GReAT: Geoscience Research Academy of Tromsø

Annual Meeting November 17th 2021

Department of Geosciences

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Geoscience Research Academy of Tromsø

UiT Norges arktiske universitet

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PROGRAMME FOR THE GReAT MEETING 17.11.2021

				CHAIR OF SESSION
10.00	***10.05***	**Welcome**		
10.05	*10.20*	Rowan Romeyn	Oral presentation	
10.20	*10.25*	Christine Tømmervik Kollsgård	PICO	
10.25	*10.30*	Maximilian Webber	PICO	Stephan Höpfl
10.30	*10.35*	Frank Werner Jakobsen	PICO	
10.35	*10.50*	Marie Stetzler	Oral presentation	
10.50	***11.05***	**Break**		
11.05	*11.20*	Paul Heckmann	Oral presentation	
11.20	*11.25*	Przemyslaw Domel	PICO	
11.25	*11.30*	Adele Westgård	PICO	Christine Tømmervik Kollsgård
11.30	*11.35*	Julian Janocha	PICO	
11.35	*11.40*	Marie Bulínová	PICO	
11.40	*11.45*	Stine Bjordal Olsen	PICO	
11.45	*11.50*	Stephan Höpfl	PICO	
11.50	*11.55*	Christine Lockwood-Ireland	PICO	
11.55	***12.55***	**Lunch**		
12.55	*13.10*	Sofia Elisabeth Kjellman	Oral presentation	
13.10	*13.15*	Carmen Braun	PICO	
13.15	*13.20*	Marina Galindos Alfarache	PICO	Przemyslaw Domel
13.20	*13.25*	Frances Ann Cooke	PICO	
13.25	*13.30*	Vårin Trælvik Eilertsen	PICO	
13.30	*13.45*	Andreas Hallberg Hagset	Oral presentation	
13.45	*13.50*	Evaluation to student 1		
13.50	*13.55*	Evaluation to student 2		
13.55	*14.00*	Evaluation to student 3		
14.00	*14.05*	Evaluation to student 4		
14.05	*14.10*	Evaluation to student 5		
14.10	*14.15*	Evaluation to student 6		
14.15	***14.30***	**Prize evaluation committee meet**		
14.30	***14.45***	**Goodbye and prizes**		

Evaluation to student 1 at 13.45-13.50

Student 1	Evaluator 1	Evaluator 2	
Adele	Naima	Claudio	1
Julian	Holger	Tom A	2
Christine TK	Amicia	Kate	3

Evaluation to student 2 at 13.50-13.55

Student 2	Evaluator 1	Evaluator 2	
Frank	Naima	Claudio	1
Sofia	Holger	Tom A	2
Marina	Amicia	Kate	3

Evaluation to student 3 at 13.55-14.00

Student 3	Evaluator 1	Evaluator 2	
Marie B	Naima	Claudio	1
Stephan	Holger	Kate	2
Frances	Tom A	Amicia	3

Evaluation to student 4 at 14.00-14.05

Student 4	Evaluator 1	Evaluator 2	
Andreas	Holger	Amicia	1
Vårin	Tom A	Naima	2
Maximilian	Claudio	Kate	3

Evaluation to student 5 at 14.05-14.10

Student 5	Evaluator 1	Evaluator 2	
Stine	Holger	Amicia	1
Carmen	Tom A	Naima	2
Rowan	Claudio	Kate	3

Evaluation to student 6 at 14.10-14.15

Student 6	Evaluator 1	Evaluator 2	
Marie S	Naima	Claudio	1
Paul	Holger	Amicia	2
Przemyslaw	Tom A	Kate	3

FROST QUAKES - THE SOUND OF A DYNAMIC CRYOSPHERE

Romeyn, R[1,], Hanssen, A[1]., Köhler, A[1,2]., Ruud, B.O[3]., Stemland, H.M[3]., Johansen, T.A[3,4]

