sensitive metal indices were found useful in approximating boundaries of the euxinic facies. This approach seems to be confirmed by the ongoing paleomagnetic study in selected Triassic sections on the Platform (Muen, Skarpryttaren, Neg-erfjellet, Kuhrbreen). Maturation of organic matter and bitumen generation were local phenomena, related to spot-like intrusions of swarms of dolerite sills during the early Cretaceous.

The sandstones of the Bravaisberget Formation occurring in the West Spitsbergen Fold Belt (the Lidfjellet – Øyrlandsodden Fold Zone) were analyzed for paleomagnetic record in order to conclude on possible bitumen generation from the Triassic succession in the active tectonic belt. Samples from the section at Moloen (southern coast of Sørkapp Land) were analyzed using petrographic methods to discriminate fractions of magnetic minerals. Pyrrhotite was revealed to be the main magnetic mineral. It has formed during burial diagenesis in a strongly reductive pore environment as a result of reduction of rudimentary sulfate and reactive iron, most probably due to oxidation of organic carbon. This means that it could mark the first appearance and migration of bitumen through the Triassic succession. Measurements of the natural remanent magnetization (NRM) show that pyrrhotite component has a high inclination, typical for the Tertiary magnetic directions. This is consistent with the major phases of tectonic activity related to Greenland transpression and formation of the fold belt along the western margin of Spitsbergen. These results suggest that generation of bitumen from the Triassic succession in Svalbard was at least twofold: (i) intrusive heating during Cretaceous on the Eastern Svalbard Platform, and (ii) Cenozoic tectonic stress and differential burial in the West Spitsbergen Fold Belt.

- Urszula Czarniecka. Petrography and geochemistry of the Middle Triassic deposits at Karentoppen, Sørkapp Land, S Spitsbergen. Trias North annual workshop 2016
- Krzysztof P. Krajewski. Depositional and diagenetic processes in the formation of the Triassic petroleum source rocks in Svalbard. Trias North annual workshop 2016

- Marek Lewandowski, Krzysztof P. Krajewski, Katarzyna Dudzisz, Rafał Szaniawski. Remagnetization of the Ladinian sandstones of the Bravaisberget Fm in Sørkapp Land, S Spitsbergen – effect of the Neogene hydrocarbon migration? Trias North annual workshop 2016
- Marek Lewandowski, Rafał Szaniawski, Krzysztof P. Krajewski, Katarzyna Dudzisz. Dating reductive fluids flow by means of paleomagnetic data – example from the Triassic sandstones of the southern Spitsbergen. International Geological Congress, Cape Town, 27.08.–4.09.2016.
- Urszula Czarniecka, Krzysztof P. Krajewski. The Bravaisberget Formation in Sørkapp Land (S Spitsbergen): Petrographic and geochemical characteristics of the westerly-sourced siliciclastic deposits in the Triassic of Svalbard. *Marine and Petroleum Geology* (submitted).
- Participation of Krzysztof Michalski and Darko Matesic in the Trias North expedition to Svalbard, 22.–29.07.2016.

