Cruise Report

of the

METROL **cruise** to the **Black Sea**

19.09. - 13.10. 2004

F.S. Poseidon cruise **P317/3**

A research project supported by the **European Commission**
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Report F.S. Poseidon – cruise no POS 317/3

Dates of Cruise: 29.09. – 13.10.2004
Areas of Research: Microbiology/Biogeochemistry

Port Calls: Istanbul, Istanbul
Institute: Max Planck Institute for Marine Microbiology

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Number of Scientists: 11

Project: METROL (Methane fluxes in ocean margin sediments: microbiological and geochemical control)

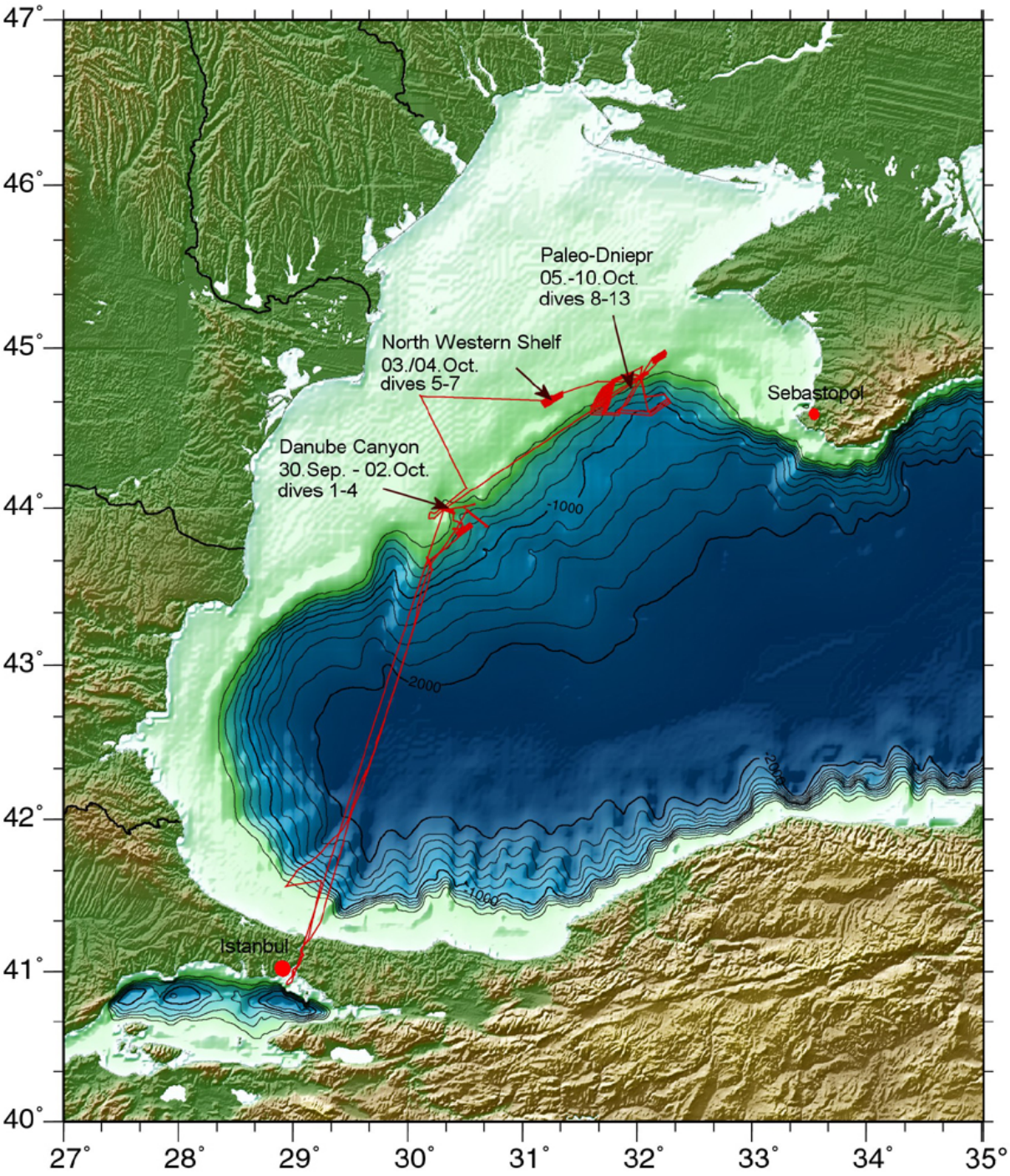

Figure 1. Criuse track POS 317/3.

1 Scientific crew

Name	Function	Institute
Joergensen, Bo Barker	Chief Scientist, biogeochemistry	MPI-Bremen
Borowski, Christian	Biogeochemistry	MPI-Bremen
Knab, Nina	Biogeochemistry	MPI-Bremen
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Greinert, Jens	Hydroacoustics, positioning	IFM-GEOMAR
Cragg, Barry	Microbiology	Cardiff University
Gulin, Maksim	Geochemistry, UKR observer	IBSS, Sevastopol
Ion, Gabriel	Chirp acoustics	GeoEcoMar, Bucharest
Secrieru, Dan	Geochemistry, ROM observer	GeoEcoMar, Constanta
Schauer, Jürgen	Submersible	Aquatec/MPI-Seewiesen
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Total 11

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IBSS	A. O. Kovalevsky Institute of Biology of the Southern Seas, National Academy of Science of the Ukrane, Prospekt Makhimova 2, 99011-Sevastopol, Ukraine
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2 Research programme

The cruise was part of the research activities in the EU-funded project METROL: “METhane fluxes in ocean margin sediments: microbiological and geochemical contROL”, which is coordinated by the MPI-Bremen. Project partners are Germany, Romania, The Ukraine, Denmark, UK, The Netherlands, and Norway. Local partners are the National Institute for Geology and Geoecology (GeoEcoMar), Bucharest, and the A.V. Kolvalevsky Institute for the Biology of the Southern Seas (IBSS), Sevastopol.

In the frame work of this program the question is addressed how the methane turnover is regulated in the Black Sea sediments. Two types of methane environments were studied: the zones of methane accumulation and anaerobic methane oxidation within the sediment, and the methane seeps on the shelf and upper slope where methane oxidation leads to carbonate and microbial mat formations.

Methane accumulates to high concentrations in the Pleistocene deposits below a few meters depth in modern Black Sea sediments. The methane diffuses up into the sulfate zone where it is oxidized to carbon dioxide. The methane-dependent sulfate reduction leads to an H_2S peak at the sulfate-methane transition. This H_2S diffuses up towards the sediment surface and into the overlying water column and it diffuses down into the limnic deposit below. The resulting, downwards progressing sulfidization front can be seen as one or several black bands of amorphous FeS at 2-5 mbsf in most of the Black Sea today. The sulfidization front is interesting in that it carries an extremely heavy sulfur isotopic signal that has recently been shown to result from its coupling to anaerobic methane oxidation (Jørgensen et al. 2004; Neretin et al. 2004). Furthermore, there are extensive areas of shallow gas accumulation that have been mapped acoustically on the northwestern shelf and slope. The interactions between the sulfur cycling, gas accumulation and methane oxidation in the Black Sea have not been known until recently and the role of sulfate reduction and methanogenesis for the overall carbon budget in Black Sea sediments has been poorly constrained. It is an additional purpose of the project to improve this database with the long-term goal to establish a methane, carbon and sulfur budget for the Black Sea.

Numerous sites of methane ebullition have been detected and mapped in recent years along the shelf break and uppermost slope of the Black Sea. At some of these sites, methane-derived carbonate structures coated by thick microbial mats have been observed and retrieved (Pimenov et al., 1997, Luth et al. 1999)). The purely prokaryotic communities of such microbial reefs from the anoxic, sulfidic zone consist predominantly of archaea and sulfate reducing bacteria living on methane as the main energy source (Michealis et al. 2002). While earlier sampling was often done by a rather destructive dredging, the deployment of the submersible JAGO enables us to very specifically collect selected parts of individual chimneys. Different microbial chimney systems in separated regions of the western and north western Black Sea shelf were visited to study the diversity of such systems under the unique conditions of the Black Sea.

Objectives of the cruise were:

A. High-resolution bathymetric mapping and mapping of gas seeps by hydro-acoustic detection of gas flares in the water column;
B. hydro-acoustic mapping of subsurface gas plumes;
C. the quantification of microbial turnover of gassy sediments and microbial mats;
D. the characterization of geochemical conditions for the anaerobic methane oxidation and its regional variation;
E. the characterization and identification of microorganisms involved in the anaerobic methane oxidation in the sediment and in microbial mats. As part of these investigations characteristic organic molecules will be identified, which can be used as biomarkers for anaerobic methane oxidizing microorganisms.

The strategy for the accomplishment of the above described objectives followed three steps:

1. Hydroacoustic mapping (high resolution swath bathymetry, flare imaging, sub-bottom profiling; objectives A and B) provided the necessary information for the selection of sediment sampling sites and submersible dive locations. A major target for all working areas (s. below) was to extend the existing bathymetric information by further high resolution bathymetric mapping.
2. Gravity cores and multi cores obtained from sites selected in relation to the distribution of free gas in the sediment served for the analyses of the rates of methane turnover-related microbial processes (anaerobic oxidation of methane, sulfate

reduction, methanogenesis) and various controlling geochemical and microbial parameters (objectives C, D and E).

3. Hydro-acoustically identified seep sites down to maximally 400 m water depth were explored in-situ with the submersible JAGO. Sampling of sediments (push cores), microbial mats associated with carbonate chimneys and gas bubbles from seep outlets served for the analyses of the processes and parameters mentioned in 2) (objectives C, D, and E).

Three working areas were chosen according to existing information on gas seeps distribution, accumulations of free gas in the sediment, and sediment geochemistry. Working areas 1 and 2 have not been subjected to submersible dive operations before.

Working area 1: Danube canyon

The Danube Canyon (also known as Viteaz Canyon) is a large shelf-indenting canyon that has developed seaward of the late Pleistocene paleo–Danube Valley. It is located on the outer north western Black Sea shelf and stretches for 26 km from ca. 44°05'N, 30°10'E to the shelf break at ca. 43°55'N, 30°20'E. The canyon is up to 110 m deep and represents the proximal end of the paleo-Danube delta system. Aggregations of methane seeps have been mapped along the canyon slope and adjacent areas, especially along the shelf break edge to both sides of the canyon and along the landward prolongation of the paleo-Danube system. Subsurface gas plumes have been mapped in sediments in the canyon and along its prolongation (Popescu et al. 2004); further information on subsurface gas distribution is available by sub-bottom profiles from METROL project partner GeoEcoMar.

This area was chosen for the collection of deep water sediment cores in order to fill gaps in a previously sampled transect of cores which were analysed for geochemical pore-water profiles and microbial process rates (Jørgensen et al. 2001), and for the search with the submersible JAGO for gas seeps and associated carbonate precipitating microbial mat communities.

Working area 2: North-western shelf

A number of gas seeps have been mapped in water depths between 100 and 300 m along the entire north western shelf break between the Danube Canyon and the paleo-Dniepr delta area (Egorov et al. 1992). Dense accumulations of seep positions are known from the area around 44°35'N 31°10'E. This area mainly served for the search for gas seeps and associated carbonate precipitating microbial mats.

Working area 3: Paleo-Dniepr

The paleo-Dniepr area has been intensively mapped for gas seep positions (e.g. Egorov et al. 1998) and has already been visited by other research cruises in the recent past (e.g. with RV Logatchev in 2001, RV Vodyianitskiy in 2003, 2004). Data on the distribution of shallow gas have been made available by the METROL project partner GeoEcoMar and by the EU project CRIMEA. On the basis of this information, further high resolution chirp echo-sounding and analyses of sediment geochemistry and microbial processes was planned in order to study the relationships between the presence and distribution of free gas and the microbially mediated gas turnover in the pore water.

Another important task was the further exploration for microbial mat communities comparable to those of the spectacular chimney forest discovered by the submersible JAGO in 2001 with RV Logatchev (Michaelis et al. 2002).

3 Narrative of cruise with technical details

Tuesday, 28. September

The group embarked during the morning. First contact with the crew and the previous researcher group gave initial impressions on what we might have to expect from diving with the JAGO submersible and the weather conditions in the research area. We gave assistance with preparing the air freight shipment of frozen samples to the leaving researcher group and loaded our research equipment in the afternoon. Start with installation of equipment in the laboratories in the evening.

Wednesday, 29. September

RV Poseidon left Karaköy harbor (Istanbul) around 10:00 h. Passage through the Bosprous for about 2 hours in calm and sunny weather - then heading towards working area 1 in the Danube Canyon area in Romanian EEZ. The transit time was used for the set up of laboratories and sampling gear.

Thursday, 30. September

Arrival in the working area 1 in the morning and begin of station work at 07:00 h; wind 8-15 kn. We started with multi-beam echo-sounding on the southern flank of the Danube canyon in order to locate gas flares and to find suitable dive sites (ship station #769). Between 10:20 h and 17:30 h sediment coring: deployments of 4 x gravity corer (GC), 1 x multi corer (MUC) and 1 x Rumohr Lot (RL) (stations #770-775). After completion of the sediment stations, mapping again - this time in a combination of swath bathymetry and chirp echo-sounding. The chirp was recovered again short before midnight and mapping was resumed with the multi-beam echo-sounder alone (#776-777).

Friday, 01. October 21

Mapping until after breakfast; the weather was calm and sunny (wind 2-8 kn). The first JAGO dive started around 09:00 h (#778) at a site which had shown multiple gas flares during the mapping. While this dive did not yet satisfy the expectations (no gas seeps, no carbonate chimneys), JAGO dive 2 (#780) brought up the first samples in the afternoon: microbial mats from a carbonate chimney, sediments recovered with push cores around a gas seep and a gas sample. Between the two dives, we performed a short test of the Chirp system (#779); from 19:30 until next morning: multi-beam echo-sounding and gas flare imaging (#781-782).

Saturday, 02. October

Wind 6-10 kn. We finished diving in the Danube area with JAGO dives 3 and 4 (#783-784) at sites which were promising according to the previous gas flare imaging. Both dives again recovered samples of carbonate chimneys, sediments and gas. Two final GC stations in this area (#785-786) were performed during the early evening before we left the area heading

towards working area 2 on the northeastern shelf break in the Ukrainian EEZ (around 44°35'N, 31°10'E).

Sunday, 03. October

We reached working area 2 in calm weather (wind 1-5 kn) around noon time and started station work with JAGO dive 5 (#787) at a site that was determined according to existing coordinates of mapped gas seeps. This dive was successful again. The day ended with bathymetric mapping/flare imaging (#788).

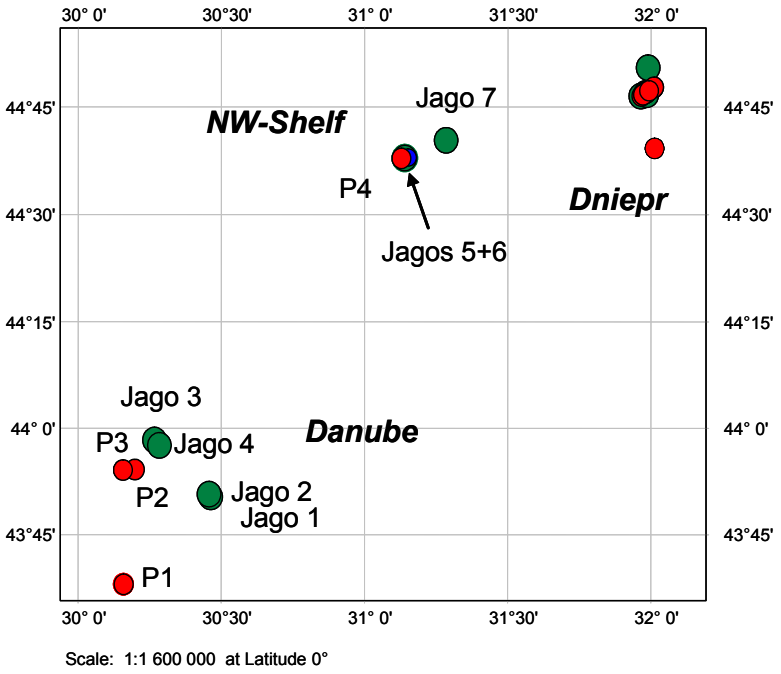

Figure 2. Sampling locations and diving positions in the three working areas paleo-Danube, NW-Shelf and paleo-Dniepr. Colours symbolize: red – gravity corer, blue - multi corer, green – submersible dives. For detailes on sampling and diving stations in the Dniepr area see Fig. 3.

Monday, 04. October

The program continued in the morning with a GC and a MUC station (#789-790) before JAGO dives 6 and 7 dives were performed successfully (#791-792; wind mostly around 7-9 kn). The dive sites had been determined again according to existing information on seep distribution and new results from mapping and flare imaging performed in the night before. After diving, we left working area 2 heading towards working area 3, where we first tested the X-Star chirp system until 22:00 h (#793). We continued with bathymetric mapping/flare imaging until the next morning (#794).

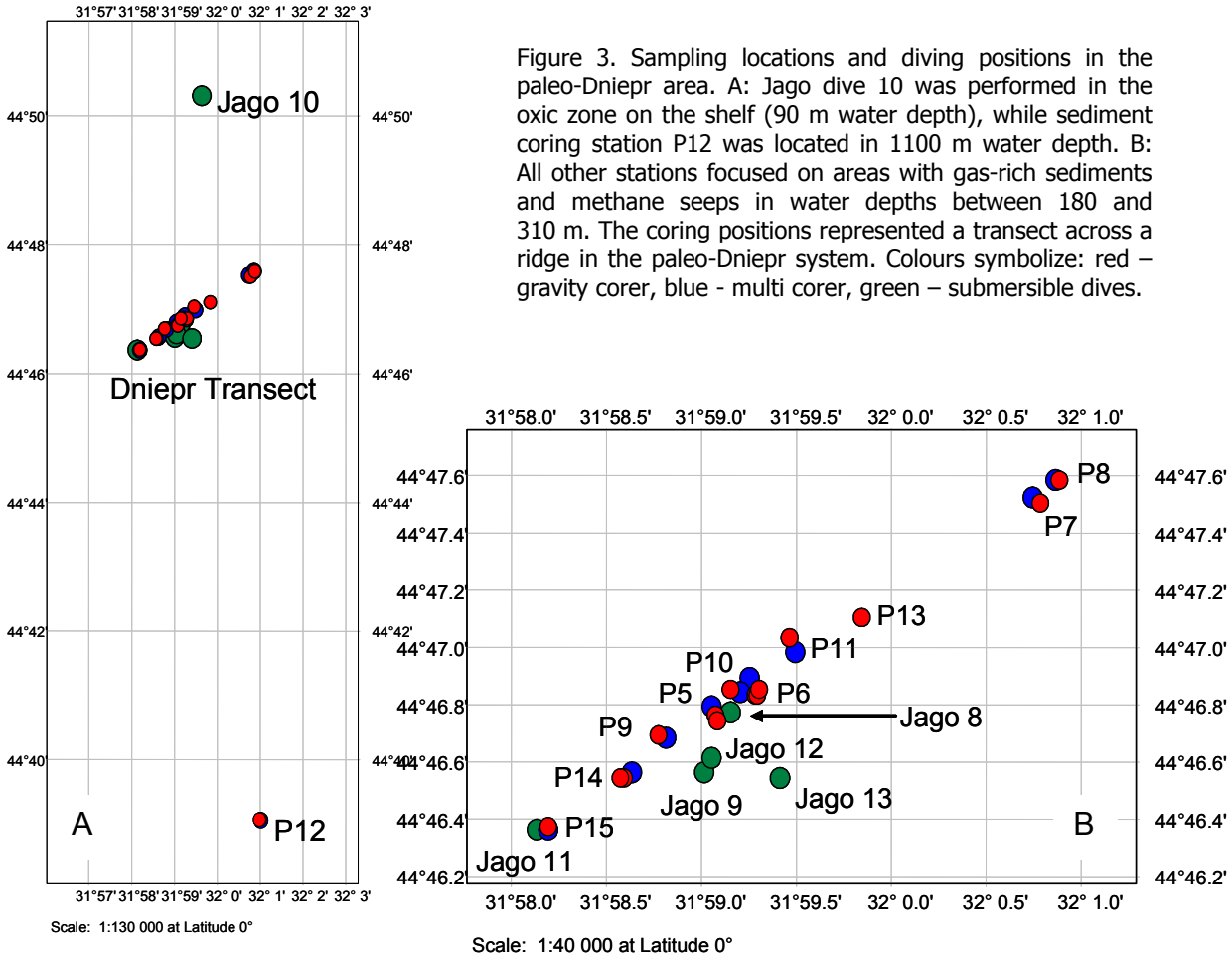

Figure 3. Sampling locations and diving positions in the paleo-Dniepr area. A: Jago dive 10 was performed in the oxic zone on the shelf (90 m water depth), while sediment coring station P12 was located in 1100 m water depth. B: All other stations focused on areas with gas-rich sediments and methane seeps in water depths between 180 and 310 m. The coring positions represented a transect across a ridge in the paleo-Dniepr system. Colours symbolize: red – gravity corer, blue - multi corer, green – submersible dives.

Tuesday, 05. October

Paleo-Dniepr area; 08:30 h JAGO dive 8 (#795, working area 3). The wind had picked up during the early morning and reached average speeds of max. 20 kn during the dive. Therefore we decided to continue with sediment coring in the afternoon. 5 GC stations were performed until 18:20 h (#786-800). The night was spent with bathymetric mapping (#801).

Wednesday, 06. October

Wind speeds of up to 24 kn still did not allow diving with JAGO. Therefore, we revisited the GC sampling sites of the day before in order to complete sampling with the MUC (#802-805) and continued the coring program in the afternoon with two GC stations (#806-807). Since the wind did not calm down in the afternoon, we continued with bathymetric mapping/flare imaging until the next morning (#808-809).

Thursday, 07. October

This day was filled again with sediment coring program while the wind calmed down a little to 12-14 kn: Between 10:30 – 16:30 h we completed three GC and three MUC stations (#810-815). Around 18:00 h we continued with bathymetric mapping/flare imaging until the next morning (#817).

Friday, 08. October
The wind had calmed down to 8 kn, which allowed to continue with Jago dives 9 and 10 (#817-818). After 20:00 h mapping again (#919-820).

Saturday, 09. October

Nice and calm weather (wind 5-6 kn). An early JAGO dive (#821), which brought back valuable push core samples, was already done at 10:00 h. The break between the morning and afternoon dives was used for bathymetric mapping (#821-a). JAGO dive 12 ended early in the afternoon, which left time for another three sediment stations (2 x GC 1 x MUC; #823-825). Mapping until the next morning (#826).

Sunday, 10. October

The day started early with sediment coring. Until noon time, we completed the sediment coring program in area 3 with 2 MUC and 4 GC stations (#827-831). The wind had temporarily picked up to 13 kn, but calmed down again in the afternoon, which allowed us to perform JAGO dive 13 (#832). This very successful dive discovered a new carbonate chimney field. We ended the work in area 3 with a CTD / in-situ pump station in the evening (#833) and then headed back to working area 1 (Danube canyon) in order to fill some gaps in the initial diving program.

Monday, 11. October

When we reached working area 1 in the early morning, the wind had strongly picked up during the night (>25 kn) and the decision whether diving was possible or not was postponed for a couple of hours. At 10:00 h, it became clear that weather would not calm down, and we decided to cancel the last two dives but do final bathymetric mapping instead (#834). Further increase of wind speeds caused us to also break off the mapping as well at 16:00 h, which furthermore marked the end of all station work for the cruise. The rest of the afternoon was used for disassembling coring gear and clearing up the working deck. The evening was dedicated to a barbecue party on the deck which took place in uncomfortable weather conditions. The ship was held in the wind for the duration of the party, and after its end, we began the transit back to harbor about half a day earlier than planned.

Tuesday, 12. October

The transit time was characterized by final sample processing, de-installation of laboratories and packing. Strong wind (8-9 bft) and the resultant ship movements limited all working activities to indoor areas.

Wednesday, 13. October

We reached Haydarpasa harbor (Istanbul) early in the morning. During the day, the containers for the submersible and the scientific gear were packed, and air freight with scientific equipment and cooled and frozen samples was handed to the ships agent.

Thursday, 14. October

The scientific party disembarked in two groups which left the ship at 07:00 and 12:30 h, respectively.

4 Scientific report and first results

4.1 Echo-sounding

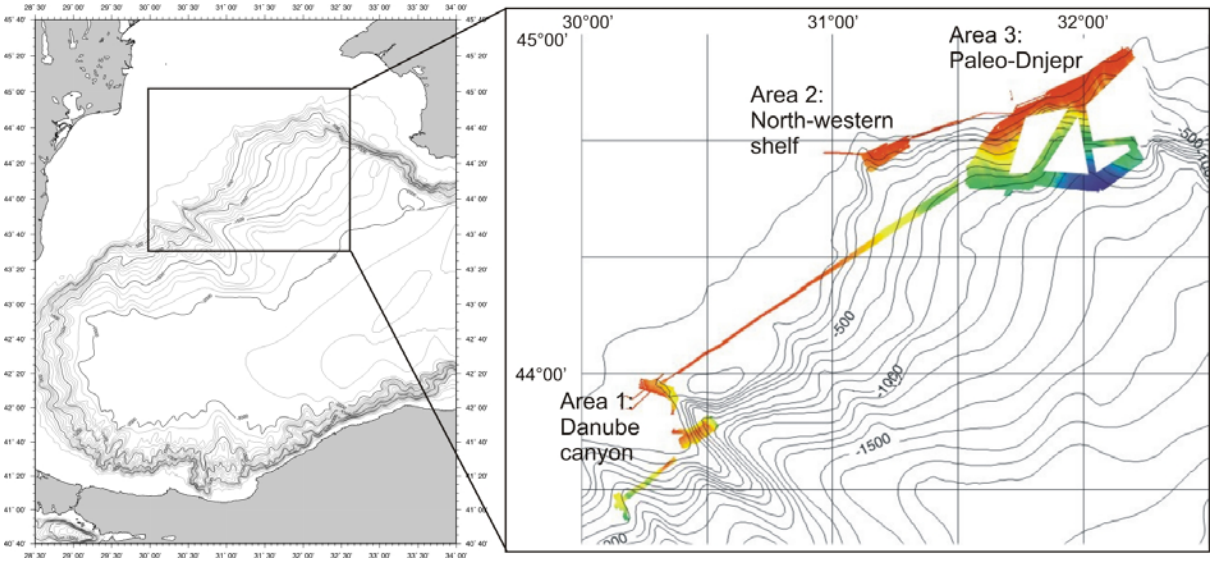

Figure 4: Bathymetric mapping during P317/3.