[1] UiT
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[3] UiB
[4] UNIS

A class of short-duration seismic events were recorded on dense, temporary geophone arrays deployed in Adventdalen, Svalbard in spring and autumn 2019. A similar class of events have also been detected in seismic records from the SPITS seismic array located on Janssonhaugen in Adventdalen, which has been in continuous operation since the 1990's. In both cases, estimated source positions are dominantly local and cluster around periglacial landforms. Correlation with periods of rapidly cooling air temperature and consequent thermal stress build-up in the ground are also observed. These events are interpreted as frost quakes, a class of cryoseism. The dense, temporary arrays allowed high quality surface-wave dispersion imaging, that demonstrates the potential to monitor near-surface structural changes through passive seismic deployments. While the lower wavenumber resolution of the coarser SPITS array is less suited to imaging near-surface layers, the long-term continuous record gives a unique insight into the temporal occurrence of frost quakes. This allows us, for example, to better understand the dynamic processes leading to frost quakes using models of ground thermal stress that are constrained by thermistor temperature measurements from a nearby borehole.

SEDIMENTARY PROCESSES ON THE CONTINENTAL SLOPE NORTH OF KVITØYA TROUGH

Tømmervik Kollsgård, C., Laberg, J.S., Rydningen, T.A., Husum, K., Lasabuda, A., Forwick, M.

"The continental margin of the northern Barents Sea is a key area for understanding the behavior and dynamics of the northern Barents Sea Ice Sheet, as well as the Arctic Ocean circulation pattern during the Last Glacial Maximum, the deglaciation, and the Holocene.
We investigate the continental slope north of Kvitøya and Nordaustlandet (Svalbard) by analyzing the seabed morphology of the improved IBCAO 4.0 bathymetric grid (Jakobsson et al., 2020), high-resolution sub-bottom profiles (CHIRP), one giant piston core and three gravity cores (4.61 to 18 m long) to gain a better understanding of the sedimentary processes occurring on the slope. We present results from the multi-proxy analysis of the sediment cores, including lithostratigraphy and radiocarbon dates.

The observations from the bathymetric data show that a trough-mouth fan buries channels and canyons, smoothing the morphology of the continental slope. Furrows superposing the trough mouth fan are likely erosional features resulting from downslope activity such as debris flows and turbidity currents. In the inter-fan areas, we interpret that an uppermost smooth morphology results from suspension fallout of sediments from ocean currents flowing along-slope, indicating that these accumulations are contourites. The rugged topography further downslope possibly represents channel and canyon systems that are only partially buried, likely due to reduced influence from ocean currents.

Analysis of the cores provides insight on the sediment properties of the contourites, debris flows, and turbidites, and radiocarbon dates shed light on the interplay and timing of the ocean current regime and the glacial dynamics.

Depositional and Paleoenvironmental Evolution of the Forlandsundet Graben, Prins Karls Forland, Svalbard – Preliminary Results

Webber, M[1]., Grundvåg, S-A[1]., Rydningen, T.A[1]., Lasabuda, A[1]., Knutsen, S-M[1,2]., Laberg, J.S[1]

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[2] Norwegian Petroleum Directorate, Harstad

The Fram Strait, situated between Svalbard and northeast Greenland, is the only deep oceanic gateway connecting the Arctic Ocean with the Atlantic Ocean. Our modern climate system in Europe, Greenland, and the Arctic is strongly influenced by the thermohaline circulation through the Fram Strait. Warm, Atlantic surface water flows into the Arctic Ocean, while cold, Arctic deep-water returns southwards to the Greenland Sea. Even though it is generally known that the Fram Strait opened following the seafloor spreading between Greenland and Svalbard, the precise timing and exact sequence of this opening, and thus the onset of its influence on the climate system, is still poorly understood. A key area to understand the sedimentological record during this geological evolution is located on the eastern side of the Fram Strait: onshore Forlandsundet, the West Spitsbergen continental margin. The sedimentary infill of the Forlandsundet Graben is cropping out on the western and eastern side of Forlandsundet as a possible exhumed part of a Proto-Fram Strait. A field campaign during the summer of 2021 will focus on the sedimentology and paleoenvironmental reconstruction of the Aberdeenflya Formation to test if an early connection between the North Atlantic and the Arctic Ocean existed prior to the Miocene. Here we present the preliminary results of our fieldwork.

