

RISK REDUCTION THROUGH DIRECT HYDROCARBON DETECTION

CONVENTION INVITATION: You are invited to visit Paul Harrington and myself at the Gore Booth at the following two conventions.

Booth 512 Frontiers + Innovation, Calgary, Alberta, Canada, **May 4 – 8, 2009**
Right across from Schlumberger.

Booth 1119 AAPG Annual Convention & Exhibition, Denver, Colorado USA,
June 7 – 10, 2009

Transition Zone Data

Think of a WORLD where you could get real direct hydrocarbon data through the transition zone! Imagine the pool expansion from onshore into the transition zone. Can you determine its size and conduct an *accurate* risk and economic assessment?

MAYBE!

Lovns Bredning, Demark Transition Zone Survey

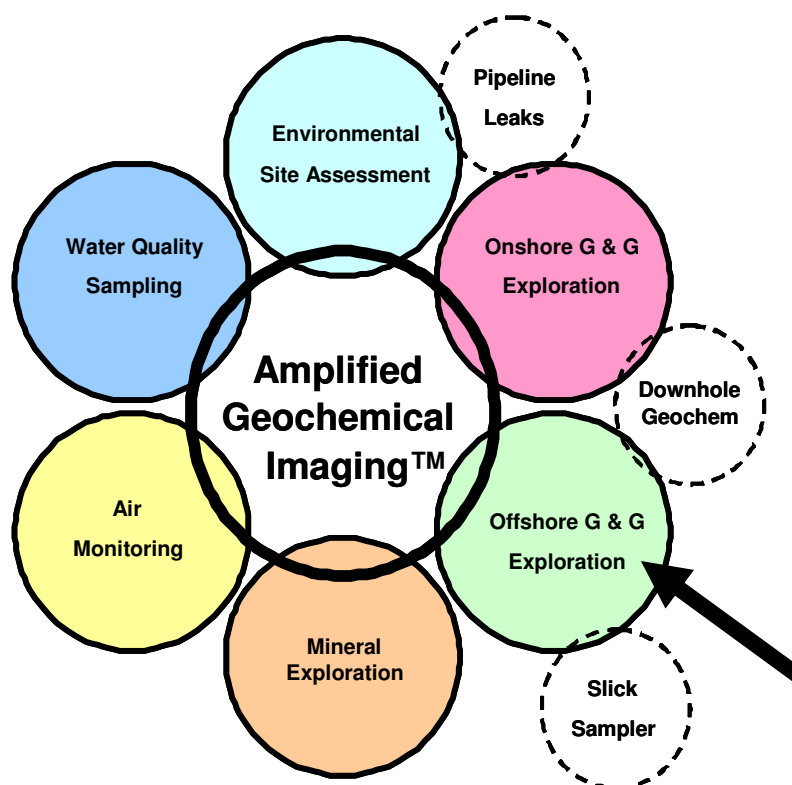
Summary

As a part of a larger onshore survey 25 Gore-Sorber modules were installed in an embayment with water depths up to 7 m.

Both installation and retrieval was conducted by a commercial scuba diver from a 6 m boat and took on average ½ hour per module. Navigation was done with a Garmin 12 GPS device.

The modules were planted up to ½ m into the seabed, and were tied to a cement-filled bucket attached with at small buoy on a ½ m leash as well as a plastic streamer. There was no surface marking of the location.