A total of 105 hours were spent for bathymetric mapping with the multi beam echo-sounder in order to map new regions (working area 2), to expand existing maps (Danube canyon, paleo-Dniepr area; existing xyz data were made available by EU project CRIMEA), or to create higher resolution data of already mapped areas (Danube canyon, existing xyz data were made available by EU project ASSEMBLAGES) (Figs 1 and 2).

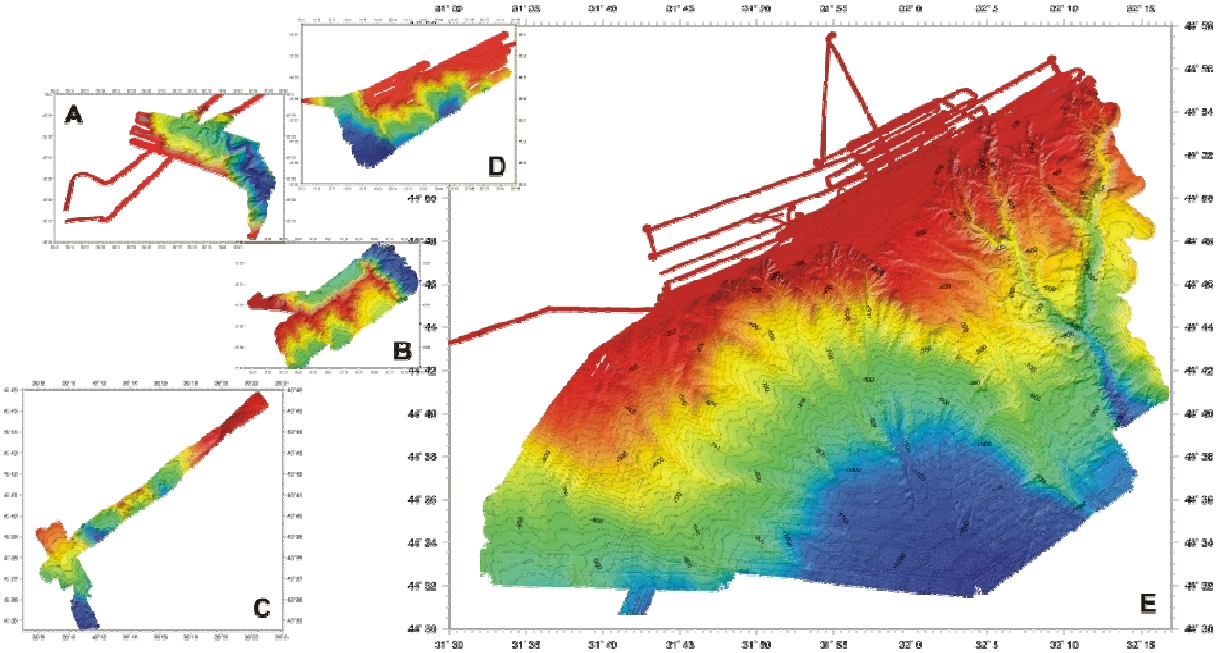

Figure 5. Overview on bathymetric maps produced during P317/3 and previous cruises. A – C: P317/3 maps of working area 1 (A, B = southern margin of the Danube Canyon, C = south of Danube Canyon); D: P317/3 map of working Area 2; E: combined map of data from P317/3 and previous mappings (CRIMEA data) of the paleo-Dniepr area.

Comparisons of the gas flare imaging with bathymetric data revealed that gas seeps often concentrate on the upper slopes of the canyon flank (Danube Canyon) or on the top of ridge structures (all working areas). Analyses of hydro-acoustic data on subsurface structures revealed, that on the ridge crests the Holocene mud layer tends to be thin or even not present, suggesting that local water current regimes hamper Holocene deposition in exposed regions. This coincided with observations on the subsurface distribution of free gas: The upper gas fronts often follow the Pleistocene-Holocene interface, suggesting that gas is migrating through the comparably permeable Pleistocene and approaches the sediment surface in exposed ridge crests, while it is capped by impermeable Holocene depositions on the slopes. Therefore, a possible significant role of the thickness of the Holocene for the regulation of gas emission into the water column of the Black Sea may be hypothesized.

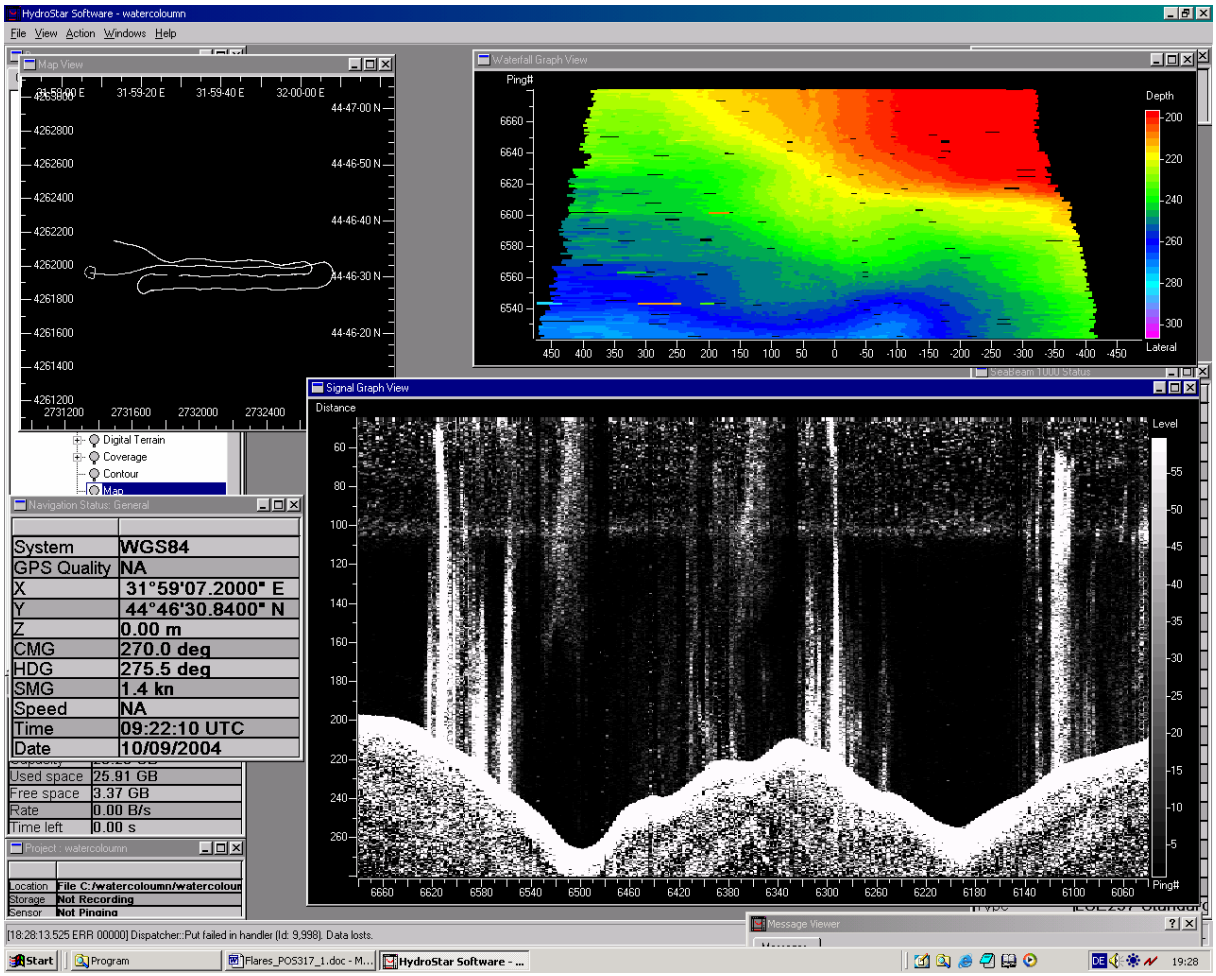

Figure 6. Gas flare imaging with the multi-beam echosounder.

4.2 Sediments

Table 1: Numbers of sampling sites and gear stations (deployments) in the working areas.

Working Area	No. of sites (site names)	Gravity corer (GC)	Multi corer (MUC)	Rumohr Lot (RL)
Danube	3 (P1-P3)	6	1	1
North East	1 (P4)	1	1	-
Dniepr	10 (P5-P15)	16	10	-

The GC was usually equipped with a 5.5-m coring tube (in shallow shelf areas only 3 m). GC samples served for two different analytical strategies:

1 - Analyses of vertical pore water gradients of CH_4 and SO_4^{2-} concentrations and porosity in order to estimate the depth of the sulfate methane transition zone and the fluxes for methane and sulfate.

2 - High-resolution analyses of vertical sediment profiles from selected sites for a variety of geochemical and microbiological parameters:

Pore water:

CH_4, H_2S, H_2, SO_4^{2-}, DIC, alkalinity, volatile faty acids, biomarkers, CH_4/SO_4^{2-} diffusion

$\delta^{13}C$-CH_4, $\delta^{13}C$-DIC, $\delta^{34}S$-SO_4, $\delta^{34}S$-DIC

AODC bacterial counts, 16S rDNA, Fluorescence In-Situ Hybridization (FISH)

Solid phase:

C_{org}, TN, $CaCO_3$, Fe, S

$\delta^{34}S_{solid\ phase}$

Process rates:

^{35}S-SRR, ^{14}C-AOM, $H^{14}CO_3^{2}$- / acetate- ^{14}C-methanogenesis

Miscellanious:

temperature, porosity

3 - Geological description.

The gravity cores were cut in 1-m sections immediately upon retrieval, and sub-sampling for the various parameters followed as soon as possible. Samples obtained with the RL and the MUC were used to analyze pore water gradients of sulfate in the top sediment layers, which are usually washed out in gravity cores. At locations where the pore-water diluted methane was present near the sediment surface, MUC cores were also used for both sub-sampling strategies.

The onboard lab work mainly concentrated on sub-sampling and preserving sediments for the various analyses and on tracer incubations experiments for process rate measurements. All analyses except for measurements of temperature and CH_4 concentrations will be done in the home based laboratories.

Onboard measurements revealed that CH_4 is was reaching far into the sulfate zone in most cores. Explanations for this are anticipated from the results of the further analyses.

4.3 JAGO dives

Unexpected good weather conditions allowed us to perform a total of 13 JAGO dives (4 x Danube, 3 x North East, 6 x Dniepr). Explorations for gas seeps and microbial mat/carbonate chimney structures revealed the following general picture:

Most gas seeps are inconspicuous and frequently consist of a single gas outlet in the sediment – often less than five centimeters wide. Although the echograms usually show marked flare signals which suggest vigorous bubble streams, many seeps release less than two bubbles per second. In-situ observations on the gas flux at such seeps revealed in-situ volumes of 0.55 – 1.44 ml s^{-1}.

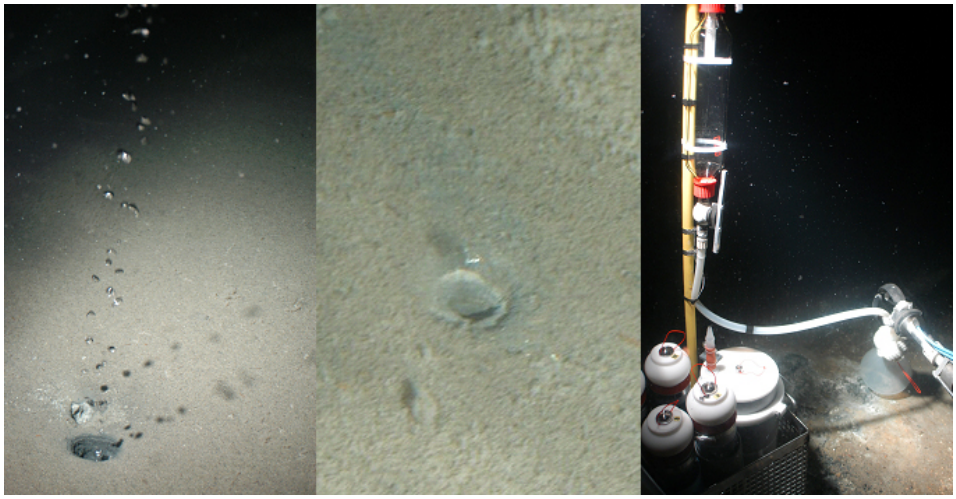

Figure 7. Methane gas seeping out of the sediment. We assume that seeps without associated carbonate chimneys represent relatively young stages with microbial mats developing in the subsurface. Although the frequency of bubble release at some sites was very low, the amount of bubbles present in the water column above such seeps was sufficient enough to produce marked signals with gas flare imaging. Seepage gas was collected with a gas sampler consisting of an inverted funnel operated by the manipulator arm and a trap flask mounted to the submersible (right photo).

Carbonate chimney structures with associated microbial mats were found in all three working areas. The height of the chimneys usually was less than 1 m. The distal ends were often characterized by dark nodules of comparably young and only little calcified mat material, while the stems and branches were more calcified.

The appearances of typical Danube-area chimneys differed from those in the North East and the Dniepr areas: The surface was often covered with dark brown to black, several centimeters long, fringe-like filamentous microorganisms which have not been described from the Dniepr area. The Danube Canyon chimneys usually did not emit gas, although they where gas-filled, as it was often evidenced by the release of bubbles when a mat nodule was sampled. Some chimneys, especially those standing on the steep Danube Canyon slopes (>45°), were additionally covered with sediment. This is apparently a result of sediment re-suspension caused by landslides, which are common phenomena on the canyon slope, as it is evidenced by many traces on the sediment.

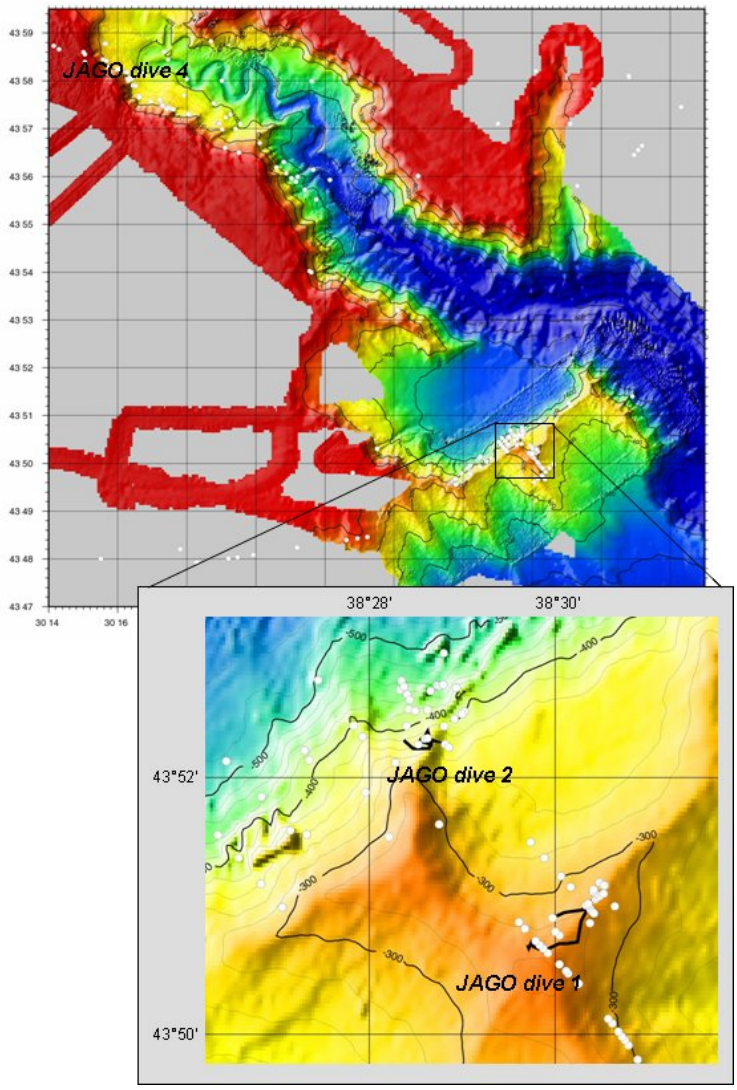

Figure 8: Bathymetric map of the Danube Canyon, combining our high resolution swath bathymetry data obtained from the south-western slope areas of the Danube Canyon with those provided by EU project ASSEMBLAGE. Large map: Red colour indicates less than 200 m water depths, blue represents deep waters (max > 900 m). White dots represent seep sites discovered by echosounding. Their distribution indicates that seeps were widely spread along the shelf break or along the upper Canyon slopes. Insert: Jago Dives 1 and 2 led to a ridge structure at the outer end of the canyon. The slope here declined very steeply (45-50°) and showed traces of frequent landslides.

Figure 9: Sediment sampling with push cores operated by the manipulator arm of the submersible.

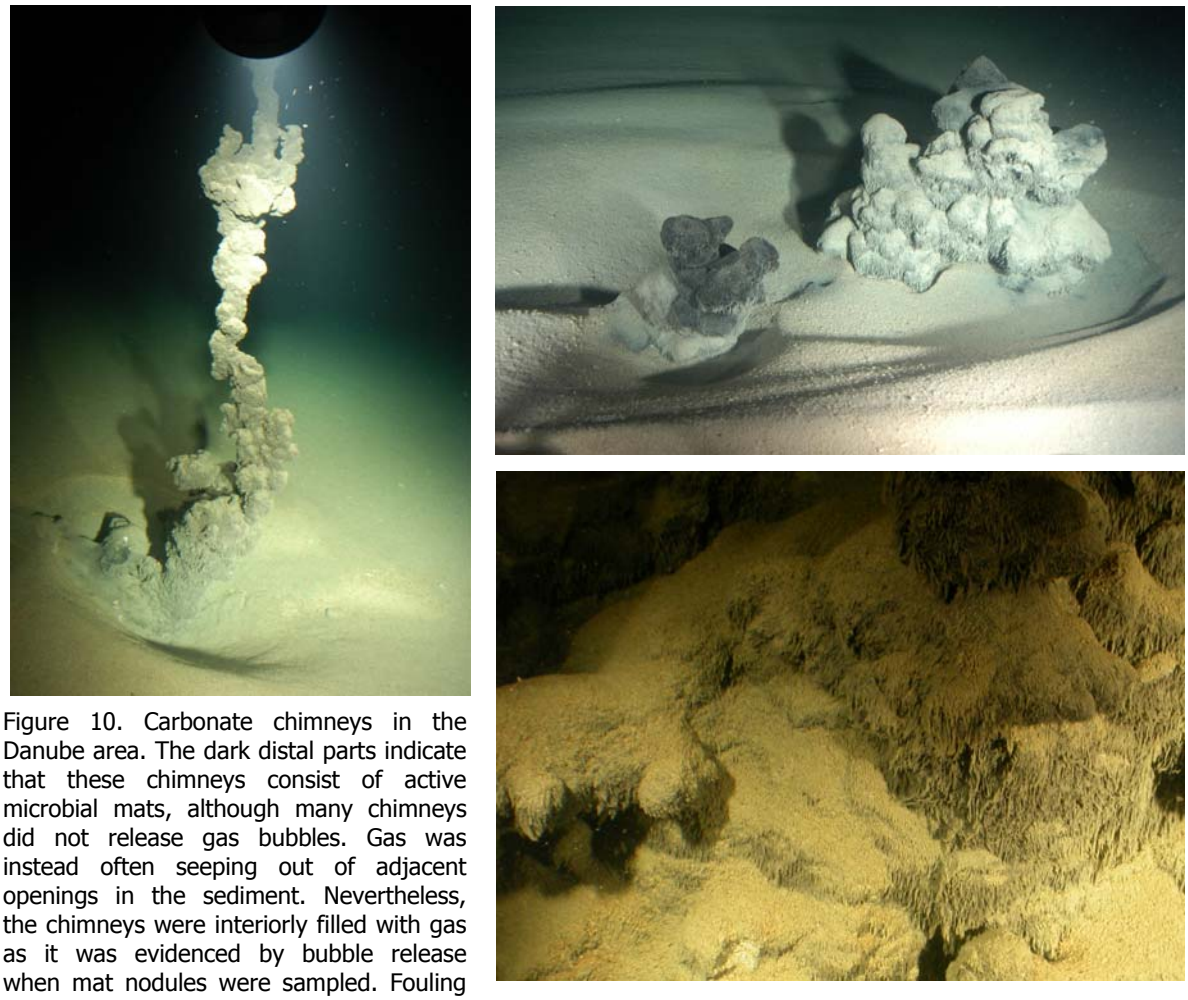

Figure 10. Carbonate chimneys in the Danube area. The dark distal parts indicate that these chimneys consist of active microbial mats, although many chimneys did not release gas bubbles. Gas was instead often seeping out of adjacent openings in the sediment. Nevertheless, the chimneys were interiorly filled with gas as it was evidenced by bubble release when mat nodules were sampled. Fouling of filamentous microorganisms was a common feature of the Danube chimneys.

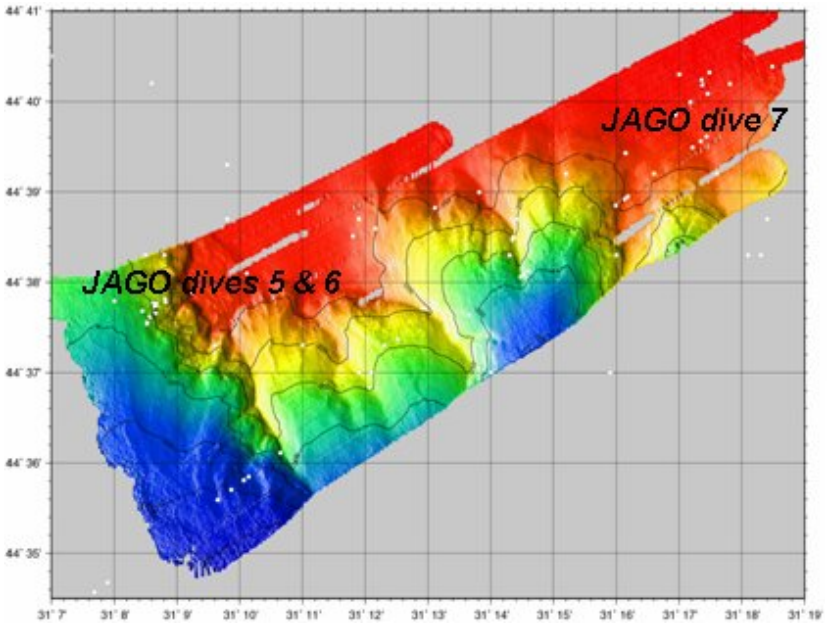

Figure 11: Bathymetric map of working area "NW-Shelf". Dives 5 and 6 were performed in and around a small chimney field in 250 m water depth. Dive 7 went to a seep area in 90 m depth on the shelf, which is above the chemocline.

Figure 12: The oxic environment above the chemocline supported *Beggiatoa*-resembling bacterial mats around the methane seeps. Shells in the sediment indicated the presence of macrobenthic life, which is absent in the anoxic water body below the chemocline.

While most chimneys were encountered as individual structures, groups of a few chimneys forming loose fields also occurred, but the chimney abundances usually did not reach those previously reported from the chimney field at 44°46.5' N, 31°59.6'E in the Dniepr area (Michaelis et. al. 2002). However, there was one exception: The very last dive (JAGO 13) discovered another spectacular chimney field of significant size, chimney density and gas flux only a few hundred meters apart.

Microbial mat material sampled in all three working areas was processed and stored alive or preserved in various ways and will serve for analyses e.g. on genetics, morphology, biochemistry, physiology etc. The sediments around the carbonate chimneys were sampled with push corers and have been processed comparable to the high-resolution scheme of the gravity corer sampling program. Other sediments collected around gas seep outlets have been transported alive to the home based laboratories, were they will serve for microbiological experiments. Gas sampled from seeps will serve for $\delta^{13}C\text{-}CH_4$ analyses.

