# Oil & Natural Gas Technology

**DOE Award No.: DE-FE0013531**

## Quarterly Research Performance

**Progress Report (Period ending 3/31/2014)**

## Assessing the response of methane hydrates to environmental change at the Svalbard continental margin

**Project Period (11/1/2013 to 10/31/2015)**


Submitted by:
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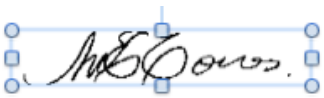

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Prepared for:
United States Department of Energy
National Energy Technology Laboratory

**Office of Fossil Energy**

## EXECUTIVE SUMMARY

In November 2013, Oregon State University initiated the project entitled: **Assessing the response of methane hydrates to environmental change at the Svalbard continental margin**. In this project, we will take advantage of a unique opportunity to collect samples from two settings on the Svalbard continental margin, by participating in two expeditions to the region organized and co-funded by Germany and Norway. These expeditions target sites where methane plumes have been observed to emanate from the seafloor at the upper edge of gas hydrate stability (area 1) and over acoustic chimneys and seafloor pockmark structures in the Vestnesa Ridge (area 2). Our objectives related to examining and modeling the biogeochemistry of these sediments nicely dovetail with our colleagues' objectives to conduct detailed mapping, hydroacoustic surveys of methane plumes, heat flow measurements and quantification and characterization of gas hydrates in areas of contrasting methane flux characteristics.
To date continue preparations for the expedition. We received the first of two instruments ordered from Los Gatos Research, which we will begin testing in May. We have arranged for a series of meeting with German and Norwegian collaborators to iron out details of the expedition and begin ordering materials and supplies needed. Microbiological protocols for DNA extraction are in place, and progress has been made in extending Crunch Flow routines to 2D.

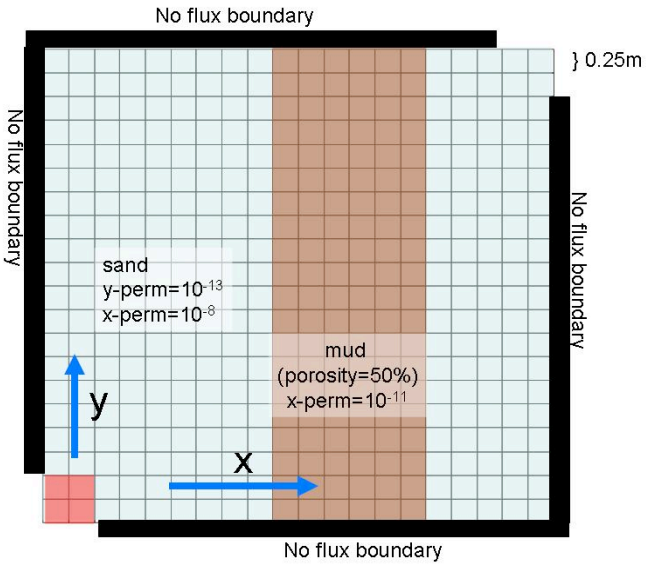
## PROGRESS, RESULTS, AND DISCUSSION

1. Received delivery of the Greenhouse Gas Analyzer ($CH_4$, $CO_2$, $H_2O$) and external N920 Pump from Los Gatos Research, CA. We are preparing Carnet documents for shipment to Germany the first week in May. Torres will travel to Bremen, Germany to receive the instruments and begin testing of the equipment (May 3 to 23rd). She will also travel to Kiel to meet with the Geomar team doing the pore water sampling/analyses to coordinate protocols and begin preparing for the expedition (ordering supplies, testing procedures etc.).