Glacial history of the NE Greenland shelf – a void in scientific knowledge

Jakobsen, F.W[1]., Winsborrow, M[1].

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Marine sediment cores are an invaluable tool for reconstructing past sedimentary environments and oceanographic conditions. While a large number of sediment cores have been retrieved from the Fram Strait, fewer have been collected from the western Fram Strait and offshore northeastern Greenland than in the east, closer to Svalbard and the Yermack Plateau. The sedimentary history of that area is therefore less well described. This area is interesting as it not only captures changing conditions on Greenland and of the Greenland Ice Sheet, but also the Arctic Ocean. The East Greenland Current carries Arctic Water out of the Arctic Ocean, through the Fram Strait, and this is the primary path for southward ice transport as well. Multi-proxy analysis of several gravity cores recovered from the western Fram Strait will eventually be used to reconstruct the local palaeoenvironments and bottom-current conditions using lithostratigraphic methods.

Here, preliminary results from one of the cores are presented. They are expected to reflect several glacial-interglacial periods, but the chronology of the core is, as of yet, unknown. The grain size distribution, physical properties, lithostratigraphy, and XRF data from this core provide some initial insights into the sedimentary processes and bottom-current activity here and how they changed over time, as well as the history of ice-rafted debris deposition at this location.

QUANTIFICATION OF METHANE RELEASE AND FATE IN THE WATER COLUMN

Stetzler, M[1]., Ferré, B[1]., Jansson, P[2]., Hanssen, A[3]., Veloso, M[4]

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[2] Multiconsult, Tromsø, Norway
[3] Research Centre for Arctic Petroleum Exploration (ARCEx), Department of Geosciences, The Arctic University of Norway, Tromsø, Norway
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Accurately quantifying cold seep sourced methane emissions into high latitude oceans is primordial to understand regional contributions to atmospheric methane budgets, especially as these areas are subject to rapid changes. Natural seafloor emissions (flares) occur both from within and outside the gas hydrate stability zone along continental slopes and shelves around Svalbard (Arctic Ocean, Fram Strait) and in the Barents Sea. I will present my PhD project, which aims to quantify cold seep-sourced methane distribution in the water column offshore Svalbard and in the Barents Sea. For this, I am using a bubble dissolution model (M2PG1; Jansson et al. 2019) which I will expand to 3D, and hydroacoustic data. I will explain the model and introduce a new interactive add-on of the ESP3 software-package (VBALab plugin).

THE EFFECT OF WATER AND CHLORINE ON GROWTH TEXTURES, NUCLEATION DELAY, AND CRYSTALLIZATION ORDER OF PLAGIOCLASE AND CLINOPYROXENE IN MAFIC MELTS.

Heckmann, P[1]., Iacono-Marziano, G[2]., Strmić Palinkaš, S[1]

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Auto-metasomatism in the form of epidotization and scapolitization indicate that the homogeneous pegmatites of the mafic-ultramafic Hamn intrusion crystallized from a melt that was enriched in water and chlorine. Dynamic (kinetic) and equilibrium experiments were performed at 1150 °C and 300 MPa, using an internally heated pressure vessel, to determine the effect of water and chlorine on the texture, nucleation delay, and crystallization order of plagioclase and clinopyroxene in a mafic melt. Each experimental run included 5 noble metal capsules filled with powder of gabbronorite doped with different amounts of distilled water and chlorine in the form of AgCl. The equilibrium experiments in combination with thermodynamic modeling (MELTS) provided a reference frame for the liquidus temperatures, phase assemblages, and mineral composition for the varying water concentrations to parameterize the dynamic experiments. These lasted 100, 250, and 1800 minutes, were performed under controlled oxygen-fugacity conditions, and were quenched rapidly. The textures of the experimental run products were analyzed with a scanning electron microscope, whereas the chemical composition of the glasses (melt) and minerals was determined with an electron microscope. The experimental results indicate that water as well as chlorine increase the nucleation delay of plagioclase. A nucleation delay of clinopyroxene could not be observed. Further, the nucleation delay seems to increase the crystal size of plagioclase.