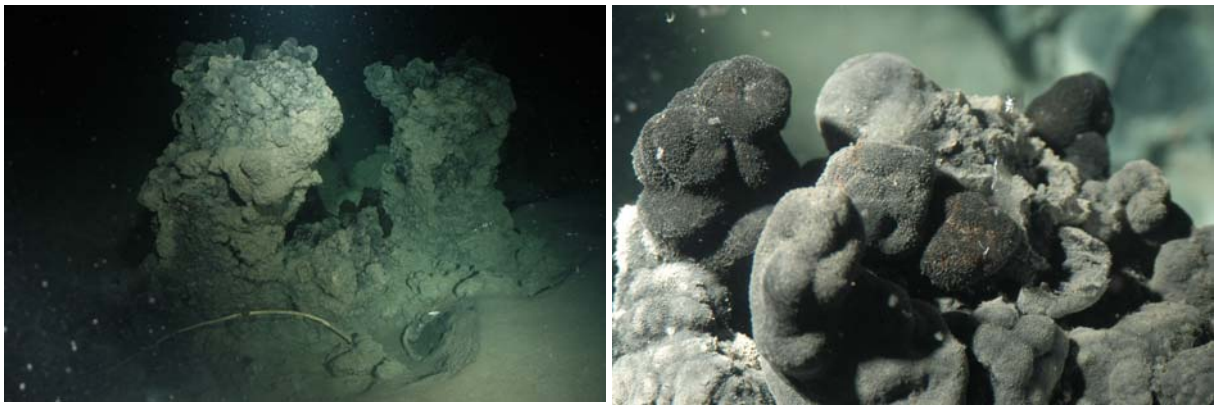

Figure 13. Bacterial mat chimney in the Dniepr area. The growth zones in distal chimney regions consist of relatively uncalcified mat material.

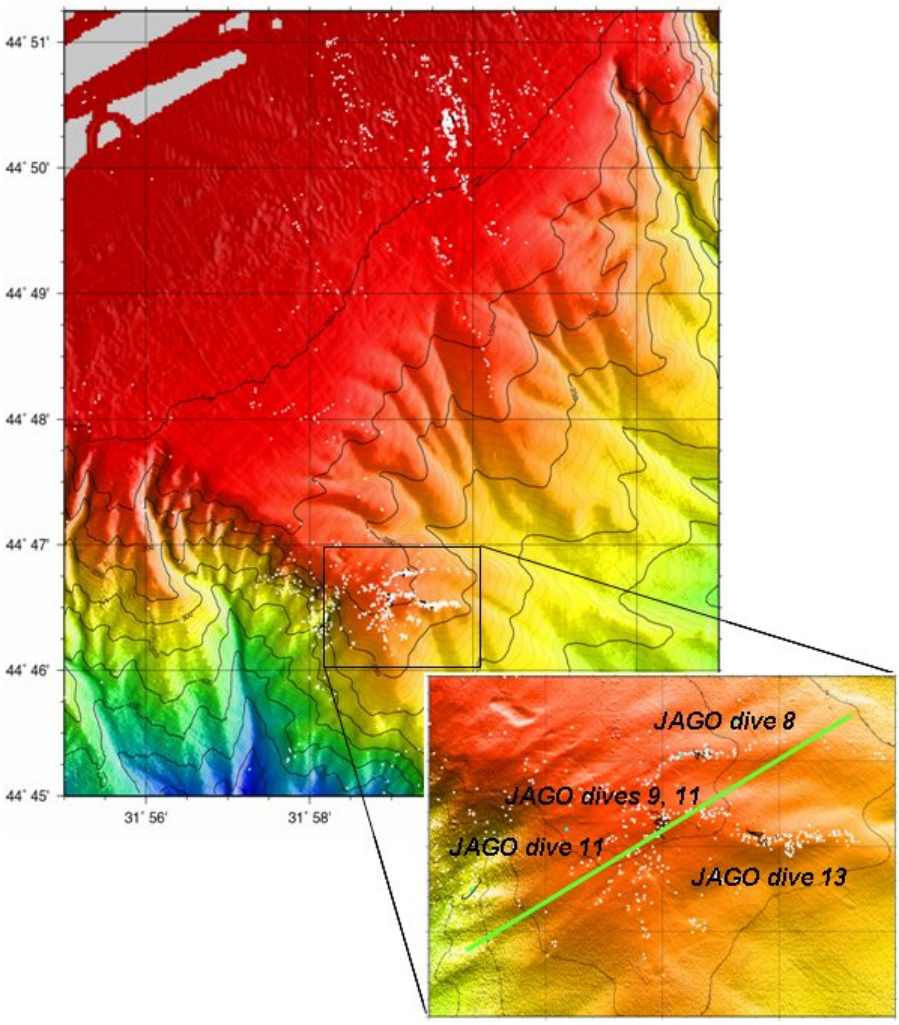

Figure 14. Bathymetric map of the Dniepr shelf break. White dots represent seep positions documented by gas flare imaging. Sediment sampling (green line in insert) and Jago dives mainly concentrated on a ridge with high seep density on the outer shelf break.

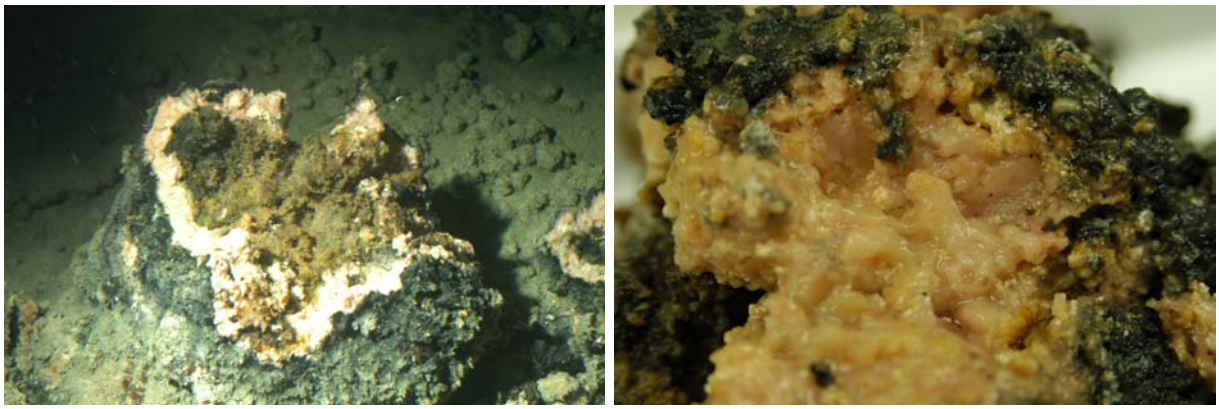

Figure 15. Left: A sampled chimney showing the internal structure. The black surface represents calcified chimney wall which is precipitated by the light-coloured bacterial mat. Right: Bacterial mat in the laboratory.

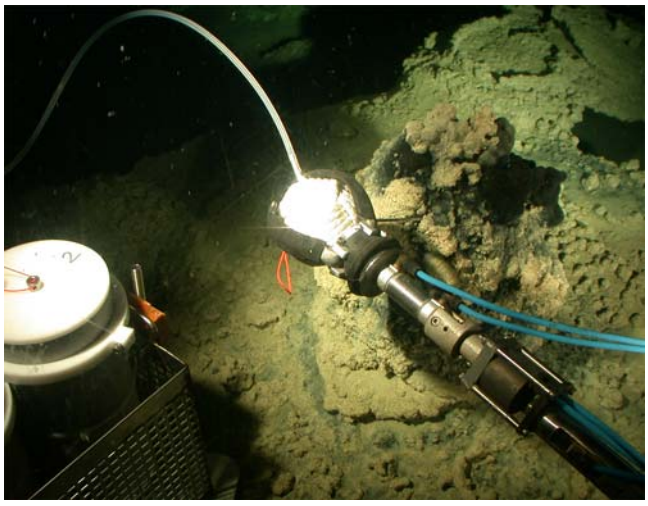

Figure 16. Fluid sampling from a chimney in the Dniepr area. The carbonate wall is pierced with a steel needle and fluids drained off the chimney's inside are collected in teflon bags.

5 Scientific equipment: moorings and instruments

- Submersible JAGO equipped with manipulator arm, sample basket/storage containers, push cores, gas and fluid samplers, video camera (http://www.orn.mpg.de/~hissmann/jago.html)
- Gravity corer (5.5 m and 3 m core tubes)
- Multi corer (modified Barnett type)
- Rumor Lot
- CTD/rosette with in situ pump (McLane)
- 50 kHz SeaBeam 1055 Multibeam Echosounder (L3 ELAC)
- Chirp echo-sounder (X-Star, EdgeTech)

6 Acknowledgements

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- CRIMEA for bathymetric maps and sub-bottom profiles of the Dniepr-area
- ASSEMBALGE for making available bathymetric data of the Danube Canyon.

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Appendices

Station list ship based coring

Ship station	Date	METROL No.	Area	METROL site name	Gear	METROL core label	Gear on bottom					
							UTC	Lat [Deg./Min.]	Long [Deg./Min.]	Lat. [Dec. Deg.]	Long [Dec. Deg.]	Water depth [m]
770	30.09.2004	P770	paleo-Danube	P1	GC	P770GC	7:42	43°37.83' N	30°09.72' E	43.630500	30.162000	687
771	30.09.2004	P771	paleo-Danube	P1	GC	P771GC [1)]	9:37	43°37.83' N	30°09.69' E	43.630500	30.161500	683
772	30.09.2004	P772	paleo-Danube	P1	GC	P772GC [2)]	10:59	43°37.78' N	30°09.67' E	43.629667	30.161167	683
773	30.09.2004	P773	paleo-Danube	P1	GC	P773GC	11:55	43°37.82' N	30°09.74' E	43.630333	30.162333	690
774	30.09.2004	P774	paleo-Danube	P1	MUC	P774MUC	13:10	43°37.82' N	30°09.74' E	43.630333	30.162333	687
775	30.09.2004	P775	paleo-Danube	P1	RL	P775RL	14:15	43°37.62' N	30°09.22' E	43.627000	30.153667	709
785	02.10.2004	P785	paleo-Danube	P2	GC	P785GC	16:31	43°54.06' N	30°12.09' E	43.901000	30.201500	105
786	02.10.2004	P786	paleo-Danube	P3	GC	P786GC	17:22	43°53.99' N	30°09.60' E	43.899833	30.160000	90
789	04.10.2004	P789	NW-Shelf	P4	GC	P789GC	5:16	44°37.76' N	31°08.66' E	44.629333	31.144333	249
790	04.10.2004	P790	NW-Shelf	P4	MUC	P790MUC	6:23	44°37.75' N	31°08.66' E	44.629167	31.144333	249
796	05.10.2004	P796	paleo-Dniepr	P5	GC	P796GC	11:47	44°46.76' N	31°59.08' E	44.779333	31.984667	189
797	05.10.2004	P797	paleo-Dniepr	P5	GC	P797GC	12:29	44°46.74' N	31°59.09' E	44.779000	31.984833	192
798	05.10.2004	P798	paleo-Dniepr	P6	GC	P798GC [2)]	13:03	44°46.83' N	31°59.29' E	44.780500	31.988167	205
799	05.10.2004	P799	paleo-Dniepr	P7	GC	P799GC	14:05	44°47.50' N	32°00.79' E	44.791667	32.013167	250
800	05.10.2004	P800	paleo-Dniepr	P8	GC	P800GC	15:12	44°47.58' N	32°00.89' E	44.793000	32.014833	253
802	06.10.2004	P802	paleo-Dniepr	P5	MUC	P802MUC	5:42	44°46.79' N	31°59.06' E	44.779833	31.984333	188
803	06.10.2004	P803	paleo-Dniepr	P6	MUC	P803MUC	6:32	44°46.89' N	31°59.26' E	44.781500	31.987667	222
804	06.10.2004	P804	paleo-Dniepr	P7	MUC	P804MUC	7:31	44°47.52' N	32°00.75' E	44.792000	32.012500	252
805	06.10.2004	P805	paleo-Dniepr	P8	MUC	P805MUC	8:22	44°47.58' N	32°00.87' E	44.793000	32.014500	252
806	06.10.2004	P806	paleo-Dniepr	P6	GC	P806GC [1)]	9:37	44°46.83' N	31°59.30' E	44.780500	31.988333	205
807	06.10.2004	P807	paleo-Dniepr	P6	GC	P807GC	10:31	44°46.85' N	31°59.31' E	44.780833	31.988500	210
810	07.10.2004	P810	paleo-Dniepr	P9	GC	P810GC	7:54	44°46.69' N	31°58.78' E	44.778167	31.979667	181
811	07.10.2004	P811	paleo-Dniepr	P10	GC	P811GC	8:41	44°46.85' N	31°59.16' E	44.780833	31.986000	202
812	07.10.2004	P812	paleo-Dniepr	P11	GC	P812GC	9:56	44°47.03' N	31°59.47' E	44.783833	31.991167	233
813	07.10.2004	P813	paleo-Dniepr	P11	MUC	P813MUC	10:51	44°46.98' N	31°59.50' E	44.783000	31.991667	234
814	07.10.2004	P814	paleo-Dniepr	P10	MUC	P814MUC	11:39	44°46.84' N	31°59.21' E	44.780667	31.986833	206
815	07.10.2004	P815	paleo-Dniepr	P9	MUC	P815MUC	12:35	44°46.68' N	31°58.82' E	44.778000	31.980333	182
823	09.10.2004	P823	paleo-Dniepr	P12	GC	P823GC [2)]	13:14	44°39.06' N	32°01.02' E	44.651000	32.017000	1014
824	09.10.2004	P824	paleo-Dniepr	P12	GC	P824GC [1)]	14:23	44°39.06' N	32°01.00' E	44.651000	32.016667	1014
825	09.10.2004	P825	paleo-Dniepr	P12	MUC	P825MUC	16:04	44°39.05' N	32°01.03' E	44.650833	32.017167	1015
827	10.10.2004	P827	paleo-Dniepr	P14	MUC	P827MUC	5:12	44°46.56' N	31°58.64' E	44.776000	31.977333	199
828	10.10.2004	P828	paleo-Dniepr	P15	MUC	P828MUC	6:07	44°46.36' N	31°58.20' E	44.772667	31.970000	308
829	10.10.2004	P829	paleo-Dniepr	P15	GC	P829GC	6:53	44°46.37' N	31°58.20' E	44.772833	31.970000	308
830	10.10.2004	P830	paleo-Dniepr	P14	GC	P830GC	7:28	44°46.54' N	31°58.60' E	44.775667	31.976667	204
830-2	10.10.2004	P831	paleo-Dniepr	P14	GC	P831GC	8:03	44°46.54' N	31°58.58' E	44.775667	31.976333	204
831	10.10.2004	P832	paleo-Dniepr	P13	GC	P832GC	8:45	44°47.10' N	31°59.85' E	44.785000	31.997500	267

GC = Gravity corer
MUC = Multi corer
RL = Rumohr Lot
[1)] detailed sampling scheme I
[2)] detailed sampling scheme II

JAGO dives

Ship station	Date	Area	Dive / JAGO no.	METROL no.	Time UTC	Description	Lat.	Lon.	Water depth [m]
778	01.10.2004	Danube	JAGO 1 / 843	P778	05:54	Start operation	43°50.20' N	030°28.01' E	276
					09:20	JAGO on deck	43°50.26' N	030°28.03' E	295
780	01.10.2004	Danube	JAGO 2 / 844	P780	11:56	Start operation	43°50.58' N	030°27.66' E	372
					15:26	JAGO on deck	43°50.65' N	030°27.72' E	340
783	02.10.2004	Danube	JAGO 3 / 845	P783	05:10	Start operation	43°58.21' N	030°16.20' E	333
					08:28	JAGO on deck	43°58.01' N	030°16.26' E	281
784	02.10.2004	Danube	JAGO 4 / 846	P784	10:57	Start operation	43°57.47' N	030°17.26' E	300
					15:25	JAGO on deck	43°57.53' N	030°17.32' E	313
787	03.10.2004	NW-shelf	JAGO 5 / 847	P787	10:28	Start operation	44°37.73' N	031°08.66' E	249
					14:23	JAGO on deck	44°37.57' N	031°08.54' E	271
791	04.10.2004	NW-shelf	JAGO 6 / 848	P791	06:37	Start operation	44°37.74' N	031°08.65' E	248
					10:28	JAGO on deck	44°37.80' N	031°08.55' E	253
792	04.10.2004	NW-shelf	JAGO 7 / 849	P791	12:32	Start operation	44°40.20' N	031°17.34' E	111
					16:00	JAGO on deck	44°40.20' N	031°17.27' E	110
795	05.10.2004	Dniepr	JAGO 8 / 850	P795	05:30	Start operation	44°46.77' N	031°59.16' E	190
					09:29	JAGO on deck	44°46.85' N	031°59.05' E	189
817	08.10.2004	Dniepr	JAGO 9 / 851	P817	07:02	Start operation	44°46.56' N	031°59.02' E	193
					10:49	JAGO on deck	44°46.45' N	031°58.76' E	204
818	08.10.2004	Dniepr	JAGO 10 / 852	P818	12:30	Start operation	44°50.30' N	031°59.65' E	92
					15:23	JAGO on deck	44°50.34' N	031°59.61' E	92
821	09.10.2004	Dniepr	JAGO 11 / 853	P821	03:00	Start operation	44°46.36' N	031°58.14' E	332
					06:44	JAGO on deck	44°46.43' N	031°58.05' E	310
822	09.10.2004	Dniepr	JAGO 12 / 854	P822	08:40	Start operation	44°46.61' N	031°59.06' E	191
					11:38	JAGO on deck	44°46.52' N	031°59.13' E	207
832	10.10.2004	Dniepr	JAGO 13 / 855	P833	09:32	Start operation	44°46.54' N	031°59.42' E	222
					14:32	JAGO on deck	44°46.49' N	031°59.52' E	232

Station list submersible based sampling

Ship station	Date	METROL No.	Area	METROL site name	Gear	METROL core label	UTC	Lat [Deg./Min.]	Long [Deg./Min.]	Lat. [Dec. Deg.]	Long [Dec. Deg.]	Water depth [m]
780	01.10.2004	P780	paleo-Danube	JAGO-2	PC	P780PC	14:20	43°50.590' N	30°27.657' E	43.843167	30.460950	370
780	01.10.2004	P780	paleo-Danube	JAGO-2	PC	P780PC	14:30	43°50.590' N	30°27.657' E	43.843167	30.460950	370
780	01.10.2004	P780	paleo-Danube	JAGO-2	PC	P780PC	14:40	43°50.590' N	30°27.657' E	43.843167	30.460950	370
780	01.10.2004	P780	paleo-Danube	JAGO-2	Manipulator arm		13:58	43°50.590' N	30°27.657' E	43.843167	30.460950	370
780	01.10.2004	P780	paleo-Danube	JAGO-2	Gas sampler		14:45	43°50.590' N	30°27.657' E	43.843167	30.460950	370
784	02.10.2004	P784	paleo-Danube	JAGO-4	PC	P784PC	12:21	43°57.475' N	30°17.261' E	43.957917	30.287683	295
784	02.10.2004	P784	paleo-Danube	JAGO-4	PC	P784PC	12:21	43°57.475' N	30°17.261' E	43.957917	30.287683	295
784	02.10.2004	P784	paleo-Danube	JAGO-4	PC	P784PC	12:21	43°57.475' N	30°17.261' E	43.957917	30.287683	295
784	02.10.2004	P784	paleo-Danube	JAGO-4	PC	P784PC	12:21	43°57.475' N	30°17.261' E	43.957917	30.287683	295
784	02.10.2004	P784	paleo-Danube	JAGO-4	Gas sampler		12:40	43°57.487' N	30°17.250' E	43.958117	30.287500	295
784	02.10.2004	P784	paleo-Danube	JAGO-4	Manipulator arm		13:48	43°57.474' N	30°17.262' E	43.957900	30.287700	295
787	03.10.2004	P787	NW-Shelf	JAGO-5	PC	P787PC	11:34	44°37.756' N	31°08.635' E	44.629267	31.143917	248
787	03.10.2004	P787	NW-Shelf	JAGO-5	PC	P787PC	11:36	44°37.741' N	31°08.644' E	44.629017	31.144067	248
787	03.10.2004	P787	NW-Shelf	JAGO-5	Gas sampler		12:01	44°37.736' N	31°08.655' E	44.628933	31.144250	248
787	03.10.2004	P787	NW-Shelf	JAGO-5	PC	P787PC	12:12	44°37.737' N	31°08.658' E	44.628950	31.144300	248
787	03.10.2004	P787	NW-Shelf	JAGO-5	PC	P787PC	12:47	44°37.669' N	31°08.668' E	44.627817	31.144467	248
787	03.10.2004	P787	NW-Shelf	JAGO-5	PC	P787PC	12:50	44°37.669' N	31°08.668' E	44.627817	31.144467	248
78M	03.10.2004	P78M	NW-Shelf	JAGO-5	Manipulator arm		11:27	44°37.756' N	31°08.635' E	44.629267	31.143917	248
791	04.10.2004	P791	NW-Shelf	JAGO-6	PC	P791PC	9:15	44°37.756' N	31°08.664' E	44.629267	31.144400	248
791	04.10.2004	P791	NW-Shelf	JAGO-6	PC	P791PC	9:20	44°37.756' N	31°08.664' E	44.629267	31.144400	248
791	04.10.2004	P791	NW-Shelf	JAGO-6	PC	P791PC	9:25	44°37.756' N	31°08.664' E	44.629267	31.144400	248
792	04.10.2004	P792	NW-Shelf	JAGO-7	PC	P792PC	13:46	44°40.178' N	31°17.380' E	44.669633	31.289667	110
792	04.10.2004	P792	NW-Shelf	JAGO-7	PC	P792PC	13:54	44°40.178' N	31°17.380' E	44.669633	31.289667	110
792	04.10.2004	P792	NW-Shelf	JAGO-7	PC	P792PC	14:08	44°40.178' N	31°17.380' E	44.669633	31.289667	110
792	04.10.2004	P792	NW-Shelf	JAGO-7	Gas sampler		15:27	43°40.179' N	31°17.382' E	43.669650	31.289700	110
795	05.10.2004	P795	paleo-Dniepr	JAGO-8	Manipulator arm		6:35	44°46.775' N	31°59.164' E	44.779583	31.986067	189
795	05.10.2004	P795	paleo-Dniepr	JAGO-8	Gas sampler		7:35	44°46.774' N	31°59.120' E	44.779567	31.985333	187
795	05.10.2004	P795	paleo-Dniepr	JAGO-8	PC	P795PC	8:54	44°46.771' N	31°59.202' E	44.779517	31.986700	192
817	08.10.2004	P817	paleo-Dniepr	JAGO-9	Fluid sampler		7:58	44°46.579' N	31°59.003' E	44.776317	31.983383	190
817	08.10.2004	P817	paleo-Dniepr	JAGO-9	Manipulator arm		8:38	44°46.700' N	31°59.011' E	44.778333	31.983517	191
817	08.10.2004	P817	paleo-Dniepr	JAGO-9	PC	P817PC	9:44	44°46.569' N	31°58.967' E	44.776150	31.982783	192
818	08.10.2004	P818	paleo-Dniepr	JAGO-10	Gas sampler		13:33	44°50.355' N	31°59.668' E	44.839250	31.994467	89
818	08.10.2004	P818	paleo-Dniepr	JAGO-10	Manipulator arm		14:18	44°50.369' N	31°59.696' E	44.839483	31.994933	92
821	09.10.2004	P821	paleo-Dniepr	JAGO-11	PC	P821PC	5:15	44°46.413' N	31°58.201' E	44.773550	31.970017	326
821	09.10.2004	P821	paleo-Dniepr	JAGO-11	PC	P821PC	5:20	44°46.413' N	31°58.201' E	44.773550	31.970017	326
821	09.10.2004	P821	paleo-Dniepr	JAGO-11	PC	P821PC	5:25	44°46.413' N	31°58.201' E	44.773550	31.970017	326
821	09.10.2004	P821	paleo-Dniepr	JAGO-11	PC	P821PC	5:30	44°46.413' N	31°58.201' E	44.773550	31.970017	326
821	09.10.2004	P821	paleo-Dniepr	JAGO-11	PC	P821PC	6:14	44°46.413' N	31°58.201' E	44.773550	31.970017	325
821	09.10.2004	P821	paleo-Dniepr	JAGO-11	PC	P821PC	6:19	44°46.413' N	31°58.201' E	44.773550	31.970017	325
821	09.10.2004	P821	paleo-Dniepr	JAGO-11	PC	P821PC	6:24	44°46.413' N	31°58.201' E	44.773550	31.970017	325
821	09.10.2004	P821	paleo-Dniepr	JAGO-11	PC	P821PC	6:29	44°46.413' N	31°58.201' E	44.773550	31.970017	325
822	09.10.2004	P822	paleo-Dniepr	JAGO-12	Fluid sampler		10:10	44°46.541' N	31°58.966' E	44.775683	31.982767	191
822	09.10.2004	P822	paleo-Dniepr	JAGO-12	Manipulator arm		10:25	44°46.541' N	31°58.966' E	44.775683	31.982767	191
832	10.10.2004	P833	paleo-Dniepr	JAGO-13	Manipulator arm		13:30	44°46.510' N	31°59.430' E	44.775167	31.990500	215
832	10.10.2004	P833	paleo-Dniepr	JAGO-13	Gas sampler		13:40	44°46.510' N	31°59.430' E	44.775167	31.990500	215