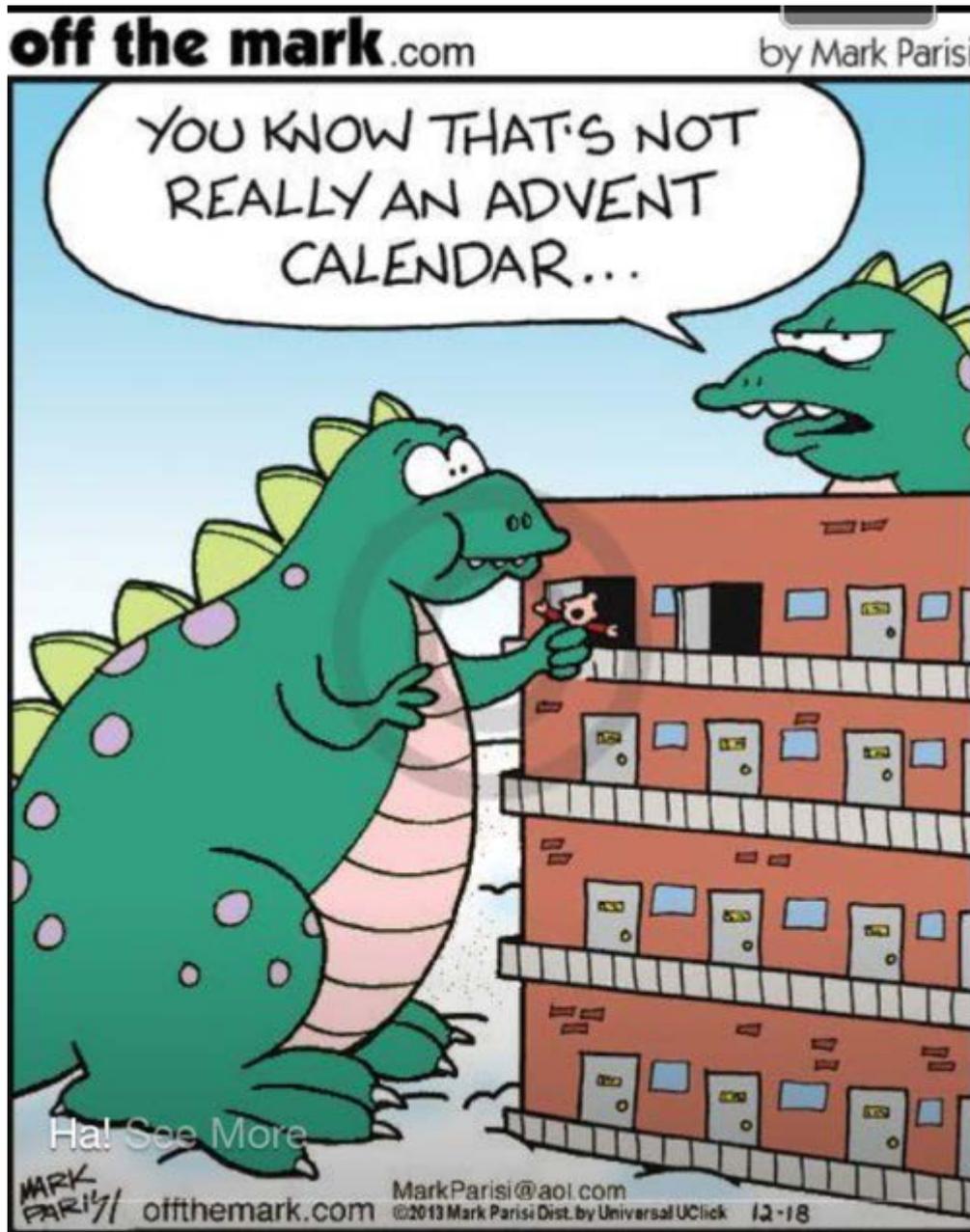
## Harmon D. Maher Jr., University of Nebraska at Omaha

During the Stalbas summer expedition of 2016 fracture orientation data was collected from the Hornsund area and from four sites on southern Edgeøya. In addition, distinctive thin horizons within the Tschermakfjellet Formation that may be ash horizons were sampled and several additional sites with these same horizons were found and sampled. Data from additional growth basins at Tjuvfjordskada similar to those at Kvalpynten occur, but which are less well exposed, was collected. The structural pattern was consistent with Kvalpynten's, and this site significantly increases the known footprint of growth basin development. An internal report on these structures has been distributed amongst the working group.

Edgeøya fracture data from the summer was analyzed, integrated with previous results, and presented as a talk entitled “Mesozoic Regional Stress Field Evolution in Svalbard” at the fall Geological Society of America Annual Meeting (<https://gsa.confex.com/gsa/2016AM/webprogram/Paper281384.html> – the PowerPoint presentation is available at this site). An associated manuscript is in preparation.

Petrographic analysis of grain mounts and XRD analysis of the potential ash layers has been conducted. A final report is near completion. Natrojarosite, a sodium iron sulfate, has been identified as a major constituent, and is responsible for the distinctive yellowish coloration. At this point results are still inconclusive as to whether these are volcanic ash beds, but potential glass shards have been found, and natrojarosite is associated with

volcanic ash alteration at other places. As soon as “ash” is well confirmed, kg’s of gathered material from the 2017 field campaign will be considered for zircon extraction and possible U-Pb dating at the UiO. This will tie nicely with biostrat and chemostrat work undertaken at UiO by Wolfram Kürschner and co-workers (in parallel project).