CLASSIFICATION OF SEISMIC EVENTS USING RANDOM FOREST ALGORITHM

Domel, P[1]., Plaza-Faverola, A[1]., Schlindwein, V[2]., Hibert, C[3]., Bunz, S[1]

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Seismological data recorded on the seafloor has much higher content of noise compared to land records. Noise complicates both detection and recognition of signals present in the dataset. We present machine learning classification method utilizing Random Forest algorithm that is applied to a conventional seismological detection approach. We show that this approach vastly improves initial separation of data and noise and saves time needed for manual processing. Reinforcing the model with additional data improves overall classification to a point, where it is difficult to decide whether manual processing would yield any further benefits.

PRELIMINARY RESULTS FROM LARGE-SCALE CULTURING EXPERIMENTS ON *NEOGLOBOQUADRINA PACHYDERMA* TOWARDS ESTABLISHING A PROXY TOOLBOX FOR SURFACE OCEAN HYDROGRAPHY AT HIGH LATITUDES

Westgård, A[1]., Meilland, J[2]., Chalk, T.B[1,3]., Milton, A[3]., Foster, G[3]., Kucera, M[2]., Ezat, M.M[1].

[1] Department of Geosciences, UiT – The Arctic University of Norway
[2] MARUM, Universität Bremen
[3] The University of Southampton

Ongoing changes in the Arctic cryosphere and ocean circulation have significant implications for regional climate and beyond. Past records of cryosphere-ocean-climate links provide invaluable insights to better constrain future climate scenarios. However, a lack of robust proxy calibrations remains a challenge in studying Arctic Ocean palaeoceanography. To this end, we have conducted culturing experiments on the polar species *Neogloboquadrina pachyderma* to establish a proxy toolbox for surface ocean hydrography and freshwater dynamics at high latitudes.

More than 1000 healthy specimens of *N. pachyderma* were picked from plankton samples from the Greenland Sea (74°N, 2°E). These were placed into twelve treatments which were determined relative to field conditions (ambient) and a realistic range of past and future conditions. Salinity ranging from 30 to 37.5, pH from 7.7 to 8.3, temperature from 2 to 7°C, as well as variable barium concentrations.

We observed calcification of new chambers and addition of crust in all treatments. Growth rate was not linear, with extended periods without apparent calcification. Overall, we observed low mortality across all treatments prior to ending the experiments. A significant number of specimens, initially described as dead (e.g., white cytoplasm, absent rhizopodial activity), recovered (colourful cytoplasm, extensive rhizopodial network, feeding etc.) in subsequent weeks testifying their ability to adapt to and/or recover from unsuitable conditions. We also observed several events of asexual reproduction. These observations suggest that *N. pachyderma* adapt to, and calcify at a wide range of conditions, which has implications for the species' response to ongoing ocean warming and acidification, as well as for future studies aiming to culture *N. pachyderma*.

We are in the process of analysing elemental ratios (e.g., B/Ca, Na/Ca, Mg/Ca, Ba/Ca) in the culture-grown calcite of *N. pachyderma* using LA-ICP-MS, which will also be discussed.