PC = Push corer

Mapping

Ship station	Date	Gear	Time UTC	Description	Lat.	Lon.	Water depth [m]	Course [°]
769	30/09/2004	ELAC	04:35	Profile 0	43°34.78' N	030°12.04' E	950	
776	30/09/2004	ELAC / X-Star	17:30	Profile # 1	43°46.97' N	030°24.75' E	600	var.
			17:43	WP 33	43°47.45' N	030°25.54' E	556	± 053
			18:56	WP 32	43°50.85' N	030°31.94' E	633	± 053
			19:09	WP 31	43°51.23' N	030°31.52' E	600	± 233
			20:30	WP 30	43°47.82' N	030°25.21' E	512	± 233
			20:50	End chirp	43°47.83' N	030°24.75' E	481	± 320
			21:07	WP 29	43°48.20' N	030°24.78' E	460	± 053
			22:08	WP 28	43°51.69' N	030°31.22' E	704	± 053
			22:24	WP 24	43°51.97' N	030°30.72' E	684	± 233
			23:23	WP 25	43°48.57' N	030°24.46' E	405	± 233
			23:42	WP 26	43°48.93' N	030°24.13' E	336	± 053
	01/10/2004		00:44	WP 27	43°52.36' N	030°30.43' E	651	± 053
			00:54	WP 27a	43°52.14' N	030°30.52' E	631	± 233
			01:58	WP 27b	43°48.74' N	030°24.28' E	364	± 233
777	01/10/2004	ELAC	03:18	Profile # 2	43°50.39' N	030°27.09' E	422	± 135
			03:33	WP 2	43°49.60' N	030°28.05' E	341	± 135
			03:41	WP 3	43°49.68' N	030°28.16' E	320	± 319
			03:55	WP 4	43°50.46' N	030°27.21' E	437	± 319
			04:04	WP 5	43°50.53' N	030°27.34' E	387	± 135
			04:18	WP 6	43°49.75' N	030°28.27' E	338	± 135
			04:27	WP 7	43°49.82' N	030°28.39' E	325	± 319
			04:40	WP 8	43°50.60' N	030°27.46' E	404	± 319
			04:48	WP 9	43°50.67' N	030°27.58' E	426	± 135
			05:01	WP 10	43°49.90' N	030°28.50' E	338	± 135
			05:08	WP 11	43°49.98' N	030°28.63' E	369	± 319
			05:23	WP 12	43°50.74' N	030°27.70' E	482	± 319
779	01/10/2004	X-Star	10:15	Start	43°50.27' N	030°22.30' E	129	var.
	01/10/2004		10:47	End	43°50.50' N	030°22.36' E	127	var.
781	01/10/2004	ELAC	16:14	Profile # 3	43°52.52' N	030°26.35' E	495	± 255
			16:24	WP 22	43°52.38' N	030°25.63' E	416	± 255
			16:30	WP 21	43°52.46' N	030°25.06' E	325	± 280
			16:47	WP 20	43°52.64' N	030°24.88' E	297	± 322
			16:49	WP 19	43°52.82' N	030°24.68' E	248	± 295
			16:54	WP 18	43°52.97' N	030°24.23' E	206	± 261
			17:00	WP 17	43°52.92' N	030°23.68' E	256	± 290
			17:02	WP 16	43°52.97' N	030°23.46' E	240	± 303
			17:06	WP 15	43°53.11' N	030°23.18' E	187	± 291
			17:10	WP 14	43°53.22' N	030°22.77' E	151	± 283
			17:15	WP 13	43°53.33' N	030°22.11' E	124	± 004
			17:48	WP 12	43°55.76' N	030°22.32' E	647	± 003
			19:08	WP 11	43°57.65' N	030°14.38' E	105	± 289
			19:16	WP 10	43°57.81' N	030°14.45' E	105	± 109
			20:21	WP 09	43°55.96' N	030°22.40' E	663	± 109
			20:31	WP 08	43°56.20' N	030°22.50' E	580	± 288
			21:31	WP 07	43°58.07' N	030°14.52' E	105	± 288
			21:42	WP 06	43°58.33' N	030°14.64' E	104	± 109
			22:37	WP 05	43°56.62' N	030°21.75' E	629	± 109
			22:47	WP 04	43°56.93' N	030°21.90' E	621	± 288
			23:44	WP 03	43°58.63' N	030°14.78' E	107	± 288
			23:56	WP 02	43°59.04' N	030°14.91' E	133	± 108
	02/10/2004		00:51	WP 01	43°57.35' N	030°22.07' E	536	± 108
782	02/10/2004	ELAC	01:04	Profile # 4	43°57.11' N	030°21.18' E	505	± 288
			01:56	WP 02	43°58.63' N	030°14.78' E	106	± 288
			02:09	WP 03	43°58.53' N	030°14.72' E	105	± 108
			02:28	WP 04	43°57.96' N	030°17.03' E	380	± 108
			02:38	WP 05	43°57.90' N	030°16.88' E	374	± 288
			02:51	WP 06	43°58.32' N	030°15.09' E	115	± 288
			02:56	WP 07	43°58.22' N	030°15.07' E	110	± 108
			03:11	WP 08	43°57.81' N	030°16.81' E	360	± 108

Mapping continued

Ship station	Date	Gear	Time UTC	Description	Lat.	Lon.	Water depth [m]	Course [°]
			03:26	WP 10	43°57.84' N	030°15.76' E	132	± 288
			03:56	WP 11	43°57.04' N	030°19.17' E	349	± 108
			04:03	WP 12	43°57.06' N	030°18.58' E	332	± 108
			04:07	WP 13	43°57.08' N	030°18.50' E	330	± 288
			04:17	WP 14	43°57.45' N	030°16.91' E	282	± 330
788	03/10/2004	ELAC	15:18	Profile # 5	44°39.60' N	031°12.84' E	113	± 065
			15:27	WP 18	44°39.36' N	031°12.83' E	116	± 243
			15:55	WP 17	44°38.18' N	031°09.59' E	127	± 243
			16:06	WP 16	44°38.15' N	031°10.36' E	121	± 065
			17:05	WP 15	44°40.78' N	031°17.54' E	121	± 065
			17:16	WP 14	44°39.51' N	031°14.62' E	107	± 062
			18:28	WP 13	44°37.11' N	031°08.24' E	323	± 062
			18:36	WP 12	44°36.85' N	031°08.39' E	321	± 241
			19:44	WP 11	44°39.33' N	031°14.76' E	108	± 241
			19:50	WP 10	44°39.14' N	031°14.93' E	112	± 061
			21:00	WP 09	44°36.60' N	031°08.56' E	343	± 061
			21:10	WP 08	44°36.28' N	031°08.75' E	354	± 059
			22:23	WP 07	44°40.18' N	031°18.00' E	119	± 059
			22:32	WP 06	44°39.92' N	031°18.01' E	130	± 238
			23:42	WP 05	44°35.90' N	031°08.99' E	383	± 238
			23:49	WP 04	44°35.60' N	031°09.28' E	415	± 061
	04/10/2004		01:00	WP 03	44°39.00' N	031°18.00' E	185	± 061
			01:09	WP 02	44°39.19' N	031°18.00' E	174	± 237
			02:13	WP 01	44°35.23' N	031°09.59' E	441	± 237
793	04/10/2004	X-Star	16:24	Start	44°40.27' N	031°16.98' E	109	± 071
			19:20	End	44°44.86' N	031°36.60' E	92	± 071
794	04/10/2004	ELAC	20:23	Profile # 6	44°44.84' N	031°44.29' E	100	090 / 071
			21:40	WP 2	44°46.90' N	031°52.63' E	104	± 071
			21:53	WP 3	44°47.36' N	031°52.47' E	93	± 248
			23:01	WP 4	44°45.05' N	031°44.28' E	95	± 248
			23:18	WP 5	44°45.17' N	031°44.27' E	93	± 068
	05/10/2004		00:30	WP 6	44°47.49' N	031°52.45' E	89	± 068
			00:41	WP 7	44°47.61' N	031°52.44' E	89	± 248
			01:56	WP 8	44°45.30' N	031°44.20' E	90	± 248
			02:09	WP 9	44°45.56' N	031°44.19' E	88	± 068
			03:23	WP 10	44°47.90' N	031°52.42' E	85	± 068
801	05/10/2004	ELAC	18:03	Profile # 7	44°36.58' N	031°51.51' E	862	± 211
			18:52	WP 2	44°33.08' N	031°46.04' E	902	± 228
			19:30	WP 3	44°33.28' N	031°40.70' E	933	± 273
			19:37	WP 3	44°33.28' N	031°40.70' E	933	± 020
			20:18	WP 4	44°37.15' N	031°42.66' E	588	± 011
			20:43	WP 5	44°39.87' N	031°43.37' E	528	± 016
			21:10	WP 6	44°42.52' N	031°44.44' E	253	± 021
			21:26	WP 7	44°44.09' N	031°45.30' E	153	± 021
			21:36	WP 8	44°44.17' N	031°45.03' E	156	± 203
			21:55	WP 9	44°42.52' N	031°44.05' E	301	±198
			22:21	WP 10	44°39.88' N	031°42.80' E	495	± 192
			22:47	WP 11	44°37.21' N	031°41.98' E	571	± 200
			23:26	WP 12	44°33.31' N	031°40.02' E	915	± 200
			23:43	WP 13	44°33.33' N	031°39.23' E	900	± 021
	06/10/2004		00:23	WP 14	44°37.32' N	031°41.36' E	553	± 011
			00:50	WP 15	44°39.91' N	031°42.09' E	410	± 022
			01:19	WP 16	44°42.57' N	031°43.59' E	258	± 027
			01:40	WP 17	44°44.38' N	031°44.91' E	114	± 002
			01:43	WP 18	44°44.66' N	031°44.92' E	109	± 068
			02:11	WP 19	44°45.59' N	031°48.13' E	236	± 059
			02:30	WP 20	44°46.49' N	031°50.22' E	250	± 067
			02:54	WP 21	44°47.33' N	031°53.04' E	103	± 100
808	06/10/2004	ELAC	11:25	Profile # 8	44°47.64' N	031°59.67' E	238	± 064

Mapping continued

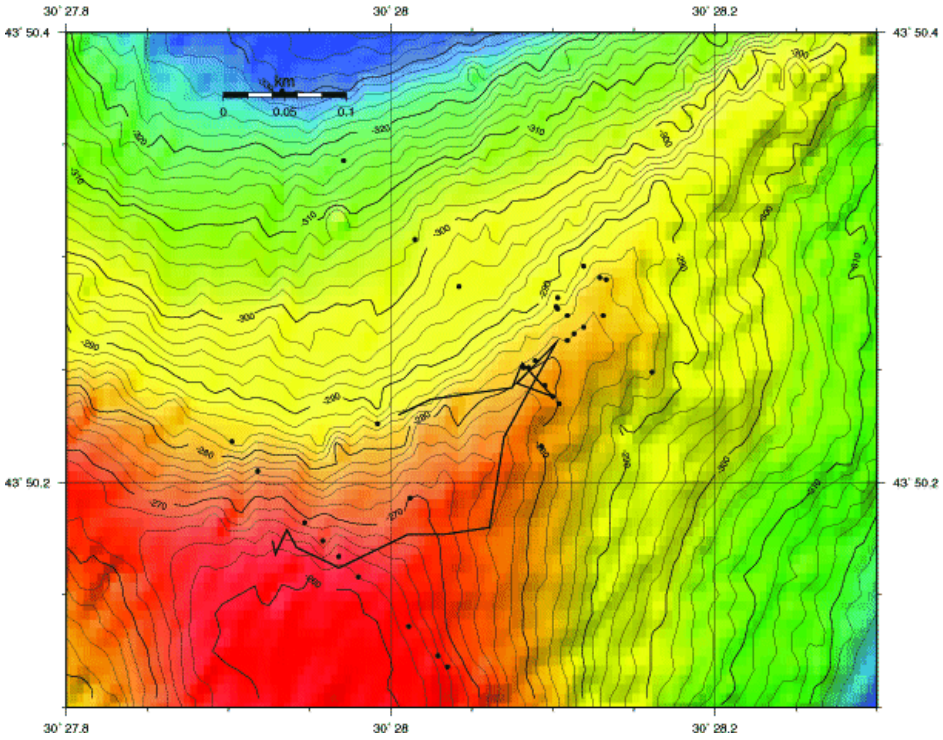
Ship station	Date	Gear	Time UTC	Description	Lat.	Lon.	Water depth [m]	Course [°]
			11:47	WP 3	44°48.21' N	032°01.68' E	276	± 245
			12:05	WP 4	44°47.56' N	031°59.72' E	232	± 245
			12:16	WP 5	44°47.47' N	031°59.79' E	245	± 065
			12:33	WP 6	44°48.11' N	032°01.75' E	286	± 065
			12:41	WP 7	44°48.02' N	032°01.82' E	279	± 245
			12:58	WP 8	44°47.38' N	031°59.86' E	248	± 245
			13:11	WP 9	44°47.29' N	031°59.93' E	267	± 066
			13:28	WP 10	44°47.92' N	032°01.90' E	301	± 066
			13:34	WP 11	44°47.82' N	032°01.99' E	306	± 245
			13:49	WP 12	44°47.19' N	032°00.01' E	265	± 245
			14:00	WP 13	44°47.09' N	032°00.08' E	275	± 065
			14:16	WP 14	44°47.73' N	032°02.06' E	310	± 065
			14:23	WP 15	44°47.64' N	032°02.12' E	306	± 245
			14:38	WP 16	44°47.00' N	032°00.16' E	288	± 245
			14:46	WP 17	44°46.89' N	032°00.23' E	291	± 065
			15:03	WP 18	44°47.55' N	032°02.19' E	315	± 065
			15:08	WP 19	44°47.46' N	032°02.27' E	324	± 245
			15:25	WP 20	44°46.79' N	032°00.31' E	271	± 245
		ELAC	17:08	Profile # 9	44°52.30' N	032°07.66' E	148	± 045
809	06/10/2004		17:33	WP 2	44°53.55' N	032°10.61' E	261	± 059
			17:46	WP 3	44°54.02' N	032°10.96' E	294	± 238
			18:37	WP 4	44°51.54' N	032°05.30' E	300	± 238
			18:42	WP 5	44°51.68' N	032°05.20' E	321	± 058
			19:34	WP 6	44°54.16' N	032°10.87' E	253	± 058
			19:43	WP 10	44°54.72' N	032°11.34' E	203	± 238
			20:37	WP 9	44°52.15' N	032°05.45' E	163	± 238
			20:43	WP 8	44°52.00' N	032°05.53' E	149	± 058
			21:40	WP 7	44°54.45' N	032°11.16' E	151	± 058
			21:54	WP 11	44°54.87' N	032°11.32' E	189	± 239
			22:47	WP 12	44°52.27' N	032°05.33' E	228	± 239
			23:03	WP 13	44°52.50' N	032°05.38' E	178	± 059
			23:59	WP 14	44°55.00' N	032°11.20' E	167	± 059
			00:12	WP 15	44°55.32' N	032°11.24' E	124	± 238
			01:07	WP 16	44°52.70' N	032°05.23' E	199	± 238
			01:22	WP 17	44°52.85' N	032°05.16' E	183	± 059
			02:15	WP 18	44°55.44' N	032°11.16' E	114	± 059
			02:24	WP 19	44°55.72' N	032°11.06' E	104	± 239
			03:09	WP 20	44°53.36' N	032°05.55' E	138	± 239
			03:25	WP 21	44°53.53' N	032°05.54' E	104	± 059
			04:18	WP 22	44°55.86' N	032°11.00' E	103	± 059
			04:27	WP 23	44°56.07' N	032°10.74' E	103	± 239
			05:14	WP 24	44°53.54' N	032°04.86' E	176	± 239
816	07/10/2004	ELAC	14:48	Profile # 10	44°44.46' N	031°44.70' E	128	± 210
			15:08	WP 2	44°42.44' N	031°43.07' E	280	± 199
			15:32	WP 3	44°39.96' N	031°41.87' E	423	± 193
			15:58	WP 4	44°37.15' N	031°40.93' E	562	± 205
			16:10	WP 5	44°36.01' N	031°40.19' E	701	± 205
			16:23	WP 6	44°36.00' N	031°39.38' E	703	± 023
			16:37	WP 7	44°37.26' N	031°40.11' E	549	± 015
			17:08	WP 8	44°40.04' N	031°41.18' E	421	± 022
			17:37	WP 9	44°42.52' N	031°42.60' E	245	± 035
			18:08	WP 10	44°44.56' N	031°44.60' E	113	± 035
			18:14	WP 11	44°44.62' N	031°44.44' E	108	± 219
			18:43	WP 12	44°42.60' N	031°42.10' E	254	± 205
			19:14	WP 13	44°40.14' N	031°40.52' E	378	± 197
			19:48	WP 14	44°37.38' N	031°39.31' E	534	± 202
			20:04	WP 15	44°36.04' N	031°38.55' E	718	± 208
			20:14	WP 16	44°36.11' N	031°37.74' E	727	± 021
			20:30	WP 17	44°37.43' N	031°38.45' E	569	± 020

Mapping continued

Ship station	Date	Gear	Time UTC	Description	Lat.	Lon.	Water depth [m]	Course [°]
			21:35	WP 19	44°42.67' N	031°41.59' E	229	± 044
			22:03	WP 20	44°44.69' N	031°44.32' E	103	± 044
			22:20	WP 21	44°44.78' N	031°44.22' E	103	± 227
			22:56	WP 22	44°42.69' N	031°41.04' E	214	± 209
			23:27	WP 23	44°40.29' N	031°39.19' E	323	± 203
	08/10/2004		00:16	WP 24	44°36.17' N	031°36.77' E	773	± 203
			00:30	WP 25	44°36.18' N	031°35.79' E	745	± 025
			01:20	WP 26	44°40.42' N	031°38.54' E	291	± 031
			01:50	WP 27	44°42.78' N	031°40.52' E	174	± 050
			02:22	WP 28	44°44.81' N	031°43.98' E	104	± 050
			02:32	WP 29	44°44.81' N	031°43.76' E	109	± 233
			03:02	WP 30	44°42.81' N	031°39.99' E	126	± 213
			03:28	WP 31	44°40.47' N	031°37.85' E	301	± 207
			04:11	WP 32	44°36.23' N	031°34.85' E	748	± 207
			04:26	WP 33	44°36.26' N	031°33.86' E	747	± 029
819	08/10/2004	ELAC	16:58	Profile # 10	44°44.81' N	031°43.57' E	98	± 239
			17:33	WP 35	44°42.79' N	031°39.45' E	119	± 235
			18:05	WP 34	44°40.48' N	031°37.14' E	294	± 215
			18:56	WP 33	44°36.26' N	031°33.86' E	748	± 209
		ELAC	18:56	Profile # 11	44°36.26' N	031°33.86' E	748	± 209
			19:22	WP 2	44°35.85' N	031°33.76' E	766	± 091
			20:08	WP 3	44°35.74' N	031°40.38' E	732	± 091
			20:20	WP 4	44°35.03' N	031°40.31' E	804	± 272
			21:04	WP 5	44°35.16' N	031°33.68' E	802	± 272
			21:18	WP 6	44°34.36' N	031°33.59' E	838	± 092
			22:01	WP 7	44°34.22' N	031°40.18' E	870	± 092
			22:15	WP 8	44°33.41' N	031°40.15' E	915	± 272
			22:59	WP 9	44°33.55' N	031°33.45' E	885	± 272
			23:15	WP 10	44°32.61' N	031°33.41' E	922	± 092
	09/10/2004		00:46	WP 11	44°32.47' N	031°41.10' E	935	± 092
821-1	09/10/2004	ELAC	-	Profile # 12	44°46.5463' N	031°59.4009' E	-	var.
			-	WP 2	44°46.5436' N	031°59.9990' E	-	var.
			-	WP 6	44°46.5167' N	031°59.9990' E	-	var.
			-	WP 5	44°46.5186' N	031°59.3998' E	-	var.
			-	WP 9	44°46.4910' N	031°59.4004' E	-	var.
			-	WP 10	44°46.4894' N	031°59.9995' E	-	var.
			-	WP 14	44°46.4633' N	031°59.9995' E	-	var.
			-	WP 13	44°46.4637' N	031°59.4004' E	-	var.
			-	WP 12	44°46.4761' N	031°59.4009' E	-	var.
			-	WP 8	44°46.5050' N	031°59.3998' E	-	var.
			-	WP 7	44°46.5030' N	031°59.9990' E	-	var.
			-	WP 11	44°46.4761' N	031°59.9995' E	-	var.
			-	WP 4	44°46.5323' N	031°59.4004' E	-	var.
			-	WP 3	44°46.5303' N	031°59.9995' E	-	var.
826	09/10/2004	ELAC	17:45	Profile # 13	44°40.04' N	032°10.95' E	904	± 082
			18:11	WP 2	44°38.46' N	032°12.60' E	983	± 143
			19:41	WP 3	44°33.69' N	032°02.93' E	1257	± 253
			19:55	WP 4	44°33.01' N	032°03.53' E	1277	± 148
			21:22	WP 5	44°37.75' N	032°13.16' E	1032	± 055
			21:44	WP 6	44°37.02' N	032°13.73' E	1044	± 151
			23:12	WP 7	44°32.25' N	032°04.09' E	1296	± 275
	10/10/2004		01:06	WP 8	44°33.31' N	031°46.84' E	858	± 036
			01:21	WP 9	44°34.24' N	031°47.76' E	883	± 094
			03:10	WP 10	44°33.54' N	032°02.57' E	1258	± 036
834	11/10/2004	ELAC	09:33	Profile # 14	43°57.46' N	030°28.81' E	235	± 128
			10:22	WP 9	43°51.11' N	030°39.97' E	870	± 262
			11:28	WP 8	43°51.05' N	030°39.27' E	815	± 308
	38270	In-situ pump	0.63819	Start	44-46,50 N	031-59,44 E	223	var.
	38270		0.72777	End	44-46,50 N	031-59,45 E	226	var.

Dive Reports

JAGO dive no 1 / 843, P778, Friday 31.09, 09:00: Bo Barker Jørgensen



On ridge in SW Danube Canyon
Equipment: 1 small anaerobic bucket, 4 push corers, 1 gas sampler
Two target areas identified from two lines with single beam mode of ELAC multibeam, called "the seven dwarfs" and "Snowwhite"
Depth: ca. 278 m, good visibility, small aggregates in bottom water, current mostly weak

Observations during descent:
Upper 30 m, many jellyfish, dolphins heard repeatedly in hydrophone, schlieren at 30 m
50-100 m, many aggregates of few mm to one cm size
115 m, many small jellyfish with long tentacles
135 m, slightly milky, fewer particles,
Bottom contact, landed on mud bottom, even surface with little topography
Thin (few mm) brown layer on top of sediment, not flocculent as otherwise observed in MUC, below grayish (light to dark gray)

09:39: "ridge" observed on sediment, only 10 cm high, later more such ridges observed running straight or curved over sediment, apparently mostly on large ridges, formed by sediment drift in bottom current?
Bubble stream observed ascending from small hole in muddy sea floor, no structures around, single steady stream of bubbles rising
Shortly after obs. low chimney with 1-2 sec pulses of small bubbles ascending every 30-60 sec from base where 2-3 black ball shaped structures were positioned, these were the only black structures observed, otherwise all carbonate structures light brown and hairy

A few chimney structures observed, one of ca 1.5 m high thin and crooked, filmed

"Snowwhite" area: few carbonate structures observed,
10:37: singular oval structure on mud bottom, 20-30 cm wide, outer appearance light brown hairy with hair hanging down, thin sediment layer on top, attempted to sample loow mat on rock surface with claw, mat fell apart like sediment, rock was too hard to sample

Moved to "seven dwarfs" area, bare mud bottom between areas, in seven dwarfs area observed few carbonate chimneys, no bubbles
11:32: 20-60 cm high chimney structure obs. and filmed
12:00: time out, ascent, no samples…

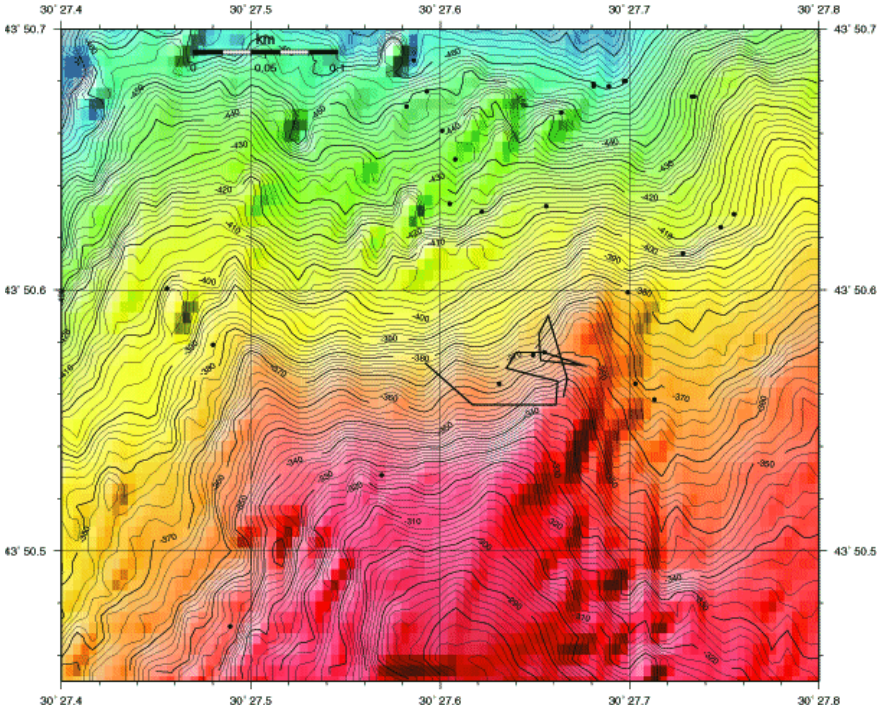
Dive track:

JAGO-Dive 843 (1) 1 Oct 2004, Danube Canyon, Romania

Pilot: Jürgen Schauer, Observer: Bo B. Jorgensen

Time	Long. E 30	Lat. N 43	Latitude	Longitude	Depth (m)	Remarks
09:08						submerged
09:30	28.005	50.23	43:50.23	30:28.005	282	touch down, slope angle 20 degrees
09:36	28.025	50.237	43:50.237	30:28.025	281	first seeps in sediment
09:42	28.075	50.242	43:50.242	30:28.075	278	fragile obstacle of 1 m height
10:07	28.081	50.253	43:50.253	30:28.081	280	close to SeepPos.88
10:32	28.1	50.238	43:50.238	30:28.100	280	at SeepPos.90, no structure, no gas seapage
10:35	28.078	50.244	43:50.244	30:28.078	281	microbial "bulb" on sediment, 20 cm in diameter, sampling not successful
10:52	28:102	50.262	43:50.262	30:28.102		ca. 40 m northeast of SeepPos.88
10:55	28.084	50.239	43:50.239	30:28.084		
10:57	28.07	50.22	43:50:220	30:28.070		moving southwest towards next SeepPos. cluster
11:00	28.061	50.18	43:50.180	30:28.061	282	
11:11	28.034	50.177	43:50.177	30:28.034	274	
11:13	28.011	50.177	43:50.177	30:28.011	270	
11:22	27.968	50.162	43:50.162	30:27.968	260	at SeepPos.69, no structure, no gas seapage
11:24	27.963	50.164	43:50.164	30:27.963	260	first structures
11:33	27.942	50.171	43:50.171	30:27.942	258	ca. 1 m high narrow carbonate structure without gas seapage
11:40	27.936	50.179	43:50.179	30:27.936	261	almost at SeepPos.71
11:43						between SeepPos.70 + 71, moving again upslope
11:47	27.929	50.168	43:50.168	30:27.929		
11:50	27.927	50.174	43:50.174	30:27.927	257	no more structures, start ascent
12:08						surfaced
Total min	180					

POS 317 / 3 – Report P780 JAGO Dive 2 / 844, Christian Borowski



Dive 2 (P317/3 station P780 JAGO) was dedicated to the exploration of an area at the south-western slope of the Danube Canyon where numerous seeps had been documented by previous hydroacoustic surveys. These have been confirmed by combined swath bathymetry and hydroacoustic flare detection performed in the night before the dive. Target area was a sequence of seeps discovered as flares on a SW to NE transect along ~ 43°27.5'N, 30°27.40'E and 43°50.40'N, 30°27.45'E in water depths between 350 and 390 m. The first target of the dive was a seep at 43°50.345' N, 30°27.395' E in 360 m water depth that was provisionally marked as "seep 6" in our bathymetric map. Jago was equipped with 1 "aneorobe-box", 4 push cores, 1 gas sampler.