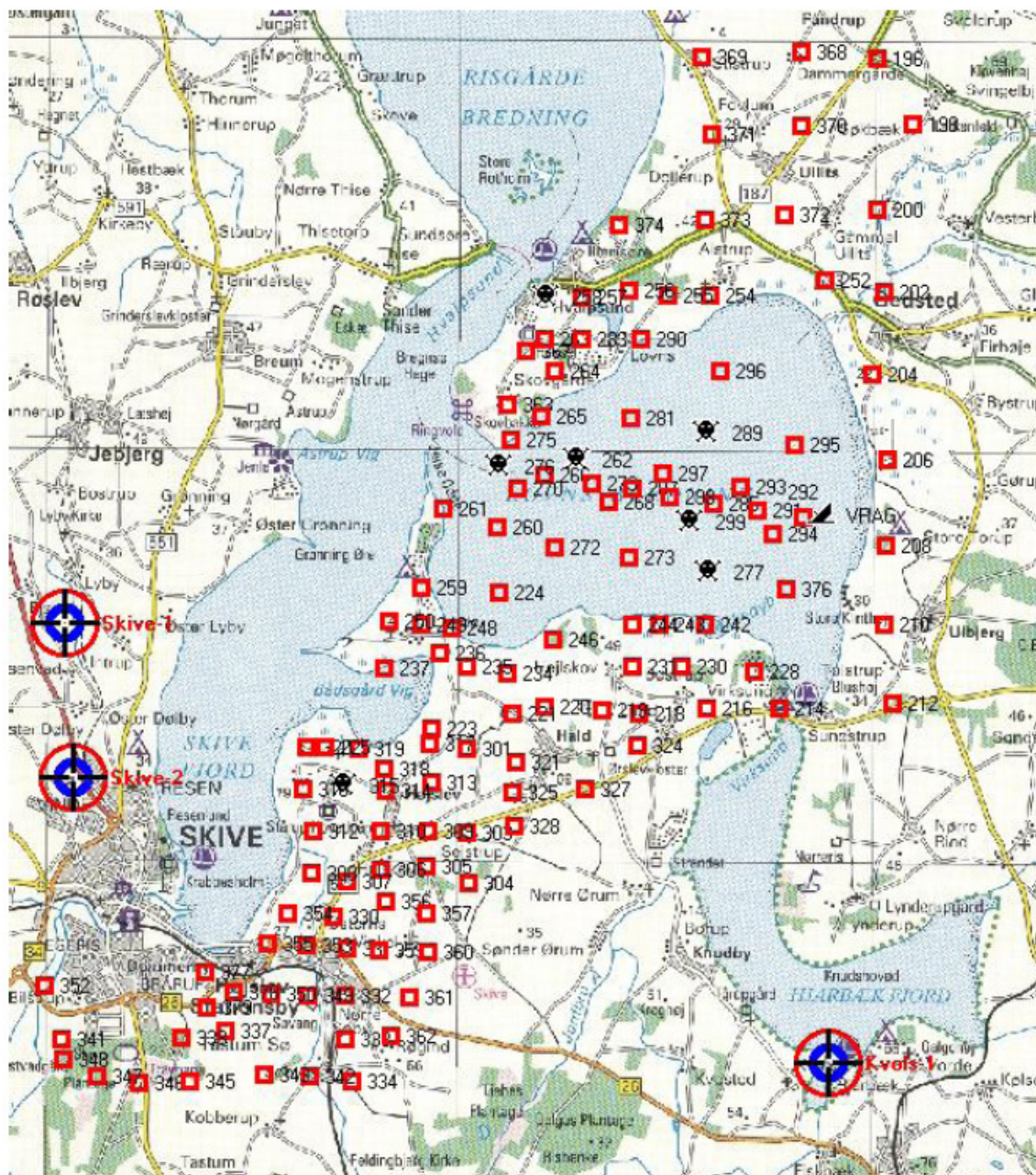
The Amplified Geochemical Imaging™ Circle of Technology



Twenty of the twenty-five modules were recovered. One of the 5 lost modules tore loose from its anchor; the remaining four modules were probably lost due to GPS inaccuracy and difficulties with boat navigation in rough weather.

Survey Layout

The marine installation was part of a survey conducted for Sterling Resources Inc. on license 2/01 in Salling, Denmark in August/September of 2002, as shown on the map below (map grid = 10 Km, lost modules are marked with a skull & crossbones icon):



The onshore grid has a spacing of about 1 Km in the southern part and about 2 Km in the northern and eastern part. Most of the marine modules zigzag across the only seismic line in the area (74-323) and have a spacing of about 600 to 700 m. This mode of deployment was chosen in order to obtain statistically relevant sampling over the seismic line and thereby get a good surface geochemical to seismic correlation. The remaining marine modules fill in the space between the seismic line and the land grid with a ca. 2 Km spacing. Water depths range between 2 and 7 m, as shown on the map below (map grid = 1 Km, 2 m bathymetry contours, lost modules are shown with a skull-and-crossbones symbol):



Survey Approvals

The license terms call for special approvals of marine activities within the license. Apart from the general survey approval from the Danish Energy Authority, approvals had to be obtained from maritime and fisheries authorities. This process started in April 2002 and was completed in late July.

The marine authorities could –out of regard for shipping safety- accept two types of sample locations markings:

- 1) Surface marking with 60 cm diameter fluorescent buoys. Sailors should – through the official “Notification to sailors” - be advised 1 month in advance of the survey start if this option were chosen.
- 2) Bottom marking extending no more that 20 cm above the seabed. The fishery authority limited the survey to a period where it would not interfere with harvesting of mussels from the seabed, resulting in a survey window including the months of July and August only. However, since the approval was received late in July there was insufficient time to notify sailors, for which reason bottom marking became the only viable option. Additionally, there was some concern that surface marking could invite tampering by “nosy” people. In the experience of the diving company surface markings are liable to be tampered with, and they firmly recommend the method used for this survey.