TECTONIC AND CLIMATIC FORCING ON UPPER PALEOZOIC RIFT BASIN SEQUENCES ON BJØRNØYA AND HORNSUND

Janocha, J[1]., Grundvåg, S-A[1]

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This PhD project investigates sedimentary rocks of the Carboniferous Billefjorden (Mississippian) and lowermost Gipsdalen (Pennsylvanian) groups on Bjørnøya and in the Hornsund area in southern Spitsbergen. The overall aim is to better understand the effects of both climatic and tectonic forcing on these coal-bearing clastic sediments. On Bjørnøya, the succession was subject to coal mining during a brief period in the 1920's, whereas the Russians mined Lower Carboniferous coals in Pyramiden, central Spitsbergen, until the late 1990's. The Billefjorden Group has previously (and recently) been studied at great detail in central Spitsbergen, whereas the equivalent successions at Bjørnøya and Hornsund have received far less attention and was last studied during the late 70's and 80's. One year into the PhD I have visited the field sites on Bjørnøya and in Hornsund and collected data. Key data that was collected are digital outcrop models, rock samples for provenance/petrography and sedimentological logs. For the first time I will present an overview of the collected data, summarize the planned uses of the various data types and outline plans for future fieldwork in the study area.

BIOGEOCHEMICAL CYCLING OF METHANE IN SUB-ARCTIC LAKE SEDIMENTS

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Small lakes in northern latitudes represent a significant source of methane to the atmosphere. Yet, the effect of rapid warming on the fate of natural methane emissions in Arctic and sub-arctic lakes is poorly understood.

The aim of my PhD project is to unravel biogeochemical processes of the methane cycle in Arctic Lake sediments from Svalbard and northern Scandinavia. Through stable isotopic and gas chromatography analyses of short sediment cores encompassing the last ~2000 yrs, I investigate the origin and age of the organic matter that serve as fuel for methanogenesis, as well as the environmental drivers of methanotrophy in the sediments.

I will present the initial results of a survey conducted this summer in northern Norway (4 lakes) and in northern Sweden (3 lakes) and outline further steps towards understanding whether – and to what extent – the biogenic methane contribution by Arctic lakes to global net methane emissions at present may be influenced by climate during the Late-Holocene.

Keywords: Arctic, lakes, sediment, methane, carbon isotopes

Seaward and alongshore growth of the Norwegian continental margin during the Neogene–Quaternary

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"The Neogene–Quaternary evolution of the northern Mid-Norwegian and the Lofoten–Vesterålen margin has been reconstructed by analyzing a large database of seismic data and exploration wells. During the Miocene, the Molo Formation accumulated along the inner shelf of the wide northern Mid-Norwegian margin, representing a coastal outbuilding. Simultaneously, widespread contourite drifts of the Kai Formation began to build-up further west on the paleo-slope and in the Vøring Basin. The accumulation of ocean current-derived contourite drifts was likely a response to the opening of the Fram Strait (c. 17 Ma) and the subsidence of the Greenland–Scotland ridge (c. 12 Ma), allowing for ocean currents to flow northwards along the Norwegian continental slope all the way to the Arctic Ocean. On the narrower Lofoten–Vesterålen margin, the Molo Formation is absent due to the high alpine mountains in this area at that time, preventing large sediment input from fluvial systems. Instead, downslope mass transport processes together with alongslope contour currents dominated in this region throughout the Miocene.

From the onset of glaciations in the Quaternary, ice streams traversed the northern Mid-Norwegian shelf and delivered large volumes of subglacial deposits to the shelf break. Some of these sediments remobilized into debris flows and turbidity currents, and together with hemipelagic sediments and contourites they accumulated in a prograding wedge. On the Lofoten–Vesterålen margin, the glacial sediment input from land was low because of the alpine mountains blocking the major ice drainage to the margin. As a result, contour currents prevailed at this margin in the Quaternary, building up drifts on the continental slope.

Deciphering the structural and metamorphic history of the Balsfjord Series in the Scandinavian Caledonides, northern Norway

Höpfel, S[1]., Konopásek, J[1]., Stünitz, H[1,2]., Bergh, S.G[1].