The dive started 15:04 h local time. During the descend we observed marine snow all through the oxic and into the inoxic zone. We passed the jelly fish zone below 100 m depth; below 200 m, the particle abundance decreased. A drift of JAGO to the north caused by mid-water currents was compensated by actively moving towards 170° already during descending. 15:35 h we touched down in 372 m depth at 43°50.572'N, 30°27.592'E, which was some 40 m west of the mapped "seep 7".

The sea floor here formed a 45-50° steep slope. It was covered with light and uniform fine sediments with smooth surfaces over large areas, however, here and there we saw clear indication of an unstable environment: Traces of objects that had rolled down slope were present as straight lines of various widths. At some places accumulations of short ripples formed an irregular horizontal wave pattern on the surface that indicated sediment instability rather due to gravity than water currents.

Guided by communication with the ship, we started our search for "seep 6" in westerly direction - with the sea floor seemingly dropping down to infinity to our left. On this course, the steepness of the slope and its topography relief caused us to move up and down for several meters within only short distances, and accurate orientation was initially hampered by

differing depth readings for Jago by the submersible itself and on the ship. The landscape we passed interchanged between a generally smooth and wavy but in many places also very rugged topography with > 50° inclination, in which numerous longitudinal down-slope stretching sediment ridges and troughs and also out-cropping sediment blocks gave evidence for frequent land sliding.

15:59 h: We reached the position of "seep 6" at 43°50.576' N, 30°27.655' E, in 375 m water depth. As the sea floor there did not harbour gas outlets we started to search the surrounding. 16:01 h we encountered an out-cropping dark structure with a diameter of few decimetres at 43°50.571' N , 30°27.675' E, 373 m depth. Closer inspection with video and the manipulator arm revealed that it consisted of a consolidated sediment block overgrown with dark brown filamentous microorganisms which were hanging down the sides like a curtain of 5-7 cm length. This structure was not associated with visible gas effluent.

16:12 h: We found a carbonate plate that horizontally cropped out of the slope. The upper surface and the outer rim was again covered with the black-brown filamentous microbes (43°50.573' N, 30°27.653' E, 370 m).

16:17 h: Only a short distance apart we finally found a carbonate chimney emerging from the 45° steep slope. The ca. 80 cm high chimney had a pyramidal structure with a base of 1.5 m in diameter. It bluntly tapered to the top and had a few laterally protruding branches which appeared like fleshy arms and hands. The structure was entirely overgrown with dark brown filamentous microbes and the horizontal surfaces were covered by a thin sediment layer. Gas flow was not observed at the chimney itself, but some 50 cm up slope there were two small openings in the sediment releasing gas bubbles. The two holes were arranged at opposite sides of another small carbonate structure (30 cm wide, 15 cm high). One of them constantly released twin pairs of approximately 1-cm wide gas bubbles every half a second, while the other produced a continuous stream of smaller bubbles (~ 5 mm diam.) which ceased from time to time for periods of several minutes.

We sampled the carbonate structure with the manipulator arm of the submersible until the "anaerobic box" was filled. Nodules of relatively un-calcified microbial mat were collected from distal ends of the main stem and the branches. This material was comparably soft and consisted of 1-cm thick microbial mat with distinct layering: a thin dark brown outer surface, an orange-brown central layer which accounted for some 80-90% of the mat material, and a thin black inner layer, which is the main zone of calcification. More central parts of the carbonate chimney stem and its branches were much more calcified and therefore only hard to sample. Nevertheless, we managed to break loose a few pieces which basically consisted of the same components as the nodules, while the inner calcified black layer dominated the material with up to 2 cm thickness. The largest sampled piece was some 15 cm long.

Push cores were collected at 20 cm, 50 cm and 100 cm off the chimney (Push cores P780 PC 3, P780 PC 1, and P780 PC 2, respectively). While the 100-cm push core entirely penetrated into the sediment, the 20-cm and 50-cm cores were stopped by hard subsurface material (presumably a carbonate plate) at 15 cm bsf. A gas sample was collected from the continuous twin-pair bubbles release. This outled was finally sampled with an additional push core (P780 PC 4) which penetrated only 5 cm, indicating the presence of a shallow carbonate plate associated with the small "chimney".

17:46 h: We ended the dive heading upslope with a short video documentation of the remnants of a land slide. This incident had occurred next to the sampled chimney where it had left a 1-m deep and 10-m wide valley only 50 cm apart from the 100-cm push core location

The ascent started 17:53 h from 358 m water depth at 43°50.566' N, 30°27.665' E. We reached the water surface 18:19 h.

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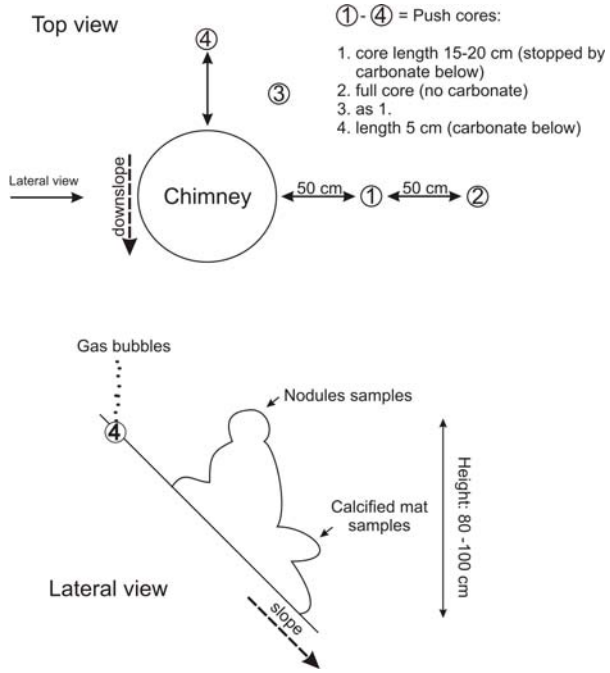


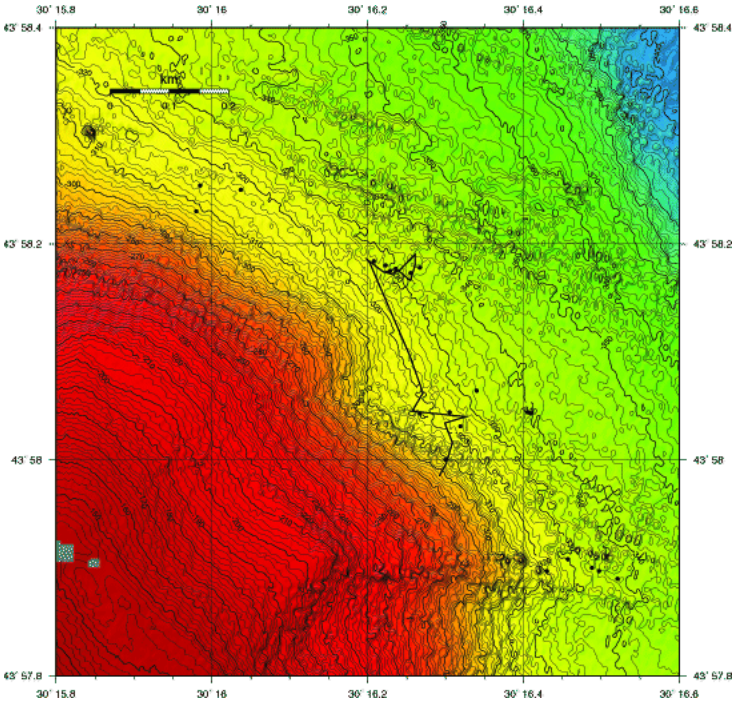
Dive track:

JAGO-Dive 844 (2) 1 Oct 2004, Danube Canyon, Romania

Pilot: Jürgen Schauer, Observer: Christian Borowski

Time	Long. E 30	Lat. N 43	Latitude	Longitude	Depth (m)	Remarks
15:05						submerged
15:35	27.592	50.572	43:50.572	30:27.592	372	touch down, steep slope
15:42					358	slope angle about 45 degrees
15:43	27.617	50.556	43:50.556	30:27.617	355	
15:50	27.661	50.556	43:50.556	30:27.661	358	
15:53	27.662	50.565	43:50.565	30:27.662	362	
15:55	27.635	50.57	43:50.57	30:27.635	370	close to SeepPos.6
15:57	27.64	50.576	43:50.576	30:27.64	375	slope slides, 50-55 degree slope angle
15:59	27.655	50.576	43:50.576	30:27.655	375	at SeepPos.6, no structure, no seapage
16:01	27.675	50.571	43:50.571	30:27.675	373	carbonate structure with hairy organic surface (ca. 25 m east of SeepPos.6)
16:12	27.653	50.573	43:50.573	30:27.653	370	black microbial structure on carbonate, hairy surface
16:17	27.652	50.583	43:50.583	30:27.652	370	removed sediment covering carbonate structure hairy organic surface, microbial mats
16:20	27.657	50.59	43:50.590	30:27.657	370	massiv carbonate structure, 80 cm high, adjacent gas outlet from sediment
16:58	27.657	50.59	43:50.590	30:27.657	370	Sampling: microbial mats, 4 pushcores in vicinity of structure and gas outlets
17:46	27.667	50.566	43:50.566	30:27.667	368	moving upslope for documentation of slope
17:53	27.665	50.559	43:50.559	30:27.665	358	start ascent
18:19						surfaced
Total min	194					

2-October-2004
Jago-dive No.3 / 845(Maksim Gulin)



Underwater visual survey was realized at the short transversal section of the canyon slope. Key features of the bottom relief are following:

- sediments at the sea floor were not dense;
- surface of the slope was covered by the sharp ridges (water currency influence) or, vice versa, by the sediment breaks (landslides).

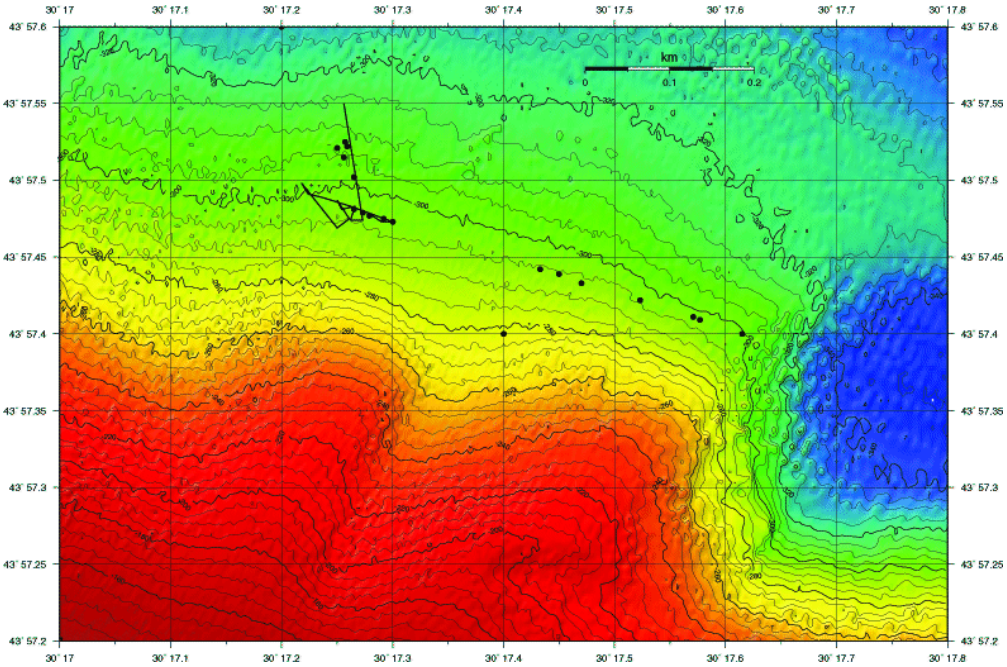
We have found only one bubble stream. Gas bubbles were discharged from the recently formed outlet. The top of this outlet had black deposits in the channel: microbial mat or sulphides.
This gas seep was not yet surrounded by carbonates. Maybe, it is possible under the influence of landslides.
Observation of the gas stream has shown an average diameter of the compressed bubbles about 0.4 – 0.5 cm (in situ size-range). Bubbles were discharged with a long duration.

Dive track:
JAGO-Dive 845 (3) 2 Oct 2004, Danube Canyon, Romania

Pilot: Jürgen Schauer, Observer: Maksim Gulin

Time	Long. E 31	Lat. N 43	Latitude	Longitude	Depth (m)	Remarks
08:33						submerged
08:56	16.223	58.174	43:58.174	31:16.223	323	touch down at bottom
09:03	16.236	58.177	43:58.177	31:16.236		crossed Jens' SeepPos. "Ship10", no structure
09:08	16.255	58.166	43:58.166	31:16.255		
09:10	16.261	58.18	43:58.180	31:16.261	330	at Jens' SeepPos. 164, no structure
09:12	16.261	58.19	43:58.19	31:16.261	331	small microbial bulb on sediment, but no gas seapage
09:16	16.251	58.183	43:58.183	31:16.251	328	
09:18	16.242	58.176	43:58.176	31:16.242		
09:20	16.231	58.172	43:58.172	31:16.231	325	
09:24	16.22	58.174	43:58.174	31:16.22	323	crossed JAGO's track between SeepPos. "Ship9" and "Ship10"
09:29	16.2	58.185	43:58.185	31:16.200		
09:32	16.203	58:182	43:58.182	31:16.203		leave first SeepPos. area for heading south
09:44	16.254	58.097	43:58.097	31:16.254	320	
09:48	16.271	58.062	43:58.062	31:16.271	317	
09:50	16.257	58.045	43:58.045	31:16.257		close to SeepPos. "Ship12", then moving eastwards crossing SeepPos. "Ship43"
10:08	16.326	58.04	43:58.04	31:16.326		
10:21	16.299	58.034	43:58.034	31:16.299	318	hole in sediment with gas flux, about 20 m ssw of SeepPos."Ship43"
10:39	16.309	58.016	43:58.016	31:16.309		moving upslope in direction of SeepPos. "Yuriy 66"
10:44	16.301	58.997	43:58.997	31:16.301	293	at SeepPos. "Yuriy 66", but no structure, no seapage
10:49	16.292	58.985	43:58.985	31:16.292	288	
10:53					288	start ascent
11:16						surfaced
Total min	163					

JAGO 4 / Dive 846, P784, Gabriel Ion
October 2th, 2004



12:10 start of diving – sunny time

- 75 m put the lights on
- 90 m layer of small jellyfish
- 14:30 295 m water depth, we reached the sea bottom
- 14:35 we have seen the first ripple on the sea bottom 8-10 cm height
- many of ripples have on top white material
- 14:51 we have seen the first hole in the SB (~10 cm Ø, h=4-5 cm), no gas expelled
- 15:04 mound with 2 holes (not active, no gas)
- 15:05 elongate depression (~ width 2 m, h~0.5 cm), which host a carbonate chimney of about 100 cm height, and 60 cm width, with a dog like feature (see image HPIM3476.jpg), the colour of the chimney is light grey and on top with some dark grey zones; no samples have been taken
- 15:23 the second location with carbonate chimney (see image HPIM3477-78.jpg, which is expelling gas bubbles (sparse, we could count them); not far from the rim of the hosting depression there are 2 small carbonate structures, from where we took push corer sample (1/2 filled), when the PC entered the sediment, a lot of bubbles came out; sample of carbonate, episodic bubbling, mainly when we hit the SB with the sampling arm; the diameter of the chimney is about 65 cm (based on laser pointers)
- 15:55 - 2 samples of bacteria mats (almost black colour)
- 16:13 we took a big piece of carbonate, which afterwards has been lost
- we took the last three (in total 4) pc no. 6,7 and 8. The corers have been take in order to have an horizontal gradient apart from the chimney area (first was nearby no. 5 and the others 6,7,8, approx. 0,5 m apart each of another)
- the third and last location (again a small depression) where we found carbonate chimney (a twin structure, see photo HPIM3512.jpg), with an active hole in between (close to the big cc), another hole on the rim, in the distance (see photo HPIM3516.jpg). These two holes and the small cc were been expelling gas (in pulses).
  The small chimney was dark grey and we has entirely sampled it (about 7 samples + a big piece, which has hopefully recovered on board of Poseidon). When the big piece has been

unrooted from the sb sediments, a quite big cloud of milky substance gas been released (see photos HPIM3527 and 3529.jpg)

- we started to move to north, searching for a big structure (reported from Poseidon, seen on multibeam)
- 17:26 a small hole on the crest of a ripple
- quite a lot of ripples organized approx. NW-SE
- 17:35 start of coming up
- **18:12 at the sea surface**

Gabriel Ion
2th October 2004

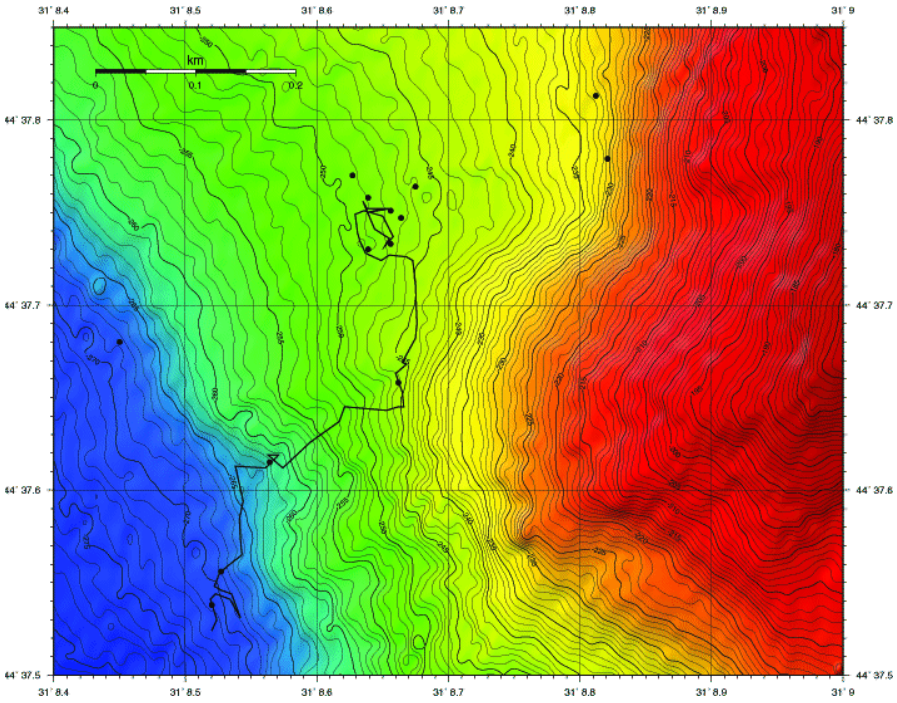
Dive track:

JAGO-Dive 846 (4) 2 Oct 2004, Danube Canyon, Romania

Pilot: Jürgen Schauer, Observer: Gabriel Ion

Time	Long. E 30	Lat. N 43	Latitude	Longitude	Depth (m)	Remarks
14:10						submerged
14:38	17.277	57.479	43:57.479	30:17.277	297	touch down at bottom
14:41	17.29	57.473	43:57.473	30:17.29	290	at SeepPos. "Ship22", no structure, no seapage
14:42	17.3	57.473	43:57.473	30:17.300	299	at SeepPos. "Ship23", no structure, no seapage
14:47	17.277	57.479	43:57.479	30:17.277	297	back at touch down position
14:48	17.262	57.483	43:57.483	30:17.262		
14:52	17.236	57.489	43:57.489	30:17.236	296	hole in sediment without gas flux
14:56	17.224	57.491	43:57.491	30:17.224		several holes in sediment but no gas flux, holes partly covered with fluff, no gas flux when touching bottom with JAGO
15:01	17.218	57.498	43:57.498	30:17.218		
15:12	17.25	57.469	43:57.469	30:17.25	295	
15:21	17.261	57.475	43:57.475	30:17.261		
15:30	17.25	57.487	43:57.487	30:17.25		several structures in a area of about 5 m diameter
15:40	17.25	57.487	43:57.487	30:17.25		start gas sampling
15:56	17.25	57.487	43:57.487	30:17.25		finished gas sampling
16:06	17.25	57.487	43:57.487	30:17.25		start sampling microbial mats from structure
16:10	17.254	57.481	43:57.481	30:17.254		carbonate structure with microbial mats and strong gas flux
16:31	17.266	57.483	43:57.483	30:17.266		
16:34						more structures in a distance of about 5 m
16:41	17.262	57.474	43:57.474	30:17.262	295	2 shallow carbonate structures in 1 flow channel, gas outlet from sediment in between both structures
16:48	17.262	57.474	43:57.474	30:17.262	295	taking 3 samples from smaller structure within flow channel
16:55	17.273	57.474	43:57.474	30:17.273		
no positioning possible due to too extensive manoeuvring of ship (navigation officer change), JAGO moves northwards						
17:23						holes in sediment without gas flux south of Maxim's seep position (43:57.568, 30:17.277)
17:29	17.256	57.55	43:57.55	30:17.256	312	
17:35	17.256	57.55	43:57.55	30:17.256	312	start ascent
18:12						surfaced
Total min	242					

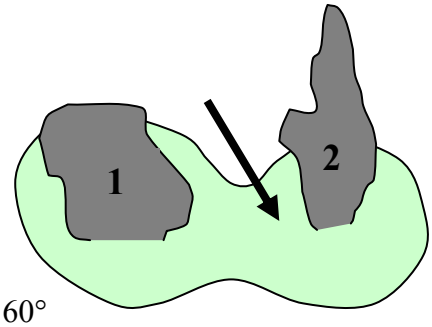
Jago Dive 5 / 847 03.10.2004



Area:
Participants: Jürgen Schauer, Nina Knab
Arrival at seafloor:
Seafloor covered with spots where marine snow has accumulated, flat.
Southwards movement to first destination.

1.) 14.07.36 190°
site with two carbonate structures right next to each other in a common crater (80-90 cm broad, 10-20 cm deep).
Structure 1: ca 30 cm broad, 20 cm high, light grey with black part on the left side
Periodical gas release (estimated 10-20 ml in 1-3 cm bubbles) from out of the structure with ca. 3 min breaks, bubbles come in rows not groups
Structure 2: ca 10-20 cm broad, 30-40 cm high, grey but top third is black
Gas release in groups of 10-15 relatively big bubbles

Sampling:
14.27.30 Structure 2 sampled in anaerobic container, structure 1 sampled as well but black part on top went up
14.32.32 Pushcore sampled from in between the structures, immediately on the left rim of structure 2 inside the crater



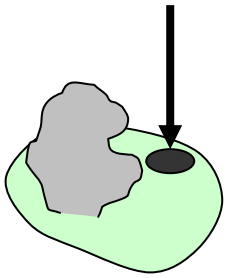
movement 4-5 m to 160°

2.) 14.45.30 160°
Structure 3: smaller than the latter ones
Not sampled

3.) 14.45.30
Structure 4: releases gas bubbles (ca. 2-3 cm) in pairs with ca. 50 cm intervals

Movement ca. 5 m to 148° **Structure 5**
Movement ca. 5 m to 146° **Structure 6**
Movement ca. 3 m to 139° **Structure 7**

4.) 14.42.30 0.48
Sampling of structure 7 14.47.00: Pushcore on black whole on right side next to the structure
Sediment soft, strong gas release when sampled.