Equipment, Personnel & Navigation

For the survey the following equipment was used:

- 6 m boat with twin outboard engines and equipped with a ladder for the diver. The boat was equipped with 3 GPS devices, sonar and came with a driver (two different drivers were used during the survey and proved to have quite different levels of skills). The boat arrived at the survey area on a trailer.
- Professional diver from Jydsk Dykker Service in Holstebro. Three different divers were used during the survey (Dennis, Robert and Claus), and all did a great job.

- Garmin 12 GPS provided by weXco. This was used for installation and retrieval, since it turned out that the boat driver active during the retrieval did not know how to operate the boat's GPS. During land surveys it has been established that the Garmin 12 GPS is accurate to within 3 m. According to the manual this device updates the position every second. However, it seems to be a bit slow in updating the direction-to-target arrow in "GoTo" mode (5 seconds?), which slowed the survey down by making it difficult to hit the target.

Installation of Modules

The following procedure was followed for the installation of the modules:

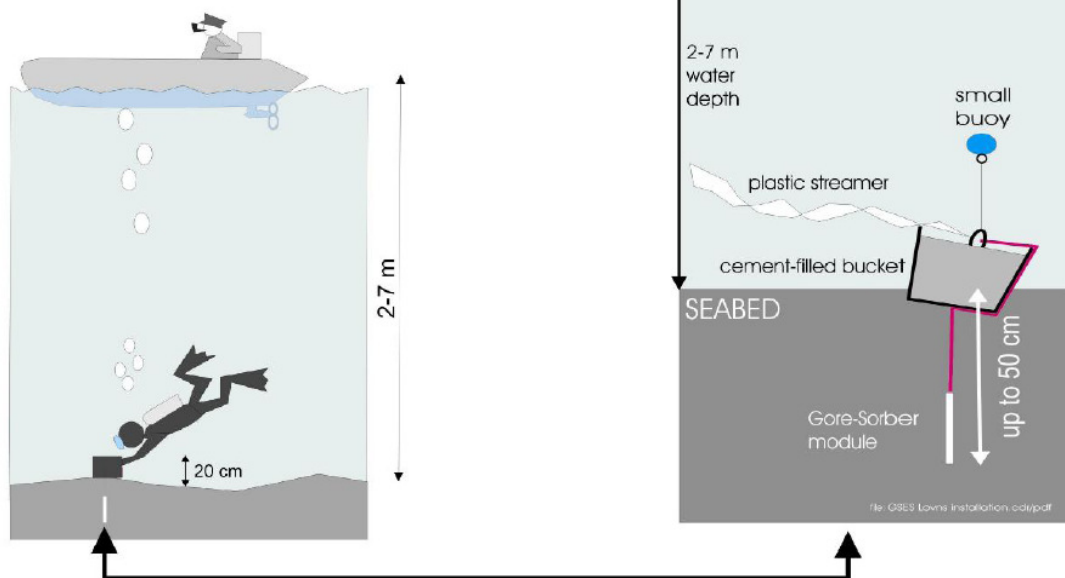
NAVIGATION: the boat was steered to the pre-selected sample location by GPS, and the diver would receive the module and the marker equipment while already in the water.

CONTAMINATION: in order to avoid contamination in general as well as contamination from the outboard engines -which may leave an oil film on the surface of the water- the modules were taken out of their bottles and affixed to the insertion rod under water. The diver wore new Latex glove for each installation.

PLANTING: the modules were inserted into the seabed with the insertion rod directly or after first making a hole in the seabed with an auger, depending on the character of the bottom sediments (coarse sediments – usually oyster beds- were seen only at locations shallower than 2-3 m). After insertion the marker bucket was placed on top of the module.

MARKER: the marker consisted of a plastic bucket filled with cement, into which a metal loop had been cemented. The weight of the bucket was about 5 Kg. Affixed to the metal loop was the string for the Gore-Sorber module, a 2 m long plastic streamer and a small buoy on a ½ m leash. The top of the cement was painted yellow for visibility. (As it turned out, it was physical contact with the marker equipment – not visual contact- that found the majority of the modules. This was due to strong algal growth in the water).