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[2] Institut des Sciences de la Terre (ISTO), Université d'Orleans, Orleans 45100, France

The Balsfjord Series is located in the central part of Troms–Finnmark County, northern Norway, and is part of the upper allochthon of the Scandinavian Caledonides. It consists of an Ordovician–Silurian metsedimentary sequence lying on top of the mostly gabbroic Lyngen Magmatic Complex (LMC). The unit exhibits an inverted metamorphic gradient, where the metamorphic conditions increase from the base to the top, from very low grade in the southeast to medium grade in the west and northwest. The Balsfjord Series is sandwiched between two high-grade units, the Nakkedal + Tromsø Nappe Complex in the hanging wall and the Nordmannvik Nappe as the top part of the Reisa Nappe Complex (RNC) in the footwall. The Nakkedal + Tromsø Nappe Complex features metamorphic peak ages of ca. 455–450 Ma and the Nordmannvik Nappe of ca. 430 Ma. The peak metamorphism of the Balsfjord Series has never been dated and the role of the inverted metamorphic gradient is not yet understood. One of the main motivations in this project is to resolve the Caledonian deformation history in the Balsfjord Series, ideally leading to a regional tectonic model explaining the tectonostratigraphic and metamorphic relationships between the abovementioned units.

Observed thrust kinematics and penetrative retrogression at the bottom of the Nakkedal + Tromsø Nappe Complex suggest that its final exhumation took place during prograde metamorphism of the underlying Balsfjord Series. The ongoing dating of the prograde metamorphism in the Balsfjord series will provide important information about a possible continuity between the timing of peak metamorphism in the Nakkedal + Tromsø Nappe Complex, the Balsfjord series and the underlying RNC.

RECONSTRUCTION OF BOTTOM CURRENT ACTIVITY, SURFACE AND BOTTOM TEMPERATURES IN THE NORDIC SEAS ON ORBITAL AND MILLENNIAL-SCALES DURING THE LAST 150,000 YEARS.

Lockwood-Ireland, C[1]., Rasmussen, T.L[1]., Noormets, R[2]

[1] CAGE, UiT
[2] UNIS

The transformation of warm Atlantic surface water into cold deep waters through convection in the Nordic Seas is a crucial component in the global climate system. The climate has varied on orbital-scales between interglacial and glacial periods during the last 150,000 years. The last glacial period was characterised by multiple, rapid climatic fluctuations on millennial-scales, known as Greenland Interstadials and Stadial (GI-GS) events or Dansgaard- Oeschger (D/O) events. Several studies suggest that these abrupt past climate change events are closely linked to the fluctuations in the strength of convection and the possible input of meltwater in the Nordic Seas. Here, we present an investigation into the changes in past circulation, bottom current activity and convection strength in relation to climate change and meltwater input on orbital (glacial-interglacial) and millennial (GI-GS or DO event) scales from marine deep-sea sediment cores. The outcomes of this study will significantly increase our understanding of the responses of past climate-ice-ocean interactions that is highly relevant to the accelerated melting of the ice caps in Greenland that we are observing today.

HOLOCENE PRECIPITATION SEASONALITY ALONG A CLIMATIC GRADIENT FROM WESTERN SPITSBERGEN TO NORDAUSTLANDET, SVALBARD

Kjellman, S.E[1]., Schomacker, A[1]., Thomas, E.K[2]

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Arctic precipitation is strongly influenced by seasonal variation in atmospheric circulation. Changes in the spatial patterns of water vapor transport result in varying degree of isotopic fractionation, which is reflected in the isotopic composition of precipitation. Arctic precipitation is predicted to increase this century as a response to a combination of increased moisture transport from low-latitudes and local evaporation from ice-free seas. Paleo water isotope records can help us investigate how the Arctic water cycle responded during past warm periods. We analyzed the hydrogen isotopic composition (δ^2H) of plant-derived *n*-alkanoic acids (leaf waxes) from four lakes across Svalbard to assess moisture source and precipitation seasonality along a climatic gradient. The δ^2H of mid-chain (C_{22}) *n*-alkanoic acids were interpreted to represent lake water δ^2H, which is affected by residence time and can reflect either summer or mean annual precipitation. The δ^2H of long-chain (C_{28}) *n*-alkanoic acids represent soil water δ^2H, which reflects growing season precipitation and evaporative enrichment. Preliminary results suggest that lakes in the arid central part of Spitsbergen experienced stronger seasonality than a lake near the milder and wetter west coast, or that the lakes received moisture from sources with different isotopic composition. One lake on Nordaustlandet had relatively ^2H-enriched values compared to the other lakes on northern Svalbard, possibly reflecting locally derived moisture experiencing less distillation. Future steps will be to evaluate different moisture source contributions by tracking moisture travel in modern times, and to analyze a new high-resolution leaf wax record covering the instrumental period to assess the leaf wax proxy systematics.

