LEIBNIZ INSTITUTE FOR BALTIC SEA RESEARCH WARNEMÜNDE

RV Sonne
Cruise Report SO 196
SUMSUN 2008

Suva – Guam – Okinawa Trough – Manila

February 19 - March 26, 2008

edited by

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with contributions of the cruise participants

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1. Introduction

1.1 SUMSUN Objective

In the frame of the agreement of Kyoto and beyond, the directives of emission trading promoted by the EU, as well as the research of deposition/dumping of CO_2 especially supported by the U.S.A and Japan, the discharge of CO_2 into the ocean is considered as a possibility to reduce CO_2 emission into the atmosphere. The injection of liquid CO_2 in midwater or at the seafloor, which are the major scenarios discussed in the IPCC 2005 special report on CCS for marine carbon storage, became less likely due to the increasing awareness of ocean acidification. At the same time, it has been promoted that storage in deep marine sediments might be the safest option for carbon storage, as density gradients favour migration into the sediment and the potential to form CO_2 hydrates acts as an additional barrier for re-entering of the CO_2 into the ocean/atmosphere system.

The expedition 196 of RV SONNE is the central field campaign of the Project SUMSUN ("StUdien zur Marinen CO_2-Sequestrierung durch Untersuchung natürlicher hydrothermaler CO_2-Austritte im Nördlichen Westpazifik". The project aims to investigate some of the few known hydrothermal locations where liquid CO_2 is stored in the upper sediment or is escaping from the seafloor in forms of droplets with CO_2 as the main component. Though the geological and hydrothermal framework resulting in the separation of a CO_2-dominated volatile phase is an interesting topic on its own, this is not in the main focus of the project. SUMSUN aims to investigate the interaction of liquid CO_2 with the seafloor and the water column and potential impact on seafloor geochemistry and biology. The rationale is to characterize a natural analogue for proposed scenarios of CO_2 deposition in the ocean.

Three of the four locations known today where liquid CO_2 generated by hydrothermal activity interacts with the seafloor and/or emanates into the water column, are located in the Okinawa Trough. The processes in the vicinity of CO_2 injection in case of direct injection or leakage from subsedimentary storage are poorly defined, mainly because of the complex phase relations between liquid CO_2, sea water, and CO_2 hydrate. The ascent of liquid CO_2 drops is also subject to ensemble relations which are not reproducible in the laboratory. The effects of increased CO_2 concentration on marine organisms are poorly investigated, in particular thresholds and adaption ability on longer timescales. Geochemical interactions are crucial because of the pH^- and pCO_2-sensitivity of a variety of important diagenetic reactions. The overarching objective of SO196 is thus to investigate the CO_2-rich vent sites in the Okinawa Trough to get insights and draw conclusions for the potential effects involved in the purposeful storage of CO_2 at the seafloor.

1.2 Scientific Program of SO196

1.2.1 SO196 Leg 1

Leg 1 of expedition 196 of RV SONNE from February 19th to February 28th, 2008 was a transit from Fiji to Guam without additional scientific purpose. For logistical reasons, it was necessary to embarque the ROV system in Suva and to use the transit for set up and maintenance of the system.

1.2.2 SO196 Leg 2

Leg 2, from March 2nd to 26th, with a total of 15 days for stationwork, had the purpose to investigate the processes resulting from the occurrence of liquid CO_2 in hydrothermal systems of the Okinawa Trough. From the three known fields where such occurrences had been reported and research permission had been granted, only two were visited due to logistical reasons. Work included:

- Investigation of the dispersion propagation of the hydrothermal plume and of the fate of CO_2 from droplet emission in the far field by CTD/water sampling program, with special emphasis on the sampling for DIC/Alk to describe changes in the CO_2-system, and He isotopes (the latter is co-emitted with the CO_2 enriched phases) including use of newly developed sensors
- Investigation of the propagation, rise velocity, and dissolution behavior of CO_2 droplets by video analysis
- Investigation of the pristine gas composition at the CO_2-vents
- Test of the potential to use Parasound for the detection of liquid CO_2 in the water column and in shallow sediments
- Investigation of alterations in the geochemistry of sediments affected by highly CO_2 -enriched pore fluids and liquid CO_2
- Measurement of in situ geochemical gradients in - and in situ fluxes at - CO_2-enriched sediments
- Quantitative assessment of the biological communities developing at sedimentary-hosted CO_2 vents, including micro-, meio-, and macrofauna.

2. Participants

Scientists SO196-1

No.	Name	Given Name	Institution
1	KLAR	STEFFEN	MARUM
2	MAI	HOANG ANH	MARUM
3	RATMEYER	VOLKER	MARUM
4	SCHNEIDER VON DEIMLING	JENS	IOW
5	SEITER	CHRISTIAN	MARUM

Crew SO196-1

No.	Name	Given Name	Rank
1	MEYER	OLIVER	Master
2	KORTE	DETLEF	Chief Officer
3	GÖBEL	JENS	2. Officer
4	BRIESEMEISTER	BJÖRN	2. Officer
5	RAABE	KONRAD	DOC
6	ANGERMANN	RUDOLF	Ch. El. Engineer
7	PREGLER	HERMANN	Syst-Manager
8	EHMER	ANDREAS	Syst-Manager
9	LINDHORST	NORMAN	Chief Engineer
10	REX	ANDREAS	2nd Eng.
11	SCHMIDTGEN	PAUL-LUCAS	OEW
12	ZEBROWSKI	DARIUSZ	Electrician
13	BLOHM	VOLKER	Fitter
14	ZEITZ	HOLGER	Motorman
15	JAHNKE	FRANK	Motormann
16	TIEMANN	FRANK	Chief Cook
17	BORECKI	WIKTOR	2. Cook
18	GRÜBE	GERLINDE	1. Steward
19	POHL	ANDREAS	2.Stwd.
20	MUCKE	PETER	Boatswain
21	KRAFT	JÜRGEN	A.B.
22	FRICKE	INGO	A.B.
23	SCHNUR	HENNING	A.B.
24	JESCHENIAK	STEFFEN	A.B.
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26	BARKOW	MICHAEL	A.B.

Scientists SO196-2

No.	Name	Given Name	Istitution
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2	DE BEER	DIRK	MPI
3	BEIER	VIOLA	MPI
4	DEHNING	KLAUS	MPI
5	DOMEYER	BETTINA	IFM-GEOMAR
6	FRANKE	PHILLIP	MARUM
7	GAUGER	STEFFEN	FIELAX
8	HAECKEL	MATTHIAS	IFM-GEOMAR
9	HOLSTE	THERESA	UNI-BREMEN
10	INAGAKI	FUMIO	JAMSTEC
11	KOEHLER	JANNA	UNI-BREMEN
12	LAGE	SUSANNE	IOW
13	MERTENS	CHRISTIAN	UNI-BREMEN
14	NAKAMURA	KO-ICHI	AIST
15	NASS	KRISTIN	IFM-GEOMAR
16	NORDHAUSEN	AXEL	MPI
17	REHAGE	RALF	MARUM
18	REHDER	GREGOR	IOW
19	MAI	HOANG ANH	MARUM
20	THOMAS	STINE	IOW
21	WIGAND	CÄCILIA	MPI
22	YANAGAWA	KATSUNORI	JAMSTEC
23	ZARROUK	MARCEL	MARUM
24	KLAR	STEFFEN	MARUM
25	RATMEYER	VOLKER	MARUM
26	SCHNEIDER VON DEIMLING	JENS	IOW
27	SEITER	CHRISTIAN	MARUM

Crew SO196-2

No.	Name	Given Name	Rank
1	MEYER	OLIVER	Master
2	KORTE	DETLEF	Chief Officer
3	GÖBEL	JENS	2. Officer
4	BRIESEMEISTER	BJÖRN	2. Officer
5	RAABE	KONRAD	DOC
6	ANGERMANN	RUDOLF	Ch. El. Engineer
7	PREGLER	HERMANN	Syst-Manager
8	EHMER	ANDREAS	Syst-Manager
9	LINDHORST	NORMAN	Chief Engineer
10	REX	ANDREAS	2nd Eng.
11	KLINDER	KLAUS	2. Eng
12	ZEBROWSKI	DARIUSZ	Electician
13	BLOHM	VOLKER	Fitter
14	ROSEMEYER	RAINER	Decksschlosser
15	ZEITZ	HOLGER	Motorman
16	JAHNKE	FRANK	Motormann
17	TIEMANN	FRANK	Chief Cook
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24	JESCHENIAK	STEFFEN	A.B.
25	BIERSTEDT	TORSTEN	A.B.
26	BARKOW	MICHAEL	A.B.
27	GLOBKE	VALERIE	Azubi
28	BARRIO DE MENDOZA	NICOLE	Azubi

Participating Organizations

- AIST National Institute of Advanced Science and Technology Tsukuba, Japan
- IFM-GEOMAR Leibniz-Institut für Meereswissenschaften an der Universität Kiel, Germany
- IOW Leibniz-Institut für Ostseeforschung Warnemünde an der Universität Rostock, Germany
- JAMSTEC Japan Marine Science and Technology Center, Japan
- MPI-Bremen Max Planck Institut für Marine Mikrobiologie, Germany
- RCOM Research Center Ocean Margins, Bremen, Germany
- UB University of Bremen, Department of Environmental Physics, Germany
- UTokyo University of Tokyo, Japan

3. Background

(K.-i. Nakamura, G. Rehder, F. Inagaki)

3.1 Geological Background

The study area is located in the Okinawa Trough, which is the backarc basin of the Ryukyu Island Arc, ranging from the southern end of Kyushu Island in the north to the northeast corner of Taiwan in the south. The Okinawa Trough has no spreading oceanic crust, although the last rifting episode began in the latest Pliocene. The information on the underlain crust composition and stratigraphy is very limited because of the truncation of seismic horizons by normal faults does not allow the tracing of time lines (seismic horizons) from the wells in the East China Sea.

However it can be assumed that the continental stratigraphy observed in the East China Sea and Taiwan Straight is in part continuing at least in the southern portion of the Okinawa Trough.

Subaerial volcanism in the Ryukyu Island Arc ends at Torishima Island north of Okinawa Island, but many submarine volcanic features continue towards the southwestern end of the Pacific side of the Okinawa Trough, evident by submarine topography as well as by aeromagnetic data. Submarine volcanic activity is also observed in the middle of the Okinawa Trough where rifting dominates.

3.2 Liquid CO_2-hosting hydrothermal sites

The occurrence of liquid CO_2 in a natural marine setting has been firstly observed in the Jade hydrothermal field, Okinawa Trough (Sakai et al., 1990). The authors describe liquid CO_2 emanating in form of droplets, as well as stored under a layer of sediments. Upon penetration, the liquid CO_2 escaped from the seabed, forming tube-shaped structures, stabilized by instantenous formation of gas hydrates. Unfortunately, the site could not be revisited for over a decade due to the installation of permanent fishery gear. The occurrence of liquid CO_2 has been reported at least from two other locations in the Okinawa Trough, the Yonaguni Knoll IV area and the Hatoma Knoll area (see below). In 2004, the emission of liquid CO_2 has been reported for the NW Eifuku hydrothermal field in the Mariana Arc system (Lupton, 2006), a submarine volcano in approximately 1600 m water depth. Thus, all sites of liquid CO_2 occurrence known so far are located in backarc systems at water depths between ~ 1200 and 1700 m.

3.2.1. Yonaguni Knoll IV hydrothermal site

The first marine geological research at this hydrothermal field was done by R/V L'Atalante under French/Taiwanese collaboration in 1996 followed by Taiwanese 38kHz echo-sounding survey in 1998, which discovered five locations of potential hydrothermal emission in the southwestern end of the Okinawa Trough. Based on the data accumulated, the manned submersible "Shinkai 6500" dive 560 discovered the hydrothermal site on July 26^{th,} 2000. Subsequent research cruises using manned submersible or ROV-technology were planned almost once a year, covering a variety of subjects including geology, chemistry, and macro-/microbiology.

Yonaguni Knolls are a complex of submarine volcanoes located in the southwestern end of Okinawa Trough, where arc volcanoes and backarc volcanoes are indistinguishable in the tectonic framework. The hydrothermal site is located in the foot of Yonaguni Knoll no. IV where a valley-like, partly sedimented area is surrounded by rocky slopes. The different hydrothermal chimneys are located roughly on a line in SE-NW direction.

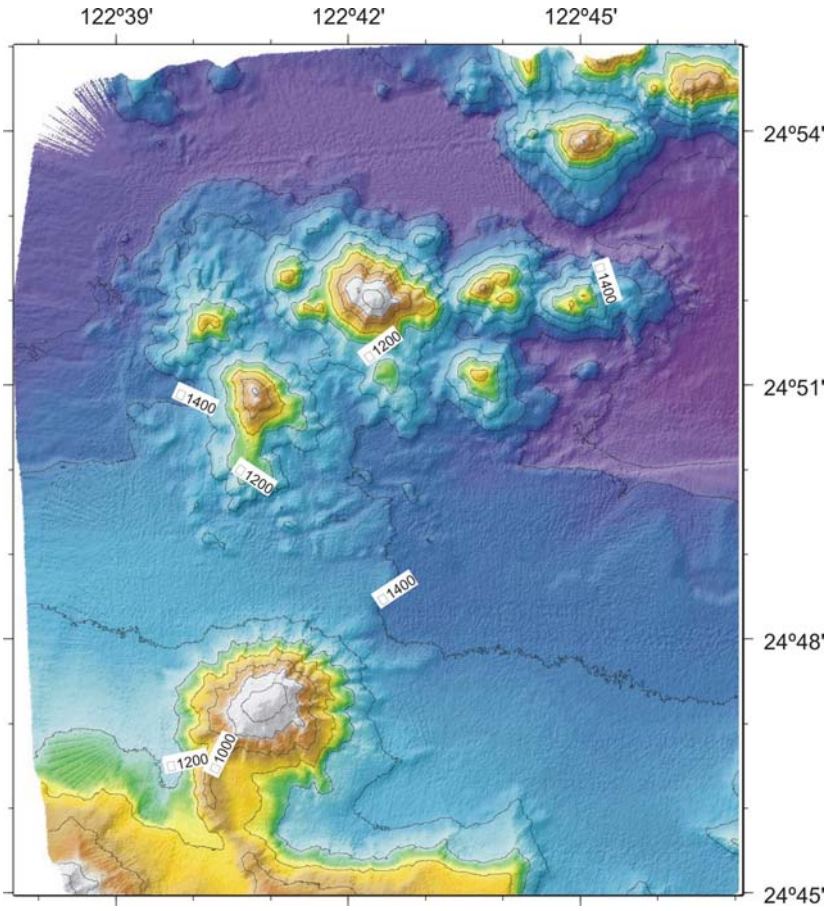

Fig. 3.1: Larger view of the working area Yonaguni Knoll IV. The map shows the entire field for which research permission had been granted

3.2.2. Hatoma Knoll

In the middle of '90s the Hydrographic Office of Japan conducted swath bathymetry surveys in the area and found volcanic features. One of the aims of the project was to specify the location of the submarine eruption that happened in 1924 somewhere north of Iriomote Island. Dr. Kazuki Watanabe at the Hydrographic Office started the project to investigate submarine volcanic features in the area by manned submersibles in 1996. In May of 1999, he discovered the hydrothermal site in the summit caldera of the Hatoma Knoll during dive 1102 of the manned submersible "Shinkai 2000". The subsequent cruises were planned almost every year using manned submersible or ROV.

Hatoma Knoll is one of the largest knolls in the knoll complex north of Iriomote Island. Its location is in the continuation of arc volcanoes from the northeast. The hydrothermal sites are located in the central cone of the summit caldera and at the foot of the northeastern caldera wall at depths of about 1400m-1500m. While the activity appears to be highest on some massive,doming structures in the center of the caldera, liquid CO_2 emission has also been documented from less intensively venting areas closer to the rim of the caldera.

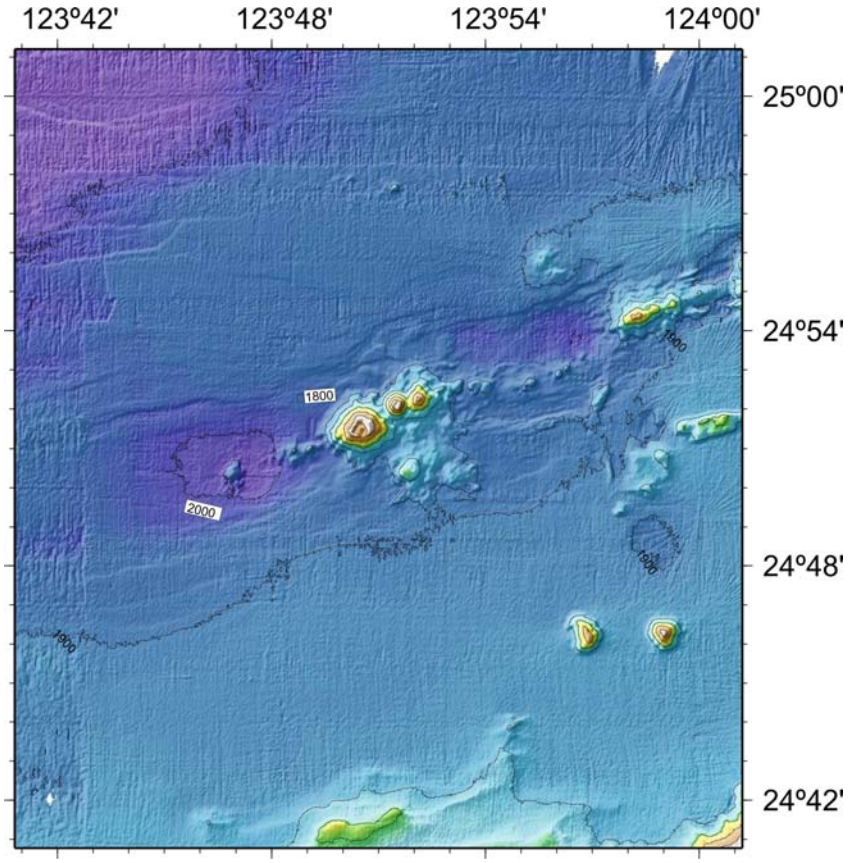

Fig. 3.2: Larger view of the working area Hatoma Knoll. The map shows the entire field for which research permission had been granted

4. Cruise Narrative

(G. Rehder)

February 15th to March 2nd

During the port call in Suva, Fiji, from February15th to 19th, the four ROV containers of MARUM Bremen were loaded, the winch was installed, and final modifications to fit the Quest 4000 ROV-system on RV SONNE requiring port assistance were accomplished. The following transit from Fiji to Guam was used for maintenance and further installation of the ROV. The scientific crew consisted of 4 members of the ROV team and Jens Schneider von Deimling as chief scientist in charge. Because of decent conditions during the transit, it was possible to compensate the one day delay during the port call in Suva, and the ship reached Guam on February 28th, after 2811 nautical miles with an average speed of 12.8 kn. After embarking 22 additional members of the scientific party on February 29th, the following 36 hours in port were used to unload 4 containers with scientific equipment and to install the scientific equipment on deck and in the labs.

