

Trias North newsletter

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

No 6
December
2017

Upcoming event

Triassic North Sedimentology Seminar

A Triassic North sedimentology seminar is scheduled for early in the new year, preliminary dates are **26-27 February 2018**.

We plan to bring together Triassic North sedimentology fans to dig deeper into the depositional environments, structures and facies of the successions we visited on Edgeøya as well as to tie into the greater perspective of tidally influenced/dominated depositional successions.

The aim is ultimately to structure our upcoming publications, but also to link everyone's work together and discuss how the work ties into our overall understanding of the regional development of the northern Barents Shelf and also of the development of tidally influenced depositional systems as a whole.

The seminar will consist of talks but also be open to discussions and debate.

Anyone wishing to participate or better yet contribute: *Know anything about tides? The structure of 3D sandbodies on Edgeøya and what they represent? Which flooding surface did what and when?* **Please send Ingrid an e-mail** (ingrid.anell@gmail.com).



Image from Landsat 7

PhD Research Fellow Beyene Girma Haile

Ready to defend

Beyene started his PhD in June 2014 under the Trias North project. On December 19th he submitted his dissertation at University of Oslo.

The main topic of Beyene's PhD work has been characterization of the reservoir quality of the Triassic sandstones of the NW Barents Shelf through diagenesis and sedimentology.

During his three years, he has studied the diagenetic history of the Triassic rocks in order to understand the evolution of reservoir properties. He has focused essentially on combining sedimentology, diagenesis, impacts of clay coatings on quartz cementation, thermal history and effects of igneous sill intrusion on diagenetic reactions through multidisciplinary techniques. On the framework of the aforementioned themes, four papers has been produced with him as the principal author.

These papers discussed major controls on sediment diagenesis from the onset of deposition to burial and eventually reservoir quality. **Paper I** (experimental diagenesis) evaluated chiefly the formation of clay coatings on surfaces of quartz and feldspar without precursor clay phases. **Paper II** discussed the links between diagenesis and sedimentology to reveal reservoir quality evolution and the factors that control the formation of clay mineral coatings in a natural diagenesis setting. The findings of Paper I and II has been published in *Marine and Petroleum Geology*.

Paper III underscores on the importance of linking source and reservoir rock temperature sensitive overprints in the stratigraphic record for unravelling the thermal history of a basin. This paper is submitted to *Basin Research*. **Paper IV** investigates the implications of sill-induced diagenesis on reservoir quality. Presently, this paper is under review in *Geoscience Frontiers*. Furthermore, Beyene co-authored three other papers (on factors the control crystal growth, on mudstone diagenesis, and on CO₂ induced silica-carbonate reaction, respectively). These three papers also consists of compulsory knowledge in order to understand diagenetic processes.

- Beyene G. Haile, Helge Hellevang, Per Aagaard, Jens Jahren: Experimental nucleation and growth of smectite and chlorite coatings on clean feldspar and quartz grain surfaces – [Link](#)
- Beyene G. Haile, Tore G. Klausen, Urszula Czarniecka, Kelai Xi, Jens Jahren, Helge Hellevang: How are diagenesis and reservoir quality linked to depositional facies? A deltaic succession, Edgeøya, Svalbard – [Link](#)
- Helge Hellevang, Beyene G. Haile, Rohaldin Miri: A Statistical Approach To Explain the Solution Stoichiometry Effect on Crystal Growth Rates – [Link](#)
- Mohammad Nooraiepour, Beyene Girma Haile, Helge Hellevang: Compaction and mechanical strength of Middle Miocene mudstones in the Norwegian North Sea – The major seal for the Skade CO₂ storage reservoir – [Link](#)
- Helge Hellevang, Beyene Girma Haile, Abednego Tetteh: Experimental study to better understand factors affecting the CO₂ mineral trapping potential of basalt – [Link](#)

In memoriam

Krzysztof Krajewski

In November we received the sad message that Krzysztof Krajewski suddenly had passed away.