Movement to 160° more smaaller carbonate structures in a distance of ca 2 m from each other

5.) 14.53.06 0.27
Pushcore of isolated black hole with gas release
Upper 5-10 cm soft sediment, then carbonate plate, core falling out of tube!

Movement to 355° (14.56.21)

6.) 14.57.02 333°
Structure 8: ca 20 cm broad
Gas release only on the very right side which looks dead. Lots of gas coming out of an opening framed by a white rim
Sampling: ca. 70 ml gas sampled from 15.02.00 to 15.05.40
Try to sample the gas releasing site with the white rim but it was too hard to get in the Pushcore

Movement ca. 3 m to 294° front left of latter structure:

7.) 15.11.30 294°
seeping hole but no carbonate plate visible
15.14.18 pictures from opening without carbonate structure)
15.15.58 Pushcore 4 from whole hole successfully taken exactly on top of the seep

Movement to second field destimation

8.) 15.34.51 335°

Structure 9: carbonate structure with seep again in the right corner from our position
15.45.27 187°

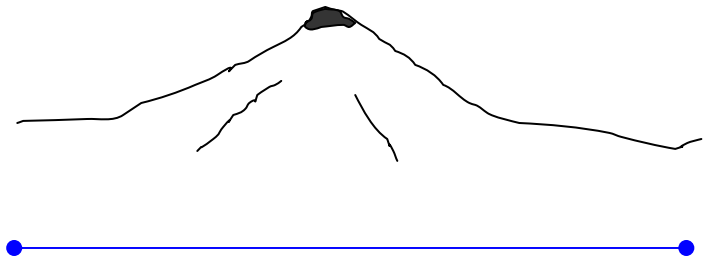
9.) 15.48.48 252
Structure 10: looks dead, no black parts only sediment color carbonate
Sampling: Pushcore 10 meets small resistance but then soft sediment

10.) 15.52.28 197°
seeping hole in sediment ca. 3 m away from last structure
16.01.00 seeping hole in sediment
16.03.29 212° another seeping hole in sediment

11.) 16.19.23
supposed to be at a seep but despite good view no gas bubbles or carbonate structures in sight, no black spots on the surface visible, but also less marine snow spots and less dead jellyfish.

12.) 16.39.16 163°
Structure 11: very big strangely formed object lying on the ground, too heavy to lift with Jago
It looks like an old carbonate structure, but solid enough not to break when shaken. No gas bubbles around.

13.) 16.42.25 139°
Cone shaped mini-hills cover the ground. They have a vulcano-like shape and black tops, sometimes with holes on the top. Digging in the sediment reveals gas-rich foundation.



1 m (estimated)

14.)16.47.26 157°
Structure 12: very black
Structure 13: 2m far right from structure 12 another (dead?) structure with gas escape on the dead (sandy-greyish) parts! (16.51.38 162°)

End of dive

Dive track:

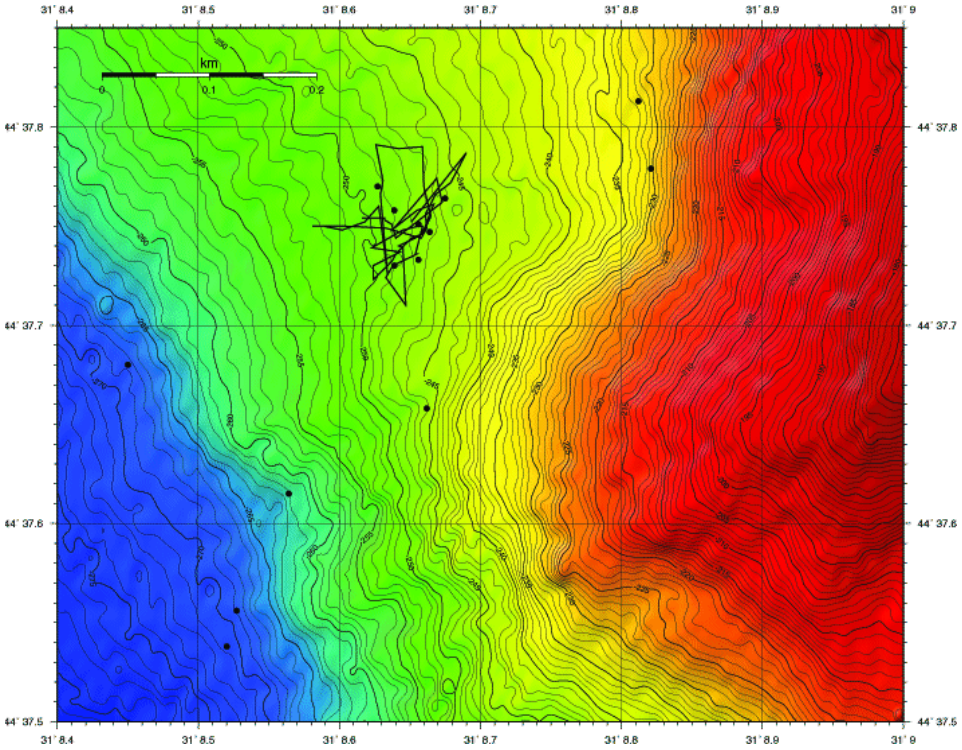
JAGO-Dive 847 (5) 3 Oct 2004, Area II. Ukraine

Pilot: Jürgen Schauer, Observer: Nina Knab

Time	Long. E 31	Lat. N 44	Latitude	Longitude	Depth (m)	Remarks
13:38						submerged
13:54	8.663	37.791	44:37.791	31:08.663	245	touch down at bottom
14:00	8.667	37.777	44:37.777	31:08.667		
14:04	8.656	37.752	44:37.752	31:08.656		
14:08	8.651	37.752	44:37.752	31:08.651		
14:11	8.638	37.75	44:37.750	31:08.638		
14:16	8.639	37.753	44:37.753	31:8.639		
14:20	8.636	37.756	44:37.756	31:08.636		
14:24	8.638	37.752	44:37.752	31:08.638	248	2 shallow carbonate structures with black microbial mats and gas outlet
14:34	8.635	37.756	44:37.756	31:08.635		first pushcore at base of structure 14:24
14:36	8.644	37.741	44:37.741	31:08.644	248	third position with carbonate structure within this field, second pushcore
15:01	8.655	37.736	44:37.736	31:08.655	248	Gassampling at next structure (all in first field)
15:06						still at position 15:01
15:09	8.652	37.732	44:37.732	31:08.652	248	pushcore trial unsuccessful - carbonate below sediment with gas outlet
15:12	8.658	37.737	44:37.737	31:08.658	248	third pushcore at gas outlet in sediment
15:18	8.65	37.748	44:37.748	31:08.65		moving westward to explore dimension of field*
15:21	8.636	37.751	44:37.751	31:08.636		about 30 m west of sampling position - no activities
15:23	8.629	37.749	44:37.749	31:08.629		moving southwards
15:25	8.631	37.739	44:37.739	31:08.631		no more structures and outlets
15:27	8.633	37.734	44:37.734	31:08.633		no more structures and outlets
15:28	8.637	37.728	44:37.728	31:08.637		no more structures and outlets, at Jens' SeepPos.
15:30	8.649	37.724	44:37.724	31:08.649		no more structures and outlets
15:31	8.655	37.727	44:37.727	31:08.655		hole in sediment (video 39:00)
15:32	8.668	37.726	44:37.726	31:08.668	245	structure with black microbial mat and adjacent gas outlet
15:34	8.673	37.724	44:37.724	31:08.673		no structure and outlets
15:36	8.675	37.712	44:37.712	31:08.675		moving south towards next SeepPos.
15:40	8.676	37.69	44:37.69	31:08.676	244	no structure and outlets
15:43	8.675	37.682	44:37.682	31:08.675		no structure and outlets
15:45	8.665	37.669	44:37.669	31:08.665		no structure and outlets
15:47	8.668	37.669	44:37.668	31:08.668		shallow carbonate structure without black mats, fourth pushcore (video 42:49)
15:53	8.668	37.668	44:37.668	31:08.668		gas outlet in sediment ca. 20 m northeast of Jens' SeepPos.
15:59	8.66	37.663	44:37.663	31:08.66	246	at Jens' SeepPos., no structure, no outlets
16:00	8.665	37.653	44:37.653	31:08.665	246	hole in sediment (with interrupted gas seapage) about 15 m south of Jens' SeepPos. 44.37.658, 31.8.664
16:02	8.666	37.645	44:37.645	31:08.666		no structure, no outlets
16:03	8.662	37.645	44:37.645	31:08.662	246	holes in sediment (video 48:46) with gas seapage
16:08	8.653	37.643	44:37.643	31:08.653		
16:13	8.621	37.645	44:37.645	31:08.621	253	
16:14	8.617	37.637	44:37.637	31:08.617		
16:16	8.595	37.626	44:37.626	31:08.595		
16:18	8.574	37.612	44:37.612	31:08.574		close to Jens' SeepPos. 44.37.615, 31.8.568, no structure, no gas outlets
16:19	8.563	37.619	44:37.619	31:08.563	260	
16:23	8.571	37.619	44:37.619	31:08.571		moved in a circle, no structure, no outlets
16:24	8.561	37.612	44:37.612	31:08.561		no structure, no outlets
16:26	8.538	37.613	44:37.613	31:08.538		
16:28	8.541	37.594	44:37.594	31:08.541	264	
16:30	8.541	37.584	44:37.584	31:08.541		
16:32	8.542	37.573	44:37.573	31:08.542		
16:34	8.543	37.565	44:37.565	31:08.543	265	
16:37	8.532	37.559	44:37.559	31:08.532		
16:38	8.526	37.555	44:37.555	31:08.526		at SeepPos. 44.37.556, 31.8.528
16:39	8.522	37.548	44:37.548	31:08.522		
16:41	8.527	37.546	44:37.546	31:08.527	268	piece of carbonate without microbial mats, no gas seapage
16:46	8.535	37.544	44:37.544	31:08.535		small elevations with gas outlets
16:48	8.542	37.531	44:37.531	31:08.542	266	small black microbial bulbs in sediment
16:55	8.534	37.541	44:37.541	31:08.534		
16:57	8.523	37.544	44:37.544	31:08.523		
16:58	8.519	37.541	44:37.541	31:08.519		
16:59	8.524	37.53	44:37.530	31:08.524		crossed SeepPos. 44.37.538, 31.8.522
17:00	8.52	37.524	44:37.524	31:08.52		
17:16						surfaced
Total min	218					

* carbonate structures and gas outlets seem to be situated on a line, about 15 m long, in direction of 160 degrees

POS317-3 station 791 / JAGO 6
Jago Dive 848 Egorov Area West, Jens Greinert



The aim of this dive was the mapping of the active seep area discovered during the previous dive (JAGO 5). The extend of the active field and the density of active seep sites within this area should be mapped and documented. In addition push cores next to an active site and gas samples should be taken. According to the CTD record the dive occurred between 240 and 248m water depth at 8.74°C water temperature and a salinity of 21.74.

Although active seeps were rather easily found during JAGO 5, we were not able to find them again during JAGO 5. With respect to the underwater navigation we searched in the correct area (approx 150m in diameter) but found only one seep location in form of a black hole at the sea floor. The hole itself had a diameter of 2cm with a black halo of 10cm in diameter and proved to be active due to a burst of approx. 20 bubbles with a rather constant size of 1 to 1.5cm in diameter. The site was samples with 3 push cores. Core 7 sampled the hole itself, Core 6 sampled the sediment directly next to it and Core 2 was taken approx. 50cm apart. During the sampling gas was released from the sediment while we took Core 7. No gas bubbles ascend when we took Core 2 outside the active area.

During the entire time of Dive 848 the seafloor showed the typical soft sediment and light grey to brown patches caused by a varying thickness of the fluffy layer. As during Dive 847, some small elevations of approx. 15cm height and 80x40 cm in diameter were seen at around 44:37.748 / 31:08.67. We also found a piece of black bacteria on the seafloor that was possible lost the dive before and felled down again after no more gas was trapped with the ‘balloon-like’ microbial mat. The repeated observation of a tree trunk and the finding of a plastic can and plastic plane have been the only observations in addition to the usual seafloor. The dive showed exemplarily the small scaled occurrence of active seep areas in general and gives evidence that the active area in the studied region is very small (some square meter) with only some active sites.

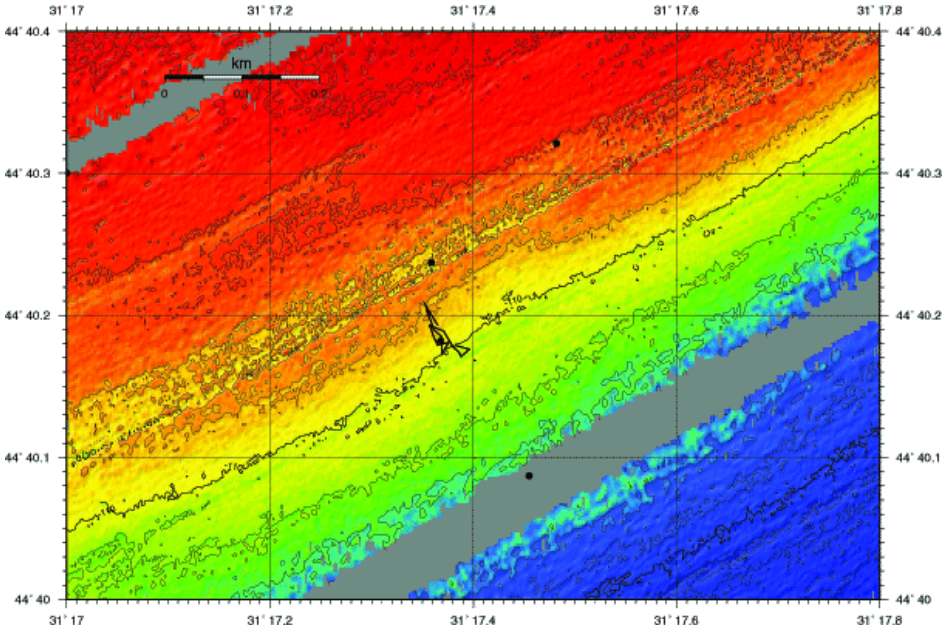
Dive track:

JAGO-Dive 848 (6) 4 Oct 2004, Area II. Ukraine

Pilot: Jürgen Schauer, Observer: Jens Greinert

Time	Long. E 31	Lat. N 44	Latitude	Longitude	Depth (m)	Remarks
10:08	8.651	37.752	44:37.752	31:8.651		
10:30	8.69	37.787	44:37.787	31:8.69	244	touch down at bottom, about 60 m north of SeepPos.44.37.764, 31.08.675
10:37	8.679	37.772	44:37.772	31:8.679		
10:39	8.668	37.766	44:37.766	31:8.668		close to SeepPos.44.37.764, 31.08.675
10:42	8.661	37.756	44:37.756	31:8.661	247	small elevations in sediment
10:43	8.662	37.749	44:37.749	31:8.662		gas seapage when JAGO touches ground
10:46	8.658	37.744	44:37.744	31:8.658		crossing JAGO's track from yesterday
10:47	8.633	37.749	44:37.749	31:8.633		
10:49	8.604	37.75	44:37.75	31:8.604		turning for moving 20 m north and then back to east
10:51	8.581	37.75	44:37.75	31:8.581		
10:53	8.589	37.75	44:37.75	31:8.589		
10:55	8.602	37.748	44:37.748	31:8.602		crossing another JAGO track, patches of fluff on plain bottom
10:57	8.618	37.752	44:37.752	31:8.618		
10:59	8.628	37.76	44:37.76	31:8.628		
11:00	8.634	37.726	44:37.726	31:8.634	247	hole of gravity corer (5-10 m north of SeepPos.44.37.759, 31.8.639)
11:02	8.629	37.766	44:37.766	31:8.629		
11:04	8.631	37.773	44:37.773	31:8.631		close to SeepPos. 44.37.77, 31.8.628
11:07	8.626	37.791	44:37.791	31:8.626		
11:10	8.642	37.789	44:37.789	31:8.642		
11:11	8.659	37.79	44:37.79	31:8.659		piece of garbage, turning towards south
11:14	8.66	37.77	44:37.77	31:8.66	243	northwest of SeePos. 44.37.764, 31.8.675
11:16	8.665	37.755	44:37.755	31:8.665		
11:17	8.659	37.746	44:37.746	31:8.659		
11:18	8.651	37.744	44:37.744	31:8.651		
11:19	8.64	37.736	44:37.736	31:8.64		
11:20	8.637	37.732	44:37.732	31:8.637		
11:21	8.624	37.723	44:37.723	31:8.624		southwest of SeepPos. 44.37.729, 31.8.639
11:23	8.624	37.73	44:37.73	31:8.624		
11:26	8.643	37.737	44:37.737	31:8.643		
11:27	8.623	37.739	44:37.739	31:8.623		
11:28	8.645	37.748	44:37.748	31:8.645	246	position where multicorer went into sediment
11:31	8.656	37.75	44:37.75	31:8.656		
11:34	8.659	37.75	44:37.75	31:8.659		
11:36	8.654	37.736	44:37.736	31:8.654		detached black microbial bulb (lost during sampling yesterday or detached by gas overpressure)
11:38	8.655	37.736	44:37.736	31:08.655		
11:41	8.638	37.73	44:37.73	31:08.638		close to SeepPos.44.37.729, 31.8.639
11:43	8.633	37.724	44:37.724	31:08.633		crossing JAGO's track
11:45	8.647	37.71	44:37.71	31:08.647		turning and moving north
11:51	8.645	37.739	44:37.739	31:08.645		
12:09	8.642	37.74	44:37.74	31:08.642		
12:11	8.657	37.745	44:37.745	31:08.657	248	
12:12	8.661	37.75	44:37.75	31:08.661		hole in sediment close to SeepPos. 44.37.747, 31.8.664
12:15	8.664	37.756	44:37.756	31:08.664	248	push coring (Pushcores #2, 7, 6, one exactly above hole in sediment)
12:18	8.667	37.761	44:37.761	31:08.667		
12:25	8.655	37.758	44:37.758	31:08.655		
12:33	8.639	37.749	44:37.749	31:08.639		
12:44	8.669	37.774	44:37.774	31:08.669		
12:46	8.673	37.762	44:37.762	31:08.673	246	
12:55	8.64	37.744	44:37.744	31:08.64		
12:57	8.637	37.751	44:37.751	31:08.637		
13:00	8.632	37.753	44:37.753	31:08.632		
13:04	8.632	37.754	44:37.754	31:08.632		
13:05	8.616	37.754	44:37.754	31:08.616		start ascent
13:21						surfaced
Total min	193					

JAGO 7. / dive 849, P791, Working area II, 110 m, Bo Barker Jørgensen



Dive in oxic part of working area II at 110 m water depth. Bathymetry was a gently sloping part of the outer shelf. Bottom was brown colored and speckled, apparently by very small mussels. Brown color probably due to detritus. Small spots of gray mud in between. Landed in area without particular structures. During movement small ridges of 5-10 cm high and small depressions were encountered. Three very local areas of dark gray spots with a rim of white were found. Called Beggiatoa mats 1, 2 and 3. These were interpreted as seep areas with seepage of sulfide rich pore fluid. The central gray part may have too much diffuse fluid seepage for Beggiatoa to establish.

The first seep and Beggiatoa mat site with a diameter of ca ½ m was sampled with three pushcores: no. 8 in the gray center, no. 18 in the Beggiatoa film at the rim, and no. 19 ca. ½ m from rim. As the core was pulled out from the center, many large bubbles escaped, the largest single burst appeared to be a 5 cm wide bubble that immediately burst. Bubbles continued to rise irregularly from the coring hole after coring.

The second seep and Beggiatoa mat site was located few tens of meters (?) from the first. It had a similar appearance as the first. It was attempted to core it, but the pushcorer hit hard ground at a depth of ca 15 cm. The sediment was loose and grainy and the core fell out.

The third seep and Beggiatoa mat site was located ca. ten meters from the second. It consisted of four round spots of about similar size and appearance as the first. A single stream of gas bubbles came up from a ca 1 cm wide hole in one area. Another similar bubble stream appeared more irregularly at another place in the same gray area. A third gas escape occurred isolated ca. 2 m away in the brown colored sediment. It was surrounded by a white Beggiatoa (?) rim of ca 5 cm diameter. Gas was sampled from the first outlet and filled half the bottle at the water surface.

No carbonate structure or other hard structures were observed on the bottom (oxic zone). The anaerobic jar was mounted on JAGO but there was nothing to sample. A few small fish (10 cm) swam by as an indication of the presence of oxygen.

The video camera of Bo ran during much of the dive. The JAGO operations were filmed and photographed. However, little was done in terms of mapping as the distance travelled was short and only few seeps were encountered. The observasions on video can be tracked to time through the clock of the video combined with spoken time read from the JAGO digital clock (local time). The camera was set to Paris time zone, summer time, i.e. 1 hour early of local time. This should provide geographical reference to the mat sites.

The dive was ended at 18:30 to get back before darkness. Poseidon was reached shortly after sundown.

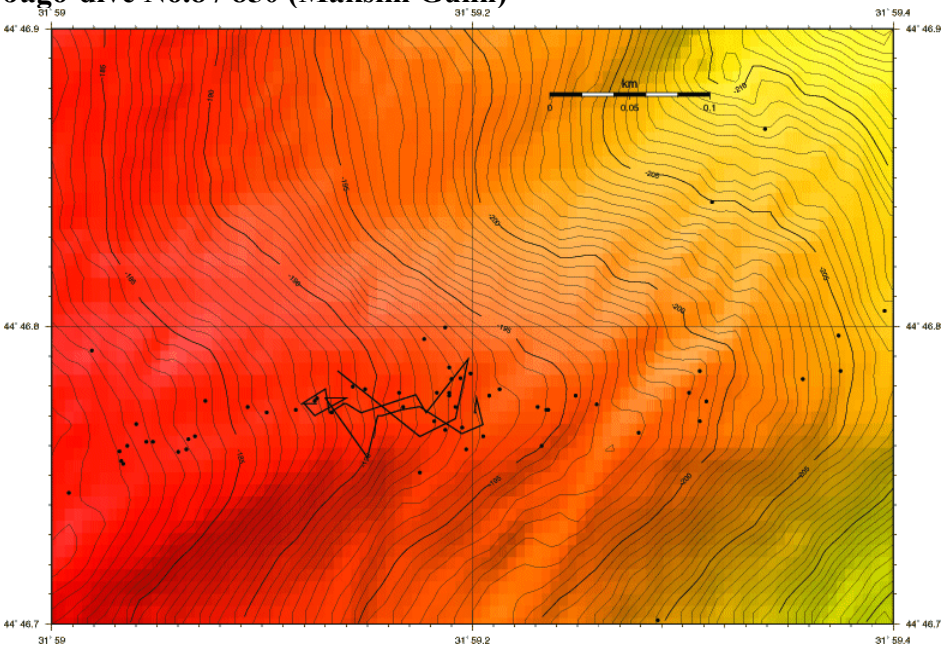
Dive track:

JAGO-Dive 849 (7) 4 Oct 2004, Shelf of Area II. Ukraine

Pilot: Jürgen Schauer, Observer: Bo B. Joergensen

Time	Long. E 31	Lat. N 44	Latitude	Longitude	Depth (m)	Remarks
15:44						submerged
15:53	17.365	40.193	44:40.193	31:17.365	108	touch down
16:01	17.353	40.207	44:40.207	31:17.353	108	
16:08	17.361	40.19	44:40.19	31:17.361	108	
16:11	17.369	40.185	44:40.185	31:17.369	108	2 small Beggiatoa patches
16:14	17.369	40.173	44:40.173	31:17.369	108	
16:17	17.376	40.181	44:40.181	31:17.376	108	
16:19	17.365	40.179	44:40.179	31:17.365	110	
16:20	17.361	40.185	44:40.185	31:17.361	110	
16:23	17.357	40.193	44:40.193	31:17.357	110	crossing JAGO's track
16:25	17.371	40.189	44:40.189	31:17.371	110	
16:28	17.38	40.178	44:40.178	31:17.38	110	patch with Beggiatoa mats
16:46	17.38	40.178	44:40.178	31:17.38	110	first pushcore (#9) at Beggiatoa patch
16:54	17.38	40.178	44:40.178	31:17.38	110	second pushcore at the same patch
17:08	17.38	40.178	44:40.178	31:17.38	110	third pushcore at the same patch
17:13	17.38	40.178	44:40.178	31:17.38	110	about 3 m beside pushcore sampling location gas outlet
17:18	17.38	40.178	44:40.178	31:17.38	110	
17:29	17.38	40.178	44:40.178	31:17.38	110	
17:36	17.38	40.178	44:40.178	31:17.38	110	
17:43	17.386	40.174	44:40.174	31:17.386	110	another patch of Beggiatoa located after turning JAGO
17:52	17.386	40.174	44:40.174	31:17.386	110	
18:08	17.388	40.171	44:40.171	31:17.388	110	
18:13	17.396	40.176	44:40.176	31:17.396	110	
18:18	17.396	40.176	44:40.176	31:17.396	110	
18:27	17.382	40.179	44:40.179	31:17.382	110	gas sampling
18:35	17.382	40.179	44:40.179	31:17.382	110	start ascent
18:45						surfaced
Total min	181					

5-October-2004
Jago-dive No.8 / 850 (Maksim Gulin)



This time, when Jago reached the seafloor, both illuminators were used: frontal – for the main visual and video observations and also upper illuminator – for surveys of landscapes.
Distribution of gas seeps at the inspected area was in form of dense spots, microgrounds of the gas outlets. It was found that gas seeps may cover to 10 – 20 % approx of the seafloor in the areas of active seepage.
In the several points of surface layer of the bottom sediments we detected accumulations of shells of the bivalve Modiolus phaseolinus.