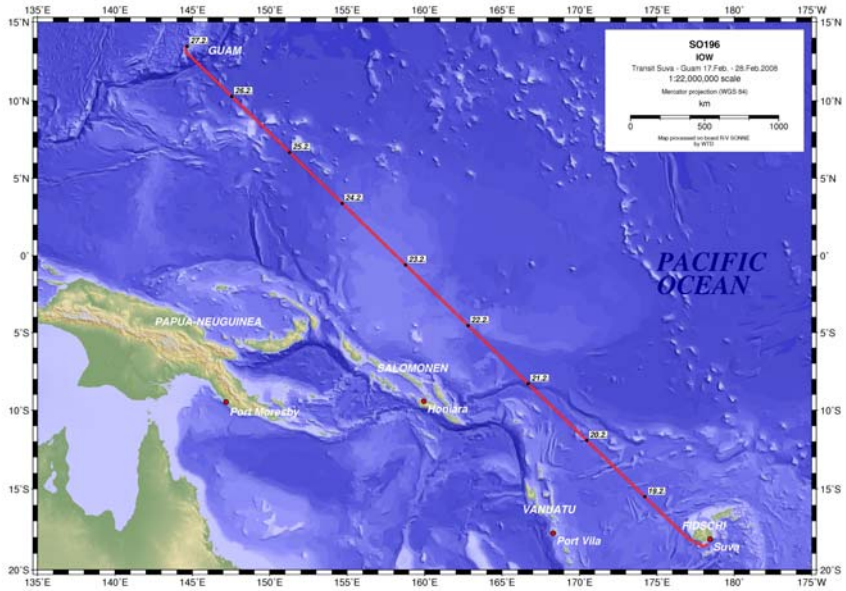

Fig. 4.1: Cruise track of SO196-1 with the transit from Suva, Fiji, to Guam. Positions at 0h UTC are indicated

RV SONNE left port at 8 a.m. on March 2nd heading towards the first working area in the Okinawa Trough, the Yonaguni Knoll IV hydrothermal field, where the occurrence of liquid CO_2 emanating from the seafloor had been recently reported. With 27 members, the scientific crew matched the maximum number of scientists that can be hosted on the vessel. In addition to the German members from the Leibniz Institute for Baltic Sea Research Warnemünde (IOW), the Max Planck Institute for Marine Microbiology in Bremen (MPI-Bremen), the Leibniz Institute for Marine Sciences in Kiel (IFM-GEOMAR), the Institute for Environmental Physics in Bremen (UB), and the Research Center for Ocean Margins Bremen (*rcom*), three scientists from the Japanese science community, the Marine Science and Technology Center (JAMSTEC), the National Institute of Advanced Science and Technology (AIST), and the University of Tokyo completed the scientific party. Two of the Japanese colleagues have comprehensive field work experience in the working area, which was of immense value for the planning and execution of the science program.

March 2nd to March 10th

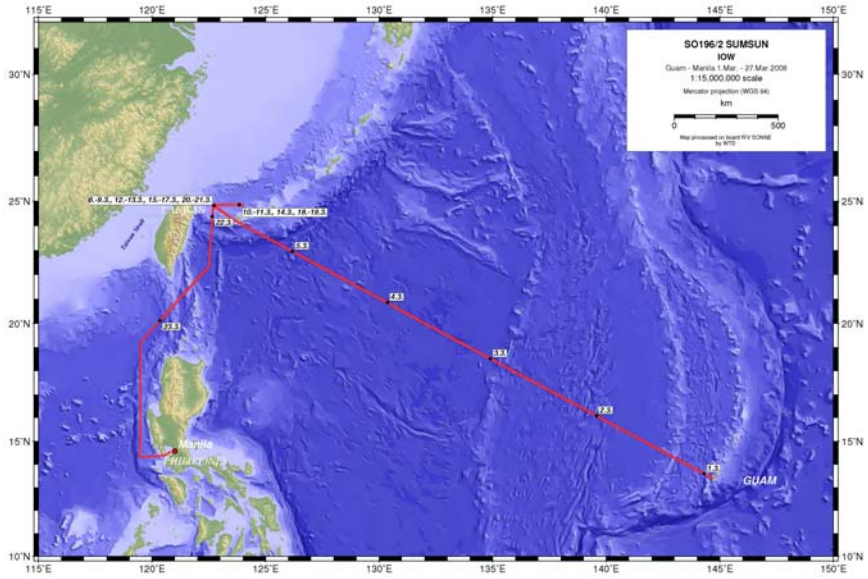

Fig. 4.2: Cruise track of SO196-2 with the transit from Guam to the working areas and further to Manila. Positions at 0h UTC are indicated

With an average cruise speed of nearly 13 kn, the Yonaguni Knoll IV working area was reached at 2 a.m. on March 7th. Yonaguni Knoll IV is an active hydrothermal field, which is well pre-investigated by several field campaigns of the Japanese marine science community. Of particular interest for the expedition is the reported emission of liquid CO_2 from some of these vents, as well as the occurrence of liquid CO_2 underneath a thin surface layer enriched in sulfur compounds, including elementary sulfur.

The scientific program was opened with a CTD cast, allowing amongst other tasks to get the sound velocity profile in the area needed for the acoustic systems as well as the new subpositioning system Posidonia. The new Posidonia-installation on Sonne was then calibrated by deployment of a transponder and by running the required calibration loops. The following test showed excellent results, which could be confirmed during the subsequent first dives with the ROV. With this, ship-owned Posidonia systems are now available on all 4 large German research vessels and allow use of a single, high quality subpositioning system.

The following first dive (Dive 197) of ROV Quest began with a couple of hours delay, as it became obvious that the wire guiding for the deployment of the Quest 4000 had to be reconfigurated, which was successfully achieved, owed to skillful work of the ships crew and the ROV team. In the early afternoon of March 7th, the first dive of ROV Quest on RV SONNE was ready to be launched. It immediately became clear that launch and recovery was a difficult task in this working area, which is located in the main axis of the Kuroshio boundary current, with current velocities of up to 3 kn at that time. Nevertheless, we were able to investigate the Moskito chimney, a vent system with fluid temperatures of more than 250°C, and to use some of the sensor packages, developed for the purpose of the cruise, for the first time. Also, the first picture with the new high resolution still camera was taken. The online temperature measurements with the high temperature probe of the GPI in Kiel worked flawlessly. The

navigation precision of < 10 m with the new Posidonia system exceeded expectations, in particular as it also became clear that the positions agreed extremely well with those reported by the Japanese pre-investigations, a fact that facilitated the work during the entire remaining cruise. In the night, the water column along a section in N-S direction across -and extending- the vent field was sampled with a total of 5 CTD/rosette casts, during which samples for He-isotopes and shorebased analysis of the carbonate system were also collected.

In the morning of March 8th, the ROV was launched for the 2nd time (Dive 198). Unfortunately, the ship had to drift with the currents for more than 600 m during the launching procedure because of the strong surface currents, so that the first four hours after bottom sight were needed to re-position the ROV back into the working area. In the following, Swallow Chimney was investigated, a cold structure with active venting of a liquid, CO_2 dominated phase. During the investigations, we observed accumulation and hydrate formation of the droplets on an overhanging part of the chimney. In situ pH- and pCO_2 measurements were performed and some bottom-near water samples were taken with the new KIPS II fluid sampler system. Further reconnaissance of the area, crossing most likely carbonate-paved sediments, lead to a site with soft sediments, where a temperature gradient of 15°C in the upper 40 cm was detected online using the 8-thermistor temperature probe kindly provided by the University of Bremen. Unfortunately, Dive 198 had to be finalized by that time due to fast changing weather conditions.

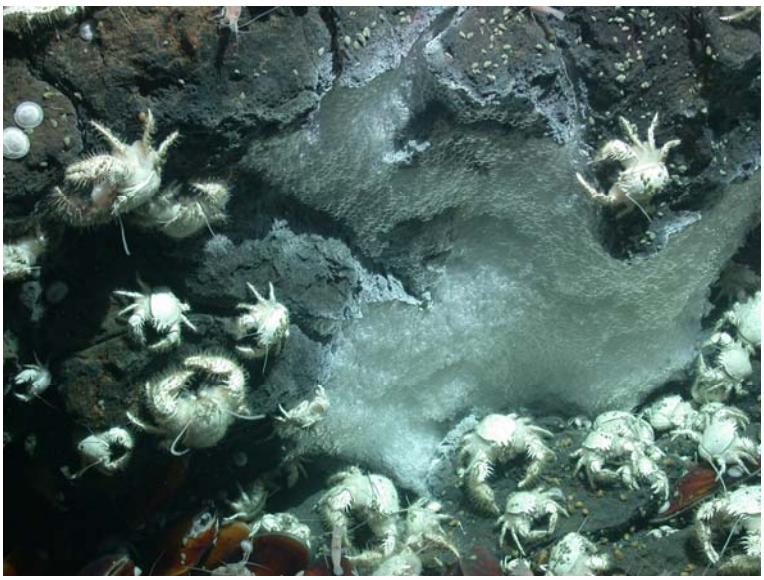

Fig. 4.3: Accumulation of liquid CO_2 forming a stryroform-like hydrate at a CO_2 vent, and vent-specific marcofauna in immediate vicinity of the vent site

The night was used for a detailed Parasound investigation of the working area, and first interpretation suggested that the detection of liquid CO_2 is feasable in the form of enhanced backscatter signals in both, water column and subseafloor. Weather conditions on March 9th did not allow ROV deployment. During the entire day, the TV-MUC was deployed to recover enough sediment from the active area for biological and geochemical investigations. Though the endeavor was difficult due to the strong prevailing currents, the nature of the sediments and the small size of the target area, it was successfully ended in the morning of March 10th, bringing gassy sediments and almost pure gas samples into the lab for the first time during the cruise.

March 10th to March 17th

After additional CTD casts, a calibration check of the Posidonia system and the recovery of the Posidonia transponder, it became clear in the morning of March 10th that the wind- and weather conditions would not allow the use of the ROV in the Yonaguni Knoll IV working area during the next days. The day was used for additional CTD casts to extend the data set of water column properties and enrichment of He and CO_2, as well as additional deployments of the TV-MUC. The latter was not only used to gain additional CO_2-enriched sediments, but the excellent video signal also allowed getting more insight into the broader picture of the geological structures and sedimentary deposits in the working area – an important documentation for future ROV dive planning. In the night, the ship steamed to the working area Hatoma Knoll, about 60 nm to the east of the Yonaguni Knoll IV area, to launch the ROV for the first time in this working area in the early morning.

Hatoma Knoll is another hydrothermal field already well documented by the Japanese colleagues. The active vents lie within a caldera; several hydrothermal structures are elevated relative to the seafloor inside of the structure. At least on three of these locations, the venting of condensed CO_2 escaping into the water column has been reported from investigations of Japanese science programs using ROV Hyperdolphin and submersible Shinkai. Unfortunately, it became clear that the sediments in the two small sediment-filled basins inside of the caldera contain solid precipitates, which impedes coring and the investigation of impact of the CO_2-enriched fluids on sediment geochemistry and biology.

Fortunately, the ROV could be deployed at this location even during northerly winds, as the problematic interaction of wind, swell and currents are less critical here. As a consequence, the strategy for the rest of the cruise was to split the station time in the two working areas in a way that during easterly and southeasterly winds, work was predominantly performed in the Yonaguni Knoll IV area. In this situation, current and wind set in the same direction, which impedes the steepening and frequency increase of the swell. During the usually prevailing winds with a northerly component, the working program in the Hatoma Knoll area was executed. A concentration of the working program in the Hatoma Knoll area was not possible, as the scientific questions related to sediment- CO_2 interaction could not be pursued in this area due to the lack of soft sediments.

The first two dives (dives 199 and 200) at Hatoma Knoll on March 11th and 12th were used for reconnaissance of the area, a first investigation of the sediments, characterization of the CO_2-emitting sites, and video-documentation of the rising droplets. First attempts to monitor the ascent of the rising droplets by following them with a monitoring box with backlight illumination hold by the ROV failed. However, this experiment – difficult to execute- was the appropriate end of the 200th dive of ROV Quest, which was celebrated after the dive. During another dive at Hatoma Knoll during this week (Dive 202, March 15th) it was possible to sample the condensed gases at four different gas emitting locations into gas tight samplers, and to determine the gas composition. Another highlight was the video documentation of a phase separation of the gas

collected above one of the gas emitting sites, which suggested a de-mixing of the gases as a result of cooling/depressurization.

During the two ROV dives in the Yonaguni Knoll IV area (Dives 201 and 203) executed during this week, it was achieved for the first time to measure the gradients of a variety of geochemical parameters within such extremely CO_2-enriched sediments by deploying the *in situ* profiler of MPI-Bremen. Additionally, the direct measurement of fluxes across the sediment surface was also successfully performed for the first time using the benthic flux chamber. By an intensive push coring program, complemented by additional stations with the TV-MUC, it was possible to determine the geochemical field as well as the changes in micro-, meio-, and macrofauna on at least one of the active locations. Very unusual measurements of the pCO_2-sensitive silicate concentrations in MUC- and gravity cores, as well as investigations of the large-field impact of the CO_2emissions on the water column, completed the flood of data gathered during this week.

March 18th to 26th

This week showed how close success and failure in marine field research lie to each other. After the successful ROV program until dive 203, a severe malfunction of the Orion 7-function arm occurred. During the following days, while it was attempted to fix the problem, the remaining necessary work of the sediment sampling program by conventional MUC/gravity coring and the sampling of the water column in the Yonaguni Knoll IV area was finalized. Based on the excellent understanding of the spatial distribution of carbon dioxide enriched sediment and areas not allowing sediment sampling gained during the dives and multi-corer surveys, it was possible to complete the sampling work on the distribution of micro-, meio-, and macrofauna. With this, it was possible to comprehensively sample and document the differences in sediment fauna between a highly CO_2-enriched system and a reference site. The successful gravity coring enhanced the understanding of the interaction of the warm CO_2-enriched fluids with the sediments down to greater depths. Mapping of the hydrothermal plume during the CTD-program, now with pH-, Eh- and backscatter sensors added, showed clear indication for at least one hitherto unknown hydrothermal vent in the northeast of the Yonaguni Knoll IV working area.

In the night from March 18th to 19th, the ship was transferred to the Hatoma Knoll area again, as the weather forecast clearly indicated that the next ROV dive mission could only take place in this area. During the next day and following night, a 24 h CTD program was fulfilled with 12 stations, which made it possible to get a high resolution grid monitoring the influence of the CO_2-rich hydrothermal system at Hatoma Knoll on the water column. First data indicated that the nearly closed structure of the caldera of Hatoma Knoll lead to strong chemical signals. Additionally, it could be shown that the “outflux” of the structure mainly occurs through a depression in the caldera wall in the south of the structure.

The 20th of March with the dive missions 204 and 205 was again a day with strong scientific and emotional ups and downs. During the launch of dive 204, the “bubble box”, a tool for monitoring the ascent of gas bubbles and droplets with a back-light diode illumination unit, was lost, though

secured by the Riggmaster arm and well fixed to the porch of the ROV. A loss not only due to the financial value of the instrument, but also because the instrument was needed for an essential part of the scientific dive mission. So it was a great relief that the instrument was found immediately after bottom sight by the ROV, clearly visible in about 100 m distance at the seafloor because of the still functioning illumination. The successful recovery of the instrument was however embittered by the fact that the repair of the Orion arm was not successful. After short discussion about the situation, it was decided to recover the ROV and execute a second dive on the same day. This dive was dedicated to monitoring of the size distribution and movement of CO_2 droplets and found its culmination in the successful monitoring of the ascent of single CO_2 droplets with the monitoring box for up to 150 m. These experiments will – after video analysis, allow quantification of the dissolution kinetics. Despite this success, we were confronted with the fact that for the remaining days, the Orion arm essential for all of our sampling systems would not be available any more.

After return under more favorable weather conditions to the Yonaguni Knoll IV area and another gravity core, ROV dive 206 was launched, now adopted to the restricted capabilities of our most important work tool. With the help of several adaptations, it was possible to deploy and relocate the benthic chamber several times. The time intervals between relocation of the chamber were used for a quantitative video-mosaique of the active sediment-covered area, which is mostly devoid of free moving macrofauna, as well as of some of the less active areas with higher abundance of non-vent organisms. After the dive, a towed transect with the video-guided MUC was performed, with the profiler installed instead of the coring device. With this, it was possible to detect a variety of geochemical gradients along a transect which appear to be well correlated with the ROV video transect of the dive before. While some TV-MUC and gravity cores were gained to fill gaps in the existing data set, repair work on the ROV continued, because the ROV cable had suffered during the last recovery and the termination had to be renewed. Additional adaption of the system and the sampling devices at the same time took place to allow at least a restricted sampling program even without the Orion arm.

Despite all these efforts, dive 207 had to be ended shortly after launch because of a pressure-related complete blackout of the communication at 700 m water depth. Fortunately, it was possible to regain control over the instrument at shallower water depth, so that the rescue of the “dead” vehicle by the already prepared Zodiac became unnecessary. Due to upcoming strong winds, the ROV program had to be terminated. After the remaining 12 hours of station time were used to fill gaps in the coring and CTD data sets, the scientific program ended in the morning of March 23rd.

After 3 days of transit, RV SONNE went into port in the morning of March 26th. Though the entire day was lost for unloading due to problems with the port authorities, all equipment could be unloaded on the 27th, so that all members of the scientific party could take their scheduled flights in the late evening of March 27th.

5. Instrumentation

5.1 EM 120 Multibeam

To map the seafloor morphology the deep water multibeam sonar system *Kongsberg Simrad EM 120* was used. This system covers up to 150°, which results in a swath width of approximately 6 times the water depth perpendicular to the ship's long axis. Depending on survey conditions (sea state, weather), water depth and seafloor reflectivity the swath width needs to be reduced to approx. 120°. The acoustic signal generated by the hull mounted transducer has a main operational frequency of 12 kHz (frequencies in the range of 11.25 to 12.60 kHz are employed to code the different transmit sectors) and allows measurement up to full ocean depth. Based on the acoustic pulse 191 depth measurements with minimum beam width of 2°x2° and an accuracy of ~1% of the water depth were derived. In addition, the echo amplitude is converted to multibeam sidescan and angular backscatter data.

To correct the refraction of the sonar signal on its way through the water column sound velocity profiles were used, gathered with profiling CTD measurements. To assign the depth measurement to a geographic position, the GPS navigation of the *Ashtech MD-XII* GPS system and the ships heading of the gyro *Anschuetz STD4* was used. The ship's motion (pitch, roll, heave) was compensated by real-time access to the shipborn *Seatex MRU 5* motion sensor data.

Raw data files are created to fit survey profiles with a time interval of not more than 30 minutes. Every raw data file is described with meta data in XML (Extensible Markup Language) syntax following the *CSDGM* (Content Standard for Digital Geospatial Metadata) meta data standard, extended for bathymetric data. The bathymetry and navigation of every raw data file is shown in a preview image in *PNG* (Portable Network Format) format. Postprocessing and visualization was realized by means of *MBsystems*, *Fledermaus* and *GMT*.

5.2 Parasound

System description, settings and flare imaging adaption

To obtain high acoustic sub-bottom penetration and sufficient resolution the *PARASOUND* system utilizes the parametric effect. Therefore two similar frequencies, e.g. 18 and 22 kHz, are simultaneously transmitted to produce an additional, parametric frequency of 4 kHz (nonlinear effect, difference frequency). The parametric component holds the narrow beam and the short pulse characteristic of the primary frequency giving rise to high spatial resolution. Whereas penetration of the parametric signal resembles the one of a 4 kHz signal. Thus, resolution (vertical and horizontal) and penetration are improved compared to conventional systems.