And then:

**Best wishes for the holidays  
and for a rocking new year!**

# 103 things we've said and done

1. Anell, Ingrid Margareta. Edgeøya – en saga i sten. *Geologiskt forum: Geologiska Föreningens populärvetenskapliga tidskrift* 2015; volum 22(87), s. 23–27
2. Anell, Ingrid Margareta; Braathen, Alvar; Faleide, Jan Inge. [Hidden below – Paleo-highs and deep structural influence on sedimentation on the Northern Barents Shelf](#). 3P Arctic Petroleum Potential AAPG Conference 2015
3. Anell, Ingrid Margareta; Braathen, Alvar; Faleide, Jan Inge; Olaussen, Snorre. [Bridging the gaps of our understanding of the Triassic of the northern Barents Shelf](#). Arctic Frontiers 2015
4. Anell, Ingrid Margareta; Braathen, Alvar; Midtkandal, Ivar; Smyrak-Sikora, Aleksandra Anna; Husteli, Berit; Ogata, Kei; Osmundsen, Per Terje. [Tracking the Triassic platform-edge: Inferences on onshore clinoform geometries upon reaching the Edgeøya platform](#). Vinterkonferansen 2015
5. Anell, Ingrid Margareta; Braathen, Alvar; Olaussen, Snorre. [The Triassic – Early Jurassic of the northern Barents Shelf: a regional understanding of the Longyearbyen CO<sub>2</sub> reservoir](#). *Norsk Geologisk Tidsskrift* 2014; volum 94, s. 83–98
6. Anell, Ingrid Margareta; Braathen, Alvar; Olaussen, Snorre. [Regional constraints of the Sørkapp Basin: A Carboniferous relic or a Cretaceous depression?](#). *Marine and Petroleum Geology* 2014; volum 54, s. 123–138
7. Anell, Ingrid Margareta; Faleide, Jan Inge; Braathen, Alvar. [Regional tectono-sedimentary development of the highs and basins of the northwestern Barents Shelf](#). *Norsk Geologisk Tidsskrift* 2016; volum 96 (1), s. 27–41
8. Anell, Ingrid Margareta; Midtkandal, Ivar. [The quantifiable clinothem – types, shapes and geometric relationships in the Plio-Pleistocene Giant Foresets Formation, Taranaki Basin, New Zealand](#). *Basin Research* 2015 s. 1–21
9. Anell, Ingrid Margareta; Midtkandal, Ivar; Braathen, Alvar. [Trajectory analysis and inferences on geometric relationships of an Early Triassic prograding clinoform succession on the northern Barents Shelf](#). *Marine and Petroleum Geology* 2014; volum 54, s. 167–179
10. Braathen, Alvar. CCS in Norway and the Longyearbyen pilot project. Guest lecture, Pretoria
11. Braathen, Alvar. Reconstructing the Triassic northern Barents Shelf; basin infill patterns controlled by gentle sags and faults. Student meeting 2013
12. Braathen, Alvar; Anell, Ingrid Margareta; Smyrak-Sikora, Aleksandra Anna; Mulrooney, Mark; Haile, Beyene Girma; Ogata, Kei; Osmundsen, Per Terje; Maher, Harmon; Buckley, Simon John; Hellevang, Helge; Olaussen, Snorre. Tectonic influence on platform infill patterns in the mid-late Triassic, Southern Edgeøya, Svalbard. Boreal Triassic II 2015
13. Braathen, Alvar; Mulrooney, Mark; Ogata, Kei; Anell, Ingrid Margareta; Smyrak-Sikora, Aleksandra Anna; Lecomte, Isabelle; Osmundsen, Per Terje; Maher, Harmon. [Trias North: Late Triassic shallow faulting in Edgeøya, Svalbard; structural style, deformation mechanisms and seismic expression](#). Vinterkonferansen 2015
14. Buckley, Simon John; Dolva, Benjamin; Braathen, Alvar; Anell, Ingrid Margareta; Mulrooney, Mark; Lecomte, Isabelle. State-of-the-art of digital outcrop mapping methods: application to the Triassic of Edgeøya, Svalbard. Triassic and Jurassic reservoir development in the Barents Sea 2015
15. Eide, Christian Haug. [Magmatiske intrusjoner på Øst-Grønland](#). *Geoforskning.no* 2016
16. Eide, Christian Haug. Reservoir architecture from outcrops: Understanding controls on seismic-to-core scale heterogeneities. Production Geoscience 2016
17. Eide, Christian Haug. Jakta på storflaumen – Ka vil DU bli? Feltgeolog? Ungdomsskolebesøk på Institutt for geovitenskap 2016
18. Eide, Christian Haug. Flaum på Vestlandet – tankar om den store flaumen i 2014. Faglig-pedagogisk dag ved UiB 2016
19. Eide, Christian Haug. Tana – a very old river: Linking an Early Triassic delta to antecedent topography. Onshore-Offshore relationships on the North Atlantic Margins 2016
20. Eide, Christian Haug; Haflidason, Haflidi. Den store flaumen i 2014 – Fjordsediment som arkiv for før-instrumentelle flaumar på Vestlandet. Geofaredagen 2016
21. Eide, Christian Haug; Helland-Hansen, William. Mass-balance of an Induan (Early Triassic) Fennoscandian-derived source-to-sink system in the Barents