During of visual observation, two types of carbonate structures were found: slabs and chimneys. Spongy-like microbial mats are located mainly on the upper parts of carbonates. Methane gas bubbles flow out through internal channels of these mats. It should be noted, however, that most part of carbonate structures was not active. This may suggest a periodical, “geyser-like” seepage of gas.
Gas bubbles were sampled for further determination of gas composition etc. Samples of sediments we obtained by the Push-corers, which allow take the sediments without disturbing their structure. All key features of the visited seep site were recorded into the video- and photo- tapes.

Dive track:

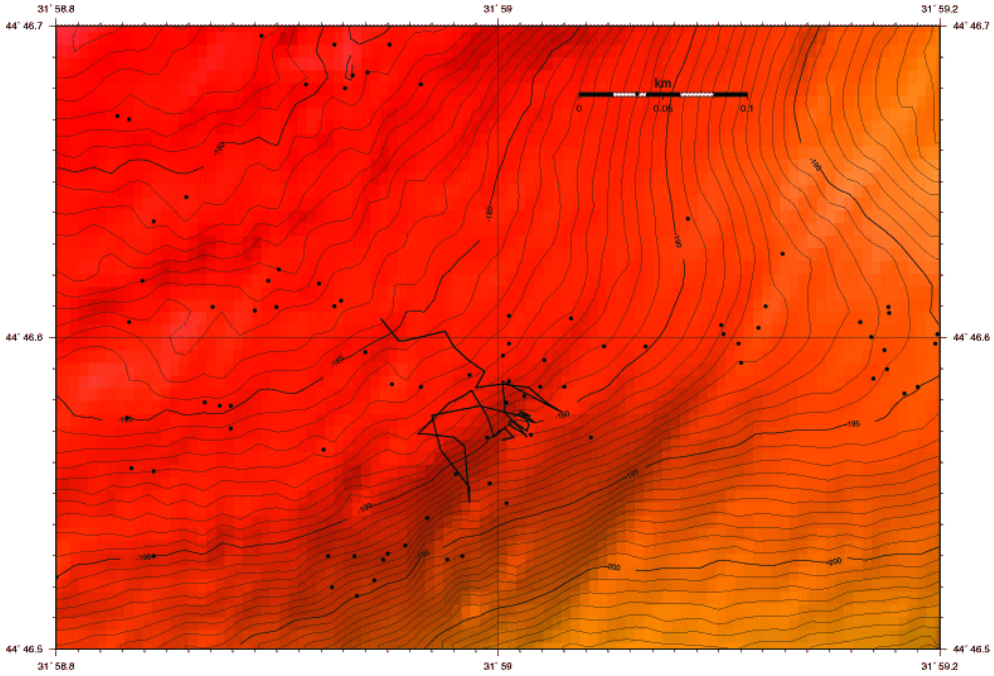
JAGO-Dive 850 (8) 5 Oct 2004, CRIMEA Ridge Ukraine

Pilot: Jürgen Schauer, Observer: Maksim Gulin

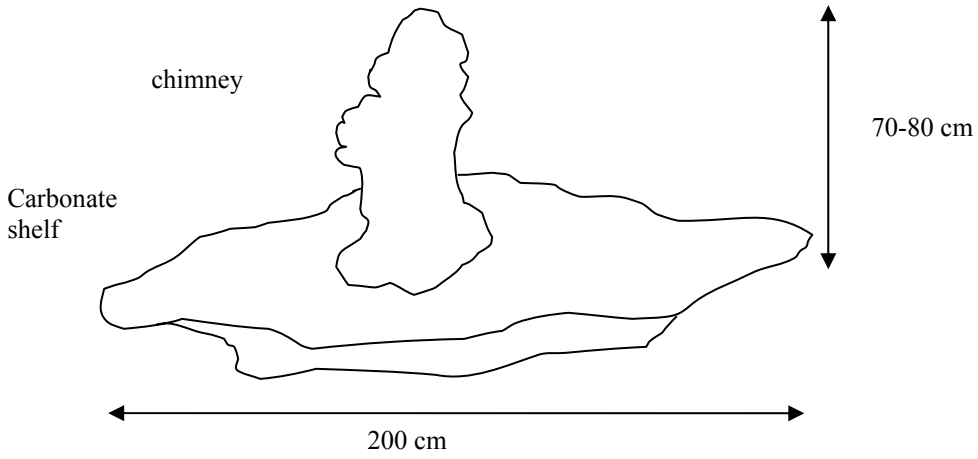
Time	Long. E 31	Lat. N 44	Latitude	Longitude	Depth (m)	Remarks
08:40						submerged
08:54	59.136	46.785	44:46.785	31:59.136	187	touch down
08:59	59.175	46.763	44:46.763	31:59.175		first carbonate plate in sediment
09:01	59.192	46.769	44:46.769	31:59.192	190	
09:04	59.198	46.789	44:46.789	31:59.198	192	scanning area
09:13	59.178	46.771	44:46.771	31:59.178		small carbonate structures in sediment, separated by 5-6m
09:22	59.173	46.777	44:46.777	31:59.173	190	carbonate plates with black microbial bulbs, gas outlets
09:35	59.164	46.775	44:46.775	31:59.164	189	collected black microbial bulbs into anaerob ton, pushcoring failed, corer didn't penetrate hard substrate
09:47	59.147	46.771	44:46.771	31:59.147	189	in centre of a carbonate field with lots of gas outlets
09:50	59.14	46.774	44:46.774	31:59.140	189	"sombrero"-shaped exposed carbonate plates, interesting area
09:53	59.138	46.774	44:46.774	31:59.138	189	stationary
10:04	59.139	46.774	44:46.774	31:59.139	189	stationary
10:24	59.132	46.771	44:46.771	31:59.132		
10:34	59.13	46.779	44:46.779	31:59.130		moving
10:39	59.119	46.774	44:46.774	31:59.119		
10:41	59.126	46.774	44:46.774	31:59.126	187	dense cluster of carbonate plates with black microbial bulbs, gas outlets
10:53	59.12	46.774	44:46.774	31:59.12		gas sampling
10:58						end of gas sampling
11:01	59.125	46.77	44:46.77	31:59.125		moving slowly westwards
11:03	59.14	46.776	44:46.776	31:59.14		west end of carbonate area, turning, moving east
11:06	59.13	46.776	44:46.776	31:59.13		first carbonate structures
11:08	59.15	46.756	44:46.756	31:59.15		crossed the carbonate field from west to east, reached east end
11:10	59.155	46.77	44:46.77	31:59.155	188	
11:12	59.157	46.77	44:46.77	31:59.157		gas outlet from sediment, pushcoring failed due to malfunction of corers
11:28	59.166	46.772	44:46.772	31:59.166		moving slowly east
11:30	59.175	46.773	44:46.773	31:59.175		at position where the first microbial bulb was sampled
11:32	59.195	46.764	44:46.764	31:59.195		end of carbonate field in this direction
11:34	59.205	46.767	44:46.767	31:59.205	192	first carbonate structures
11:37	59.202	46.776	44:46.776	31:59.202		
11:49	59.201	46.771	44:46.771	31:59.201		edge of carbonate field, strong gas flux from outlet in sediment
11:54	59.202	46.771	44:46.771	31:59.202	192	taking pushcore
11:57	59.202	46.771	44:46.771	31:59.202	192	pushcoring successful, start ascent
12:19						surfaced
Total min	219					

*Carbonate structures and gas outlets are situated in patches on a west-east ridge

Report Dive 9 / 851, P817, Tina Treude



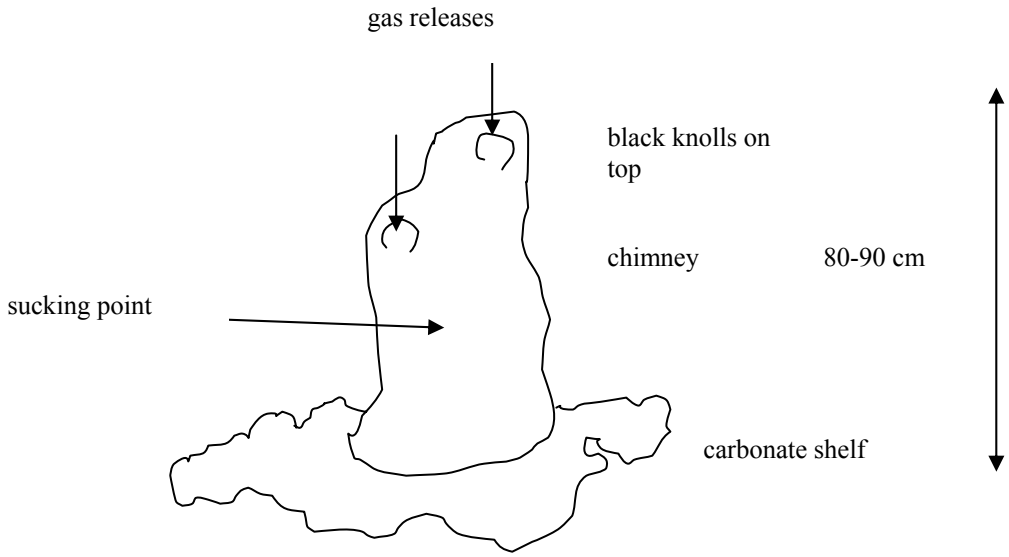
10:05 from board
10:11 start diving
10:23, 186.5 m touchdown above an area with large carbonate shelves that cover the whole area. Within the shelves a lot of clam shells were embedded.
10:24 heading 130°
10:28, 186 m very big shelves with black microbial knolls on top. At a lot of the shelves the sediment was washed off at the basement, wherefore they stood free in the water column. There was one big chimney structure (70-80 cm high, ca. 30 cm in diameter).
10:36 186 m another chimney structure with gas releases (see drawing). A big area with carbonate shelves along the whole track, partly with black microbial knolls on top.



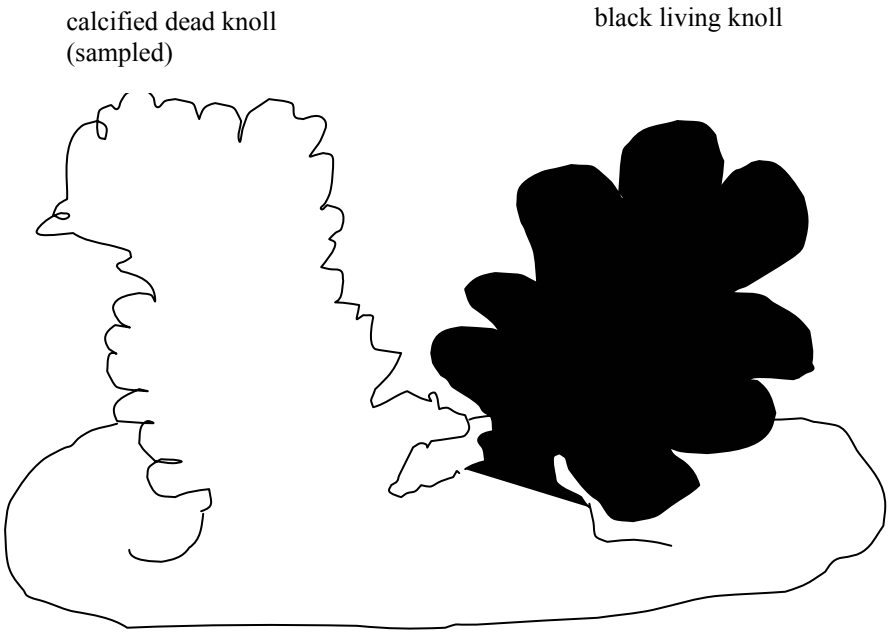
10:24, 190 m 4-5 small chimney structures and black microbial knolls at the same place (2-3

2 m

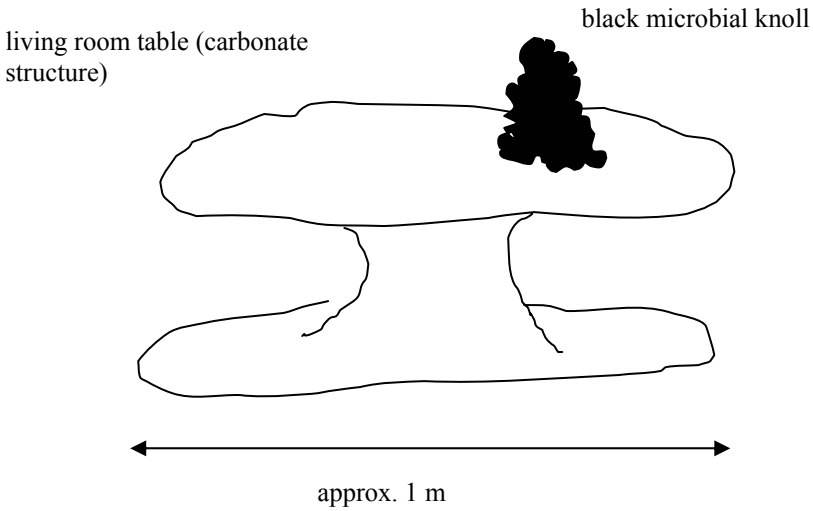
m distance from each other). Out of some of the structures gas was released periodically.
10:45, 190 m soft bottom, no structures
10:47, 193 m small hill with carbonate shelves
10:49, heading 280°
10:51, 190 m again a lot of carbonate shelves partly with black microbial knolls on top and gas releases
10:52, 190 m, WP 12, one larger chimney of 80 to 90 cm height. Gas was released ca. every 30 seconds. In between there were no gas releases. Always several bubbles were released at the same time.
11:02 sucking water from the center of the chimney (see drawing). The water was cloudy and contained a lot of particles. The suck-needle was pushed 20 cm into the chimney center. When pulling out the needle the pinkish color of internal mat was visible. Pictures were taken from the chimney and the needle inside.



11:18 making a movie of gas releases out of the chimney
11:29 taking pictures and making movies of the other side of the chimney
11:31, 191 m leaving chimney
11:34, 193 m, WP 15, taking a sample of a calcified, inactive microbial knoll. The calcified knoll was standing directly beside an active black knoll (like twins). Pictures were taken of them. When sampling the calcified knoll, gas was released.



11:42, singing dolphins
11:48, 193 m hole with regular gas releases in the sediment. We tried to sample it but there was a carbonate crust below it. Around the hole there was a black color and gas bubbles were released permanently. The hole was located in a depression filled with sediment. Therefore no carbonate shelves were visible (only in the very surrounding area). We placed a metal sphere (6 mm in diameter) beside the rising gas bubbles as a scale and filmed the releases. The rising speed was measured along the strip of the metal sphere (16 cm).
12:05 we placed the metal sphere beside the hole to get a scale
12:19, 193 m, leaving the hole, heading 330°
12:23, 191 m, a lot of small black microbial knolls in distances of 1-3 m from each other. They were placed on top of carbonate shelves.
12:27, 191 m, a gathering of old calcified and fresh black microbial knolls. We took some pictures.
12:30, 191 m, carbonate shelves, shelves and again shelves…….did I mention that there were shelves….?
12:33, 192 m, tracks in the sediment (maybe from the rabbit that has been seen on a former dive?...).
12:35, 193 m, heading 120°
12:36, 193 m, WP 14, a living room table on which a black knoll was served for lunch (a carbonate structure that looked like a living room table with a black microbial knoll on top). We took some pictures. In the surrounding there were also other small chimneys.



12:38, 194 m, heading 30°
12:43, 192 m, a black dot in the sediment (no gas releases visible). It looked as if there was a microbial knoll about to grow into the water column. We placed pushcore no. 1 on it. When pushing the pushcore into the sediment (which was very hard), a lot of gas bubbles were released. A half full sediment core was retrieved.
12:50, 192 m, heading 50°, carbonate shelves on the way
12:56, 190 m, heading 20°, soft bottom, no carbonates
12:58, 190 m, heading 40°, going back to the carbonate field. Sometimes several (2-3) shelves were positioned on top of each other (visible, when the sediment was removed from the side – maybe by currents).
13:00-13:15 Jürgen filmed me while telling three times “Oh look, there are gas bubbles released from the chimney!”
13:15 go on driving
13:21, 192 m, taking a sample of a carbonate shelf
13:24, end of dive, getting back to the surface
At 120-100 m layer of Ctenophora
13:39 surfacing
NICE DIVE ☺

Dive track:

JAGO-Dive 851 (9) 8 Oct 2004, Carbonate Field west of GHOSTDABS, CRIMEA Positions, Ukraine

Pilot: Jürgen Schauer, Observer: Tina Treude

Time	Lat N 44:46.	Long E 31:	Latitude	Longitude	Depth (m)	Remarks
10:12						submerged
10:23	606	58.947	44:46.606	31:58.947	187	touch down, first carbonate plates
10:30	599	58.955	44:46.599	31:58.955	187	field with carbonate, microbial bulbs and gas seapage
10:33	599	58.958	44:46.599	31:58.958		first pillar-shaped structures, about 80-90 cm high
10:38	602	58.976	44:46.602	31:58.976		excellent area with lots of carbonate structures and gas venting
10:40	597	58.980	44:46.597	31:58.980		
10:41	593	58.986	44:46.593	31:58.986		
10:42	589	58.994	44:46.589	31:58.994	190	good structures
10:43	584	58.990	44:46.584	31:58.990		
10:44	585	59.002	44:46.585	31:59.002		
10:46	584	59.014	44:46.584	31:59.014		end of carbonate and seep area ?
10:47	579	59.022	44:46.579	31:59.022	190	some carbonate but not as dense as before
10:49	576	59.029	44:46.576	31:59.029		turn towards 280 degrees
10:52	586	59.002	44:46.586	31:59.002		lots of carbonate structures with black microbial bulbs and gas venting
10:54	579	59.003	44:46.579	31:59.003		good structure for fluid sampling
10:58	579	59.003	44:46.579	31:59.003		stationary for fluid sampling
11:06	580	59.003	44:46.580	31:59.003		stationary for fluid sampling
11:24	580	59.003	44:46.580	31:59.003		stationary for fluid sampling
11:32	580	59.003	44:46.580	31:59.003		end of fluid sampling
11:33	576	59.003	44:46.576	31:59.003	191	searching for carbonate to sample
11:38	570	59.011	44:46.570	31:59.011		collected carbonate bulb
11:42	568	59.013	44:46.568	31:59.013	192	
11:45	569	59.012	44:46.569	31:59.012	192	collected piece of carbonate close to WP15
11:47	572	59.005	44:46.572	31:59.005		search for gas seep from sediment
11:48	573	59.005	44:46.573	31:59.005		hole with gas seapage
11:51	573	59.007	44:46.573	31:59.007		
11:56	570	59.013	44:46.570	31:59.013		close to WP15
12:02	572	59.014	44:46.572	31:59.014		
12:06	576	59.011	44:46.576	31:59.011		
12:07	575	59.008	44:46.575	31:59.008		
12:09	575	59.014	44:46.575	31:59.014		end of experiment to measure gas bubble size
12:13	576	59.011	44:46.576	31:59.011		
12:20	573	59.016	44:46.573	31:59.016		push coring not successful because of shill layer below sediment surface
12:27	575	59.009	44:46.575	31:59.009		
12:29	578	58.992	44:46.578	31:58.992		
12:30	575	58.97	44:46.575	31:58.97		
12:33	564	58.974	44:46.564	31:58.974	193	
12:36	552	58.987	44:46.552	31:58.987		carbonate structures getting less
12:38	547	58.987	44:46.547	31:58.987		in direction of 120 degrees more pillar-like structures visible at horizon
12:41	565	58.985	44:46.565	31:58.985		
12:43	568	58.98	44:46.568	31:58.98		
12:44	569	58.967	44:46.569	31:58.967		black patches on sediment, early stages of microbial mats ?, push coring
12:50	569	58.964	44:46.569	31:58.964		end of push coring
12:54	572	58.968	44:46.572	31:58.968		
12:57	579	58.978	44:46.579	31:58.978		
12:58	581	58.984	44:46.581	31:58.984		at the edge of carbonate field
13:00	583	58.988	44:46.583	31:58.988		
13:08	575	58.995	44:46.575	31:58.995		
13:14	571	58.997	44:46.571	31:58.997		
13:15	568	58.998	44:46.568	31:58.998		
13:19	571	59.003	44:46.571	31:59.003	192	
13:21	568	59.007	44:46.568	31:59.007		collected piece of carbonate between WP 14 and WP15
13:25	567	59.002	44:46.567	31:59.002		start ascent
13:38						surfaced
Total min	206					

POS317-3 station 818 / JAGO 10
Jago Dive 852 Dnepr Area 92m water depth (CRIMEA Shallow Shallow Site)
Jens Greinert

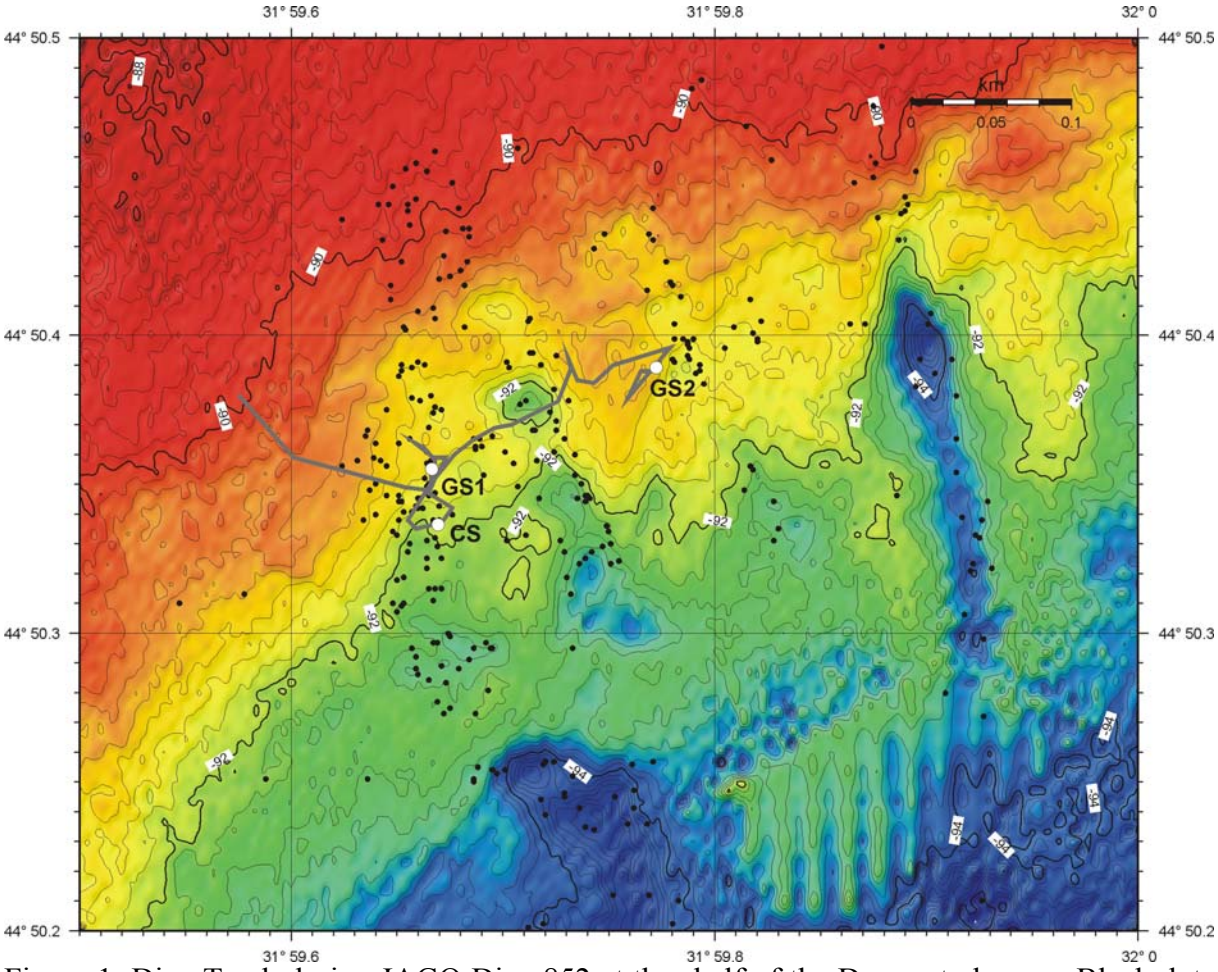


Figure 1: Dive Track during JAGO Dive 852 at the shelf of the Dnepr study area. Black dots are seep positions; GS1 and 2 are the positions of the gas flux measurements. A carbonate chunk was at CS.

Aim of this dive was the detailed observation of the so called Shallow Shallow Site of the CRIMEA project. The area at 92m water depth is in the oxic zone and characterized by a patchy occurrence of Beggiatoa. During CRIMEA a close correlation between the occurrence of gas flares and areas of high backscattering detected during multi beam mapping was observed. To investigate if gas in the sediment, different sediment compositions (e.g. course vs. fine grained sediment) or a sediment cementation causes the higher backscatter, we planned to survey a wider area covering both high and low backscatter sediments. In addition detailed bubble size and flux measurements by video and bubble catching was planned.

The dive started in the west in an area of low backscatter, heading towards the east (Figure 1) and ends at an area with rather dense and large Beggiatoa mats with sizes of few square meter. As typical for a water depth of 92m in the oxic zone, small (10-15cm) cod-like fish were seen close to the bottom.