The hull-mounted transducer array comprises 128 elements arranged within a 1 m by 2 m area. The system requires up to 70 kW of electric power due to the low degree of efficiency of the parametric effect. In the T/R electronic cabinets, transmit and receive beam forming, signal generation and the separation of the primary (18 kHz+-(2-5.5)) or 33 kHz+-(2-5.5) and

parametric frequency (2-5.5 kHz) is carried out. Since the two-way travel time in the deep sea is long compared to the length of the reception window of up to 266 ms, *PARASOUND* may send out a burst of pulses at 400 ms intervals, until the first echo returns. The coverage in this discontinuous mode is dependent on the water depth and also produces non-equidistant shot distances between bursts. After separation of the incoming parametric echoes, the corresponding signals are digitized using a *HP 3852 DAU* (Digital Analogue Unit) and visualized online via *PARASTORE*.

In most applications only the parametric signal is considered useful and the primary frequencies echoes are ignored. But, for bubble detection issues in the water column, the primary frequencies are better suited and, by courtesy of Volkhard Spiess (University Bremen), a second *DAU* could be brought on board to additionally record primary frequency signals digitally. Therefore, the analogue voltage receive channel of the high frequency (18 kHz or 33 kHz) was digitized. The signals were digitally downsampled to 7 kHz. Data storage was accomplished by the *PARADIGMA* software. Due to system specific settings the combined *PAR/NBS* mode must be used if the primary frequency storage is required, otherwise, the transmit trigger - inevitably for signal digitization - is not sent by the system.

The high amount of power needed for sufficient parametric signal generation requires the use of all array elements during transmit. Consequently the transmit-beam angle covers 4°. Wide angle beam forming could be realized through choosing pure NBS mode, but then, the transmit trigger is missing and data storage is not possible without further system adaptations.

To improve the *S/N*, the ship was operated in the most silent way to avoid noise, i.e. reduced speed and shutdown of pumps. Postprocessing comprises band-pass filtering around the parametric centre frequency and the digitally downsampled 7 kHz NBS signal, respectively. To account for the huge range in echo amplitude and to obtain maximum sensitivity in the online presentation, the gain was adapted manually to even resolve weak backscatter in the water column. For postprocessing of both, the *NBS* and the parametric data (ps3 format), we used the software *SENT*.

Prior to this cruise one of the T/R cabinets failed. But during the port call in Suva/Fiji this problem could be fixed and trouble-free operation was feasible during most of the time.

5.3 Subpositioning system Posidonia

To ascertain precise deployment of underwater gears and vehicles the acoustic underwater positioning system *Posidonia 6000*, manufactured by *IXSEA OCEANO SAS*, was used. With the help of an acoustic array the system is able to track the subsea position of a Posidonia pinger down to 6000 m water deep with an accuracy of 0.5 % of the range. The acoustic array is composed of two ultra short baselines and mounted in the moon pool. The general

measurement principle is based on a bi-directional exchange of acoustic signals. After the four hydrophones of the acoustic array have received the transponder signal, the processing unit detects the signal, measures the phases of the signals and the time between the interrogation and the reply. It calculates the relative position of the pinger to the antenna and the corresponding absolute geographical coordinate.

The required sound velocity information of the water column was provided by a profiling CTD measurement prior to the calibration. For precise positioning, the system needs realtime heading, roll and pitch information that was provided by the shipborn *Seatex MRU 5*. To correct constant attitude errors caused by the installation of the acoustic array, the system was calibrated on the 06.03.2008 near the working area at 24:49.60N 122:44.14E in approx. 1500 m water depth. A release transponder mooring was deployed and the ship performed an "8" figure trackline around the transponder. The results of the calibration, calculated with the Posidonia calibration software *POSICAL*, are shown in Fig. 5.1.

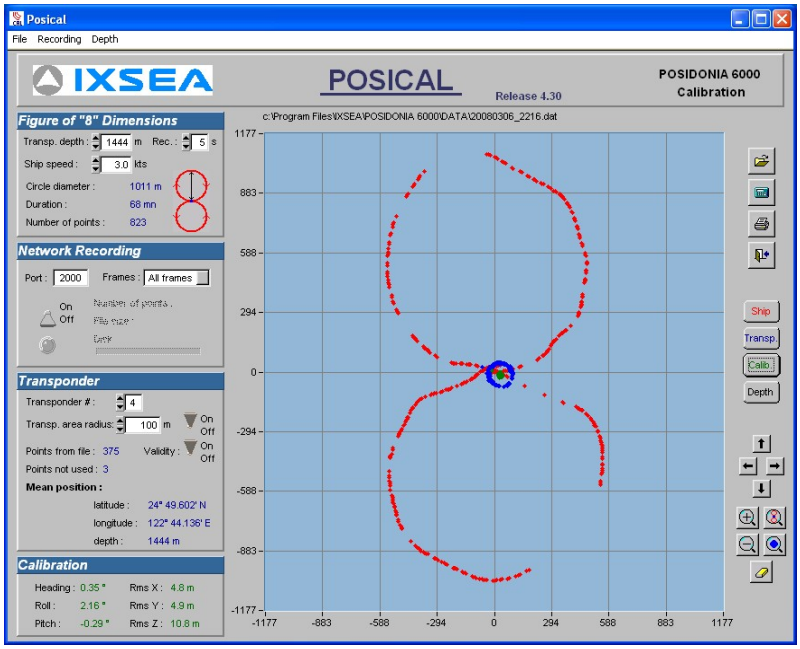

Fig. 5.1: Posidonia calibration track

The parameters of the first calibration were verified by a second trackline to get the following final angular offsets (Table 5.1)

Table 5.1: calibration coefficients derived from calibration survey

heading	+0.34 deg
pitch	-0.13 deg
roll	+2.11 deg

The calibration values (Table 5.1) were fed into the Posidonia system for all future applications. Although the system antenna was sometimes lifted up in the moon pool to allow sailing faster than 8 knots, re-calibration during SO196 was not necessary. Prior to this cruise the repositioning of the moonpool mounting was tested in a ships dock and shows only very little misalignment between the repeated lowering/lifting operations (pers. comm. Rudolf Angermann). Only in case of readjusting the fixation of the antenna and/or MRU would require a re-calibration of the system.
The validation of the subpositioning accuracy was feasible by comparing former marker positions set by previous JAMSTEC cruises and gave absolute accuracy better than 10 m.

5.4 ROV Quest

5.4.1 Technical description and performance

The deepwater ROV (remotely operated vehicle) “QUEST 4000m” used during SO196 aboard RV SONNE, is installed and operated at MARUM, Center for Marine Environmental Sciences at the University of Bremen, Germany. The QUEST ROV is based on a commercially available 4000 m rated deepwater robotic vehicle designed and built by Schilling Robotics, Davis, USA. Since installation at Marum in Mai 2003, it was designed as a truly mobile system specially adapted to the requirements of scientific work aboard marine research vessels for worldwide operation. At the end of SO196, QUEST has a total record of 207 dives performed during 18 expeditions.

QUEST was operated by a team of 8 pilots/technicians on a daily basis with a mean dive time of 12hrs. Close cooperation between ROV team and ships crew on deck and bridge allowed a quick gain of experience for the handling procedures during deployment and recovery. Since QUEST was installed for the first time aboard RV SONNE, the cruise was also a testbed for interfacing the ship and vehicle, and could prove even in difficult handling situations during heavy weather. During diving, close cooperation allowed secure handling on deck and precise positioning and navigation of both ship and ROV at depth, which was essential for accurate sampling and intervention work such as instrument deployment and recovery. The ROV team is very grateful for this kind of steady support from the entire ships crew during the cruise.

5.4.2 QUEST System description

The total QUEST system weighs about 45 tons (including the vehicle, control van, workshop van, electric winch, 5000-m umbilical, and transportation vans) and can be transported in four standard ISO 20-foot vans. Using a MacArtney Cormac electrically driven storage winch to manage the 5000m of 17.6 mm NSW umbilical, no additional hydraulic connections are necessary to host the handling system.

The QUEST uses a Doppler velocity log (DVL, 1200kHz) to perform Stationkeep, Displacement, and other auto control functions. The combination of 60-kW propulsion power with DVL -based

auto control functions provides exceptional positioning capabilities at depth. Designed and operated as a free-flying vehicle, QUEST system exerts such precise control over the electric propulsion system that the vehicle maintained relative positioning accuracy within decimeters. Although these data were not used for absolute navigation, they are an essential tool for vehicle control during flight and dynamic positioning on the seafloor, especially during situations with higher currents. Absolute GPS-based positioning is performed using the new shipboard IXSEA Posidonia USBL positioning system. Performance of the USBL system reached an absolute accuracy in the range of 5-10 m.

The QUEST SeaNet telemetry and power system provides a convenient way to interface all types of scientific equipment, with a current total capacity of 16 video channels and 60 RS-232 data channels. The SeaNet connector design allows easy interface to third-party equipment, particularly to prototype sensor and sampling devices, by combining power-, data-, video - distribution plus compensation fluid transport all through one single cable-connector setup. This ease of connection is especially important in scientific applications, where equipment suites and sensors must be quickly changed between dives. When devices are exchanged, existing cables can be kept in place, and are simply mapped to the new devices, which can consist of video, data, or power transmission equipment.

The QUEST control system provides transparent access to all RS-232 data and video channels. The scientific data system used at MARUM feeds all ROV- and ship-based science and logging channels into a commercial, adapted real-time database system (DAVIS-ROV). During operation, data and video including HD are distributed in realtime to minimize crowding in the control van. Using the existing ship’s communications network, sensor data can be distributed by the real-time database via TCP/IP from the control van into various client laboratories, regardless of the original raw-data format and hardware interface. This allows topside processing equipment to perform data interpretation and sensor control from any location on the host ship.

Additionally, the pilot’s eight-channel video display is distributed to client stations into the labs on the ship via simple CAT7 cable. This allows the simple setup of detailed, direct communication between the lab and the ROV control van. Thus, information from the pilot’s display is distributed to a large number of scientists. During scientific dives where observed phenomena are often unpredictable, having scientists witness a "virtual dive" from a laboratory rather than from a crowded control van allows an efficient combination of scientific observation and vehicle control.

Post-cruise data archival will be hosted by the information system PANGAEA at the World Data Center for Marine Environmental Sciences (WDC-MARE), which is operated on a long-term base by MARUM and the Alfred Wegener Institute for Polar and Marine Research, Bremerhaven (AWI).

As a new approach, two computers were setup in the science lab to improve the access to both the remote sidescan sonar control as well as extended planning and dive tracking using GIS. In accordance to GIS data preparation using ArcGIS by the science party, the IFREMER - developed software tool MIMOSA was successfully used to display and follow ROV and ship tracks upon GIS based map layers in realtime.

5.4.3 Scientific equipment suite

During SO196, the following scientific equipment suite was handled with QUEST. Table 5.2 additionally provides information about responsibilities, deployments and purpose of the respective external devices installed on QUEST.

ROV based tools, installed on vehicle:

- Realtime Sea and Sun CTD with turbidity sensor
- Pushcores, max. 8 (geochemistry)
- INSINC Pushcores (microbiology)
- Realtime 8 channel T-Lance (continuous sediment temperature measurements)
- Hi-Temp Lance with online datastream (fluid temperature measurements)
- KIPS II discrete 38 sample water probe (water and fluid chemistry)
- ROV drawbox basket (carbonate sampling)
- CO_2 Sensor (in-situ gas measurements)
- MPI handheld sensor (Microbiology and fluid chemistry)
- Handnets
- 4 Quantitative Gas Pressure Samplers
- In situ CO_2 phase transition experiment with T-Logger
- Simple markers

Table 5.2: Table listing of additional tools attached to the ROV

Tool	Person in charge	Purpose	Dive
Push corer	Boetius	Precise core sampling for geochemistry and microbiology	197, 199, 201, 203
Gas sampler	Rehder	Pressure preserving sampling of escaping CO_2 gas bubbles and/or fluid droplets	199, 200, 202
T-corer	Nakamura	Phase change behavior investigations of hydrate during rise through the water column	199, 200, 202
T-lance	Schneider v.D.	Measurement of surficial sediment temperature and gradients for later heat flux estimates	197, 198, 199, 201, 202, 203, 205
pCO_2 Contros	Schneider v.D.	Test of novel device for near surface pCO_2 concentration measurement of seawater	197, 202
Bubble box	Rehder	Constraining rise velocities, hydrate rim generation and dissolution processes of rising bubbles/droplets	200, 205
Microprofiler	de Beer	Seafloor-water interface profiling with respect to O_2, H_2S, pH and redox potential	201
KIPS II	Boetius	Sampling of bottom-near fluids into metal-free bottles	197, 198, 200, 201, 203, 205, 206
Insinc corer	Boetius	In situ incubation device to determine sulfate reduction rates in surface-near sediments	201, 203

5.4.4 Quest internal equipment and online tools

The space inside the QUEST 5 toolskid frame allows installation of mission-specific marine science tools and sensors. The initial vehicle setup includes two manipulators (7-function and 5-function), 7 color video cameras, a digital still camera (Insite SCORPIO, 3.3 Megapixel), a light suite (with various high-intensity discharge lights, HMI lights, lasers, and lowpower dimmable incandescent lights), a Sea&Sun online CTD, a tool skid with drawboxes, and an acoustic beacon finder. Total lighting power is almost 3 kW, total additional auxiliary power capacity is 8 kW. In addition, the permanently installed Kongsberg 675kHz Type 1071 forward looking Scanning Sonar head provided acoustic information of bottom morphology and was used for detection of gas emissions. Also, a Benthos 1600 type dual frequency sidescan sonar was permanently installed and was used during one dive for mapping of seafloor structures and detection of seep sites.

Continuous PAL video footage was recorded on MiniDV tapes with two colorzoom camera (Insite PEGASUS or DSPL Seacam 6500). In order to gain a fast overview of the dive without the need of watching hours of video, video is continuously frame-grabbed and digitized at 5sec intervals, covering both PAL and HD video material.

For extremely detailed video closeup filming, a near-bottom mounted broadcast quality (>1000 TVL) 3CCD HDTV 14 x Zoom video camera was used (Insite Zeus). Spatial Resolution of this camera is 2.2 MegaPixel at 59.94 Hz interlaced. Recording was performed on demand onto

tapes in broadcast-standard digital Sony HDCAM format, using uncompressed 1.5 Gbit HD-SDI transmission protocol. Image display takes place on an HD 46” TFT display screen inside the control van, providing excellent closeup view and covering the full dynamic range of the camera. Distribution of the camera`s HD-SDI signal was performed through capable coax cable into the science lab, for realtime display on a smaller 26” HD TFT screen.

Additionally, a custom built high definition still camera was used, based on a combination of a 70 mm Photosea optics and housing equipped with a Kodak ProBack Plus digital 16 MegaPixel Back. The system was used for the first time during two dives and provided outstanding image color depth and dynamic in combination with very high spatial resolution. Precise adjustment of focal length and object distances yet has to be improved, which unfortunately was not possible during the cruise due to time constraints and payload limitations.

As a standard still image camera, an Insite Scorpio Digital Still camera was used, providing standard 3.3. MegaPixel spatial image resolution. Both still cameras use the same 2 strobelights installed at the vehicles upper front porch.

5.5 Description of external tools for ROV

5.5.1 Handheld

The Handheld (Fig. 5.2) is a device based on the profiler electronics, and records continuously the signals from pH, redox, CO_2 and temperature microsensors. The device is maneuvered with the arm of the ROV towards areas of interest, and was typically used to measure the chemistry in water emanating seeps. It was deployed during almost all dives, except for the last one when the CO_2 sensor was broken. After initial difficulties, it proved to be a robust device.

Fig. 5.2: The handheld is placed above a CO_2 vent to record temperature, pH, CO_2 and redox effects

5.5.2 Pressure retaining gas samplers

For expedition SO196, four pressure retaining gas samplers were constructed to allow sampling of the emanating gas without depressurization. The sampler design was similar to that of samplers developed by J. Hohenberg for *rcom* Bremen, but with a smaller inner volume of only 62 mL to avoid the handling of extremely large volumes of CO_2 after depressurization. Opening and closing is achieved via turning a large ¼ turn valve with a flow through diameter of 16 mm. Small 5 mL subsamples were designed to be directly attached to the main pressure sample to allow storage of one sample prior to any handling aboard. However, it appeared that the sealing of these subsamples was not well suited for a negative pressure gradient (i.e. inside pressure smaller than outside pressure), and thus were only used for storing pressurized subsamples taken in the lab. Except for the 5.5 mL and 62 mL pressure containers, all parts are assembled pressure-rated materials from stock. The devices are rated to 300 bar. A technical drawing and picture of the entire set is shown below.

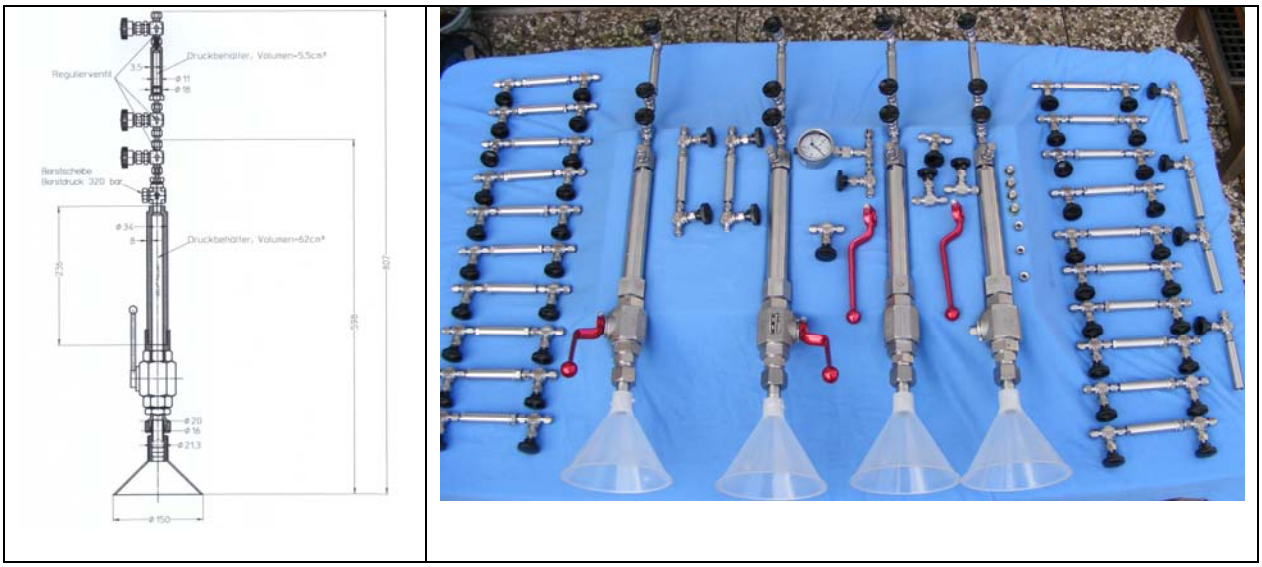

Fig. 5.3: Technical drawing of the pressure-retaining gas sampler and picture of the entire set of sampling and subsampling units

5.5.3 T-lance

To measure surficial temperatures and gradients in the sediment a metal lance equipped with 8 thermistors (University Bremen, Germany) was attached to the ROV. Prior to the cruise a low temperature calibration (0-90°C, carried out at 13.02.2008) allowed for an accuracy of +/+0.005 K, and, at environmental temperatures around 2°C, give a resolution better than 1 mK.

