

## 2020 NFiP Annual Report as of 10.12.20

### Petroleum Research School of Norway

### *Nasjonal forskerskole i petroleumsfag (NFiP)*

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#### Introduction

Petroleum Research School of Norway (NFiP) has since it was established in 2010 provided activities for PhD students from all of the five universities in Norway within petroleum related disciplines. Education of petroleum researchers at Norwegian universities benefits from coordinated, interdisciplinary collaboration between the Norwegian universities graduating PhD's in petroleum related scientific disciplines. In 2016, NFiP obtained financial support from The Research Council of Norway (RNC) amounting to NOK 23mill for the next 8 years. This support enabled NFiP to continue and expand the educational efforts.

NFiP was established to provide a national tool to improve the PhD education within petroleum related sciences in Norway. This is achieved by coordinating lectures given by the different universities and providing intensive courses, seminars and conferences for all PhD students in Norway with research projects related to petroleum. The objective is also to establish discussion groups, collaborating opportunities and interdisciplinary meeting places for PhD students and their supervisors in Norway and internationally, for more information please see <https://nfip.no/>.

Adhering to the new transparency strategy of the Research Council of Norway, NFiP strongly supports open-access of scientific contributions to the public at large. Thus, current and previous scientific presentations related to NFiP activities are freely available at <https://nfip.no/> under the specific course/seminar.

Members of NFiP include University of Bergen (UiB), University of Stavanger (UiS), University of Oslo (UiO), Norwegian University of Science and Technology (NTNU), University of Tromsø (UiT), and the University Center at Svalbard (UNIS).

More than 1500 students (PhD and MSc students) have participated in NFiP activities in total. Thus, the average annual participation is more than 200 students participating at NFiP activities. Unfortunately, the pandemic in 2020 shut down most activities, even though some digital activities were initiated.

## 2020 NFiP Activities

### 2020 Courses, Conferences and Seminars provided by NFiP and in NFiP collaborations.

There were no courses, conferences, nor seminars provided by NFiP in 2020 due to the outbreak of Covid-19. The IOR Norway Conference 2020 was scheduled to be financially supported and co-hosted by NFiP as a collaborative effort with The National IOR Center of Norway at the University of Stavanger. NFiP had also scheduled a Whole Value Chain CCUS Conference Week in Colorado, USA, in October 2020. The conferences are postponed until the spring of 2021. Digitalization of a field excursion course at Svalbard has been initiated and a national course in Drill String Dynamics is in the works.

### 2019/2020 Student/Researcher Exchange

NFiP promotes and supports collaborative international petroleum research initiatives; preferentially between universities that have signed MoU's with NFiP, by providing financial travel support for students. NFiP has negotiated three additional MoUs during the project period: U. of Texas A&M at Corpus Christi, U. of Barcelona and Danish Technical University, the latter two still pending. Previously, NFiP has signed MoU with eight universities in the US and three universities in Europe.

NFiP's Short Term Exchange Program (STEP) financially supports students to spend collaborative research time in counterpart countries of international research collaborators. During 2019, the following new student exchange programs were granted financial support:

First Name	Surname	Affiliation	Destination	From	To
Peter	Betlem	UNIS	Vrije University, Amsterdam	11.11.2019	25.11.2019
Solveig	Riisøen	NORCE	UT Austin, USA	23.09.2019	23.10.2019
*Leilei	Zhang	Rice University	University of Bergen	18.3.2020	15.4.2020
*Jacquelin	Cobos Mora	Aalborg University	University of Bergen and Colorado School of Mines, USA	13.1.2020	25.4.2020
*Metin	Karakas	University of Bergen (based in Texas)	University of Bergen	01.01.2020	01.06.2020

\*Postponed due to outbreak of Covid-19.

During 2019-2020, the following students were supported with maximum 10 000 NOK to attend conferences:

First Name	Surname	Affiliation	Destination	From	To
Anna	van Yperen	University of Oslo	AAPG 2019 Annual Convention and Exhibition, San Antonio, USA	19.5.2019	22.5.2019
*Arun Kumar	Panneer Selvam	University of Stavanger	SPE IOR 2020 Conference, Tulsa, USA	18.4.2020	22.4.2020
Andreas	Hagset	University of Tromsø	34th Nordic Geological Winter Meeting	8.1.2020	10.1.2020
Fredrik	Wesenlund	University of Tromsø	34th Nordic Geological Winter Meeting	8.1.2020	10.1.2020

\*Postponed due to outbreak of Covid-19.

