

R/V HEINCKE

Cruise Report HE-475

**Multidisciplinary investigations
at the Dutch Dogger Bank seep area (North Sea)**

Bremerhaven - Bremerhaven

25.10. - 06.11.2016

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MARUM – Center for Marine Environmental Sciences

The cruise was performed by
MARUM – Center for Marine Environmental Sciences

R/V HEINCKE cruise HE-475

The cruise was dedicated to two different main objectives: it was meant to test sampling equipment but should be also be used to acquire data for scientific analyses and interpretation. Testing equipment included a formerly defect multicorer, and most importantly, the first sea trial of the newly built autonomous underwater vehicle 'IMGAM-AUV'. As this cruise follows already three prior cruises conducted in the same work area in the southern North Sea (HE-413 in 2014, HE-444 in 2015, and HE-459 in March 2016), we collected now already valuable data regarding the temporal variability of the analysed seep area. In the work area gas emissions are abundant in a water depth of about 44 m over an area covering about 8 km². Ship-based echosounder allow visualizing the gas bubbles emanating from the sediments through the entire water column reaching the sea surface. During the last cruise HE-459, we could prove that the bubbles do transport a fraction of the methane up to the atmosphere. With this cruise we therefore aimed to also systematically and quantitatively investigate these fluxes.

The cruise was planned to start in Bremerhaven on Tuesday, 25th of October. However, several problems occurred while installing our main device on board, the IMGAM-AUV, inhibiting its functionality to be deployed at sea. Therefore, some additional experts from Atlas Electronic were ordered to fix the problems while waiting in the harbour. On Wednesday, 26th of October, several test deployments in the harbour basins were performed that fortunately went successfully and allowed us to leave finally the harbour in the morning of the 27th of October. First target was reaching the wind-shaded east side of Helgoland to deploy the multicorer that did not work on prior cruises. The deployment was very successful and revealed full functionality after repairs on land. Due to bad weather conditions and reduced vessel speed we arrived in the work area in the Netherlands sector of the North Sea at noon time on Friday, 28th of October, where we started immediately with the first station. The ship's owned sound velocity probe revealed a profile used to implement into the multibeam system of the ship. Still the same afternoon, we performed a sampling station within a gas seep area using CTD and minicorer to sample both the water column and surface sediments. This set of sampling was repeated again on the 29th and 30th of October in two other locations in this work area. During night time we mapped the area extensively using all hydroacoustic methods available on RV Heincke but also using continuous air and surface water measurements with three different Greenhouse Gas Analysers (GGAs) revealing methane concentrations and carbon isotopes. On Sunday, 30th of October weather conditions improved such that we could deploy for the first time the IMGAM-AUV, which was technically very successful and data for payload implementation have been recorded. Monday, 31th of October, we deployed the multicorer for the second time in order to prove the functionality in different sedimentary environments, which was fortunately also successful.

Afterwards, we started our transit to Cuxhaven, where we arrived on Tuesday, 1st of November. We unloaded most of the scientific equipment except the IMGAM-AUV and changed part of the scientific crew. We continued our cruise on Wednesday, 2nd of November with the goal to deploy once more the IMGAM-AUV directly within the seep area to map and sample gas bubble emissions. After reaching the work area again on Thursday, 3rd of November, weather conditions became calm enough around noon. Although the entire ship's crew did a great work and deployed the IMGAM-AUV into water, a fin of the AUV broke away with the water contact resulting that the deployment had to be interrupted. After intense discussion, we had to decide that further deployments of the vehicle are not possible during this cruise. Therefore we finished our mapping, which covered also

parts in the German sector of the North Sea, and left the area on Friday, 4th of November to arrive in Bremerhaven on Saturday, 5th of November in the morning. Despite the damage during the last deployment of the IMGAM-AUV, HE-475 was a very successful cruise regarding both, testing of our new equipment and sampling for scientific purposes.