The measuring system consists of a 400 mm long and 14.2 mm diameter metal lance. Its interior is equipped with 8 temperature sensors each 40 mm apart from each other and is connected to a 265 mm long pressure housing holding corresponding electronics. A y-mold serial RS-232 connection from here yields both, data storage in the RBR data logger and

remote access of the logger. By means of looping the RS-232 signal through the fibre glass cable connection between the ROV and the ship, the temperature measurement could remotely be controlled and monitored from the ROV control container on deck. Furthermore, this connection yielded redundant data storage except for errors potentially caused during conversion and transmit. The logging interval was set to 2 seconds for all deployments.

Most of the time, the temperature lance was logging during the downcast of the ROV through the water column. The large temperature range from the warm surface layer to the deep sea low temperature environment is useful to later compare the lance sensor data with the ones gathered from CTD. The same strategy was pursued during the upcasts of the ROV.

Temperature lance measurements were planned on ROV survey lines to later obtain a grid showing locality of maximum temperature and respective temperature gradients and heat flux. At the start of each deployment, the lance was grabbed by the ROV arm, then stuck into the sediment as far as possible and subsequently disengaged to reduce any movement of the lance (Fig. 5.4). Sometimes penetration through the dead load of the lance required permanent but careful handle control using the ROV arm. The lance remained 5-15 minutes in the sediment until no significant further temperature change could be seen in the online data.

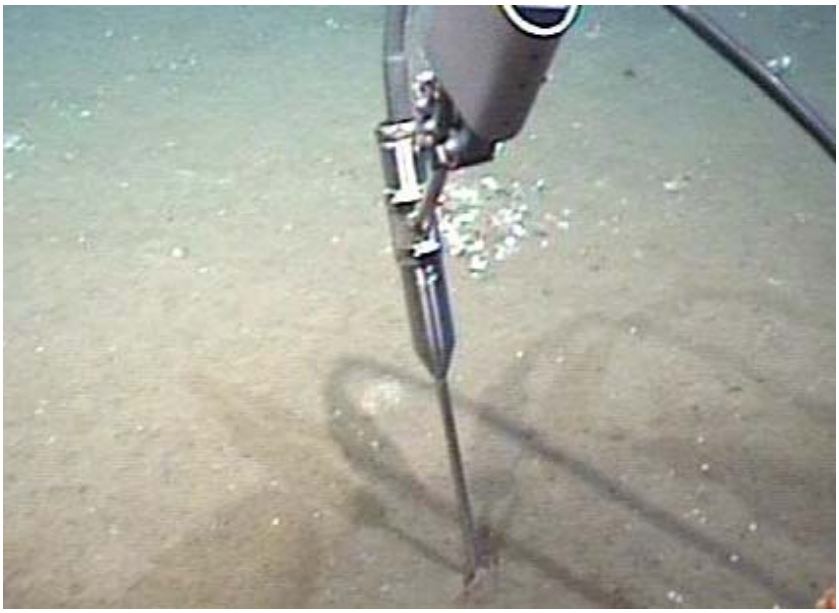

Fig. 5.4: ROV arm is pushing the T-lance into the sediment during dive 199-3

5.5.4 High-T probe

Hot fluid venting was reported at Yonaguni to locally escape from the volcanic chimneys with temperatures exceeding 300°C. Therefore, a high temperature probe was necessary to measure such hot fluids. We used a probe from the Christian-Albrecht University Kiel (Dieter Garbe-Schoenberg), which has demonstrated to be reliable for high temperature measurements at hydrothermal vents sites (Koschinsky et al., 2008). The high-temperature negative temperature coefficient (NTC) resistor is positioned in the very tip of the steel tube. While the probe's sensor tube and it's interior can be used up to a maximum temperature of about +450 °C, care should be taken, not to exceed +60°C at the connector and the connection cable.

Table 5.3: Calibration coefficients for the high temperature probe

Calibration values for logger # 12644	
K_0	0.0008055470087264
K_1	0.0002252125333931
K_2	-0.0000000851718397
K_3	0.0000000828220546

5.5.5 Benthic Chamber Module

The benthic chamber module (Fig. 5.5) is a modified version of the free-falling chamber lander previously used to study benthic processes in the deep-sea (Wenzhöfer and Glud, 2004). This small benthic module consists of a circular chamber, an electronic cylinder, a water sampling system and a battery, which can be operated by the ROV. The chamber encloses an area of ca. 280 cm^2 together with 3-6 l of overlying bottom water. It was equipped with an Anderaa oxygen optode, a pH and a CO_2 sensor (Dive 203), or a Redox sensor (Dive 206). Furthermore, we installed a temperature sensor inside the chamber to measure heat flux during the incubation, as well as a reference temperature sensor outside of the chamber. At preprogrammed time intervals 5 water samples (each 50 ml) were retrieved for later analyses of O2, CH_4, DIC, pH and total alkalinity, together with samples of bottom water obtained via the KIPS system.

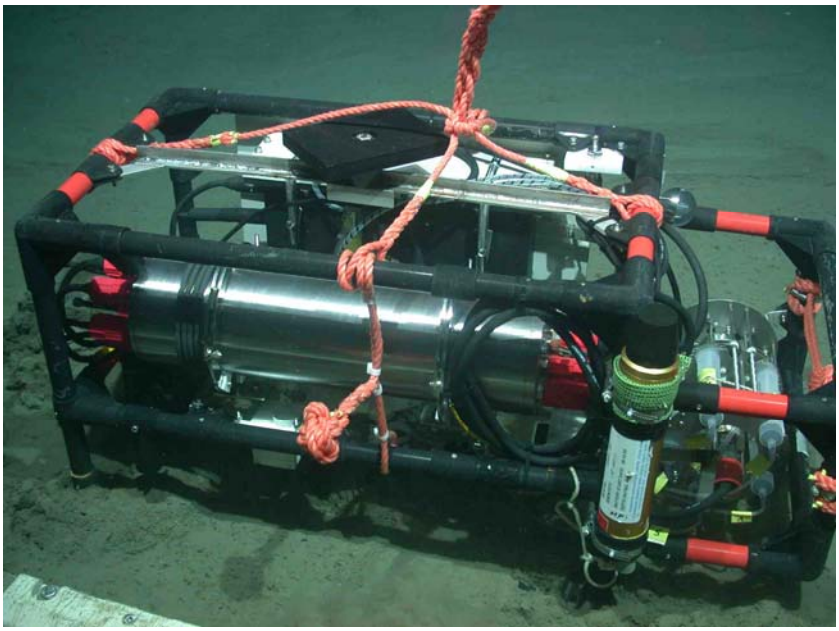

Fig. 5.5: Benthic chamber measurement

The benthic chamber was deployed at the Abyss vent, at 2 neighboring sites, and once at the reference site ca 700 m west of the Abyss vent, to measure total oxygen consumption and fluxes of other solutes.

5.5.6 Microprofiling

For in situ biogeochemical measurements at the seafloor-bottom water interface, a profiling module was equipped with microsensors for O_2, H_2S, pH, redox potential, temperature and CO_2. Microsensors allow a spatial resolution of 25 µm, and can be used both in the laboratory and in situ. They are thus a powerful technique when samples cannot be recovered to the shipboard laboratory without substantial artefacts. This is the case with sediments and bottom water from seep areas as sampled during SUMSUN, which have very high concentrations of CO_2 and CH_4 gases that escape during transit to the surface, leading to a pH increase.

5.5.7 Bubble imaging box

For the monitoring of the shrinkage of CO_2 droplets during the ascent through the water column, a bubble imaging box was constructed by the machine shop of IOW, basically following the design of a device used at the Monterey Bay Aquarium Research Institution (MBARI). The box is open at the top and the bottom to allow almost free vertical through-flow, while restricting lateral movement by the sidewalls. The front and sidewalls are made of transparent polycarbonate, while the backwall is made of a white, opaque plastic which acts as a light diffuser at the same time. The inner monitoring box has a dimension of 30x100x25cm (WxHxD). The walls are fitted into an aluminum frame extending behind the opaque backwall. Behind the wall, there is room for the Li-Ion Power Pack manufactured by CONTROS, which powered an array of deep-sea rated LEDs developed by the same company and providing an evenly distributed backlight illumination. An adjustable handle is mounted to allow some options for mounting the device to the ROV using the manipulator arm of the Quest 4000 ROV.

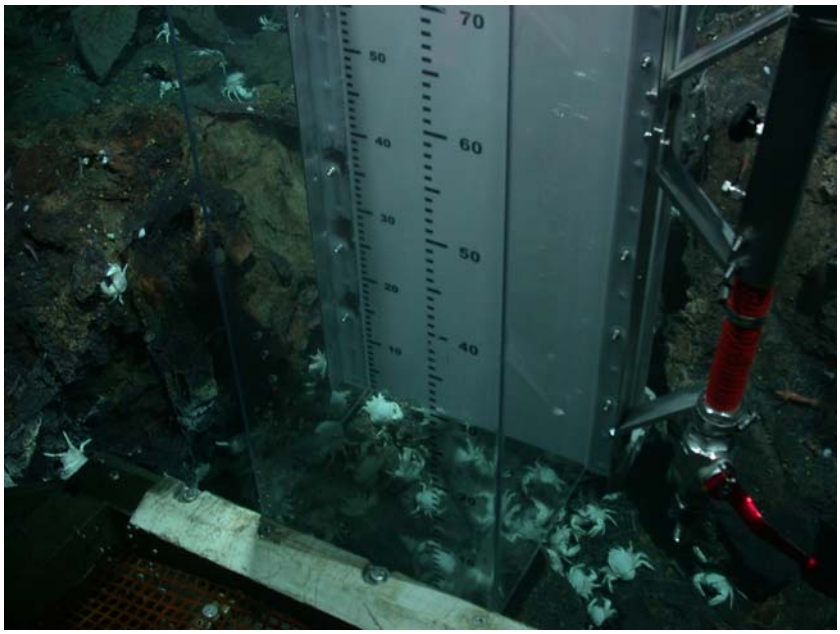

Fig. 5.6: Bubble imaging box at the seafloor above a CO_2/ CH_4 droplet emitting site. The front is positioned on the porch of the ROV, a gas sampler is attached on the right side of the frame

5.6 CTD Rosette

5.6.1 CTD, LADCP, Water samples

Conductivity-temperature-depth (CTD) casts were carried out using a Sea-Bird Electronics, Inc. SBE 911plus system (Univ Bremen). The unit was equipped with additional sensors for oxygen (SBE 43, Univ Bremen), pH (SBE 18, IOW), pCO_2 (Contros HydroC, IOW), and a redox potential (Eh) sensor build by K.-i. Nakamura (AIST). After the failure of the pCO_2 probe (St. 41) it was replaced by an optical backscatter sensor taken from the ROV. The underwater unit was attached to a SBE 32 carousel water sampler with room for 24 Niskin bottles. Two bottles were left out for an acoustic Doppler current profiler to be lowered together with the water sampler, hence a maximum of 22 bottles was used. The complete system worked properly throughout the entire cruise. Salinity samples were collected for later analysis and conductivity calibration at home. In total, 38 CTD casts were carried out, including five towed transects in the Yonaguni working area.

The ADCP used was a RD Instruments 300 kHz Workhorse Monitor, powered by an external battery supply, that consisted of 35 commercial quality 1.5 V batteries assembled in a pressure resistant Aanderaa housing. An inverse method incorporating the bottom track velocities was used for the post processing of the raw data. The overall performance of the instrument was very good: The range was typically 150 m. With lowering and heaving velocities of 1 m/s of the instrument, this range amounted to typically 100 estimates of current shear in each depth cell. The resulting current data were of good quality.

For measurements of the Helium concentrations and isotopic signature, water samples were taken in the water column from the Niskin bottles. In total 316 samples were collected, 242 at Yonaguni and 74 at Hatoma. The samples were sealed free of headspace and gas tight in copper tubes (sample volume 40 ml). Helium isotope measurements will be carried at Univ. Bremen with a fully automated UHV mass spectrometric system. The sample preparation includes gas extraction in a controlled high vacuum system. Helium and neon are separated from permanent gases in a cryo system at 25 K. A split of the sample is analyzed for ^{4}He, ^{20}Ne and ^{22}Ne with a quadrupole mass spectrometer. At 14 K He is separated from Ne and released into the sector field mass spectrometer for analysis of ^{3}He and ^{4}He. The facility achieves about ± 0.2% precision for $^{3}He/^{4}He$ ratios, and ± 0.5% or better for helium and neon concentrations.

591 samples were taken for shore-based high precision measurement of the CO_2 system in the CO_2 lab of IOW. 250 ml ground glass stoppered glass bottles poisoned with 100 microliter $HgCl_2$-solution were used (some 500 mL samples were taken as well). Samples will be measured ashore for total DIC and alkalinity using a SOMMA coulometric detection system (DIC) and state-of-the art alkalinity titration. Calibration is performed using CRM standards (A.G.Dickson, Scrippps Instituion of Oceanography).

5.6.2 Additional sensors (pCO2)

For detecting elevated pCO_2 concentration in the water column the novel CO_2 sensor *HydroC* manufactured by *CONTROS System & Solutions GMBH* (Germany, Kiel) was attached during both, CTD and ROV operations. This device consists of a pressure resistant titanium housing (6000 m) of 380 mm length, a silicone membrane to allow CO_2 to diffuse into a bulb detection cell, a low-power laser emitting at a frequency tuned to match a specific CO_2 absorption band, and a microcomputer system control and data logger unit. Accuracy and resolution are specified to be 30 ppm and 1 ppm with a detection limit of 30 nM. The response time ranges between 10-30 seconds. The interior of the sensor is separated from water by the silicone membrane attached on a sinter metal, which allows CO_2 molecules to diffuse from the water into the sensor's interior. The flux into the sensor is controlled by the concentration gradient between water and the sensor's detection bulb, the turbulent flow at the membrane's surface, and the properties of the membrane itself. To account for temperature effects, the sensor continuously measures the in situ temperature inside the detection cell. The underlying principle is the detection of the attenuation of the laser beam caused by optical absorption of the CO_2 molecules within the detection cell. Depending on the number of CO_2 molecules inside of the bulb, light intensity changes are registered and converted into a voltage signal. The sensor offers two kinds of outputs:(1) calibrated signals are calculated from the *HydroC* system considering all available sensor information giving maximum precision. This digital data is available via RS-232 to both, the internal data logger and external interface for online monitoring using *SMART-DI* software. Unfortunately, such an online connection could not be established throughout the cruise and calibrated data could only be generated after post-processing. (2) an analogue voltage signal with linear relationship to CO_2 concentration ('zeroing value': 0 Volt; maximum concentration 2500 µM: 5 Volt). This volt signal was fed into the "user poly 1" channel of the *Seabird 911* CTD system and yielded an online CO_2 sniffing capability during water column CTD deployments. In this case, the system was independently powered by a Li-Ion power pack to overcome power supply limitations of the *Seabird* CTD system (maximum power supply is 360 mA). A schematic workflow can be found in Fig. 5.7.

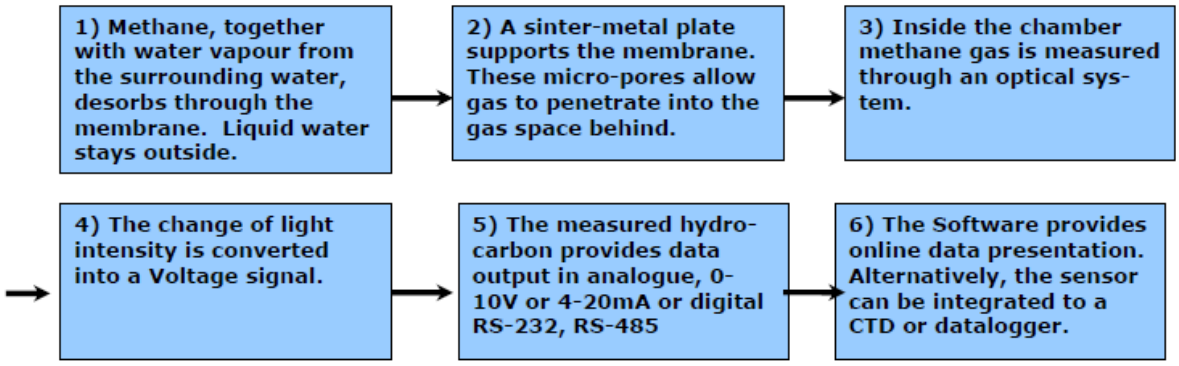

Fig. 5.7: Work flow of the *HYDOC*- CH_4 measuring process. The principle of this sequence remains the same for measuring CO_2 instead of methane

6. Scientific results

6.1 Bathymetry

(J. Schneider v. Deimling)

6.1.1 Surveying and postprocessing

A multibeam survey was conducted in the Hatoma Knoll area comprising five tracklines (Fig. 6.1). The swath width was selected 120° and the total coverage includes a 20 % overlapping swath between the respective profiles. An area of 10x8 nm was surveyed with a ship speed of 8 knots allowing continuous seafloor coverage. With regard to limited ship time and previously conducted bathymetric surveys during Japanese cruises (s. Cruise Narrative) we decided not to explicitly survey the second working area Yonaguni Knoll IV. Nevertheless, the EM 120 swath data was recorded whenever station work was not affected by the 12 kHz EM 120 transmit pulse. Along the way complete coverage of the Yonaguni working area was feasible (Fig. 6.3). “Off-survey” bathymetry is of poor quality, especially while the vessel is heavily turning. To avoid including too many spurious echoes only inner swath data (beam 20-170) recorded with vessel speed >5 knots have been included into post processing. Even in case of large raw data directories (~4GB) the extraction of these soundings may readily be accomplished by a combination of *UNIX find* and *MBSYSTEMs mbdatalist* and *mblist* commands. As a result only soundings of survey–like arrival and departure tracks, which were recorded during 2 weeks of station work, have been extracted from raw data. Thus, a bathymetric chart of remarkable quality could be generated (Fig. 6.3, Fig. 6.4).