### 2019 student exchange programs

*PhD student Peter Betlem, UNIS, Svalbard, Norway – visit at Vrije Universiteit Amsterdam, Holland*

**Project Name: Fault-related CCS leakage risks**

**Institution:** UNIS, Svalbard  
**PhD student:** Peter Betlem  
**Project Supervisor:** Kim Senger, Alvar Braaathen, Elin Skurtveit  
**Institution Visited:** Vrije Universiteit Amsterdam  
**Hosted By:** Kei Ogata, VU  
**Period:** Nov. 11<sup>th</sup> - Nov. 25<sup>th</sup>, 2019

**Project Summary:**

The focus lies on the creation of i) detailed geometrical rock physics models of faults in shale-dominated successions, ii) correlations between geological input and geophysically-detectable properties such as resistivity and elasticity, and iii) the representation thereof in industry-standard geological models. Early, constructive input from co-supervisor Kei Ogata (Assistant Professor in Tectonics of Sedimentary Rocks; Vrije Universiteit Amsterdam) and industry advisors (Niko Kampman, Reservoir Engineer; Kees K. Hindriks, Sr. Geomechanicist; Kevin Bisdorn, Geomechanicist; Shell Global Solutions) is vital to the project and facilitated through a short-term stay in Amsterdam.

*PhD student Solveig Riisøen, NORCE, Bergen – visit at UT Austin, Texas, USA*

**Project Name:** Large-scale drilling fluid flow-loop  
**Institution:** NORCE, Bergen  
**PhD student:** Solveig Riisøen  
**Project Supervisor:** Fionn Iversen, Rune Time  
**Institution Visited:** Department of Petroleum & Geosystems Engineering, UT Austin  
**Hosted By:** Eric van Oort, UT Austin  
**Period:** Sept. 23<sup>rd</sup> - Oct. 23<sup>rd</sup>, 2019

**Project Summary:**

The objective of this collaboration will be to study the fluid frictional pressure loss in a flow-loop and compare the results with the modelled frictional pressure loss based on the rheology of the drilling fluid. The main objective will be to investigate the effect of particles (both concentrations and particle size) and the impact on the investigated pressure loss in a flow-loop with two different diameters. The test fluid will be a KCl/polymer water-based mud with addition of solid particles. A series of measurements, in both the rheometer and flow-loop, will be investigated using different concentrations of particles in combination with changing the particle size. The rheology curve will be fitted using Herschel Buckley model. The uncertainties will be investigated, mainly with focus on the experimental error and the propagation of these on the modelled frictional pressure loss.

During 2020, the following new student exchange programs were granted financial support:

First Name	Surname	Affiliation	Destination	From	To
*Stian	Almenningen	University of Bergen	Colorado School of Mines, US	2.5.2020	30.5.2020
*Linda	Haaland	NTNU	Prins Karls Forland, Svalbard	1.8.2020	10.8.2020

\*Postponed due to outbreak of Covid-19.

During 2020, the following students were supported with maximum 10 000 NOK to attend conferences:

First Name	Surname	Affiliation	Destination	From	To
*Peter	Betlem	UNIS	International Conference on Gas Hydrates 2020, Singapore	21.6.2020	26.6.2020
*Ricardo	Vasconcellos Soares	University of Bergen	European Conference on the Mathematics of Oil Recovery XVII, Edinburgh, UK	14.9.2020	17.9.2020
*Lingya	Wang	University of Bergen	European Conference on the Mathematics of Oil Recovery XVII, Edinburgh, UK	14.9.2020	17.9.2020
*Mohammad	Nezhadali	University of Bergen	Ensemble Kalman Filter (EnKF) Workshop, Geilo, Norway	10.5.2020	13.5.2020
*Mohammad	Nezhadali	University of Bergen	European Conference on the Mathematics of Oil Recovery XVII, Edinburgh, UK	14.9.2020	17.9.2020

\*Postponed due to outbreak of Covid-19.