Krzysztof was an esteemed member of our project team, leading the work of project partner Polish Academy of Sciences. Less than a month earlier he had participated in the closing seminar of Trias North in Oslo with the same great enthusiasm and good spirit he had always shown during field work and scientific meetings.



Krzysztof during his career contributed with great scientific knowledge to the geological studies in the Arctic, particularly in Svalbard and the Barents Sea area. Within Trias North, he had a prime position with his advanced insight into problems related to the mineralogy, geochemistry, biology, diagenesis and depositional environments of the marine Triassic shales. His scientific results were of major importance for our general understanding of fundamental geological, hydrological and bio-geochemical processes in the marine realm.

We will remember Krzysztof as a highly competent researcher and not at least for his positive mind, enthusiasm and for encouraging young scientists.

Some Trias papers in 2017

- Ingrid Margareta Anell, Ivar Midtkandal: The quantifiable clinothem – types, shapes and geometric relationships in the Plio-Pleistocene Giant Foresets Formation, Taranaki Basin, New Zealand; *Basin Research*, volume 29, page 277–297, doi 10.1111/bre.12149 – [Link](#)
- Christian Haug Eide, Nick Schofield, Dougal Alexander Jerram, John Anthony Howell: Basin-scale architecture of deeply emplaced sill complexes: Jameson Land, East Greenland; *Journal of the Geological Society*, volume 174, page 23–40, doi 10.1144/jgs2016-018 – [Link](#)
- Christian Haug Eide, Nick Schofield, Isabelle Lecomte, Simon John Buckley, John Anthony Howell: Interpretation of Sill-Complexes in Sedimentary Basins: Implications for the “Sub-Sill Imaging Problem”; *Journal of the Geological Society*, doi 10.1144/jgs2017-096 – [Link](#)
- Christian Haug Eide, Tore Grane Klausen, Denis Katkov, Anna Suslova, William Helland-Hansen: Linking an Early Triassic delta to antecedent topography: Source-to-sink study of the southwestern Barents Sea margin; *Geological Society of America Bulletin*, volume 130, page 263–283, doi 10.1130/B31639.1 – [Link](#)
- Christian Haug Eide, Reidar Muller, William Helland-Hansen: Using climate to relate water-discharge and area in modern and ancient catchments; *Sedimentology*, doi 10.1111/sed.12426 – [Link](#)
- Tore Grane Klausen, Jonas Aas Torland, Christian Haug Eide, Alaei Behezad, Snorre Olaussen, Domenico Chiarella: Clinofold development and top set evolution in a mud-rich delta-the Middle Triassic Kobbe Formation, Norwegian Barents Sea; *Sedimentology*, doi 10.1111/sed.12417 – [Link](#)
- Tore Grane Klausen, Reidar Muller, Jirí Sláma, Snorre Olaussen, Bjarte Rismyr, William Helland-Hansen: Depositional history of a condensed shallow marine reservoir succession: stratigraphy and detrital zircon geochronology of the Jurassic Stø Formation, Barents Sea; *Journal of the Geological Society*, doi 10.1144/jgs2017-024 – [Link](#)
- Harmon Maher, Kei Ogata, Alvar Braathen: Cone-in-cone and beef mineralization associated with Triassic growth basin faulting and shallow shale diagenesis, Edgeøya, Svalbard; *Geological Magazine*, volume 154, page 201–216, doi 10.1017/S0016756815000886 – [Link](#)
- Mark Mulrooney, J Leutscher, Alvar Braathen: A 3D structural analysis of the Goliath field, Barents Sea, Norway; *Marine and Petroleum Geology*, volume 86, page 192–212, doi 10.1016/j.marpetgeo.2017.05.038 – [Link](#)

And there will be more in 2018 ...

