Seabed Sampling for Stratigraphy and Seep Studies Offshore Greenland and Norway

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Summary

Gravity coring and dredging has been used to obtain extensive seabed sampling of escarpments and potential hydrocarbon seep sites offshore Greenland in the northeast Atlantic. Sampling of sub cropping strata and thin overburden sediments provide consistent information on ages of the strata and the nature of potential active hydrocarbon systems. Our results are the first to document active hydrocarbon systems in the Baffin Bay, the northeast Greenland shelf, and on the southern Jan Mayen Ridge.

Introduction

One of the last frontier areas for oil and gas exploration with a large potential of hydrocarbon accumulations is located in the Arctic. Here little geological information is available due to rough weather and heavy sea-ice conditions. Seabed sampling of subcropping strata and thin overburden sediments can provide new information on (1) the age and geology of sequences interpreted from seismic reflection data and (2) the nature of potential active hydrocarbon systems.

Data and Methods

Between 2008 and 2012, VBPR and TGS surveyed several under-explored areas around Greenland (Baffin Bay, Nuuk West, Ammassalik Basin, and Northeast Greenland shelf) and the southern Jan Mayen Ridge (Figures 1 and 2). The sampling was done using gravity coring for point samples and dredging along steep escarpments for collection of a wider variety of near in-situ rocks that are difficult to sample by gravity coring. The main focus of the sampling was possible Jurassic, Cretaceous, and Paleocene subcropping sequences. Collected rocks samples were dated using biostratigraphy, and analyzed for source and reservoir properties. Shallow seismic amplitude anomalies, depressions on the seafloor, terminations of deep-seated faults, salt diapirs, and piercement structures were targeted for hydrocarbon seep studies. Samples from the lowermost part of the gravity cores were analyzed for headspace gas, GCMS, and biomarkers.

Results

Biostratigraphy results show that gravity core rock samples from the bit and lowermost core are dominantly in the correct age sequence in relation to the interpreted seismic stratigraphy. Cretaceous and Paleocene rocks were recovered in both the northeast and northwest Atlantic, and Jurassic or sequences were sampled offshore northeast Greenland and on the southern Jan Mayen Ridge. The subcrop gravity core samples were used to generate pseudo-wells which facilitates a direct geology-seismic tie. Dated dredge samples complement the gravity cores and fill the gaps between sampling stations. Our results are the first to document active hydrocarbon systems in the Baffin Bay, the northeast Greenland shelf, and on the southern Jan Mayen Ridge. The seep analyses and source rock studies suggest the presence of Cretaceous and Jurassic oil sources locally within the peak-oil window. The hydrocarbon source rock and maturation data serve as important calibration points for basin modeling studies.

Conclusions

The robust gravity core and dredge seabed sampling methods provide results that can be integrated with geological and geophysical data in frontier basins to increase exploration confidence and reduce risks.