## 2020 student exchange programs

*PhD student Leilei Zhang, Rice University, Houston, USA – visit at University of Bergen, Norway*

**Project Name:** CO2 foam for improved oil recovery  
**Institution:** Rice University  
**PhD student:** Leilei Zhang  
**Project Supervisor:** George Hirasaki and Sibani Biswal  
**Institution Visited:** University of Bergen  
**Hosted By:** Arne Graue  
**Period:** Mar. 18<sup>th</sup> - Apr. 15<sup>th</sup>, 2020

### Project Summary:

The research topic is CO2 foam for improved oil recovery, which is directly aligned with my PhD dissertation. University of Bergen is a leading institution in CO2 foam research, we collaborated in designing a pilot CO2 foam test in west Texas for the purpose of CCUS and IOR. During the STEP period, I would like to visit our collaborated labs for research and attend an conference to present our research to the industry.

*PhD student Metin Karakas, University of Bergen (based in Texas) – visit at University of Bergen, Norway*

**Project Name:** CO2 Foam Pilot evaluation  
**Institution:** University of Bergen  
**PhD student:** Metin Karakas  
**Project Supervisor:** Arne Graue  
**Institution Visited:** University of Bergen  
**Hosted By:** Arne Graue  
**Period:** Jan. 1<sup>st</sup> - Jun. 1<sup>st</sup>, 2020

**Project Summary:**

Main focus will be the analysis of dynamic data for CO<sub>2</sub> Foam Pilot evaluation. This will be done using numerical and analytical models. The end result will be a better understanding on CO<sub>2</sub> Foam Evolution in real reservoir conditions.

*PhD student Jacquelin Cobos Mora, Aalborg University – visit at University of Bergen, Norway, and Colorado School of Mines, USA*

**Project Name:** Wettability changes in carbonates  
**Institution:** Aalborg University  
**PhD student:** Jacquelin Cobos Mora  
**Project Supervisor:** Erik Sjøgaard  
**Institution Visited:** University of Bergen and Colorado School of Mines  
**Hosted By:** Arne Graue  
**Period:** Jan. 13<sup>th</sup> - Apr. 13<sup>th</sup>, 2020

**Project Summary:**

The project at UiB and Colorado School of Mines align with PhD research tasks since I am studying wettability changes in carbonates from a chemical point of view. UiB was chosen because their institution possess equipment for wettability alteration and wettability determination. On the other hand, Colorado School of Mines has advanced instruments to characterize rock surfaces.

The main research tasks that will be performed at UiB are:

- Evaluate the stability and reproducibility of the altered wettability
- Determine the distribution of the altered wettability by a non-imaging technique
- Explore the rock surface behavior in reactive environments
- Understand the mechanisms that control the wettability alteration at the complex rock/brine/oil thin interface

*PhD student Stian Almenningen, University of Bergen, Norway – visit at Colorado School of Mines, USA*

**Project Name:** Sedimentary Gas Hydrates  
**Institution:** University of Bergen  
**PhD student:** Stian Almenningen  
**Project Supervisor:** Geir Ersland  
**Institution Visited:** Colorado School of Mines  
**Hosted By:** Carolyn Koh  
**Period:** May 2<sup>nd</sup> - May 30<sup>th</sup>, 2020

**Project Summary:**

Characterization of natural gas hydrates in porous media by Raman Spectroscopy. Special focus on gas hydrates in unconsolidated sand and geomechanical stability during hydrate formation, CO<sub>2</sub> injection, and hydrate dissociation.

*PhD student Linda Haaland, NTNU, Trondheim, Norway – visit to Prins Karls Forland, Svalbard, Norway*

**Project Name:** Geological fieldwork  
**Institution:** NTNU  
**PhD student:** Linda Haaland  
**Project Supervisor:** Per Terje Osmundsen and Kim Senger  
**Institution Visited:** Prins Karls Forland, Svalbard (fieldwork)  
**Hosted By:** -  
**Period:** Aug. 1<sup>st</sup> - Aug. 10<sup>th</sup>, 2020

### **Project Summary:**

Fieldwork along the west Svalbard margin is planned to take place mainly on the island of Prins Karls Forland in order to investigate the relationships between the geology of the Forlandsundet area and crustal thinning along the continental margin. Specifically, studies of kinematics of the Pinkie unit, a so far ambiguously identified metamorphic core complex on Prins Karls Forland, are to be carried out. In addition, the structural and sedimentological investigations near the Eocene-Oligocene Forlandsundet Basin is to be carried out in order to refine and expand on previous tectono-sedimentary models of the basin. This work is seen as a crucial part of deepening our understanding of the transition between transpression to transtension along the western Spitsbergen margin.