Some Trias talks in 2017

Talks at the project's final workshop

- Alvar Braathen: Trias North – from ambitions to results – did we answer the key questions?
- Christian Haug Eide, Tore Grane Klausen, William Helland-Hansen: An integrated view of sedimentary systems in the Triassic Barents Sea
- Snorre Olaussen: Upper Triassic to Middle Jurassic key sequence stratigraphic surfaces onshore offshore Arctic Norway; guidelines for prediction of facies development
- Mark Mulrooney, Bjarte Rismyhr, Honore Dzekamelive Yenwongfai, Johan Leutscher, Snorre Olaussen, Alvar Braathen: Impacts of small-scale faults on continental to coastal plain deposition: Evidence from the Realgrunnen Subgroup in the Goliat field, Southwest Barents Sea, Norway
- Honore Dzekamelive Yenwongfai, Nazmul Haque Mondol, Isabelle Lecomte, Jan Inge Faleide: Quantitative Seismic interpretation strategies for petrofacies discrimination within the Triassic: A Goliat Case Study
- Harmon Maher, Alvar Braathen, Mark Mulrooney, Kei Ogata, Per Terje Osmundsen, Kim Senger, Aleksandra Anna Smyrak-Sikora: Regional fracture systems & local fracture domains in Svalbard's diabase sills
- Simon John Buckley, Kari Ringdal, Benjamin Dolva, Isabelle Lecomte, Christian Haug Eide, Ingrid Margareta Anell, Alvar Braathen: Digital outcrop modelling results and workflows for derived synthetic seismic imaging
- Jan Inge Faleide: Barents shelf tectonic evolution – recent advances
- Alvar Braathen, Mark Mulrooney, Beyene Girma Haile, Tyler Ross Appleyard, Anna Elisabeth van Yperen, Aleksandra Anna Smyrak-Sikora, Ingrid Margareta Anell, Kei Ogata, Ivar Midtkandal, Per Terje Osmundsen, Harmon Maher, Snorre Olaussen: “Delta collapse” – Edgeøya delta system compared to the Ferron delta (Utah)
- Kei Ogata, Mark Mulrooney, Alvar Braathen, Harmon Maher, Aleksandra Anna Smyrak-Sikora, Ingrid Margareta Anell, Per Terje Osmundsen, Snorre Olaussen, Christian CavoZZi, Fabrizio Balsamo, Yago Nestola, Fabrizio Storti: Architecture, deformation style and petrophysical properties of a Late Triassic growth fault system in southern Edgeøya, East Svalbard
- Aleksandra Anna Smyrak-Sikora: Sedimentary architecture of halfgrabens and grabens fill; Kvalpynten, SW Edgeøya
- Ingrid Margareta Anell, Alvar Braathen, Daniela Røhnert, Kei Ogata, Per Terje Osmundsen, Aleksandra Anna Smyrak-Sikora, Gareth Steven Lord, Simon John Buckley, Harmon Maher, Snorre Olaussen: Findings of five field foragings. Sandbody distribution, clinoform geometries and depositional environments of Edgeøya, Svalbard
- Lina Hedvig Line, Jens Jahren, Helge Hellevang: Diagenesis and Reservoir Quality of Anisian and Carnian channels in the southwestern Barents Sea
- Krzysztof Michalski, Marek Lewandowski, Krzysztof Krajewski, Darko Matesic, Rafal Szaniawski, Katarzyna Dudzisz: Palaeomagnetic analyses of Edgeøya/Sørkapp Triassic samples
- Urszula Czarniecka: Westerly-sourced siliciclastic deposits in the Triassic of Svalbard as a part of the source to sink framework of the Arctic

- Beyene Girma Haile, Tore Grane Klausen, Urszula Czarniecka, Kelai Xi, Jens Jahren, Alvar Braathen, Helge Hellevang: Diagenesis of Upper Triassic sandstones, Edgeøya, Svalbard
- Krzysztof Krajewski; Geochemical signals in the Triassic source-reservoir rocks in Svalbard
- Geir Birger Larsen: Closing remarks – the industry perspective