Red titles should be clickable!

- Sea: Implications for early Triassic landscape and exhumation. 32nd Nordic Geological Winter Meeting
22. Eide, Christian Haug; Howel, John A.; Buckley, Simon John; Martinius, Allard W.; Oftedal, Bjørn Terje; Henstra, Gijs Allard. [Facies model for a coarse-grained, tide-influenced delta: Gule Horn Formation \(Early Jurassic\), Jameson Land, Greenland](#). *Sedimentology* 2016
  23. Eide, Christian Haug; Klausen, Tore Grane. Source-to-Sink and sediment balance of the Triassic Barents Sea: Changes in paleogeography and reservoir properties in response to contrasting sediment supply. Arctic Exploration – Understanding the Barents Sea potential 2016
  24. Eide, Christian Haug; Schofield, Nick; Lecomte, Isabelle; Buckley, Simon John; Howell, John Anthony. Seismic imaging of deeply emplaced sill complexes. 2nd Virtual Geoscience Conference
  25. Eide, Christian Haug; Schofield, Nick; Jerram, Dougal Alexander; Howell, John Anthony. [Basin-scale architecture of deeply emplaced sill complexes: Jameson Land, East Greenland](#). *Journal of the Geological Society* 2016
  26. Gabrielsen, Roy; Braathen, Alvar. Dynamics, Architecture and Influences on Fluid Flow in Normal Faults. Winter Conference 2015
  27. Gabrielsen, Roy; Braathen, Alvar; Skar, Tore. Normal Faults in Sedimentary Rocks; Dynamics, Architecture and Influences on Fluid Flow. Geometry and Growth of Normal Faults 2014
  28. Gabrielsen, Roy Helge; Braathen, Alvar; Kjemperud, Magnus Vestheim; Valdresbråten, M.L.R. [The geometry and dimensions of fault-core lenses](#). *Geological Society Special Publication* 2016; volum 439
  29. Gabrielsen, Roy Helge; Sokoutis, Dimitrios; Willingshofer, Ernst; Faleide, Jan Inge. [Fault linkage across weak layers during extension: an experimental approach with reference to the Hoop Fault Complex of the SW Barents Sea](#). *Petroleum Geoscience* 2016; volum 22 (2), s. 123–135
  30. Harstad, Trond Svånå. [Sandstone Provenance of the De Geerdalen Formation, Svalbard – Emphasis on Petrography and Chromum Spinel Compositions](#). Trondheim: NTNU 2016 98 s.
  31. Haugen, Turid. [A Sedimentological Study of the De Geerdalen Formation with Focus on the Isfjorden Member and Palaeosols](#). Trondheim: NTNU 2016 155 s.
  32. Helland-Hansen, William; Sømme, Tor Oftedal; Martinsen, Ole Jakob; Lunt, Ian; Thurmond, John. [Deciphering earth's natural hourglasses: Perspectives on source-to-sink analysis](#). *Journal of Sedimentary Research* 2016; volum 86(9), s. 1008–1033
  33. Johansen, Sondre Krogh. [Sedimentology and facies distribution of the Upper Triassic De Geerdalen Formation in the Storfjorden area and Wilhelmøya, eastern Svalbard](#). Trondheim: NTNU 2016 191 s.
  34. Klausen, Tore Grane. [Outcrop expression of channelized deposits in the Carnian De Geerdalen Formation and their link to the subsurface Snadd Formation of the Barents Sea](#). Force Underexplored plays 2015
  35. Klausen, Tore Grane. [Facies distribution and detrital zircon signatures of the Early to Middle Jurassic Stø Formation of the Barents Sea](#). Advances in siliciclastic and carbonate sedimentology: concepts and case studies from the Norwegian Continental Shelf, Force 2016
  36. Klausen, Tore Grane; Helland-Hansen, William; Müller, Reidar. Considerations surrounding decompaction and restoration of clinoforms – towards quantification of prodelta and shelf edge geometries in the Triassic succession of the Barents Sea. Winter Conference 2015
  37. Klausen, Tore Grane; Helland-Hansen, William; Müller, Reidar. [Quantitative clinoform characterization – Triassic Barents Sea offshore Northern Norway](#). Annual Convention and Exhibition Calgary 2016
  38. Klausen, Tore Grane; Helland-Hansen, William; Ryseth, Alf. Meanders to ribbons: basin-scale deltaic evolution in the Barents Sea offshore Northern Norway. Sedimentology of Paralic Reservoirs: Recent Advances and their Applications 2015
  39. Klausen, Tore Grane; Müller, Reidar; Slama, Jiri; Helland-Hansen, William. [Evidence for Late Triassic provenance areas and Early Jurassic sediment supply turnover in the Barents Sea Basin of northern Pangea](#). *Lithosphere* 2016
  40. Klausen, Tore Grane; Ryseth, Alf Eivind; Helland-Hansen, William; Gawthorpe, Robert; Laursen, Inger. [Regional development and sequence stratigraphy of the Middle to Late Triassic Snadd Formation, Norwegian Barents Sea](#). *Marine and Petroleum Geology* 2015; volum 62, s. 1021–22
  41. Klausen, Tore Grane; Ryseth, Alf Eivind; Helland-Hansen, William; Gjelberg, Helge Kollsete. [Progradational and Backstepping Shoreface Deposits in the Snadd Formation](#). AAPG Annual Convention and Exhibition
  42. Klausen, Tore Grane; Ryseth, Alf Eivind; Helland-Hansen, William; Gjelberg, Helge Kollsete.