Keywords: Arctic, lake sediment, biomarkers, plant wax δ^2H, paleoclimate, precipitation

CHANGING PALAEOENVIRONMENT AND PALEOCEANOGRAPHIC CONDITIONS IN THE WESTERN FRAM STRAIT – PRELIMINARY LITHOSTRATIGRAPHIC RESULTS

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The marine sediments of the Western Fram Strait can capture the effects of changing conditions on Greenland and the Greenland Ice Sheet, but also the Arctic Ocean as the East Greenland Current carries Arctic Water out of the Arctic Ocean, through the Fram Strait. This is the primary path for southward ice transport as well. While a large number of sediment cores have been retrieved from the Fram Strait in general, much fewer have been collected from the western Fram Strait and offshore northeastern Greenland than in the east, closer to Svalbard and the Yermack Plateau. The sedimentary history of that area is therefore less thoroughly investigated. Marine sediment cores are an invaluable tool for reconstructing past sedimentary environments and oceanographic conditions, and this work focuses on multi-proxy analysis of a gravity core recovered from below the NE Greenland shelf in the western Fram Strait. Based on preliminary correlations, the core likely covers several glacial-interglacial periods, and upcoming paleomagnetic data should improve the age determination of the core. The grain size distribution, physical properties, lithostratigraphy, and XRF data from this core provide some initial insights into the sedimentary processes and bottom-current activity here and how they changed over time, as well as the history of ice-rafted debris deposition at this location.

CRYSTAL ORIENTATIONS OF THE RETROGRESSED GABBRO FROM THE LYNGEN MAGMATIC COMPLEX

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At low temperature conditions, viscous deformation mechanisms can operate in the deformation of mafic rocks. However, due to temperature constraints, crystal plastic mechanisms are not active. Instead, concurrent mineral reactions may facilitate deformation. We aim to explore the relationship between mineral reactions and deformation at low temperature conditions by determining if Crystal Preferred Orientations (CPO) can be generated by preferential mineral growth. Here we present textural data of retrogressed gabbro of the Lyngen Magmatic Complex (LMC). We analyzed the CPO of each phase of representative samples for greenschist, epidote-amphibolite and amphibolite metamorphic grades. Hornblende records the strongest CPO and is well developed CPO in all three samples. The titanite CPO is also well developed and shows strong similarities to the hornblende CPO. We interpret that they both deformed at the same time and that titanite formed during the breakdown of the original clinopyroxenes. Hornblende presents maximum clusters perpendicular to foliation in (100), and parallel to foliation in (010) and (001). All three clusters show 90° relationship, with [010] perpendicular and [001] parallel to the lineation. Girdles in (010) and (001) are inferred to be due to rotation in the YX plane. Titanite maximum clusters are perpendicular to foliation in (001), and parallel to foliation in (100) and (010). Clinozoisite shows a very weak CPO (most evident in the epidote-amphibolite sample), yet the 90° relationship is still visible in the greenschist sample and could perhaps suggest the presence of a CPO. The remaining phases do not show CPO, and the lack of textures in plagioclase and quartz indicates absence of crystal plastic deformation. We now explore if rigid body rotation or preferential growth by diffusion creep are responsible for the CPO of hornblende.