Fig. 1 Overview of the cruise track during R/V HEINCKE cruise HE-475

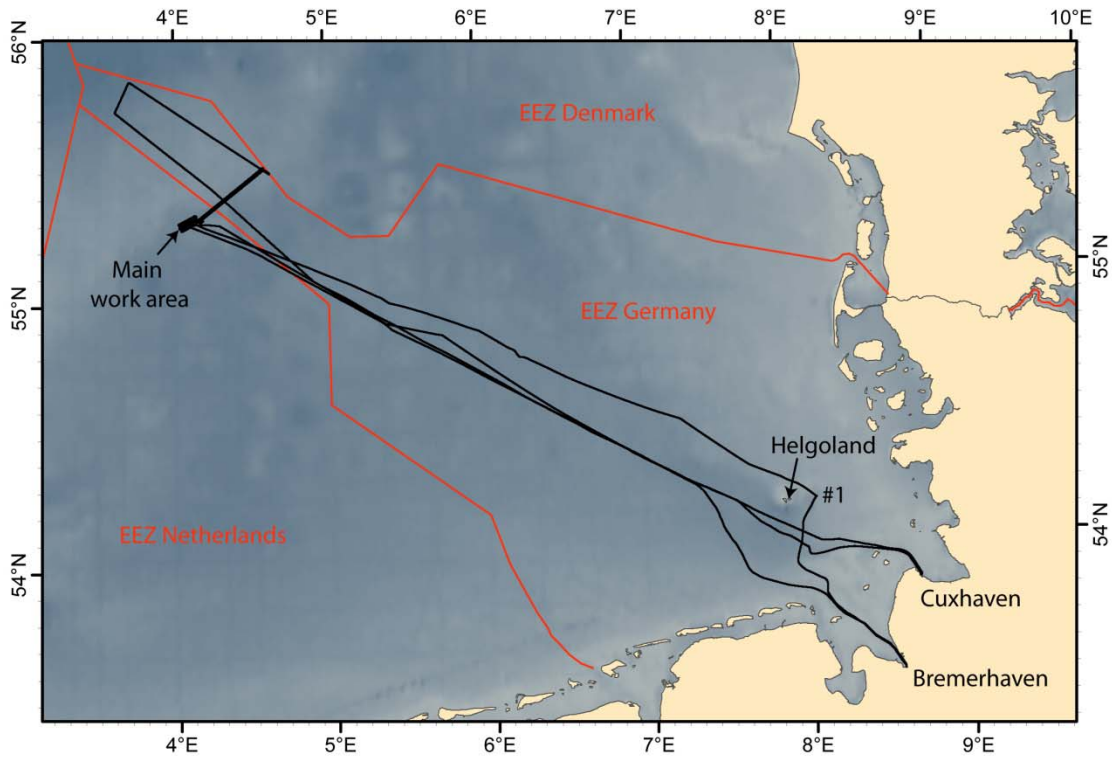
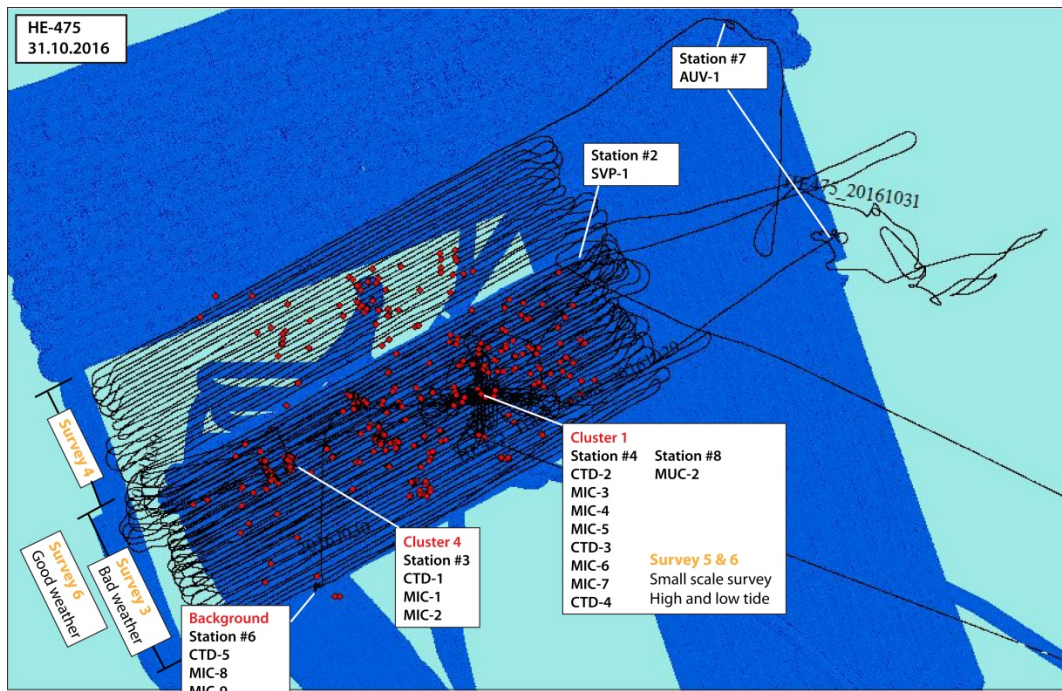