Other presentations

- Urszula Czarniecka: Provenance signature of the westerly-sourced siliciclastic deposits in the Triassic of Svalbard (in-house workshop)
- Christian Haug Eide, Nick Schofield, Dougal Alexander Jerram, John Anthony Howell: Basin-scale architecture of deeply emplaced sill complexes (Norwegian Geological Winter Meeting)
- Christian Haug Eide, Tore Grane Klausen, Denis Katkov, Anna Suslova, William Helland-Hansen: Linking an Early Triassic delta to antecedent topography: source-to-sink study of the southwestern Barents Sea margin (International Meeting of Sedimentology)
- Malin Flesland, Atle Rotevatn, Isabelle Lecomte, Christian Haug Eide: Understanding seismic imaging and controls on sill intrusions using lidar data from East Greenland (Norwegian Geological Winter Meeting)
- Beyene Girma Haile, Jens Jahren, Helge Hellevang: New insights about thermally driven diagenetic changes due to the emplacement of magmatic sills into reservoir sediments at Wilhelmøya (Svalbard): Implications for reservoir quality (Norwegian Geological Winter Meeting)
- William Helland-Hansen, Christian Haug Eide, Tore Grane Klausen, Alvar Braathen: Internasjonal forskningsgruppe studerer triaslagrekken på Svalbard og i Barentshavet med nytt blikk: Ny forståelse av et gigantisk elve- og deltasystem (NFR Petromaks statuskonferanse)
- Lina Hedvig Line, Jens Jahren, Helge Hellevang: Diagenesis and Reservoir quality of Anisian and Carnian channels in the southwestern Barents Sea (Force workshop: Triassic Park)
- Lina Hedvig Line, Jens Jahren, Helge Hellevang: Reservoir characterization of Triassic sandstones in the southwestern Barents Sea (Norwegian Geological Winter Meeting)
- Aleksandra Anna Smyrak-Sikora, Per Terje Osmundsen, Alvar Braathen, Kei Ogata, Ingrid Margareta Anell, Berit Husteli, Mark Mulrooney, Snorre Olaussen: Sedimentary architecture of siliciclastic, syntectonic graben and halfgraben fill in Kvalpynten, Edgeøya, Svalbard (Norwegian Geological Winter Meeting)
- Honore Dzekamelive Yenwongfai, Nazmul Haque Mondol, Isabelle Lecomte, Jan Inge Faleide, J Leutscher: Integrating prestack inversion, machine learning, and forward seismic modelling for petrofacies characterization: A Barents Sea case study (4th International Workshop on Rock Physics)
- Honore Dzekamelive Yenwongfai, Nazmul Haque Mondol, Jan Inge Faleide, Isabelle Lecomte: Petrofacies characterization using prestack inversion and neural networks within the Snadd Formation of the Goliat Field, SW Barents Sea (Norwegian Geological Winter Meeting)

Modesty section

Some words of praise

In connection with the Trias final workshop this fall, there was also a final meeting in the project board. The industry representatives concluded that the project had been quite a success, so we dare to close this newsletter with some words from Geir Birger Larsen of Lundin:

“The Trias North project led by UiO with UNIS and UiB and research intitutes as collaborating Norwegian institutions and international partners and with sponsors from the oil industry has been an exceptionally well-conducted geo project – well organized and with a very high professional standard. Dedicated students and supervisors have produced an impressive work that has resulted in several academic articles in prestigious international geoscience journals. The research results and the sharing of these with industry sponsors throughout the project have been exemplary.”

Triassic greetings for the Xmas season and the coming year

The Trias North Project has staged several field trips to Svalbard. Last year we invited our industrial sponsors to join. Now Leif Bjørnar Henriksen from Statoil has put together a great movie with impressions from the field. You should enjoy the holiday peacefulness by watching it at <https://www.youtube.com/watch?v=YeO9pPAnkso>. Below is a screenshot showing some of the project associates studying local sediments.

Stay cool!