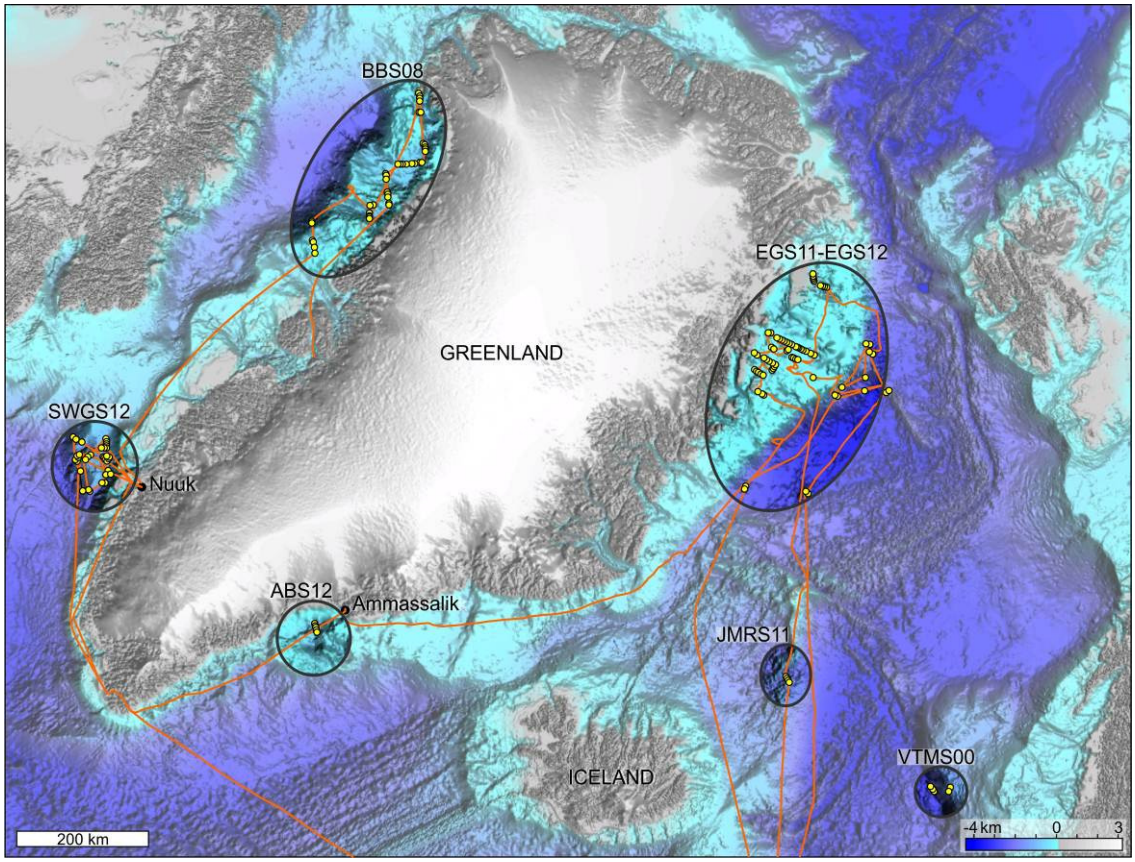

Figure 1 *Seabed sampling stations (yellow circles) around Greenland and in the NE Atlantic Ocean.*

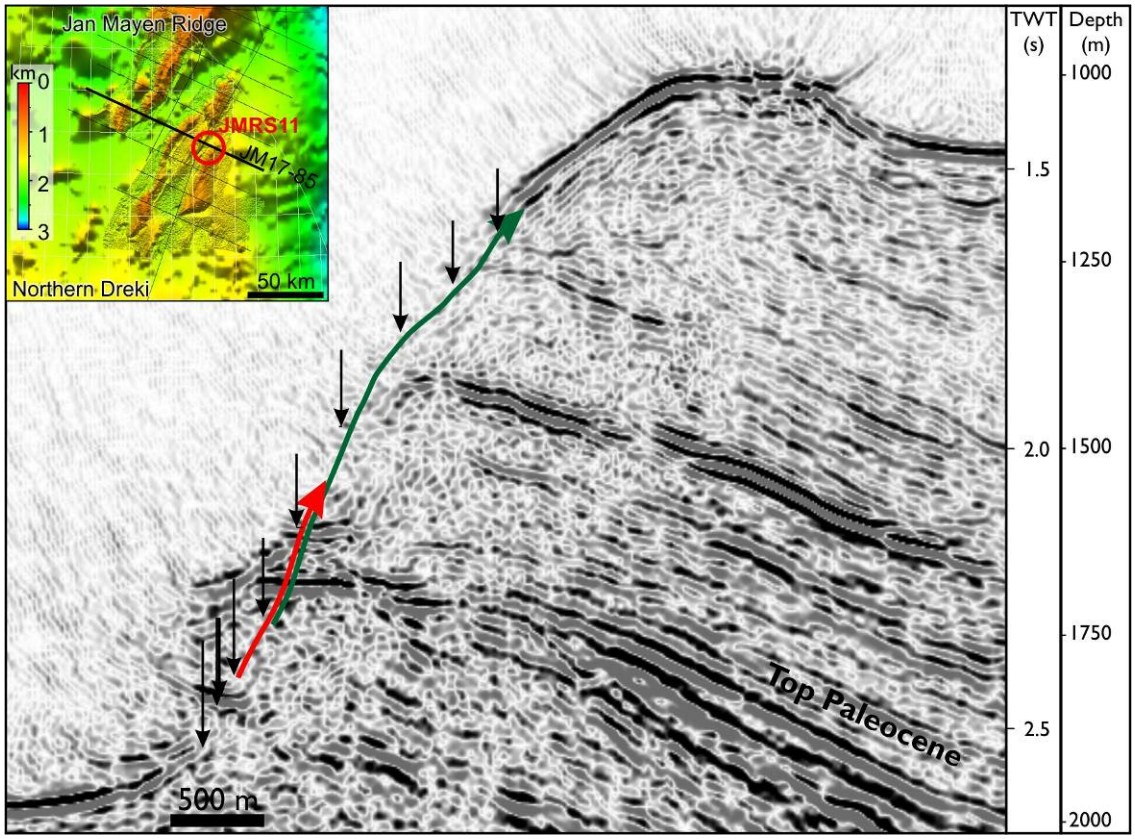

Figure 2 *Seabed sampling locations along the southern Jan Mayen Ridge in the Northern Dreki area. Vertical black arrows show gravity core locations. Red and green arrows show dredge profiles.*