Fig. 2 Map of the main work area showing the flare cluster and Stations sampled during HE-475



Personel aboard R/V HEINCKE HE-475**Table 1:** Scientific crew part 1 (25.10.-01.11.2016)

	Name	Function
1	Miriam Römer	Hydroacoustic
2	Stefan Wenau	AUV Detector
3	Hanno Keil	AUV Detector
4	Lara Meyer	Hydroacoustic
5	Susan Mau	MUC/MIC
6	Jan Hartmann	Picarro (water)
7	Janice Malnati	Sampling
8	Mirko Lange	CTD
9	Marc Viehweger	AUV Sampler
10	Morten Nielsen	AUV
11	Claus Eriksen	AUV
12	Max Abildgard	AUV

Personel aboard R/V HEINCKE HE-475**Table 2:** Scientific crew part 2 (01.11.-06.11.2016)

	Name	Function
1	Miriam Römer	Hydroacoustic
2	Stefan Wenau	AUV Detector
3	Hanno Keil	AUV Detector
4	Lara Meyer	Hydroacoustic
5	Marc Viehweger	AUV sampler
6	Morten Nielsen	AUV
7	Claus Eriksen	AUV
8	Gerrit Meiecke	AUV Team MARUM
9	Jens Renken	AUV Team MARUM

Station	Gear	Gear-Number	Ship-Site-Number	Latitude (°N)	Longitude (°E)	date	time	depth	REMARKS
21901-1	MUC	MUC-1	HE475_001	54.18916667	8.08966667	27.10.2016	12:11	22.5	successful, all cores recovered
21902-1	SVP	SVP-1	HE475_002	55.31833333	4.10366667	28.10.2016	11:55	39	SVP for EM710
21903-1	CTD	CTD-1	HE475_003	55.30013333	4.05666667	28.10.2016	14:22	44	successful, all bottles closed
21903-2	MIC	MIC-1	HE475_003	55.30045	4.05636667	28.10.2016	14:50	44	Two short cores, 1 leg did not deploy, 1 empty core
21903-3	MIC	MIC-2	HE475_003	55.3005	4.05738333	28.10.2016	15:03	44	2 cores with sediment, 1 leg did not release, 1 tube empty. 2 cores sampled
21904-1	CTD	CTD-2	HE475_004	55.3066	4.09113333	29.10.2016	06:35	44	successful, all bottles closed
21904-2	MIC	MIC-3	HE475_004	55.30636667	4.0906	29.10.2016	06:50	44	2 good cores, PW core too short
21904-3	MIC	MIC-4	HE475_004	55.30673333	4.08986667	29.10.2016	07:02	44	fail, no PW core
21904-4	MIC	MIC-5	HE475_004	55.30606667	4.09036667	29.10.2016	07:11	44	1 good core, again no PW core
21905-1	CTD	CTD-3	HE475_005	55.30608333	4.09031667	29.10.2016	13:15	44	All bottles closed. Sampling at 35m (12:12) and 20m (13:14) + 2 from same depths for Picaro
21905-2	MIC	MIC-6	HE475_005	55.30616667	4.08988333	29.10.2016	13:32	44	fail, because core not long enough
21905-3	MIC	MIC-7	HE475_005	55.30618333	4.09035	29.10.2016	13:47	44	1 good PW core, 1 good "normal" core
21905-4	CTD	CTD-4	HE475_005	55.30623333	4.09038333	29.10.2016	14:30	44	After deployment test of Picaro pump for 10 min. 1 Sample for Picaro in 1m depth. Niskin bottles closed at 20m depth. All bottles closed when arriving on ship.
21906-1	AUV	AUV-1	HE475_006	55.33033333	4.141	30.10.2016	08:28	40	System tests successful
21907-1	CTD	CTD-5	HE475_007	55.28776667	4.0615	30.10.2016	14:54	44	All bottles closed.
21907-2	MIC	MIC-8	HE475_007	55.28788333	4.06123333	30.10.2016	15:06	44	1 leg not deployede, 3 empty cores --> MIC-9. 1 leg of MIC has been broken.
21907-3	MIC	MIC-9	HE475_007	55.28786667	4.06163333	30.10.2016	15:12	44	3 cores, 2 long enough for sampling, 3rd of bad quality
21908-1	MUC	MUC-2	HE475_008	55.30661667	4.09148333	31.10.2016	07:04	44	successful, 11 cores filled, 1 with water
21909-1	AUV	AUV-2	HE475_009	55.30616667	4.0935	03.11.2016	10:09	0.6	Deployment failed.

Table 3: Station list of R/V Heincke cruise HE475