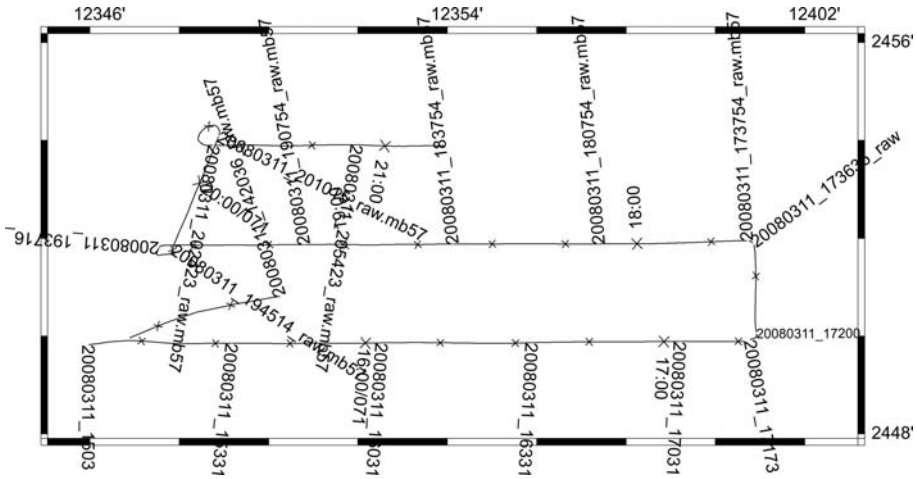

Fig. 6.1: Location, file- and timestamps of Simrad EM 120 navigation data covering the Hatoma Knoll area

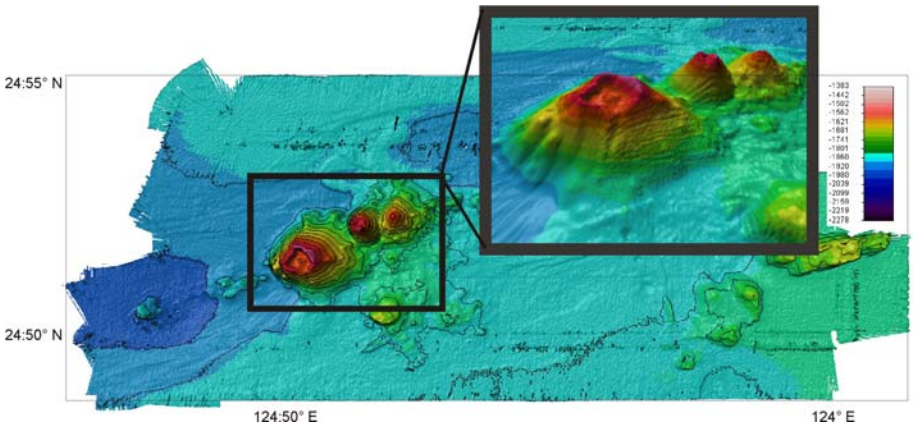

Fig. 6.2: Bathymetric chart of the Hatoma Knoll area illuminated from northwest

6.1.2 Hatoma Knoll

Hatoma Knoll is an active submarine volcano located near the southwestern Ryukyu Islands. Bathymetric mapping revealed a circular caldera structure with maximum height at its north-easterly flank peaking at 1395 m water depth (Fig. 6.2). The inside of the caldera (~1530) exhibits a round-shaped 30 meters high mound. The total height of Hatoma volcano measured from the topmost rim down to its morphologic base comprises 600 m showing relatively continuous slope gradients. The caldera rim has a prominent outcrop at its southern part potentially derived from former flank collapse and slumping. This might be further investigated by the use of EM 120 backscatter data and sub-bottom information around the southern flank of Hatoma Knoll.

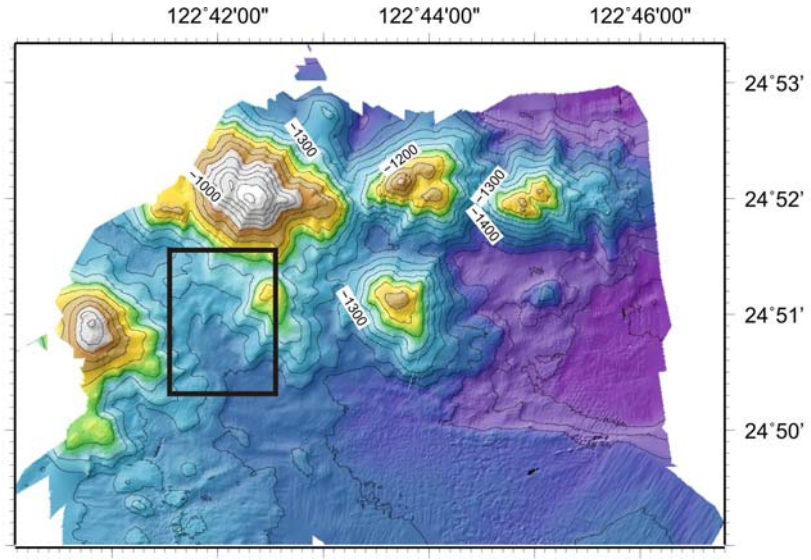

Fig. 6.3: Bathymetric chart gathered during SO196. Rectangular area highlights the main working area

Within the chimney environment of Yonaguni Knoll IV penetration is reduced to only a few meters. From visual inspection (TV MUC, ROV) and coring it was found, that the upper sediment is mostly very soft. Thus, we suggest a shallow, subsurface structure (potentially containing free gas or liquid CO_2) prohibiting further acoustic penetration.

The Yonaguni Knoll IV working area is located in a 1 nm wide valley surrounded by seamounts in the west and northeast (Fig. 6.3). The depth of this valley gently increases towards southeast. Although explicit surveying of this area was not conducted during SO196, the contour plot in Fig. 6.4 demonstrates, that the "off-survey" data quality can compete with published data (Konno et al., 2006). This is due partly to the approach of using many soundings gathered during several days. Thus, the number of soundings per area increases and improves later statistical approaches, i.e. blockmedian filtering and gridding. Depending on the focus of the ship cruise and the dynamics of the water column (layering/soundspeed changes, tide level variation) this approach is feasible.

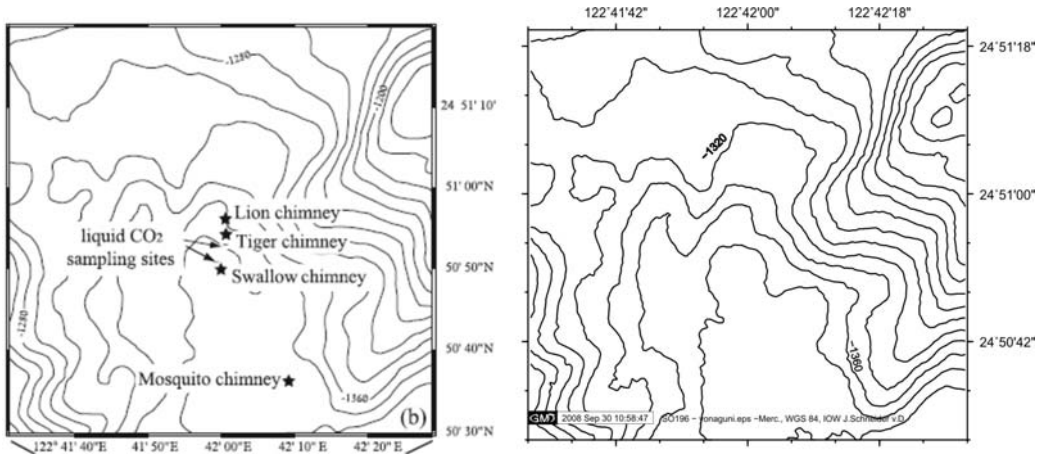

Fig. 6.4: Contour plots from the bathymetry given in (Konno et al., 2006) (left plot) and the data gathered during SO196 (right plot)

6.2 Parasound

(J. Schneider v. Deimling)

6.2.1 Water column imaging

The hull-mounted *PARASOUND* system was operated during most of the time during SO196 using two modes, the one optimized for sub-bottom profiling and the other for flare imaging (water column monitoring with respect to rising gas bubbles).

The caldera rim at Hatoma and a valley structure within the study area of Yonaguni Knoll IV exacerbate recording and data interpretation. With respect to water column inspections, the side-lobe signals partially cross into the 'silent' water column acoustic domain. Though, we identified several data patterns that are most likely caused by rising reflectors such as gas bubbles or fluid CO_2 droplets (Fig. 6.5). Due to limited man power, a continuous monitoring of the water column was not feasible.

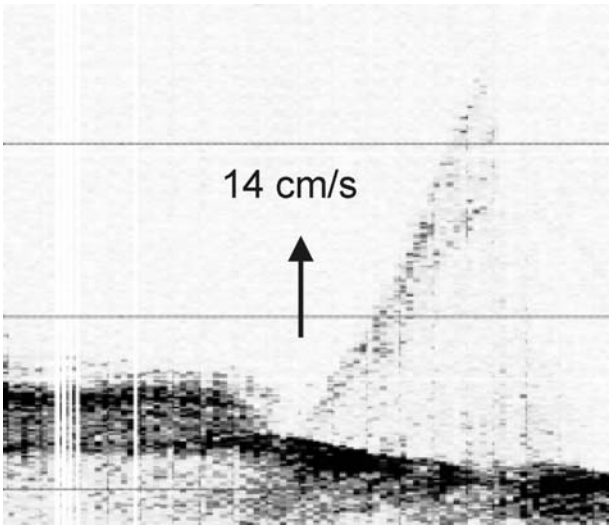

Fig. 6.5: 18 kHz water column reflection recorded by *PARADIGMA*. Data pattern indicates a rising reflector

Even in the lower parametric frequency data some suspicious water column reflection were detected above the chimneys in the centre valley in form of a 'cloud' (Fig. 6.6).

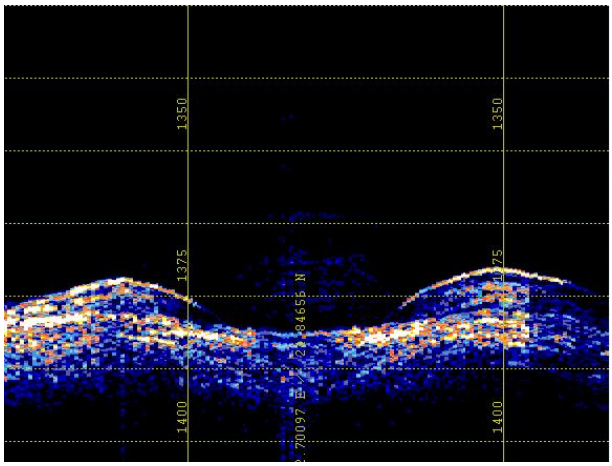

Fig. 6.6: 3 kHz water column data around Tiger chimney

6.2.2 Subbottom profiling

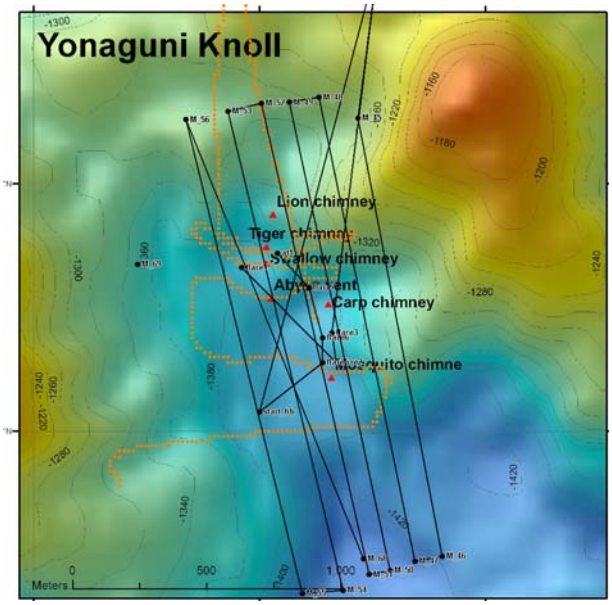

Fig. 6.7: Parasound survey #1(st. 12) tracklines covering all chimneys centred around Abyss

Several *PARASOUND* profiles have been recorded in the vicinity of active chimneys (Fig. 6.7) to better constrain the subsurface sediment character. Outside of the venting area the subseafloor appears well layered, undisturbed with a maximum penetration of around 50 m (Fig. 6.8). In Fig. 6.8 acoustic blanking is visible; its origin is unknown and was not further constrained, because it was recorded off the area of interest.

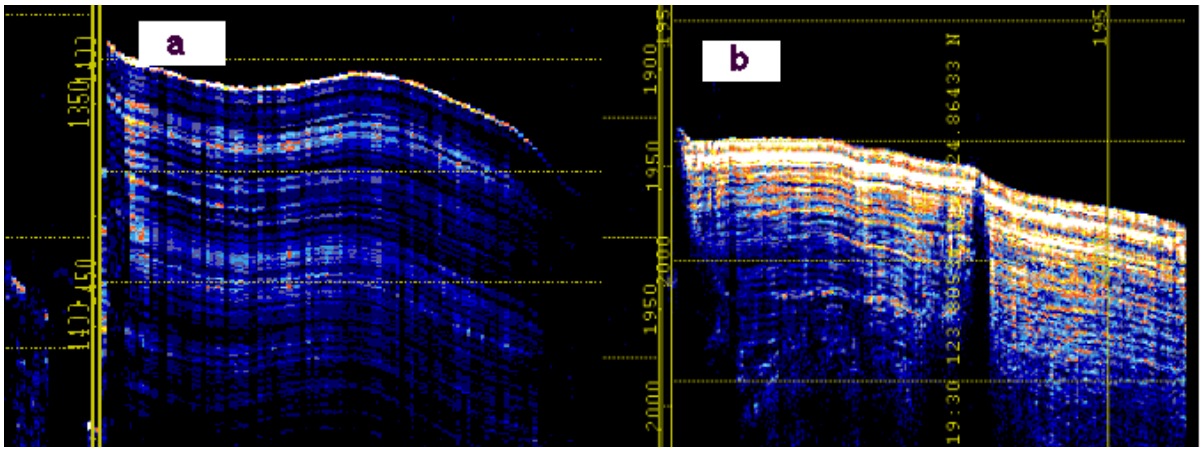

Fig. 6.8: Parametric echogram in the reference/off-study area of the Yonaguni (a) and Hatoma (b) Knoll areas

Within the chimney environment of Yonaguni Knoll IV penetration is reduced to only a few meters. From visual inspection (TV MUC, ROV) and coring it was found, that the upper sediment is mostly very soft. Thus, we suggest a shallow, subsurface structure (potentially containing free gas or liquid CO_2) prohibiting further acoustic penetration.

Several Parasound profiles have been recorded simultaneously with TV-MUC tracks to later compare video seafloor observation, coring results and the sea surface and subbottom backscatter. Locally, a profound transition from weak to strong surface reflections could be observed (Fig. 6.9). The elevated seafloor backscatter might be caused by the so called sulphur pavement structures, which are characterized by surficial sulphur cementated sediment. These observations must be cross-checked with video observations and core samples in the future.

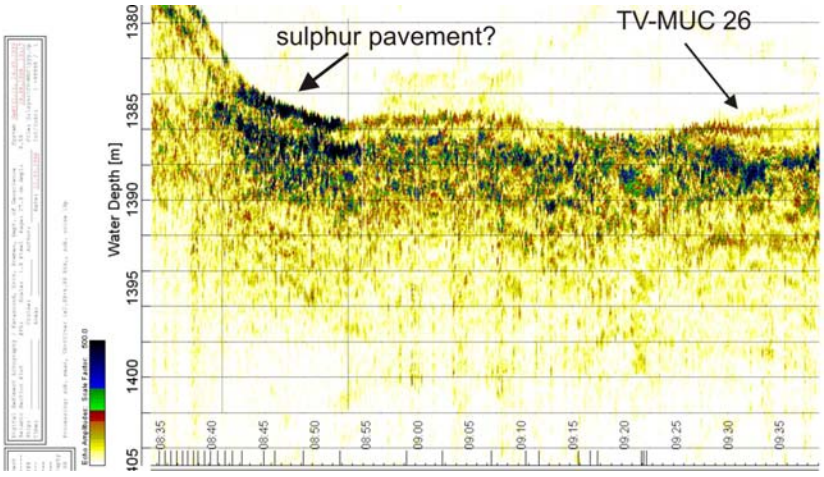

Fig. 6.9: Parallel recording of Parasound data during TV-MUC-26 track in the swallow chimney area

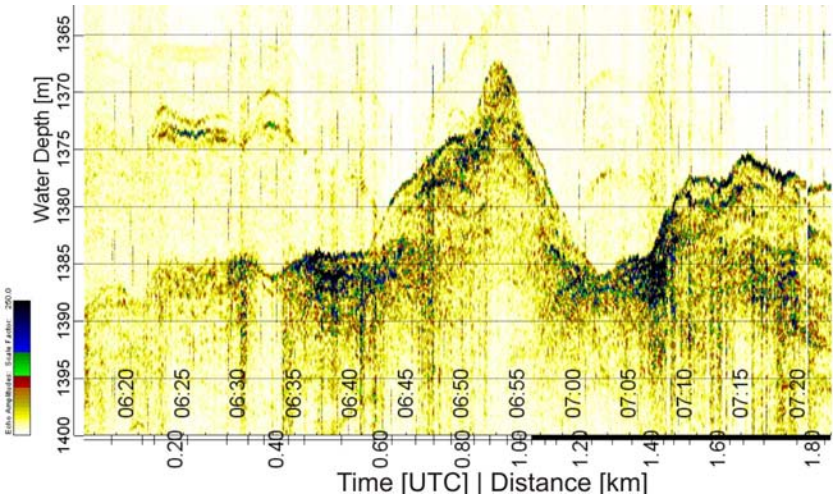

Fig. 6.10: Parasound profile recorded during TVMUC10 track

6.3 Water column investigations

(C. Mertens)

6.3.1 CTD Rosette

Yonaguni

A total of 25 CTD stations was carried out in the Yonaguni Knoll area. Two of them were taken at the eastern border of the working area to serve as reference stations and five casts were tow-yos. Figure 6.11 shows the location of the individual stations. The tow-yo stations had to be carried out in northeastward direction because of the prevailing Kuroshio current with a strength

of 1 to 3 knots, that did not allow to tow the instrument into another direction without causing great tension on the wire and large instrument tilt which decreases the quality of the velocity measurements. Two of the tow-yo casts were intended for plume mapping while the three others were carried out to follow an pH and Eh anomaly observed in the depth range between 700 and 800 m.

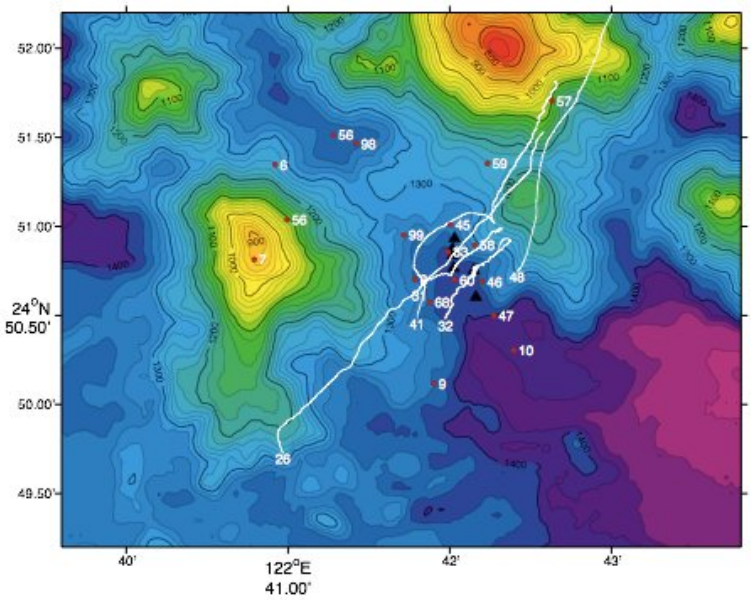

Fig 6.11: Map of CTD stations carried out at Yonaguni Knoll IV. Stations with vertical profiles are shown as red dots and tow-yo tracks are shown as white lines

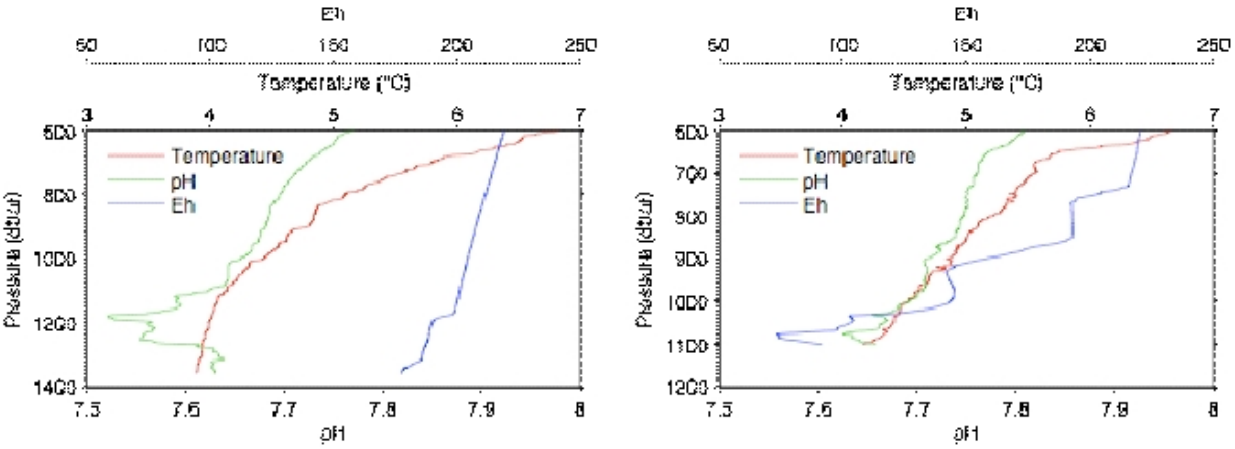

Fig. 6.12: Vertical profiles of temperature, pH and Eh uncalibrated data at two different locations in the Yonaguni Knoll IV area: One close to the known vents (station 68, left) and one northeastward of the vents (station 57, right)

Many of the casts show clear plume signals in the chemical parameters pH and Eh, two examples are shown in Fig. 6.12. The first one (station 68) is from a cast close to the known vents sites. It shows a maximum decrease in pH of about 0.1 at about 1200 m and a corresponding Eh signal at the same depth. The plume has a thickness of about 200 m and its

maximum height is 400 m above the seafloor, which is clearly too high for a purely hydrothermal plume. A second Eh signal is found close to the seafloor, which is a common feature in several of the CTD casts. The second example in Fig. 6.12 shows several strong Eh signals at different depths between 700 m and the seafloor, but smaller pH anomalies compared to station 68. This station was the most northeastern one in the working area and about 1 nm away from the known vent sites. The strength of the Eh signal indicates hydrothermal activity in close proximity.