Red titles should be clickable!

- Progradational and backstepping shoreface deposits in the Ladinian to Early Norian Snadd Formation of the Barents Sea. *Sedimentology* 2016
43. Krajewski, K. P.; Weitschat, W. **Depositional history of the youngest strata of the Sassendalen Group (Bravaisberget Formation, Middle Triassic-Carnian) in southern Spitsbergen, Svalbard.** *Annales Societatis Geologorum Poloniae* 84/2014
44. Lecomte, Isabelle. Understanding and analyzing seismic images: insight through appropriate modelling. Årsmøte OSEG 2015
45. Lecomte, Isabelle; Lavadera, Paul Lubrano; Botter, Charlotte; Anell, Ingrid Margareta; Buckley, Simon John; Eide, Christian Haug; Grippa, Antonio; Mascolo, Valentina; Kjoberg, Sigurd. **2(3)D convolution modelling of complex geological targets – beyond 1D convolution.** *First Break* 2016; volum 34(5), s. 99–107
46. Lecomte, Isabelle; Lavadera, Paul Lubrano; Schmid, Daniel Walter. **Understanding and Analysing Seismic Images – Insight through Appropriate Modelling.** EAGE 2015
47. Lecomte, Isabelle; Lubrano-Lavadera, Paul Louis Francois; Anell, Ingrid Margareta; Buckley, Simon John; Schmid, Daniel Walter; Heeremans, Michel. **Ray-based seismic modeling of geologic models: Understanding and analyzing seismic images efficiently.** *Interpretation* 2015; volum 3(4), s. SAC71–SAC89
48. Maher, Harmon; Senger, Kim; Ogata, Kei; Braathen, Alvar; Mulrooney, Mark; Smyrak-Sikora, Aleksandra Anna; Osmundsen, Per Terje. **Mesozoic Regional Stress Field Evolution in Svalbard.** GSA Annual Meeting 2016
49. Mulrooney, Mark; Braathen, Alvar. **Outcrop Scale Normal Faults affecting the Longyearbyen CO<sub>2</sub> Reservoir, Svalbard.** Winter Conference 2015
50. Murase, Takemi; Klausen, Tore Grane; Muller, Reidar; Helland-Hansen, William. Sedimentology of clinoformal successions; Kobbe and Snadd formations (Triassic), Barents Sea. Winter Conference 2015
51. Ogata, Kei; Anell, Ingrid Margareta; Braathen, Alvar; Osmundsen, Per Terje; Smyrak-Sikora, Aleksandra Anna; Husteli, Berit; Olaussen, Snorre; Maher, Hermon. **Syn depositional faulting in the Late Triassic succession of Kvalpynten, Edgeøya, East Svalbard.** Congress of the Italian Geological Society 2014; *Rend. Online Soc. Geol. It.*, Suppl. n. 1 al, volum 31