The role of structural and sedimentary features on seepage evolution along Vestnesa Ridge

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Vestnesa Ridge is a ~5km thick contourite drift located on the west Svalbard margin. Geophysical observations, paleontological proxies and basin modeling suggest that fluid seepage intensified ca. 2.7Ma and remained active along the entire ridge until a few thousand years ago, when activity ceased in the west but remained active in the east. It is suggested that the leakage of gas is tectonically controlled with faults and fractures playing a key role in feeding the seeps. However, strong tectonic forces are not necessarily required to explain sediment deformation. Overpressured fluid can also play a critical role in faulting, initiated by an abrupt increase in sedimentation. In 3D seismic, we observe high density, small (<10m) fluid flow features, attributed to episodic discharge of overpressured fluids. We investigate the difference in the spatial and temporal occurrence of these features across the ridge.

A deglacial regional meltwater outburst event occurred during ca. 15Ka. The widespread high sedimentation event may have formed an undercompacted, high fluid pressure layer beneath. This is expressed in the seismic by a prominent reflection interface at the boundary between the high fluid pressure layer beneath and the impermeable layer above. Local gas pockets are also defined in the impermeable clay laminates. We use chirp data to map deglacial (0-29Ka) sediment thickness; both near-surface 3D seismic volumes, and regional 2D seismic lines, to study the role of structural and sedimentary features, on seepage evolution along Vestnesa Ridge.

Deglacial and post-glacial sedimentary processes south of Kvitøya, northern Barents Sea

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Under today's warming climate, the Greenland and Antarctica ice sheets marine-terminating margins experience thinning and retreat. To better predict the future evolution of the ice sheets requires knowledge of how marine-terminating ice margins behave over timescales longer than the observational climate records. We provide one such reconstruction from the former marine-based Barents Sea Ice Sheet.

We present swath-bathymetry and TOPAS sub-bottom profiler data, in addition to multi-proxy analyses of four sediment gravity cores retrieved from water depths of c. 250-550 m in troughs south of Kvitøya, NW Barents Sea. Mainly two types of landforms dominate the morphology: Elongated ridges semi-parallel to the strait (~2-5 m high) interpreted to be recessional moraines representing re-advances or still-stands of the ice front during its retreat. Also, several hill hole pairs- (~4-11 m high) are observed indicating a complex retreat pattern.

The lowermost lithological unit in each of the gravity cores retrieved across the GZW is composed of muddy diamicts, interpreted to be a subglacial till. Laminated mud overlying the diamict is interpreted to represent sedimentation from meltwater plumes that emanated from a nearby ice margin. The uppermost unit in all cores is defined by massive, olive brown marine mud containing scattered clasts. This unit is interpreted to be deposited from suspension settling and ice rafting in a glacier-distal environment like at present.

Radiocarbon dates provide minimum ages for the formations of the recessional moraines, and, thus, age constraints on both the timing of ice retreat and significant changes in environmental conditions in this part of the Barents Sea.

TRACING LOWER CRETACEOUS SOURCE ROCKS ACROSS THE SW BARENTS SHELF

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The presence of a thermal mature and viable source rock (SR) is one of the key risk factors in exploration. Across the Norwegian Continental Shelf, Upper Jurassic black shales has traditionally been given most attention. Despite its wide distribution on the SW Barents Shelf, the Upper Jurassic Hekkingen Formation only appear to be oil-mature in a narrow belt along the western margin of the Hammerfest Basin and the Loppa High. The presence of alternative SR units is therefore crucial for exploration success in these frontier areas.
By combining high-resolution regional 2D data, well logs, and a digitalized Rock-Eval database, this study aim to map the lateral and stratigraphic distribution and variability of potential SR units within the Lower Cretaceous succession in the marginal basins on the SW Barents Shelf.

Our findings suggest that a lower Aptian SR unit may be viable in the shallow Fingerdjupet Subbasin, Hammerfest Basin and Bjørnøya Basin. However, several factors limit its lateral extent and accumulation potential. Among these are the structural delimitation as these units accumulated in active rift basins. Periods of anoxia and relative high sedimentation rates are key processes in these restricted basins in order for accumulation and preservation to take place.