## **2020 Board Meetings**

February 6<sup>th</sup> 2020 and December 14<sup>th</sup>, 2020.

## **2020 Chairman Activities**

NFiP was promoted by visits and presentations at: Colorado School of Mines, Golden, CO, USA, Rice Univ. and Univ. of Houston, TX, USA, Colorado State University (CSU), Ft. Collins, CO, U. of Tulsa, USA, USDOE, Pittsburgh, USA, Occidental, Houston, TX, USA and OED, NPD and NRC in Norway.

Chair of the Executive Board of NFiP has participated/presented at various occasions and events.

### **Selected talks by the Chairman where NFiP was presented; Sept. 2019 – Dec. 2020:**

1. Arne Graue: *“Opportunities for Offshore International Whole Value Chain CCUS”*, Interdisciplinary CCUS Workshop at U. of Houston, Houston, TX, USA Sept. 23-24<sup>th</sup>, 2019.
2. Arne Graue: *“CO<sub>2</sub> as a Commodity for Methane Production from Hydrate Reservoirs”*, 4<sup>th</sup> Interdisciplinary CCUS Workshop at U. of Houston, Houston, TX, USA Sept. 23-24<sup>th</sup>, 2019.
3. Arne Graue: *“CO<sub>2</sub> for EOR as CCUS”*, Welcoming address, 4<sup>th</sup> Biennial CO<sub>2</sub> for EOR as CCUS Conference, Rice U., Houston, TX, USA, Sept. 25<sup>th</sup>- 27<sup>th</sup>, 2019.
4. Arne Graue: *“CO<sub>2</sub> Foam EOR and CO<sub>2</sub> Injection in Hydrates – CCUS Enablers for Efficient, Cost Saving and More Sustainable Oil & Gas Production: Offshore International Whole Value Chain CCUS Collaboration”*, 4<sup>th</sup> Biennial CO<sub>2</sub> for EOR as CCUS Conference, Rice U., Houston, TX, USA, Sept. 25<sup>th</sup> – 27<sup>th</sup>, 2019.
5. Arne Graue: *“CO<sub>2</sub> as a Commodity for Methane Production from Hydrate Reservoirs – CCUS Enabler for Efficient, Cost Saving and More Sustainable Oil & Gas Production”*, 4<sup>th</sup> Biennial CO<sub>2</sub> for EOR as CCUS Conference, Rice U., Houston, TX, USA, Sept. 25<sup>th</sup>- 27<sup>th</sup>, 2019.
6. Arne Graue: *“Northern Lights – Whole Value Chain CO<sub>2</sub> Storage on NCS”*, 4<sup>th</sup> Biennial CO<sub>2</sub> for EOR as CCUS Conference, Rice U., Houston, TX, USA, Sept. 25<sup>th</sup>- 27<sup>th</sup>, 2019.
7. Arne Graue: *“ENERGY for the FUTURE - Disruptive New CCUS Technologies for More Sustainable EOR”*, Norwegian Energy Day 2020, Houston, TX, USA March 5<sup>th</sup>, 2020.
8. Arne Graue: *“Disruptive New CCUS Technologies for Reduced Carbon Emissions and New Energy Solutions”*, Norwegian Energy Week 2020, Houston, TX, USA December 7-11<sup>th</sup>, 2020.

### **NFiP Web-site**

The NFiP web-site has been further improved and updated through 2020: <https://nfip.no/>  
The NFiP secretariat, at Dept. of Physics and Technology, UiB, with Prof. Martin Fernø as coordinator, and Jarand Gauteplass/Stian Almenningen/Else Johannesen as secretary, has been of great value for the 2020 activity.

*December 10<sup>th</sup>, 2020*

***Arne Graue***

***Chair NFiP Executive Board***