52. Olaussen, Snorre; Husteli, Berit; Lord, Gareth Steven; Rismyhr, Bjarte; Johannessen, Erik P.; Mørk, Atle. **The Norian transition in Svalbard and the Barents Sea.** Boreal Triassic II 2015
53. Osmundsen, Per Terje; Braathen, Alvar; Maher, Harmon. First crustal-scale extension at the Arctic margin: the Devonian Keiserhjelmen Detachment, Svalbard. 3P Arctic Petroleum Potential AAPG Conference 2015
54. Osmundsen, Per Terje; Braathen, Alvar; Maher, Harmon. Structural framework at the NE Atlantic-Arctic margin junction: the Devonian Keiserhjelmen Detachment, Northern Svalbard. 7th International Conference on Arctic Margins – ICAM 2015
55. Osmundsen, Per Terje; Braathen, Alvar; Rød, Rita Sande; Hynne, Ingrid Bjørnerheim. **Styles of normal faulting and fault controlled sedimentation in the Triassic deposits of Eastern Svalbard.** *Norwegian Petroleum Directorate Bulletin* 2014 (11), s. 61–79
56. Ringdal, Kari; Buckley, Simon John; Lecomte, Isabelle; Anell, Ingrid Margareta; Braathen, Alvar. From photorealistic outcrop models to synthetic seismic images. *2nd Virtual Geoscience Conference, Proceedings Volume.* Bergen: Uni Research AS 2016 ISBN 978-82-8361-004-8, s. 182
57. Smyrak-Sikora, Aleksandra Anna; Osmundsen, Per Terje; Braathen, Alvar; Mulrooney, Mark; Olaussen, Snorre. Three-dimensional model of facies distribution within a Triassic half-graben, SW Edgeøya, Svalbard. 2nd Virtual Geoscience Conference 2016
58. Smyrak-Sikora, Aleksandra Anna; Osmundsen, Per Terje; Braathen, Alvar; Ogata, Kei; Anell, Ingrid Margareta; Husteli, Berit; Olaussen, Snorre. **Depositional setting and internal architecture of syn-tectonic, siliciclastic half-graben fill, Edgeøya, Svalbard.** Vinterkonferansen 2015
59. Støen, Simen Jenvin. **Late Triassic sedimentology and diagenesis of Barentsøya, Wilhelmøya and eastern Spitsbergen.** Trondheim: NTNU 2016 151 s.
60. Yenwongfai, Honore Dzekamelive; Mondol, Nazmul Haque; Faleide, Jan Inge; Lecomte, Isabelle. **Prestack inversion for porosity, shale volume and sand probability in the Havert Formation of the Goliat field, SW Barents Sea.** *SEG technical program expanded abstracts* 2016, s. 3543–3547
61. Yenwongfai, Honore Dzekamelive; Mondol, Nazmul Haque; Faleide, Jan Inge; Lecomte, Isabelle. **Prestack Simultaneous Inversion to Predict Lithology in the Realgrunnen Subgroup of the Goliat Field, SW Barents Sea.** 78th Conference and Exhibition, EAGE 2016

Red titles should be clickable!