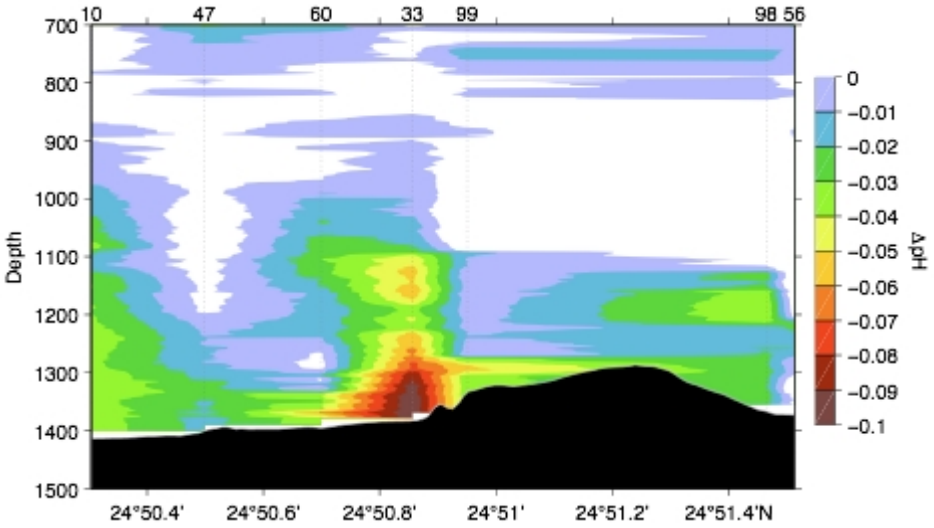

Fig. 6.13: Anomalies of pH along a (non-synoptic) section in the valley were the Yonaguni vents are located

In general all of the CTD profiles taken along the center of the valley, where the Yonaguni vents are located, show pH anomalies at least below 1100 m (Fig. 6.13). The largest anomalies are found directly above the known vents, but also away from the sources significant pH decreases were found. A mid-depth pH anomaly that is situated around 750 m at the northern stations was tracked eastward during a tow-yo station and is presumably caused by hydrothermal activity of unknown sources.

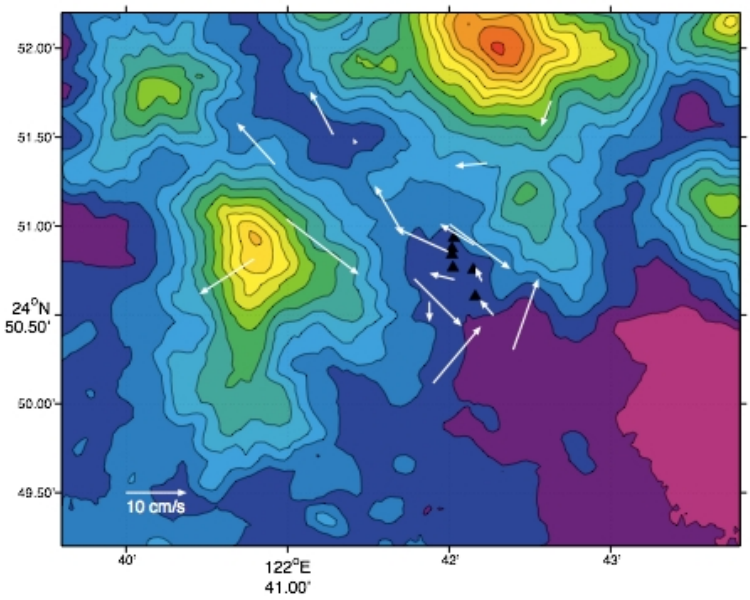

Fig. 6.14: Bottom currents from LADCP measurements; shown are the mean velocities in the lower 100 m of the water column

The number of casts does not allow a quantitative analysis of the current field in the working area, especially a resolution of the tidal cycle would require time series measurements. Nevertheless, in the bottom layer the observations show that the currents tend to follow the topographic features and in the central valley, where the vents are located, it appears that the currents reverse with the tides. Noticeable is also the strength of the current close to the seafloor that reach up to 20 cm/s in a 100 m vertical average (Fig. 6.14).

Hatoma Knoll

At Hatoma Knoll 12 CTD casts were carried out, one several miles away as a reference station. The other casts were all close to the caldera of Hatoma Knoll, were the known vents are located (Fig. 6.15). Six stations were taken inside the caldera, four at the southern rim and one at the northern rim.

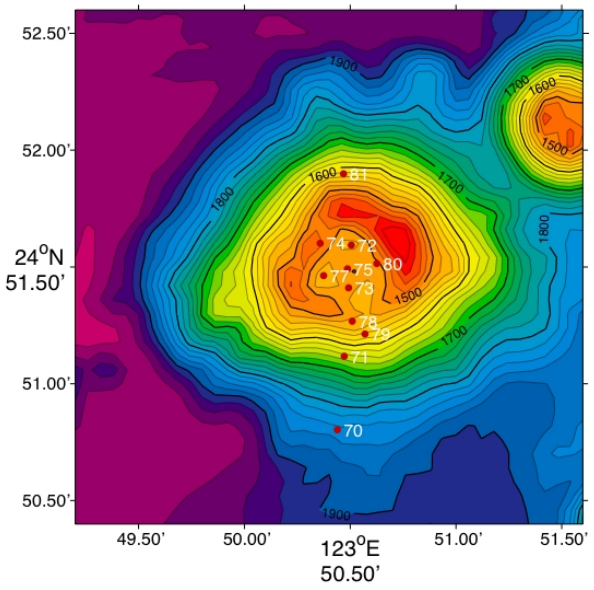

Fig. 6.15: Map of CTD stations carried out at Hatoma Knoll

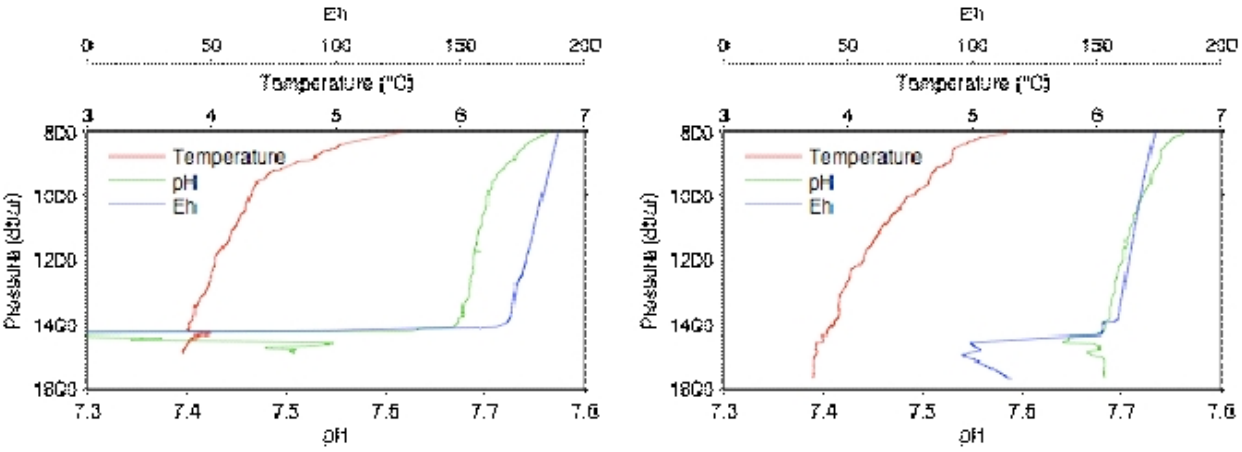

Fig. 6.16: Vertical profiles of temperature, pH and Eh at two different locations in the Hatoma Knoll area: One above the vents in the center of the caldera (station 75, left) and one at the southern rim of the caldera (station 79, right)

All stations inside the caldera show strong plume signals in a depth range of 100 to 150 m above the seafloor, which is a typical height for hydrothermal plumes in the Pacific. Fig. 6.16 shows two examples of vertical profiles: One taken directly above the vents in the center of the caldera (station 75) which was actually in the buoyant plume as can be seen from the large positive temperature anomaly at about 1450 m. The layer where the largest decrease in pH an Eh was observed is rather thin with only 20 to 30 m. The other station shown in Fig. 6.16 (station 79) was located at the southern rim of the caldera, where the bathymetry allows the escape of the plume from the caldera. Although only a few hundred meters south of the vents the plume signal is already much weaker. Further profiles show three distinct layers with plume signals of different strength which indicates the origin from different sources.

The horizontal structure of the pH anomalies above the caldera of Hatoma Knoll is shown in Fig. 6.17. In the south the signal quickly disappears. This is probably caused by westward currents that were observed at this location. On the northern side pH anomalies where found farther outside the caldera.

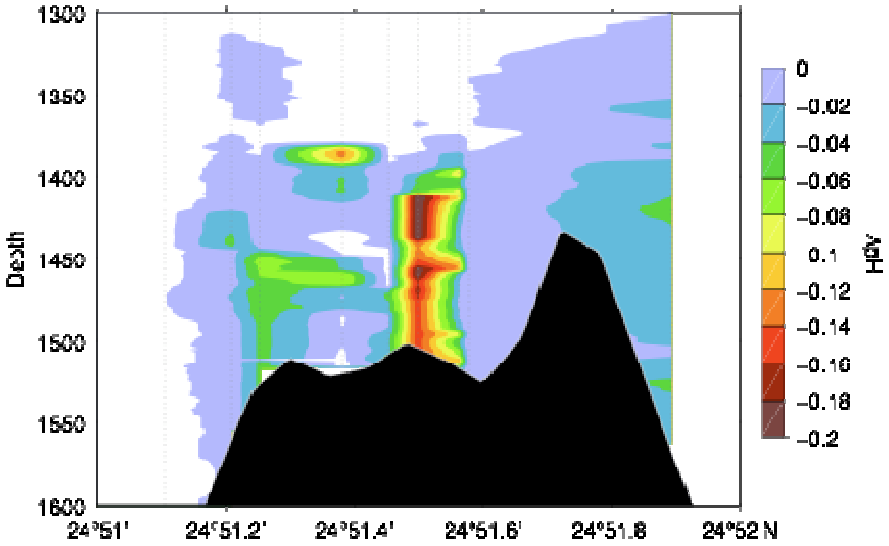

Fig. 6.17: Cross section in north-south direction showing the pH anomalies above the caldera of Hatoma Knoll

HydroC pCO2

Laboratory test

The sensor was tested in the lab prior to its deployment. After warm up for approximately 20 minutes, the micro voltage signal baseline remained fairly stable around 550 mV. By breathing towards the silicone membrane CO_2 concentration was temporarily increased at the sensor-air interface. The enhanced CO_2 supply at the membrane can be considered a pulse, which vanishes subsequently away due to the fast dilution with environmental air. The sensor almost immediately responded to this by a sudden voltage increase up to 720 mV (Fig. 6.18: 23:33 o'clock). Then, a gentle signal decline follows lasting around 5 minutes until the values drop to the initial 550 mV level. It is noteworthy, that even an increased number of people in one room affect the measurement as can be seen by a minor signal increase around 00 o'clock.

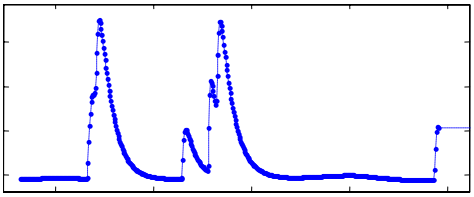

Fig. 6.18: Laboratory test time series of the *HydroC* data showing immediate signal increase due to breathing against the membrane

CTD deployments

The *HydroC* was attached to CTD casts number 1-12. At CTD 13 water invaded the system giving rise to total failure.

The V1 voltage channel of the *Seabird* system allowed 'online' examination of *HydroC* data using *Seasoft*. This should allow for more efficient water sampling with respect to pCO_2. During CTD downcast, the sensor voltage did not respond until reaching 550-700 meters water depth. Then, the voltage gradually increases with depth. After passage of the maximum water depth the sensor voltage keeps rising for a few minutes and then gradually decreases again during the upcast. The delayed signal decline is attributed to some latency effects giving rise to a very strong hysteresis between up- and downcast data. Significant voltage change was found e.g. at CTD 7 (Fig. 6.19). At 21:10 o'clock, the voltage of the pCO_2 sensor suddenly increases during the upcast, while the pH sensor data shows lowered values. Due to the dynamics of the carbonate system, we expect such a correlation between pH and pCO_2 to occur. Later geochemical analysis of taken water samples with respect to pH and pCO_2 will clarify if such a peak (Fig. 6.19) is caused by elevated gaseous CO_2 in the water and will disclose the sensitivity of the sensor. Then absolute values calculated by means of the manufacturer's calibration coefficients can be compared with analytical results (given the calibration coefficients, the absolute pCO_2 concentration during the downcast is calculated for CTD 7 at 20:50 o'clock to be 8000µM and at 21:10 to be 12600µM).

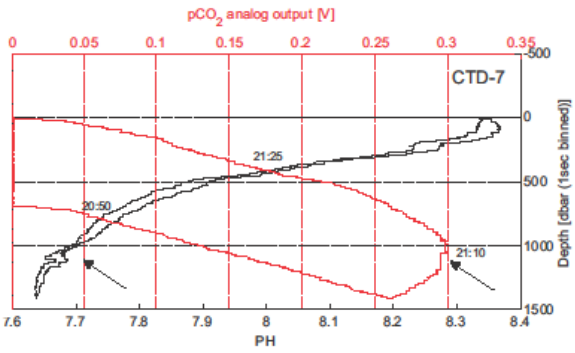

Fig. 6.19: Correlation between pH deviation and pCO_2 sensor response at 21:10 o'clock

6.3.2 Near bottom sensoring using the Handheld

(D. de Beer)

The Handheld was mounted to the ROV to continuously record pH and CO_2 at 1-5 m above bottom during the dives, as well as for targeted measurements above vents and seeps (5-10 minute measurements). These data will be carefully analyzed at a later stage, which was too time consuming during the cruise. Fig. 6.20 shows some preliminary data (raw signals).

Table 6.1: List of stations: with targeted handheld measurements

Dive	Measurements 1	Measurements 2
197	N 24 50.6156 E 122 42.1666	
198	N 24 50.8371 E 122 42.0190	N 24 50.8602 E 122 42.0102
199	N 24 51.4535 E 123 50.3803	N 24 51.5819 E 123 50.4425
200	N 24 51.5162 E 123 50.5611	
201	On ROV but not used	
202	N 24 51.5757 E 123 50.4512	N 24 51.4921 E 123 50.4782
203	On ROV but not used	
204	On ROV but not used	
205	On ROV but not used	

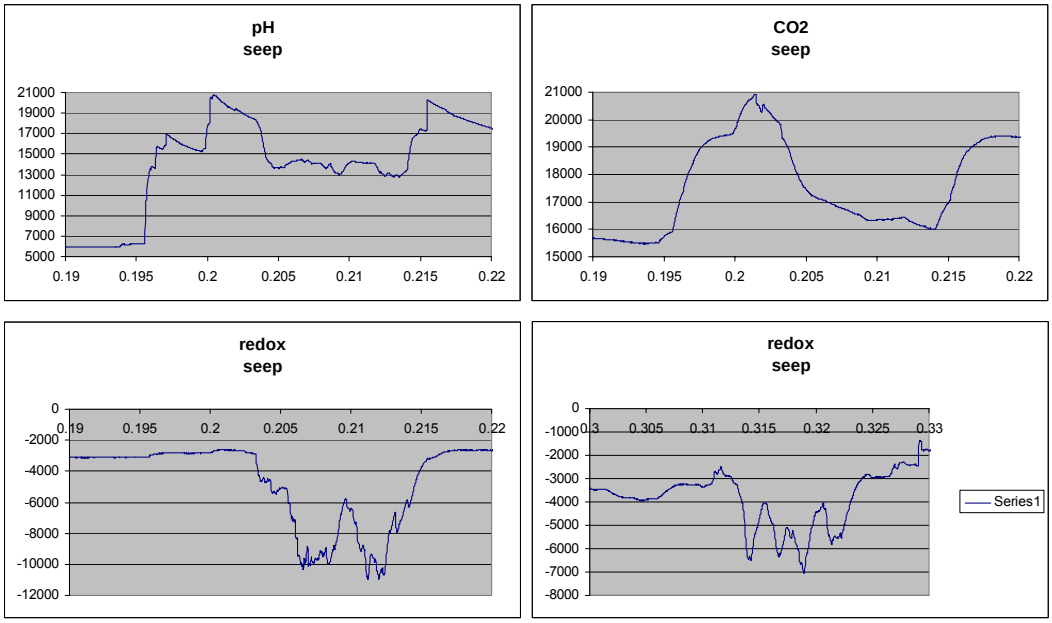

Fig. 6.20: Sensor measurements recorded above a CO_2 seep. pH signals increase with decreasing pH; CO_2signals increase with increasing CO_2, and redox signals decrease with decreasing redox state. The time is given as fraction of the day, normally the handheld was placed for ca 10 minutes

6.4 Sedimentary studies and investigations at Yonaguni Knoll IV

6.4.1 Porewater Geochemistry

(M. Haeckel)

Introduction

The geochemical analyses of the porewaters and sediments of CO_2 seepage sites in the Okinawa Trough aim at the investigation of the interaction between liquid or supercritical CO_2 and the sediments. We also intend to quantify the amount of CO_2 that is transported from the seafloor into the overlying bottom waters as well as the dynamics of CO_2 hydrate formation. Therefore, a comprehensive geochemical dataset has been collected on the research cruise SO196 (Tab. 6.2, Fig. 6.21).