INSTALLATION OF GORE-SORBER MODULES IN LOVNS BREDNING



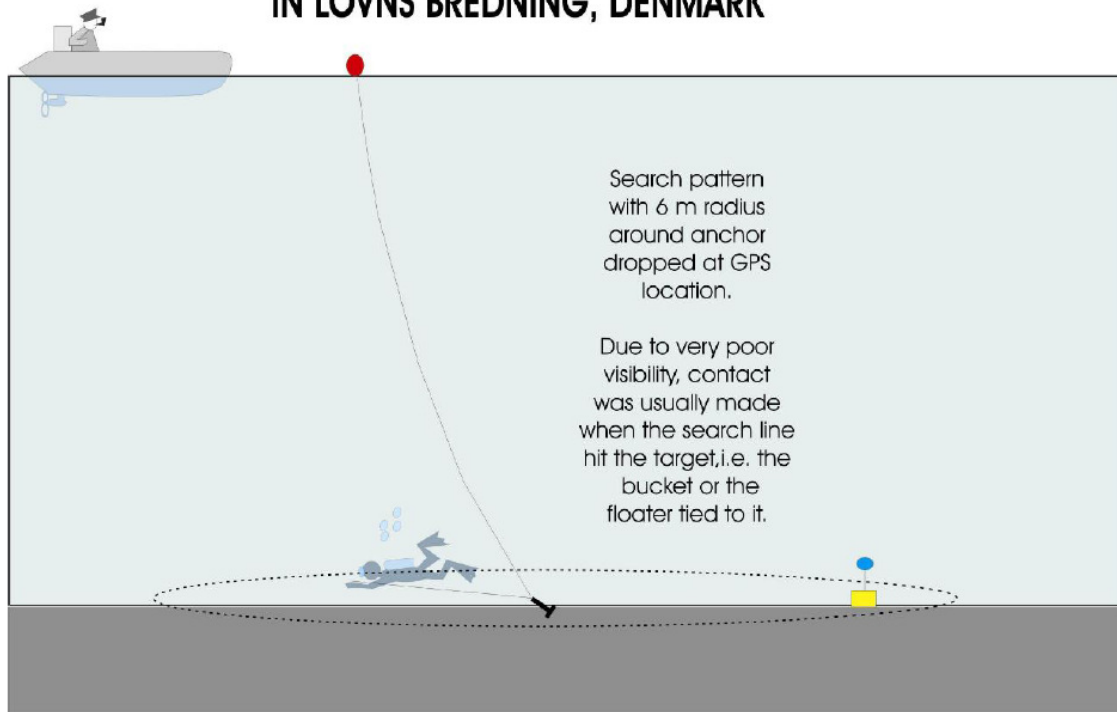
Retrieval of Modules

- The boat was steered to the sample location, where an anchor with a buoy was dropped.
- The diver would go into the water with the capped module bottle wearing new Latex gloves and a 6 m long search rope.
- Arrived at the bottom, the diver would tie the search rope to the anchor and make at least one complete circle around the location.

- If the marker was found the module would be inserted into the bottle on the bottom and capped. Next the diver would tie the bucket to the search rope and then surface himself. The surface crew would then recover the diver and marker, and steam to the next location.
- If the marker was not found, the diver would be recovered from the water and the boat would again go the GPS position of the sample for another try. Up to 3 tries were attempted at each location.

A total of 5 modules (20%) were not recovered; 1 was missing from the marker, while 4 markers could not be located.

RETRIEVAL OF SHALLOW MARINE GORE-SORBER MODULES IN LOVNS BREDNING, DENMARK



Recommendations

It is believed that the following recommended changes to the fieldwork procedure could make shallow marine surveys more efficient with respect to cost and recovery rate:

- During the installation phase the diver jumped into the water when the pre-set GPS location was reached. However, due to wind and currents caused by the rough weather at the time, the boat could move up to 10 m between when the “now” was yelled out and the diver hit the water. In order to minimize this distance it is recommended that an anchor with a buoy be dropped at the GPS location before the diver enters the water.
- To minimize GPS error, DGPS should be used. DGPS is accurate to within less than one meter and is available on most diving boats. Alternatively a faster updating GPS arrow in “GoTo” mode combined with a steady approach at slow speed (i.e. experienced boat driver) would reduce installation and retrieval time.
- A boat driver experienced in underwater search missions would reduce installation and recovery times.

Article is courtesy of Peter Willumsen & Henning Brich Hansen, September 4, 2002.



The boat used for the survey



Steaming through Virksund

Marine installation
in
Lovns Bredning



Cement-filled bottom markers



Crew demonstrates the bottom marker with attachments

For further information regarding **Amplified Geochemical Imaging Technology**, contact Bob Potter, Geochemtech Inc. at **(403) 863 9738** or ropotter@geochemtech.com

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