## And at Trias North meetings

62. Abay, Tesfamariam Berhane; Jochmann, Malte; Olausson, Snorre. Regional maturation trends of the Upper Paleozoic to Cenozoic strata in the Svalbard Archipelago- compiled data from organic geochemistry, vitrinite and migrated hydrocarbon analyses. Diagenesis and provenance workshop 2015
63. Andresen, Arild. Provenance of Triassic sediments in the Barents Sea: What do we know and what do I want to know? Diagenesis and provenance workshop 2015
64. Anell, Ingrid Margareta; Braathen, Alvar; Faleide, Jan Inge. Shifting stress regimes and deep structural control on Triassic sedimentation. Datasharing workshop 2015
65. Anell, Ingrid Margareta; Lecomte, Isabelle; Braathen, Alvar; Buckley, Simon John. Synthetic seismic expression of the onshore Kvalpynten case study: Growth-faults. Low-angle prograding deltaic system. Trias North annual workshop 2016
66. Anell, Ingrid Margareta; Midtkandal, Ivar. Quantifiable clinothems and missing clinofoms: How studies down under can help our understanding of the Triassic of the Barents Shelf. Datasharing workshop 2015
67. Braathen, Alvar. The Trias North project – status per May 2016. Trias North annual workshop 2016
68. Braathen, Alvar. Trias North summary – status and outlook. Datasharing workshop 2015
69. Buckley, Simon John; Dolva, Benjamin; Mulrooney, Mark; Smyrak-Sikora, Aleksandra Anna; Lecomte, Isabelle. 3D photogrammetric modelling of Kvalpynten: background and overview of LIME functionality. Datasharing workshop 2015
70. Buckley, Simon John; Ringdal, Kari; Lecomte, Isabelle; Anell, Ingrid Margareta; Braathen, Alvar; Eide, Christian Haug. Virtual outcrops to synthetic seismic modelling. Trias North annual workshop 2016
71. Czarniecka, Urszula. Petrography and geochemistry of the Middle Triassic deposits at Karentoppen, Sørkapp Land, S Spitsbergen, Svalbard. Trias North annual workshop 2016
72. Eide, Christian Haug. Source-to-sink aspects of the Triassic Barents: Sea Preliminary results, perspectives and plan. Datasharing workshop 2015
73. Eide, Christian Haug; Helland-Hansen, William; Klausen, Tore Grane. Source-to-sink study of Fennoscandian-derived sedimentary fans of the Havert Formation. What do I know and what do I want to know. Diagenesis and provenance workshop 2015
74. Eide, Christian Haug; Klausen, Tore Grane; Anell, Ingrid Margareta; Suslova, Anna; Katov, Denis; Helland-Hansen, William. Source-to-sink and mass-balance of the entire Triassic Barents Sea – Ideas, Plans and preliminary results. Trias North annual workshop 2016
75. Faleide, Jan Inge. Recent advances in understanding the tectonic setting of the Triassic Barents Shelf. Data-sharing workshop 2015
76. Faleide, Jan Inge. Seismic attributes and facies of the Triassic Barents Shelf. Datasharing workshop 2015
77. Gabrielsen, Roy Helge; Sokoutis, Dimitrios; Willingshofer, Ernst; Faleide, Jan Inge. Experiments on horizontal and vertical fault linkage and its relevance for the Hoop Fault Complex. Trias North annual workshop 2016
78. Gabrielsen, Roy; Sokoutis, Dimitrios. Fault initiation, fault growth and fault linkage; Musings from analogue experiments. Datasharing workshop 2015
79. Gac, Sebastien; Faleide, Jan Inge. Contractional structures in the Barents Sea: Insights from numerical modeling. Trias North annual workshop 2016
80. Haile, Beyene Girma; Klausen, Tore Grane; Hellevang, Helge; Jahren, Jens; Bjørlykke, Knut. Burial diagenesis of De Geerdalen Formation control by depositional facies distribution, Edgeøya, Svalbard. Trias North annual workshop 2016
81. Haile, Beyene Girma; Xi, Kelai; Jahren, Jens; Aagaard, Per; Bjørlykke, Knut; Hellevang, Helge. Burial Diagenesis in Triassic Sandstones: key to understand reservoir quality evolution. Datasharing workshop 2015
82. Haile, Beyene Girma; Xi, Kelai; Jahren, Jens; Aagaard, Per; Bjørlykke, Knut; Hellevang, Helge. Burial diagenesis in Triassic siliciclastic reservoirs of the Barents Sea region. Diagenesis and provenance workshop 2015
83. Klausen, Tore Grane. Clinofom study – progress in quantifications. Datasharing workshop 2015
84. Klausen, Tore Grane. Recent advances in understanding the Triassic sedimentary systems of the Barents Shelf. Datasharing workshop 2015
85. Krajewski, K. P. Depositional and diagenetic processes in the formation of the Triassic petroleum source rocks in Svalbard. Trias North annual workshop 2016
86. Kürschner, Wolfram Michael; Müller, Steven; Hounslow, Mark. Triassic palynostratigraphy and environ-

Most of these presentations are available for Trias members at our joint Dropbox.