Onboard, the collected samples were analysed for their content of NH_4^+, PO_4^{3-}, SiO_4^{4-}, H_2S, Cl^-, Fe^{2+}, (ex situ) pH, and alkalinity. In addition, sub-samples were taken for further shore-based analyses (concentration and $d^{13}C$ isotope ratio of CH_4 and CO_2, metal cations, SO_4^{2-}, Br^-, and I^- concentrations, isotopic ratios of Sr, Cl, H, and O, U/Th ratio, ^{222}Rn, porosity, elemental CNS content of the solid phase).

The geochemistry group collected a total of 288 samples from 32 cores and 3 CTDs. The sampling locations were primarily chosen based on video observations that suggested potential CO_2 seepage. Onboard, we focussed on the chemical analyses of the composition of the pore fluids.

Materials and methods

Sediment pore water sampling

Surface and subsurface sediment samples were retrieved using a TV-guided multi-corer (TV-MUC), a gravity corer (GC), and push cores (PC) taken by the ROV Quest of MARUM Bremen. The sediment of the MUCs and PCs were extruded out of the plastic liners and cut into 1-3 cm thick slices. In case of the GCs, 3-cm thick slices were taken in approximately 20-40 cm intervals. Subsequently, the porewater was extracted using a low pressure-squeezer (argon at 1-4 bar). While squeezing the porewater was filtered through 0.2 µm cellulose acetate Nuclepore filters or 0.45 µm regenerated cellulose Whatman filters and collected in recipient vessels. In the latter case the porewater was re-filtered with 0.2 µm syringe filters. About 5 ml of each wet sediment slice was collected for porosity analyses. For concentration and isotope analyses of hydrocarbons and carbon dioxide, a defined sediment volume of 3 cm^3 was sampled into a glass vial containing 3 ml 0.1 M NaOH solution, tightly cramped, and suspended (vigorous shaking for 1 h). The above procedures were performed at approximately in situ temperature of 4 °C in the cold room onboard the ship. Aliquots of the extracted porewater were taken for several shore-based analyses. The samples for the ICP-AES analysis were acidified with 20 µl of 30 % suprapure HCl per 3 ml of porewater sample (i.e, pH<1). All samples for analyses subsequent to the cruise at the shore-based laboratories were stored refrigerated.

Gravity Corer

Since sediment coring was anticipated to be challenging in the Yonaguni Knoll IV area and even more so at Hatoma Knoll, only a 3-m long steel barrel was mounted to the head weight of ~1 metric ton. The gravity corer was used without the coring rack of the vessel and it was equipped either with a plastic foil for rapid pore water and gas hydrate sampling or a plastic liner allowing for core archiving after sediment sampling. Generally, the gravity corer was lowered into the sediment at a speed of 0.6-0.8 m/s.

A total number of 12 gravity cores were deployed at Yonaguni Knoll IV, focussing on the area between Abyss Vent and Swallow Chimney (Fig. 6.21). Gravity coring turned out to be difficult because the sediments at Yonaguni Knoll IV are extensively covered by massive sulphur-rich precipitates of hydrothermal origin. However, we were able to recover 9 cores with up to 300 cm of sediment successfully (Tab. 6.3). The other 3 gravity cores recovered only a few pieces of the sulphur precipitates of the sediment surface.

Porewater analyses

Analyses for the nutrients NH_4^+, PO_4^{3-}, SiO_4^{4-}, Fe^{2+}, and H_2S were completed onboard using a Hitachi UV/VIS spectrophotometer. The respective chemical analytics follow standard procedures (Grasshoff et al., 1999), i.e. ammonium was measured as indophenol blue, phosphate and silicate as molybdenum blue, iron with ferrospectral and sulfide as methylene blue. Since high sulfide contents (> 1 mM) interfere with the reactions of NH_4^+, PO_4^{3-}, and SiO_4^{4-}, these sub-samples were acidified with 20 µl of 30 % suprapure HCl and bubbled with argon to strip any H_2S prior to the analysis.

The total alkalinity of the porewater was determined by titration with 0.02 N HCl using a mixture of methyl red and methylene blue as indicator. The titration vessel was bubbled with argon to strip any CO_2 and H_2S produced during the titration. The IAPSO seawater standard was used for the calibration of the method. The porewater content of chloride was determined by Mohr's titration, i.e. titration of a porewater aliquot with 0.01 M $AgNO_3$ solution and a mixture of $KCrO_4/K_2Cr_2O_7$ as indicator. Again, the IAPSO seawater standard was used for calibration.
The pH of the wet sediment sample was determined in the cold room with a glass electrode. Temperature was also recorded at the time of the measurement and the electrode was calibrated with 2 solutions of defined pH values, 2-Aminopyridine and N,N-Dimethyl-1,4-phenylene-diamine-monohydrochloride (Dickson, 1993). Ex situ pH values do not reflect the true pH of the sediment, because, the dominating carbonate and calcium carbonate equilibria show considerable pressure dependence.

The analytical precision and accuracy of each method is given in Table 6.3. Further details of the analytical procedures can be found on IFM-GEOMAR's webpage (http://www.ifm-geomar.de/index.php?id=1858&L=1).

Water column radiochemistry

In addition to the sediment and porewater geochemistry, excess radon concentrations ($^{222}Rn_{ex}$) in 12 seawater samples from different water depths of 3 CTD casts were determined. For this purpose, for each sample 1 l of seawater was collected in plastic bottles that were closed with a gas-tight 2-way srew-cap. ^{222}Rn is a member of the ^{238}U decay chain and directly produced by the decay of ^{226}Ra in the marine sediments. Because ^{238}U is enriched in sediments its production is depth-dependent and increases as a function of the sediment thickness below the water column. ^{222}Rn is an excellent tracer in order to determine diffusion and advection rates because as a radioactive noble gas it is chemically inert and decays with a half-life of about 3.5 days (λ=0.0001374 1/min). Thus the time-dependent transport of ^{222}Rn can be observed as a function of time and sediment depth directly onboard of a ship through liquid-scintillation-alpha counting (Purkl and Eisenhauer, 2004). The results from ^{222}Rn depth profile measurements can then be compared and applied to other gases of interest (e.g. CH_4, CO_2) supplied from the sediments to the water column. Due to its short half-life, this method requires onboard measurements as soon as possible after sample recovery. A "Triathler" and a ship-going Perkin Elmer Guardian liquid scintillation counter (LSC) were used in combination with the Maxi-Light scintillation cocktail to determine the activity. 22 ml of the scintillation cocktail was added to the water sample and then the sample was automatically shaken for 6 h prior to measuring the scintillation extract.

The amount of excess ^{222}Rn is calculated by subtracting the “supported” amount of ^{222}Rn, which is in activity-equilibrium with ^{226}Ra. Hence, a back-measurement of the sample must be conducted about >4 half-lives after the first measurement, i.e. in the home-based laboratory. High ^{222}Rn concentrations in the back-measurements are indicative for fluid flow related anomalies of dissolved $^{226}Ra_{ex}$, i.e., due to gas transport through marine sediments. Due to its rather long half-life of 1600 years the investigation of the $^{226}Ra_{ex}$ systematics may be performed on acidified U-Th sub-samples later on, if required. Therefore, also 2-L seawater samples were taken for U-Th-isotope measurements allowing the complementary investigation of Radium concentrations, depending on the findings in the ^{222}Rn samples (^{226}Ra is the highly soluble divalent mother isotope of ^{222}Rn and the daughter isotope of the pre-dominantly particle-bound ^{230}Th). The U/Th water samples were acidified with 6 ml of pure 4.5N HNO_3 (pH=1-2) and spiked with 550 µl of a standard solution (defined amount of $^{229}Th/^{225}Ra$) and vigorously shaken. During the entire sampling procedure thorough precautions have been taken to avoid any sample contamination, particularly from dust particles.

Results

The investigation of porewater and sediment geochemistry focused on 2 seep sites in the southern part of the Yonaguni Knoll IV area, Swallow Chimney and Abyss Vent (Fig. 6.21). A reference site was chosen about 0.5 nautical miles SSW of the seep sites.

Both seep sites show a distinct difference with respect to the CO_2 phase behaviour due to their varying fluid temperature (Fig. 6.22). At Swallow Chimney the rising fluids have a temperature of

~5 °C at the sediment surface and hence, liquid CO_2 is being expelled from this vent. On contact with the cold seawater the liquid CO_2 droplets immediately start to form a hydrate skin and get arrested on the rock/sediment surface forming a bubbly/foamy gas hydrate. In contrast, at Abyss Vent the temperature of the fluid at the sediment surface is >40 °C directly in the vent and increases to >90 °C in half a meter depth. Even metres off the vent, the temperature increases from ~5 °C at the surface to >15 °C within a few centimeters of the sediment. Thus, the p,T conditions do not allow for hydrate formation in the sediments at Abyss Vent and supercritical CO_2 bubbles are released into the water column. This variation in the temperature of the fluid also generates the small, but distinct, differences in the porewater geochemistry of both vents.

Reference Site

At the reference site the porewater geochemistry of the surface sediments is dominated by oxic and suboxic degradation of organic matter (Figs. 6.23 and 6.24). Sulfate reduction is not observed in the top 300 cm of the sediment and hence, sulfide remains completely absent throughout the cores. During organic matter degradation NH_4 and PO_4 are released into the porewater leading to moderate increases with increasing sediment depth. Suboxic degradation, i.e. utilization of manganese(IV) and iron(III) minerals, are reflected by the slight increase in total alkalinity form ~2.3 meq/l in the bottomwater to ~10 meq/l at the base of the gravity cores. Chlorinity is constant at ~545 mM and dissolved silicate concentrations increase downcore to an asymptotic value of 330-360 µM.

Abyss Vent

Towards Abyss Vent the hydrothermal signature of the vent fluid becomes increasingly evident, primarily from a steepening in the geochemical gradients (Fig. 6.23), also indicating fluid flow at the vent site. Pore fluids at the vent are strongly enriched in dissolved silicate (up to >0.8 mM; Fig. 6.23), which is typical for hydrothermal fluids. Half a meter off the vent, the warm porewater is even oversaturated in dissolved silicate (~2 mM) with respect to normal seawater (<1 mM), and upon retrieval white amorphous silicates precipitated in the bottom water of the multicores. The porewater also shows increased concentrations of sulfide (up to >2 mM) and total alkalinity (up to >60 meq/l). Generally, sulfate reduction from anaerobic degradation of organic matter and anaerobic oxidation of methane (AOM) can only account for TA values of up to 60 meq/l, but not more. Additionally, sulfate reduction rates measured onboard and onshore (see chapter 6.4.4. on 'Microbiology') hint at very low rates in the vent sediments. Thus, the observed TA values of >60 meq/l must be attributed, at least partly, to a different process. An additional source for the observed high alkalinity values could potentially be the CO_2-induced weathering of reactive silicates. Wallmann et al. (2008) could show that in sediments of productive continental margins the CO_2 produced during methanogenesis is almost completely converted into HCO_3^- and that this is attributed to the weathering of reactive silicates in anoxic sediments. In the sediments at Yonaguni Knoll IV, CO_2 concentrations are orders of magnitude higher as indicated by the low pH values observed (pH<6) than in the sediments investigated by

Wallmann et al. (2008). Further investigations of the porewater and sediment samples are needed to verify or falsify this idea.

Swallow Chimney

The sediments around Swallow Chimney are extensively covered with volcanic rocks and hence, we were not able to successfully deploy any multicorer. However, we were able to recover sediments with several gravity cores (Fig. 6.24). The collected porewaters exhibited some distinct differences compared to Abyss Vent. Firstly, they were extremely enriched in NH_4, which is potentially produced by high-temperature degradation of organic matter at large sediment depths. Secondly, the chlorinity is lower (<450 mM) than at the reference site and Abyss Vent (~545 mM). This could be due to gas hydrate formation but also originate from a Cl-depleted fluid rising from greater depth. Total alkalinity is generally high (>40 meq/l) and also shows a subsurface maximum of >60 meq/l. Similarly, dissolved silicate concentrations are generally high (>0.6 mM) and show even more elevated values at the sediment surface (~1 mM). Hence, they cannot be explained by advective or diffusive transport from the hydrothermal fluid source from below. Both subsurface maxima, TA and SiO_4, can eventually be explained by silicate weathering in this zone, where the less mobile liquid CO_2 accumulates and/or gets arrested in hydrate coated droplets. Again, we need to further investigate the collected samples to substantiate or discard this idea.

Table 6.2: List of geochemical sampling sites and collected sub-samples

Station	Area	Latitude (S)	Longitude (E)	Water depth / m	PW	Poros / CNS	IC	ICP-AES	CH_4 / CO_2	$\delta^{13}C$ / DIC	Iso	Acetate	U/Th	Rn	Glovebag	Hard rock	Length / cm	No. of samples
005 D1-197 PC14	YK, Abyss V.	24°50.785	122°42.064	~1390	X	X	X	X	X	X	X						18	10
011 D2-198 KIPS 22/23	YK, Swallow C.	24°50.839	122°42.019	1373	X	X	X	X	X	X	X							2
011 D2-198 KIPS 26	YK, Swallow C.	24°50.859	122°42.010	~1390	X	X	X	X	X	X	X							1
015 MUC 3_1	YK, Reference	24°50.827	122°42.086	1372	X	X	X	X	X	X	X						32	14
015 MUC 3_2	YK, Reference	24°50.827	122°42.086	1372	X		X	X					X		X		34	14
018 MUC 6	YK, Abyss V.	24°50.783	122°42.004	1372	X	X	X	X	X	X	X					X	0	1
019 MUC 7	YK, Abyss V.	24°50.813	122°42.051	1384	X	X	X	X	X	X	X						6	7
020 MUC 8	YK, Abyss V.	24°50.837	122°41.994	1362	X	X	X	X	X	X	X		X		X		17	10
025 MUC 10	YK, Abyss V.	24°50.819	122°42.041	1392	X	X	X	X	X	X	X						37	15
027 D3-199 PC22	Hatoma Knoll	24°51,566	123°50,469	~1530	X	X	X	X	X	X	X						13	7
027 D3-199 PC25	Hatoma Knoll	24°51,592	123°50,491	~1530	X	X	X	X	X	X	X						13	7
030 D5-201 PC1	YK, Abyss V.	24°50.781	122°42.025	~1390	X	X	X	X	X	X	X						18	10
030 D5-201 PC5	YK, Abyss V.	24°50.781	122°42.025	~1390	X	X	X	X	X	X	X						20	11
030 D5-201 KIPS 23	YK, Abyss V.	24°50.781	122°42.028	~1390	X	X	X	X	X	X	X							1
030 D5-201 KIPS 27	YK, Reference	24°50.825	122°42.085	~1390	X	X	X	X	X	X	X							1
033 CTD 11	YK, Swallow C.	24°50.857	122°41.991	1379									X	X				4
034 GC 1_1	YK, Swallow C.	24°50.841	122°42.003	1382	X	X	X	X	X	X	X						300	11
034 GC 1_2	YK, Swallow C.	24°50.841	122°42.003	1382	X		X	X					X		X		300	7
043 GC 3_1	YK, Swallow C.	24°50.849	122°42.019	1383	X	X	X	X	X	X	X						90	8
043 GC 3_2	YK, Swallow C.	24°50.849	122°42.019	1383	X		X	X					X		X		90	4
044 D7-203 PC11	YK, Abyss V.	24°50.781	122°42.025	~1390	X	X	X	X	X	X	X						20	11
044 D7-203 PC24	YK, Abyss V.	24°50.781	122°42.025	~1390	X	X	X	X	X	X	X						14	8
044 D7-203 PC33	YK, Abyss V.	24°50.781	122°42.025	~1390	X	X	X	X	X	X	X						22	12
050 GC 4	YK, West	24°50.816	122°41.987	1386													0	0
051 GC 5	YK, East	24°50.816	122°42.036	1383												X	0	1
054 MUC 19	YK, Abyss V.	24°50.781	122°42.038	1387	X	X	X	X	X	X	X	X					26	10
055 MUC 20	YK, Abyss V.	24°50.818	122°42.076	1318	X	X	X	X	X	X	X	X					30	11
057 CTD 19	YK, North	24°51.707	122°42.629	1071									X	X				4
065 MUC 23	YK, Reference	24°50.355	122°41.736	1324	X	X	X	X	X	X	X	X					33	12
069 CTD 24	YK, Reference	24°50.680	122°46.500	1654									X	X				4
085 GC 8_1	YK, Reference	24°50.355	122°41.736	1320	X	X	X	X	X	X	X	X					300	14

085 GC 8_2	YK, Reference	24°50.355	122°41.736	1320	X		X	X					X		X		300	8
086 Dive10-206 KIPS	YK, Abyss V.	24°50.778	122°42.038	~1390	X													4
088 GC 9_1	YK, Abyss V.	24°50.774	122°42.043	1399	X	X	X	X	X	X	X	X					120	9
088 GC 9_2	YK, Abyss V.	24°50.774	122°42.043	1399	X		X	X					X		X		120	4
089 GC 10	YK, Canyon	24°51.660	122°43.534	1418	X	X	X	X	X	X	X	X					300	9
091 GC 12	YK, Swallow C.	24°50.850	122°42.026	1384												X	0	1
093 MUC 26	YK, Swallow C.	24°50.846	122°42.019	1386												X	0	1
095 MUC 28_1	YK, Abyss V.	24°50.781	122°42.028	1394	X	X	X	X	X	X	X						22	12
095 MUC 28_2	YK, Abyss V.	24°50.781	122°42.028	1394	X		X	X					X		X		24	8

GC = gravity corer; MUC = TV guided multi-corer; PC = ROV guided pushcore; CTD = Water sampler; PW = porewater analytics of TA, H_2S, pH, NH_4, PO_4, SiO_4, Cl; IC = ion chromatography (SO_4, Br, Cl, I); ICP-AES = cations; Iso = Porewater isotope ratios of O, H, Cl, Sr; YK = Yonaguni Knoll IV

Table 6.3: Analytical methods for measuring porewater parameters

Parameter	Method	Detection limit	analytical error (accuracy)
H_2S	Photometer	2 µmol/l	2 %
NH_4^+	Photometer	2 µmol/l	5 µmol/l
PO_4^{3-}	Photometer	1 µmol/l	5 µmol/l
SiO_4^{4-}	Photometer	1 µmol/l	5 µmol/l
Fe^{2+}	Photometer	1 µmol/l	5 µmol/l
Cl^-	Mohr titration		5 mmol/l
pH (ex situ)	Glass electrode		0.2
Alkalinity	Titration		0.05 meq/l

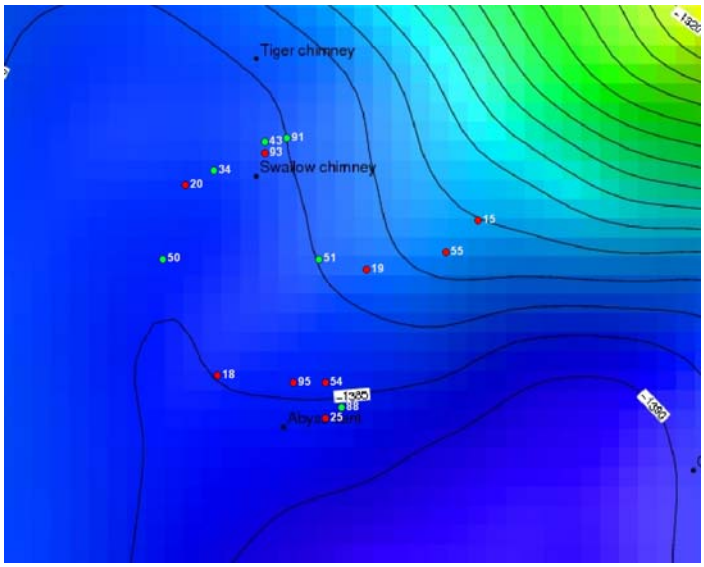

Fig. 6.21: Locations of coring sites (station numbers in white) in the Yonaguni Knoll IV area. GCs: green dots, TV-MUCs: red dots. The reference cores were taken about 0.5 nautical miles to the SSW