The greyish sediment close to the landing point showed accumulations of small shells and patches of fluff on an almost flat morphology with ripples of 10s cm height. Few larger shells

possible Modiolus (approx. 10cm long) were scattered at the seafloor during the entire dive. Due to the water depth we were able to see the seafloor even with out lights which we used to look into greater distances searching for white Beggiatoa mats. We found a cluster of Beggiatoa mats (GS1 in Figure 1) with several bubbling spots at the periphery of the high backscatter area. Between 3 and 7 spots were simultaneously active some of them very constant, others more periodically. Most of the bubbles did NOT escape from Beggiatoa mats but from their periphery. The holes from which bubbles were released had a white, 1-3cm wide halo of Beggiatoa. Only from time to time short bursts of some bubbles were seen escaping from Beggiatoa mats.
We made visual bubble size measurements by holding a steel sphere directly into the bubble stream. The bubble size was determined to be between 5 and 7mm with a rather homogeneous size spectrum over all active spots. One spot also show smaller bubbles of approx. 1mm in diameter released together with bigger bubbles when a new bubble burst was released. Due to their size, the bubbles were almost of circular shape. Video sequences were taken to measure the flux visually by counting the amount of bubbles released over a certain amount of time. Using the funnel we collected bubbles of a certain volume and measured the time (Table 1):

Table 1: Bubble flux measurements

Time	**Delta time**	**Volume ml**	**Remarks**
Measurement at GS1			
16:38:26 – 16:39:56	00:01:30	50ml	0.55ml/s; 33.3ml/min; 2l/h; 48l/d; 25.8m^3/y
16:40:32 – 16:41:40	00:01:08	50ml	0.74ml/s; 44.1ml/min; 2.6l/h; 63l/d; 28.4m^3/y
Measurement at GS2			
17:41:38 – 17:42:11	00:00:33	50ml	
- 17:42:48	00:00:37	50ml	
- 17:43:22	00:00:34	50ml	
- 17:43:56	00:00:34	50ml	
17:41:38 – 17:42:11	00:02:18	200ml	1.44ml/s; 87ml/min; 5.2l/h; 125l/d; 35.6m^3/y

The volumes shown in Table 1. are in-situ volumes at 91.5m water depth which still have to be transferred to STP.
Moving towards the east we passed some smaller clusters of Beggiatoa mats which occurred randomly not visible related to the micro morphology. Using the claw of JAGO we grabbed into the sediment within one of the Beggiatoa mats. It was obvious that below Beggiatoa the sediment is strongly carbonate cemented forming a massive layer which could not be penetrated by the claw. The carbonate cemented parts are still covered by a thin, soft layer of sediment which in comparison to the surrounding looks smoother with a more brownish colour. Only 10cm apart of Beggiatoa the sediment was soft and comparable to the soft sediment outside the high backscatter area. Thus we strongly suggest that the high backscattering is caused by a patchy like carbonate cementation accumulating in areas of methane venting, which causes a wider spread strong backscattering behaviour of the sediment. Moving around in the close vicinity of the first gas sampling point, we sampled a carbonate block of cemented shells that lay elevated on the seafloor (CS in Figure 1).
Heading to the east we passed a smaller clusters of Beggiatoa which appears along a line of approx. 4m and a seepage area where bubbles were released from small pockmarks with halos of thin Beggiatoa mats. Moving towards 80° we passed an area without signs of seepage/Beggiatoa but extensive dredge marks very likely from a lander recovery during the CRIMEA cruise in 2003. In one of these dredge-marks we observed some Tunicata and small

orange sponges of cm size. Finally we ended at the largest Beggiatoa area seen during the dive with a higher flux rate of 5.2l/h in respect to 2.6l/h as measured at the GS1 site. The main hole released so many bubbles that a bubble column was formed instead of a bubble stream. On board the mixed gas sample from GS1 and GS2 were transferred into vials for later geochemical analyses on shore. Due to lack of time we could not visit a larger depression further to the east which was planned for this dive. According to the CTD record the dive occurred between 89 and 91m water depth at 7.4°C and a salinity of 18.67.

Dive track:

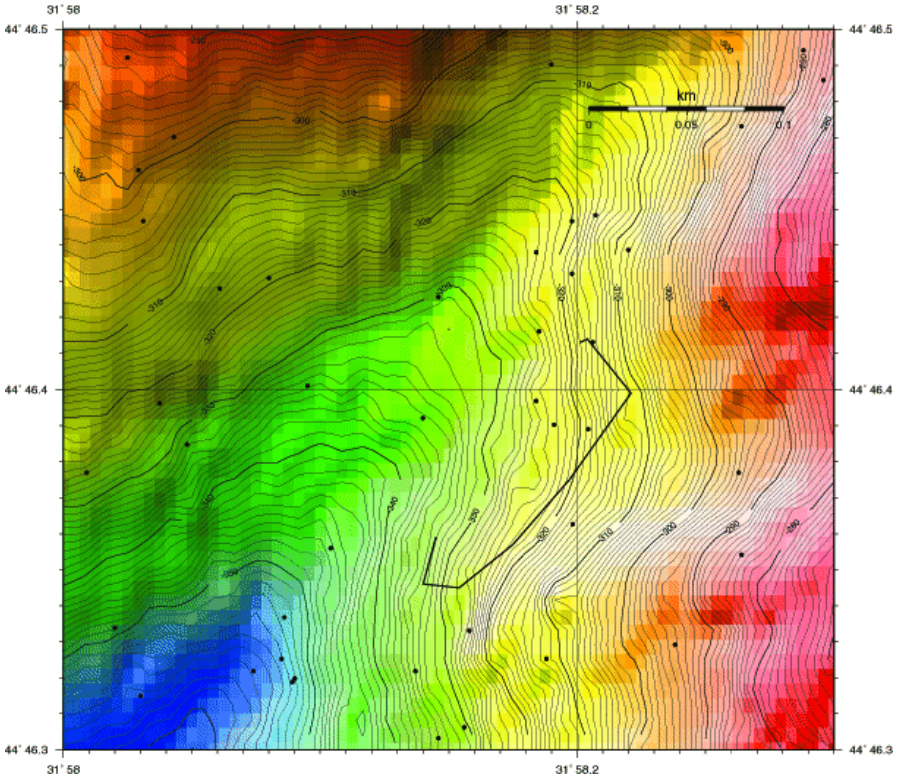
JAGO-Dive 852 (10) 8 Oct 2004, Shallow Seep Area, CRIMEA Positions, Ukraine

Pilot: Jürgen Schauer, Observer: Jens Greinert

Time	Lat N44:50	Long E31:59	Latitude	Longitude	Depth (m)	Remarks
15:44						submerged
15:52	380	575	44:50.380	31:59.575	89	touch down
15:59	359	601	44:50.359	31:59.601		disturbing noise by Russian ship near-by
16:02						lots of tracks from CRIMEA dredge
16:04	349	654	44:50.349	31:59.654		first patches with Beggiatoa close to WP2
16:05	348	665	44:50.348	31:59.665		first gas seeps close to WP2
16:07	351	666	44:50.351	31:59.666		excellent Beggiatoa patches and gas seeps, day light when JAGO lights are switched about 20 m northeast of WP2
16:25	354	666	44:50.354	31:59.666		still stationary at Pos. 16:07
16:33	355	668	44:50.355	31:59.668		stationary, measuring size of gas bubbles and quantity of gas flux
16:40	358	668	44:50.358	31:59.668		stationary, gas flux 50 ml in 70 seconds
16:46	362	663	44:50.362	31:59.663		moving on to next seep
16:48	364	658	44:50.364	31:59.658		
16:51	359	667	44:50.359	31:59.667		
16:53	359	673	44:50.359	31:59.673		at nice patch of Beggiatoa, want to inspect whether carbonate is below
16:57	356	671	44:50.356	31:59.671		moving southwest towards WP2
17:00	338	655	44:50.338	31:59.655		at WP2, no mats, no gas seeps
17:02	335	659	44:50.335	31:59.659	93	turned and move in direction of WP4
17:04	337	671	44:50.337	31:59.671		
17:05	342	676	44:50.342	31:59.676		patch with Beggiatoa
17:10	347	665	44:50.347	31:59.665		
17:11	352	668	44:50.352	31:59.668		
17:13	360	677	44:50.360	31:59.677		
17:15	365	686	44:50.365	31:59.686		nice patch of Beggiatoa and carbonate, try to sample piece of cabonate
17:18	369	696	44:50.369	31:59.696	92	sampled piece of carbonate
17:21	370	704	44:50.370	31:59.704		
17:23	378	726	44:50.378	31:59.726		
17:25	389	732	44:50.389	31:59.732	93	several Beggiatoa patches, small pockmarks, small carbonate hill at horizon
17:29	392	731	44:50.392	31:59.731		
17:32	385	735	44:50.385	31:59.735		
17:37	384	743	44:50.384	31:59.743		
17:39	390	752	44:50.390	31:59.752		large field of Beggiatoa patches, gas flux quantification at rel. continuous gas seep
17:53	396	779	44:50.396	31:59.779		
17:55	379	759	44:50.379	31:59.759		turned and move in direction of 40 degrees towards WP5
17:59	388	765	44:50.388	31:59.765		
18:01	388	772	44:50.388	31:59.772		large patch of Beggiatoa ahead
18:02	389	775	44:50.389	31:59.775		photo documentation
18:07	388	772	44:50.388	31:59.772		start ascent
18:13						surfaced
Total min	149					

Dive Jago 11 / 853, P821; Achim Mischker

No report.



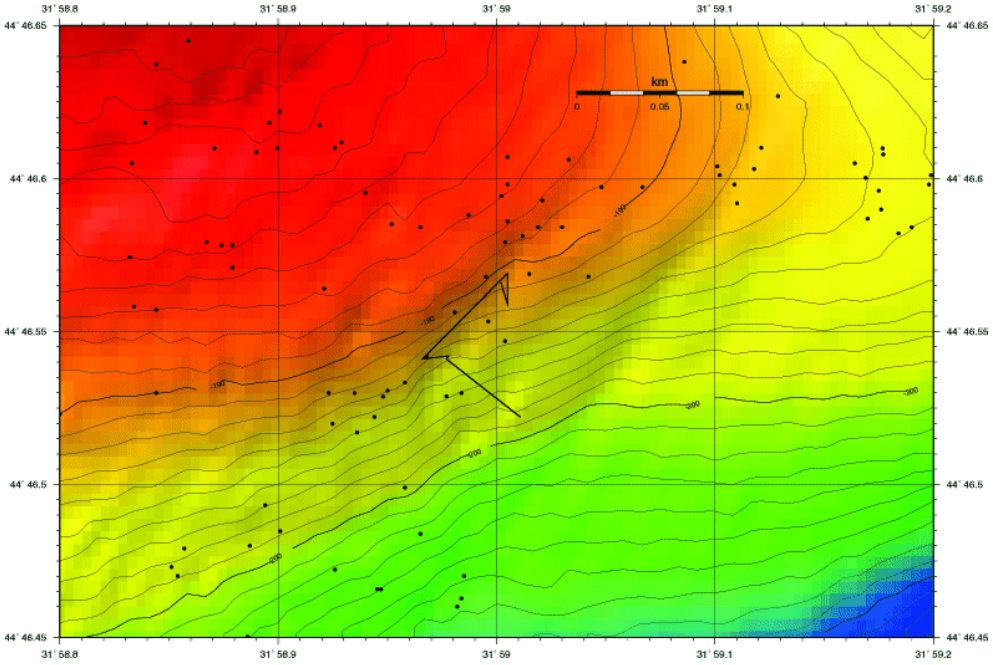
Dive track:

Attention: values for latitude should read: 44°46.xxx'

Pilot: Jürgen Schauer, Observer: Achim Mischker

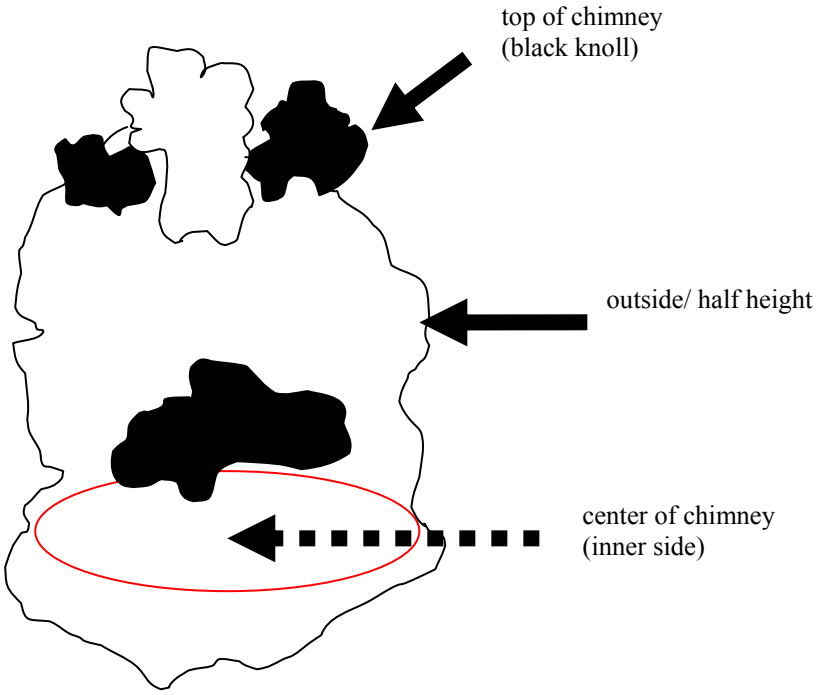
Time	Lat N44:50	Long E31:58	Latitude	Longitude	Depth (m)	Remarks
06:53						submerged
07:16	359	145	44:50.359	31:59.145	345	touch down at steep slope
07:21						moving upslope
07:25	346	140	44:50.346	31:59.140		
07:27	345	154	44:50.345	31:59.154	330	
07:30	357	175	44:50.357	31:59.175		
07:32	375	197	44:50.375	31:59.197		
07:36	399	221	44:50.399	31:59.221	324	
07:38	414	204	44:50.414	31:59.204		some holes in sediment with gas seapage
07:40	413	201	44:50.413	31:59.201		good hole with gas seapage for sampling
07:57	no positioning possible due to ship manoeuvring and steep slope					
08:15	"	"				took 4 pushcores at pos. 07:40
08:27			44:50.	31:59.		took gas sample at pos. 07:40, some more holes close by
08:33			44:50.	31:59.	326	holes in neighbourhood not active
08:35			44:50.	31:59.		more holes
08:37			44:50.	31:59.		
08:41			44:50.	31:59.	323	several holes with gas seapage
08:44			44:50.	31:59.		
08:50			44:50.	31:59.	325	2 holes in sediment with gas outlet, suitable for push coring
08:54			44:50.	31:59.		
09:02			44:50.	31:59.		
09:11			44:50.	31:59.		
09:14			44:50.	31:59.		took all pushcores
09:18			44:50.	31:59.		
09:22			44:50.	31:59.		
09:37						surfaced
Total min	164					

Report Dive 12 / 854, P822, Tina Treude



This dive goes back to the area of dive 9, P817 to take some detailed samples from a chimney.

12:10 start diving
12:22, 187 m, touchdown, heavy currents, carbonate shelves (for detailed description of this area see dive protocol of dive 9, P817), heading 310°, see figure DSCN7772
12:27, 187 m, small chimney with gas releases, see figure DSCN7774
12:28, 187 m, a lot of small chimneys (20-40 cm) side by side
12:30, 187 m, we found a nice chimney for taking samples (see figure DSCN778 to 7801) but it was impossible to push the needle into the trunk to suck the internal water of the chimney (too much carbonated). After the first trial of pushing in the needle, the chimney released a lot of gas permanently through the black knoll on the top. We made several pictures and movies of the structure.
12:51, 188 m, searching for another suitable chimney, heading 240°
13:01, 191 m, we found an appropriate chimney with regular gas releases and a black and a grey (carbonated) knoll on top (see figure DSCN7805 to 7807)
13:10, sucking internal water from the chimney (needle was pushed 20 cm into the middle of the chimney trunk, see figure DSCN7813 to 7826)
13:25, taking samples of the chimney from the top of chimney (black knoll), the outside/half height and the center (inner part) of the chimney (see picture DSCN7828 to 7833)



13:43 the chimney was sampled and broken apart. After this, a permanently stream of gas bubbles was released from the center of the chimney (see picture DSCN7838)
14:10, 193 m, searching for a suitable place to deploy a marker on a microbial mat in the sediment that might rise to a chimney in the future (for long-term observations). However, the current was so strong that it was impossible to hold against it.
14:12, little slope with soft bottom and clam shells.
14:19 end of dive, getting back to the surface

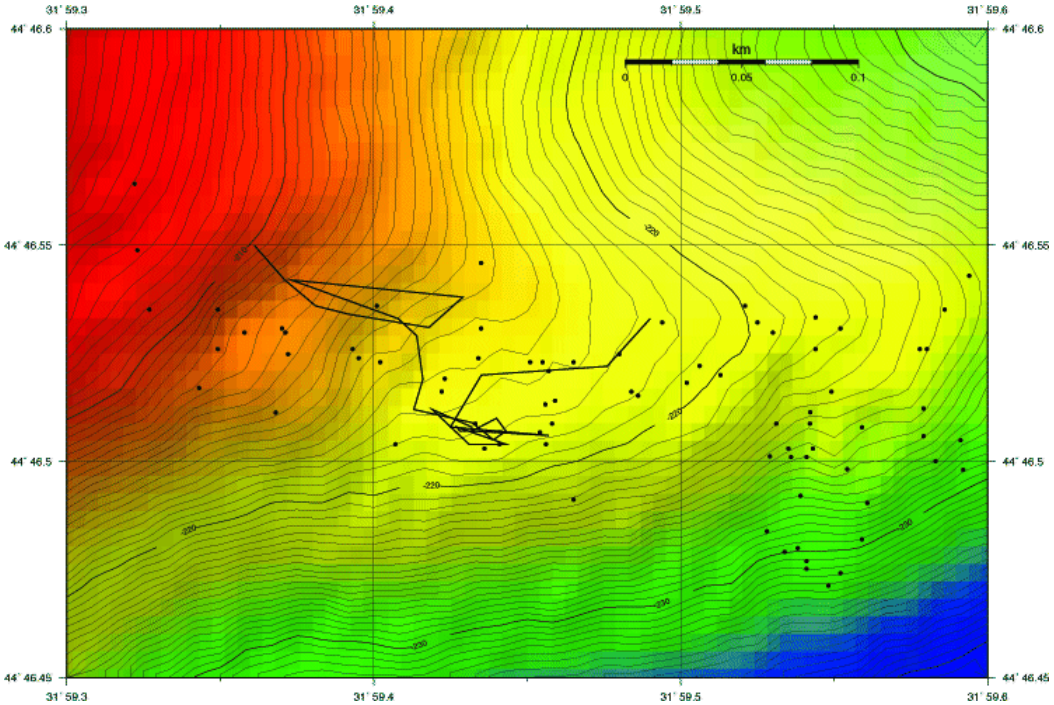
Dive track:

JAGO-Dive 854 (12) 9 Oct 2004, Carbonate Field west of GHOSTDABS Field, Ukraine

Pilot: Jürgen Schauer, Observer: Tina Treude

Time	Lat N 44:46.	Long E 31:	Latitude N	Longitude E	Depth (m)	Remarks
12:09						submerged
12:23	566	59.002	44:46.566	31:59.002	187	touch down at carbonate field, current from west
12:31	559	59.005	44:46.559	31:59.005	188	found good pillar-shaped structure for fluid sampling and microbial mats
12:40	569	59.005	44:46.569	31:59.005	188	stationary for sampling
12:50						sampling not successful, fluid sampler pipe did not penetrate through carbonate "skeleton" of pillar, start searching for new structure
13:03	541	58.966	44:46.541	31:58.966	191	found good pillar-shaped structure for fluid sampling and microbial mats
13:34	interference with other hydroacoustic signal, source deployed yesterday by Russian ship ?					
13:55	542	58.978	44:46.542	31:58.978	191	fluid sampling at pillar successful, collection of microbial mats from from three different parts of pillar, strong current, difficult to keep position
14:01	541	58.977	44:46.541	31:58.977		
14:09	527	59.002	44:46.527	31:59.002	195	still carbonate plates and local activities
14:15	522	59.011	44:46.522	31:59.011		strongly shifted by current
14:20						start ascent
14:29						surfaced
Total min	140					

JAGO dive no 13 / 855, P833,
Sunday 10.10.2004, 13:00: Bo Barker Jørgensen



Dive area ca. 170 m west of GHOSTDABS area, Position 44°46.56N, 031°59.44E,
218 m water depth, good visibility, small aggregates in bottom water, current mostly weak
Equipment: 4 push corers, 1 gas sampler

Target of dive was to survey a new area where multibeam showed strong flare that rose to at least 1400 m above seafloor. Most of the time was spent on video recording and photo in order to document the area. The video camera was recording during most of the transits between observation points. The timer of the video camera and of the digital camera will enable geographical correlation.

JAGO landed on the muddy sea floor in a rather flat area which is the same ridge on which the GHOSTDABS field is located. Upon a few tens of meters transit towards the east, small spherical carbonate structures were obs. on sediment. Next a few low chimneys were obs. and then many chimneys in a local field. Suggested name for this new area is the METROL field. The new area had a row of particularly large chimneys with heights of up to ca. 170 cm. There were also single chimneys and lower rounded carbonate structures. Most chimneys had several black spheres on top and sometimes also on the side.

From many/most chimneys there was a steady fine stream of bubbles rising. Several were recorded by video. Also on the mud surface we observed multiple buble streams. Some were recorded on video. They were at 1 m distance or more from the nearest chimney. The bubble emission may be quantified based on the size of the bubbles as video recorded together with the arm of JAGO. The field has some similarity to the GHOSTDABS field, but the chimneys are not as high and dense. The area has the advantage that access to the chimneys is good.

While observing three holes with bubble emission the instrument platform of JAGO incidentally cut into a low chimney and broke off the top. Two 15-20 cm large pieces were picked up and placed in the sampling box. These pieces are being dried and will be transported back to the MPI. No other samples were taken at the bottom.

During the slow ascent, a stream of bubbles was followed by JAGO. It was indeed possible to maintain position so that the bubble stream remained just in front of the window. At 50 m above seafloor the funnel was positioned in front of JAGO to collect the rising bubbles. Collection was continued to 70 m above seafloor. Then the gas volume was transferred to the gas bottle and succesfully brought to the surface. The size of the bubbles appeared to have become smaller at 70 m above than at the seafloor. funnel of JAGO

Dive track:
Attention: values for latitude should read: 44°46.xxx'

JAGO-Dive 855 (3) 10 Oct 2004, Big Flare west of GHOSTDABS Field, Ukraine

Pilot: Jürgen Schauer, Observer: Bo Jorgensen

Time	Lat N44:50	Long E31:59	Latitude	Longitude	Depth (m)	Remarks
12:52						submerged
13:06	550	361	44:50.550	31:59.361	209	touch down at soft bottom
13:09	542	371	44:50.542	31:59.371		
13:11	536	381	44:50.536	31:59.381		
13:12	534	392	44:50.534	31:59.392	212	
13:13	531	418	44:50.531	31:59.418		
13:15	538	429	44:50.538	31:59.429		
13:20	542	373	44:50.542	31:59.373		
13:24	533	408	44:50.533	31:59.408		
13:25	529	414	44:50.529	31:59.414	214	
13:26	519	416	44:50.519	31:59.416	215	small black microbial bulb on sediment
13:29	512	413	44:50.512	31:59.413		microbial bulb on sediment
13:30	no positioning possible due to interferring signal (mourings deployed by Russian Hydrographic Vessel ?), ship manoeuvrering					
13:31	"	"				pillar-like structures of 150 cm height with gas seapage
13:35	"	"				try to approach active field from other direction
13:38	"	"				on top of central field, lots of gas below JAGO
13:40	"	"				at the periphery of field, still some large structures
14:15	"	"				JAGO still stationary
14:52	"	"				JAGO still at main field
15:03	509	432	44:50.509	31:59.432		finally good signal, JAGO above main field
15:16	505	439	44:50.505	31:59.439		
15:19	507	443	44:50.507	31:59.443		
15:22	510	440	44:50.510	31:59.440		
15:30	507	432	44:50.507	31:59.432		at the periphery of central pillar field, in front of 4 holes in sediment with gas seapage central field ca. 20-30 pillars, largest 150-170 cm high, all with gas outlet, not as dense as in GHOSTDABS field, easier for manoeuvrering
15:32	507	428	44:50.507	31:59.428		signal now relative constant, close to Jens' SeepPos. 44.46.504, 31.59.441
15:35	508	427	44:50.508	31:59.427		
15:41	504	443	44:50.504	31:59.443		
15:51	504	431	44:50.504	31:59.431		
15:55	512	419	44:50.512	31:59.419		
16:00	508	432	44:50.508	31:59.432		
16:02	507	432	44:50.507	31:59.432		
16:13	506	457	44:50.506	31:59.457		
16:18	again bad positioning due to interferring signal (strong acoustic signal) and ship movements					
16:47	508	425	44:50.508	31:59.425		try to collect gas bubbles in a height of 100 m above the main field
17:00	520	435	44:50.520	31:59.435	176	following rising air bubbles, shifted by current to north
17:06			44:50.	31:59.	165	about 30 m drift away from main field
17:08	522	476	44:50.522	31:59.476	150	drifted towards east
17:13	533	490	44:50.533	31:59.490	136	could follow bubbles up to this depth, lost flare now, bubble size decreased start ascent
17:23						surfaced
Total min	271					