- mental history: how to correlate the Early Carnian in the Arctic with the Tethys realm. Datasharing workshop 2015
87. Lecomte, Isabelle; Buckley, Simon John; Anell, Ingrid Margareta. Seismic modelling: Edgeøya and other illustration cases. Datasharing workshop 2015
88. Lewandowski, Marek et al. Remagnetization of the Ladinian sandstones of the Bravaisberget Formation, Sørkapp Land; effect of the Neogene hydrocarbon migration? Trias North annual workshop 2016
89. Line, Lina Hedvig; Jahren, Jens. Reservoir characterization of Middle – Upper Triassic Kobbe and Snadd Formations in the southwestern Barents Sea. The role of chlorite coating. Trias North annual workshop 2016
90. Maher, Harmon; Braathen, Alvar; Mulrooney, Mark; Ogata, Kei; Osmundsen, Per Terje; Smyrak-Sikora, Aleksandra Anna. South Edgeøya shale detachment geometry and mechanics. Datasharing workshop 2015
91. Mueller, Steven; Kürschner, Wolfram Michael. The Carnian Pluvial Phase in the Boreal. Trias North annual workshop 2016
92. Mulrooney, Mark; Braathen, Alvar; Leutscher, J. Structural Architecture of the Goliat Field, SW Barents Sea, Offshore Norway. Trias North annual workshop 2016
93. Mørk, Atle. The geology of North Eastern Svalbard as studied summer 2015. Trias North annual workshop 2016
94. Mørk, Atle. The geology of Svalbard as a key to the Barents Sea. Datasharing workshop 2015
95. Mørk, Mai Britt Engeness. Diagenesis and reservoir properties of Triassic-Jurassic sandstone formations with emphasis on the Longyearbyen CO<sub>2</sub>-well. Diagenesis and provenance workshop 2015
96. Ogata, Kei; Cavozi, Christian; Mulrooney, Mark; Storti, Fabrizio; Braathen, Alvar. First test results on analogue modelling of shallow vs. deep rooted faults with syn-sedimentary infill: the Kvalpynten case. Datasharing workshop 2015
97. Ogata, Kei; Mulrooney, Mark; Braathen, Alvar; Maher, Harmon; Balsamo, Fabrizio. Characteristics of listric and planar growth fault systems of southern Edgeøya. Datasharing workshop 2015
98. Ogata, Kei; Mulrooney, Mark; Braathen, Alvar; Maher, Harmon; Smyrak-Sikora, Aleksandra Anna; Anell, Ingrid Margareta; Osmundsen, Per Terje; Olausen, Snorre; Cavozi, Cristian; Balsamo, Fabrizio; Nestola, Yago; Storti, Fabrizio. Field-based characterisation and analogue modelling of the South Edgeøya growth faults systems. Trias North annual workshop
99. Olausen, Snorre; Krajewski, Krzysztof; Haugen, Bo; Dalen, Geir. Middle Triassic of South Spitsbergen – the Karentoppen case. Is the outcrop a valid analogue for Middle Triassic coarse grained clastic wedges in the Barents Sea?. Datasharing workshop 2015
100. Osmundsen, Per Terje; Smyrak-Sikora, Aleksandra Anna; Braathen, Alvar; Olausen, Snorre; Ogata, Kei; Anell, Ingrid Margareta. Growth basins at Edgeøya: sedimentary architecture and facies relationships. Datasharing workshop 2015
101. Paterson, Niall William; Mangerud, Gunn. Heading towards a refined palynozonation for the late Middle - Late Triassic of the Barents Sea area. Trias North annual workshop 2016
102. Piazza, Veronica; Hammer, Øyvind; Nakrem, Hans Arne. Late Smithian (Early Triassic) ammonoid biostratigraphy of Spitsbergen. Datasharing workshop 2015
103. Yenwongfai, Honore Dzekamelive; Mondol, Nazmul Haque; Faleide, Jan Inge; Lecomte, Isabelle. Quantitative seismic reservoir characterization within the Realgrunnen Subgroup and the Havert Formation in the Goliat Field, SW Barents Sea. Trias North annual workshop 2016

## Thanks to