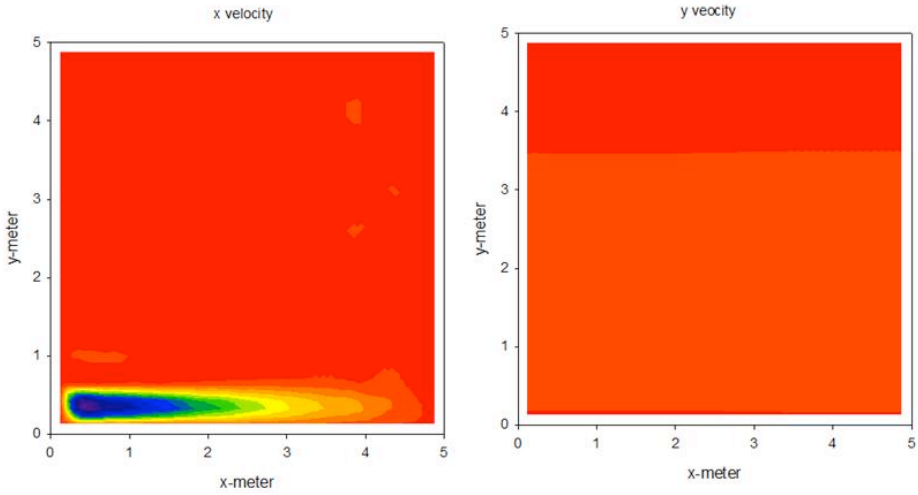
2. We began coordination with Michael Carroll (CAGE) and incoming CAGE postdoc fellow Friederike Gründger (now at Gottfried Wilhelm Leipniz University Hannover, Germany) regarding microbiological sampling during the Svalbard expeditions and identify areas for scientific collaboration between CAGE, Bremen and OSU. Grundger will coordinate sampling, and sharing of sampling materials. Future Skype calls are planned to finalize these plans.

3. As a part of his preparation for analysis of Svalbard samples, Scott Klasek (Graduate student funded in this project) has succeeded in extracting and amplifying microbial DNA from rock samples. Positive and negative controls for the extractions in the low biomass cores yielded amplifiable DNA and an absence of DNA, respectively, demonstrating that Klasek has mastered the required skills for handling samples that will come from Svalbard.

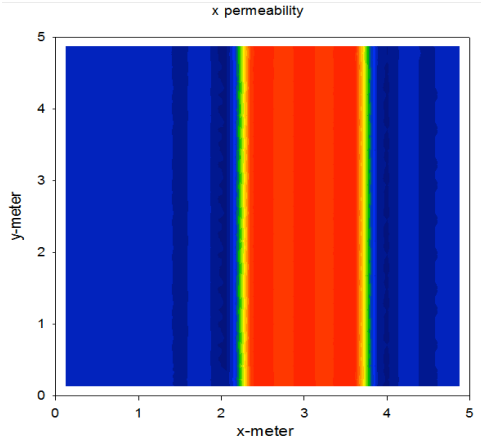
4. We have started to investigate the 2-D capability of CrunchFlow. A trial case was simulated to familiarize the functions. We simulates a case with a conservative tracer flows across sediments with different properties. The tracer was injected from the lower left of the model frame. Constant Darcy velocity was assigned for x and y direction; in other words, flow direction is diagonal of the model frame. A layer of mud with high porosity but low permeability was sandwiched by sand layers, which have low porosity but high permeability. Anisotropic permeability (i.e., different permeability in x and y direction) was set for the sand layers. No flux boundary was set for the four boundaries of the model frame. An illustration of the model frame is provided below:



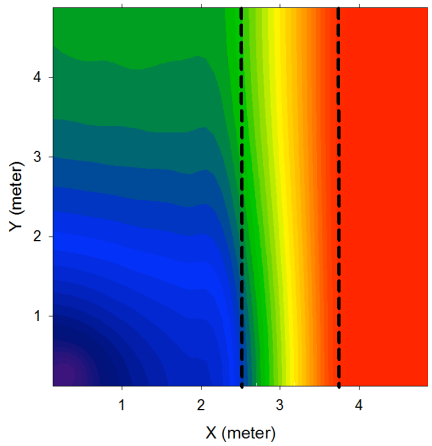

The assigned distribution of fluid velocity in x and y direction is (purple: high velocity; red: low velocity):




The distribution of permeability in x direction is as follow (red: high porosity and low permeability mud; blue: low porosity and high permeability sand):




The concentration distribution after running the model for 100 days (purple: high concentration; red: low concentration; dash lines mark the boundaries between mud and sand):




Due to the dominancy of x-direction permeability, flow is almost horizontal. The low permeability in the mud layer prevents the invasion of the flow. Only very few tracer flows across the mud layer and enters the sand to the right.

## MILESTONE STATUS

We are well within our planned progress regarding Milestone 1:

**Title:** Complete preparations for expedition

**Planned Date:** July 1, 2014

## PROBLEMS OR DELAYS

The second instrument from Los Gatos Research (methane isotope analyzer, (enhanced performance configuration for Range 3 with LN2-cooled detector) is back ordered because of And the MCIA-Range 3 (QC-EP-L) analyzer is not scheduled to release to production (due to material supply shortages) until mid- May. Under this schedule the instrument would be on track to deliver by the end of June as originally promised, and still within our schedule to test and use on the expedition

## PRODUCTS

This progress report

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