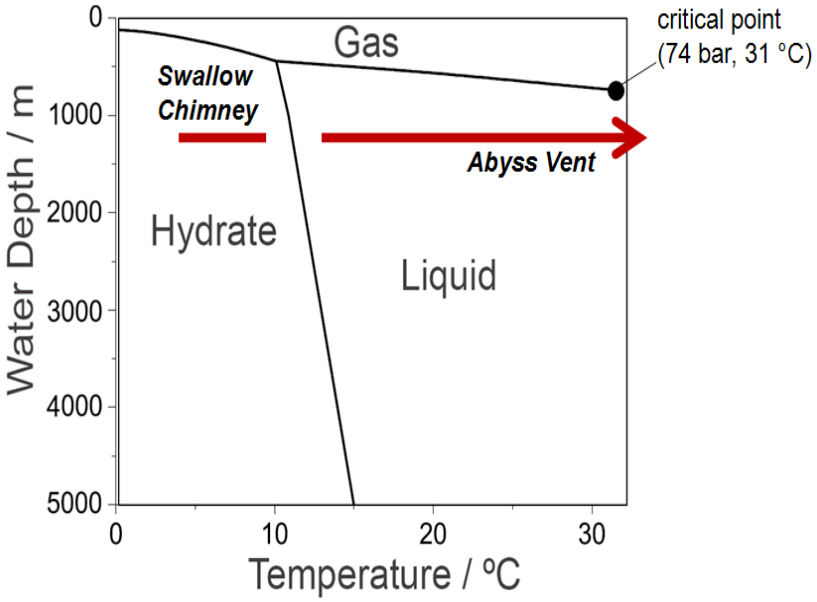

Fig. 6.22: Phase diagram of CO_2 in seawater (after Duan and Sun, 2006). Indicated in red are the p,T conditions at the 2 primary investigation sites in the Yonaguni Knoll IV area, Swallow Chimney and Abyss Vent. Due to the prevailing porewater and bottomwater temperatures, CO_2 hydrates are only stable in the surface sediments of Swallow Chimney, whereas at Abyss Vent liquid and supercritical CO_2 dominate

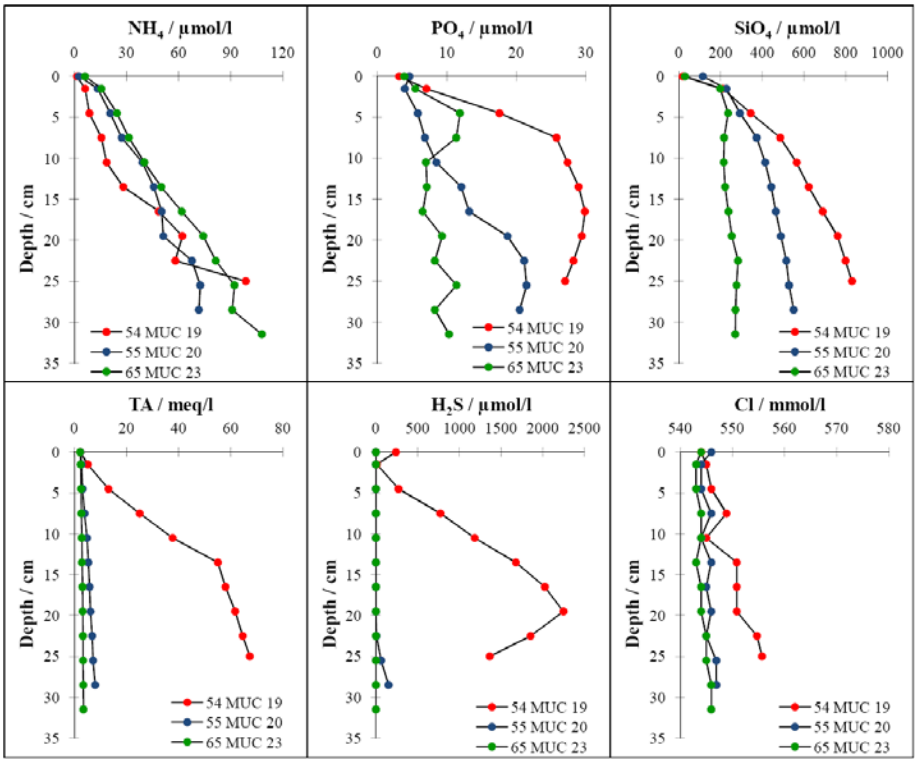

Fig. 23: Porewater geochemistry of surface sediments (0-33 cm) in the Yonaguni Knoll IV area at the Abyss Vent site (54 MUC 19), between Abyss Vent and Swallow Chimney (55 MUC 20), and at a reference station (65 MUC 23)

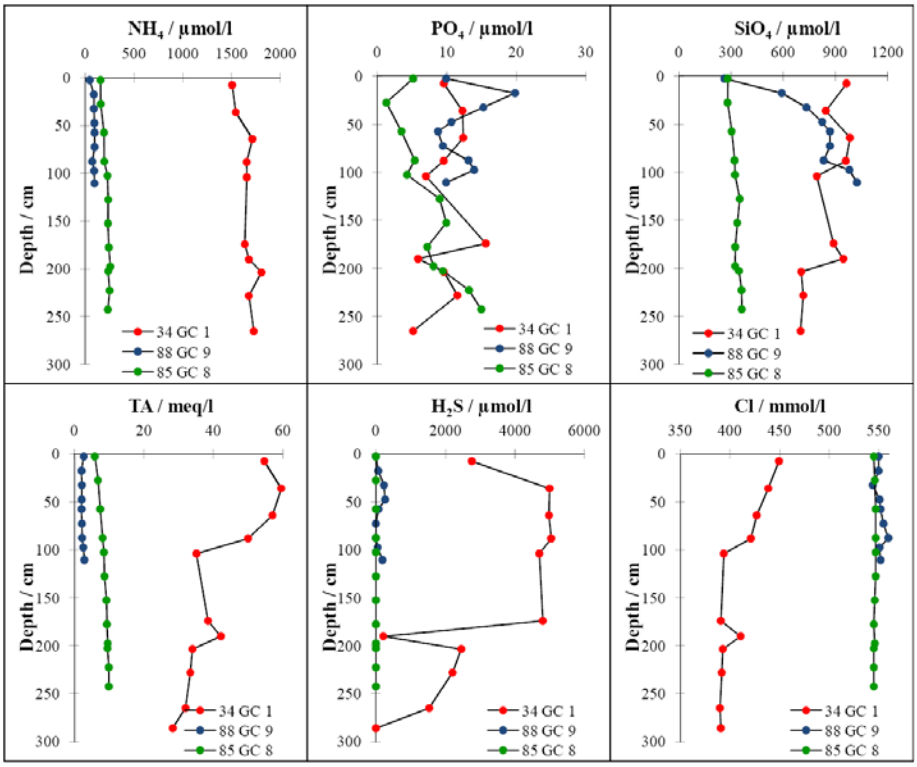

Fig. 6.24: Porewater geochemistry in the upper 3 m of the sediments in the Yonaguni Knoll IV area at the Swallow Chimney site (34 GC 1), the Abyss Vent site (88 GC 9), and at a reference station (85 GC 8)

6.4.2 Sediment temperature measurements

(J. Schneider v. Deimling)

Warm fluids have been reported to locally arise within the sediments in both working areas and have a crucial impact on the sediment's geochemistry, especially if gas hydrates are present. Thus, the T-Lance was extensively used during several ROV dives.

It was known from the beginning of the cruise, that sensor #2 is not working. This problem could not be fixed during the cruise and consequently, data from sensor #2 must be disregarded in any case. Else, the temperature gradients between adjacent sensors appear reasonable with respect to heat flux from the depth towards the seafloor, i.e. the lower (deeper) the sensor number the higher the temperature value it measured.

During the initial dives 198 and 199, all T-Lance sensor data were severely disturbed by strong artificial oscillations on a minute scale showing absolute amplitude of 3 K (Fig. 6.25).

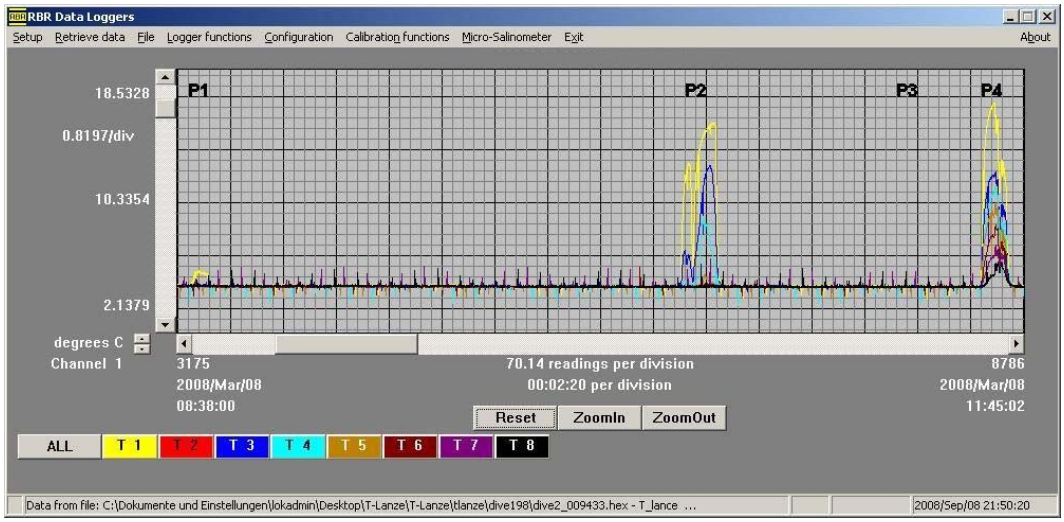

Fig. 6.25: Raw temperature data presentation gathered during dive 198. P1, P2, P3 and P4 point out penetration events

This artefact is thought to have been caused by grounding problems within the electrical circuit of the ROV, which could be fixed for subsequent dives. Although this artefact strongly affects the *S/N* and the resolution of the measurement, huge temperature gradients (Tab. 6.4) still allow to obtain reasonable temperature gradient information for these casts.

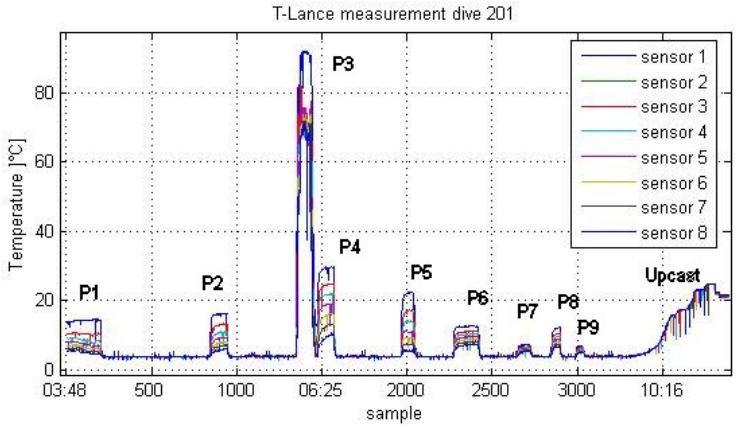

Fig. 6.26: Temperature data of P1-P9 gathered during dive 201 including the subsequent water column upcast

Extraordinary high temperature values of 91°C (Yonaguni) and 61°C (Hatoma) values were measured in approximately 40 cm sediment depth. Further temperature data and positioning of deployment can be found in Tab. 6.4.

Table 6.4: Table showing some prominent surficial sediment temperature events from ROV-T-Lance deployment

Divenr	Gridpoint	Penetration	max. temp. [°C]	begin penetration [UTC]	lance removal [UTC]	Lat (Posidonia)	Long (Posidonia)
198	P1	weak	4.9	08:41:02	08:44:42	24 50.8368	122 42.0175
	P2	medium	16.40	10:29:14	10:37:00	24 50.8581	122 42.0110
	P3	weak	3.82	11:17:31	11:21:39	24 50.8515	122 42.0067
	P4	full	18.00	11:35:42	11:41:20	24 50.8463	122 42.0058
199	P1	medium	4.97	01:23:57	01:29:47	24 51.4061	123 50.3790
	P2	weak	3.83	01:39:35	01:41:47	24 51.4091	123 50.3843
	P3	weak	4.00	01:45:23	01:49:16	24 51.4093	123 50.3826
	P4	weak	3.97	01:50:12	01:52:53	24 51.4095	123 50.3838
	P5	medium	10.27	02:12:57	02:24:23	24 51.4268	123 50.4062
	P6a	full	10.61	02:24:37	02:27:53	24 51.4263	123 50.4058
	P6b	full	13.33	02:27:53	02:36:24	24 51.4263	123 50.4058
	P7	medium	3.87	02:38:30	02:41:18	24 51.4269	123 50.4061
	P8	medium	6.89	03:09:53	03:11:03	24 51.4445	123 50.4038
	P9	medium	7.90	03:11:38	03:25:45	24 51.4448	123 50.4025
		no		03:33:24		24 51.4509	123 50.3896
		no		03:49:31		24 51.4546	123 50.3837
		no		04:05:18		24 51.4507	123 50.3799
	P10	medium	14.80	04:08:13	04:28:45	24 51.4523	123 50.3792
	P11	no	22.11	04:32:50	04:34:28	24 51.4545	123 50.3777
	P12	full	7.26	09:01:10	09:10:30	24 51.5666	123 50.4688
	P13	weak	4.52	09:53:05	09:59:58	24 51.5923	123 50.4912
200	Test wc			01:20:41	11:46:08		
	P1		4.27	03:48:43	05:47:08		
201	P1	full	14.43	03:48:20	04:11:26	24 50.7820	122 42.0247
	P2	full	16.12	05:26:20	05:38:07	24 50.7799	122 42.0328
			4.43	05:51:32	05:56:54		
	P3	full	91.77	06:24:26	06:34:42	24 50.7848	122 42.0273
	P4	full	39.30	06:35:38	06:37:44	24 50.7830	122 42.0260
	P5	medium	12.99	06:38:26	06:39:50	24 50.7822	122 42.0238
	P6	full	29.57	06:39:57	06:51:09	24 50.7820	122 42.0238
	P7	full	22.40	07:37:28	07:45:24	24 50.7702	122 42.0377
	P8	full	12.60	08:13:03	08:30:05	24 50.8258	122 42.0834
	P9	medium	7.16	08:56:48	09:04:16	24 50.8088	122 42.1019
	P10	full	12.07	09:20:08	09:25:44	24 50.7973	122 42.0676
	P11	full	7.00	09:36:56	09:42:25	24 50.8221	122 42.0820
202	P1			03:06:31	03:10:19	24 51.5750	123 50.4499
	P2		5.40	04:10:20	04:20:57	24 51.5757	123 50.4505
	P3		5.20	04:38:34	04:44:45	24 51.5771	123 50.4507
	P4		8.91	11:02:38	11:03:41	24 51.4938	123 50.4793
	P5		13.37	11:06:08	11:08:35	24 51.4939	123 50.4786
	P6a		43.42	11:09:38	11:11:44	24 51.4950	123 50.4795
	P6b		61.10	11:12:54	11:17:34	24 51.4943	123 50.4796
203	P1	full	4.69	05:17:51	05:46:19	24 50.7837	122 42.0347
	P2	full	47.77	06:15:08	06:24:56	24 50.7800	122 42.0290
	P3	full	55.90	06:27:37	06:34:37	24 50.7807	122 42.0288
	P4	medium	7.01	06:59:14	07:10:26	24 50.8362	122 41.9952
	P5	full	20.39	07:10:54	07:20:00	24 50.8372	122 41.9965
	P6	full	44.27	07:32:22	07:41:35	24 50.8520	122 42.0231
	P7	full	40.83	07:43:55	07:53:15	24 50.8512	122 42.0229
	P8	full	5.19	09:50:44	10:03:06	24 50.7989	122 42.0951
	P9	full	4.84	10:29:00	10:53:58	24 50.7685	122 42.1037

6.4.3 Microprofiling

(D. de Beer)

We have deployed the profiler during dive 201, and obtained 3 sets of profiles from different locations within the seep area around the Abyss vent. We have also deployed the profiler with the MUC for a videoguided transect along the Yonaguni basin. Furthermore, we measured profiles ex situ in many sediment samples in the lab.

Table 6.5: Microsensor measurements during SUMSUN

Station	Device	location	comments
30	ROV 201	N 24 50.781 E 122 42.0307	In situ; a few meters away from abyss vent
30	ROV 201	N 24 50.782 E 122 42.0251	In situ; at abyss vent (marker 8)
30	ROV 201	N 24 50.826 E 122 42.0842	In situ, at marker 9, 150 m NE of abyss vent
87	TV MUC / MIC	N 24 49.770 E 122 42.500	In situ, Transect from SW of Abyss Vent to NE Yonaguni Knoll IV
15	TV-MUC 3	N 24 50.827 E 122 42.086	150 m NE of Abyss Vent
19	TV-MUC 7	N 24 50.808 E 122 42.006	70 m NW Abyss Vent
20	TV-MUC 8	N 24 50.838 E 122 41.992	20 m W of Swallow Chimney
25	TV-MUC 25	N 24 50.394 E 122 41.766	Ex situ, reference site

The in situ measurements were aimed to target seep areas of different CO_2 fluxes. The profiler did not sink in as deep as expected, thus all profiles have a small penetration depth. During dive 201, the oxygen sensors broke during the first repositioning of the profiler. Total sulfide was calculated from the pH and the H_2S profiles, the DIC from the CO_2 and pH. The pH in the bottom water was confirmed with KIPS samples.

The bottom water has a low pH that further decreases in the sediments where a value of 4.5 was measured at > 5 cm sediment depth at the seep site (Fig. 6.27). DIC concentrations in the bottom water were 10-20 mM, and near the seep 80 mM. In the sediments, values of 1 M were measured, and near the seep site 3 M. This represents 60 atm, thus upon retrieval only a fraction of the CO_2 will remain (1 atm at maximum). As the pH is far below the pK_1, almost all DIC is in the form of CO_2. Such high CO_2 levels must have severe effects on life. Most probably, no life is possible below 1-2 cm, as 0.3 % of the CO_2 is hydrated as H_2CO_3. This apolar compound can pass membranes, and dissipate the proton motive force. Whether all components of the PMF will be dissociated is unsure, but no ΔpH can be maintained. Most uncouplers lead to full PMF loss at <1 µM to 10 µM concentrations, while H_2CO_3 concentrations are in the order of 1-10 mM. Bacteria will then have to cope with a cytoplasm pH of 4.5, but even bacteria living in acid mine drainage (pH 1) or in alkali lakes (pH 11), have to maintain a near neutral intracellular pH. Only near the sediment surface microbial life may be possible, and in sediments that are ventilated by burrowing organisms. The sulfide

profiles are almost perfectly linear, indicating the absence of sulfate reduction. Oxygen penetration is ca 1 mm. Oxygen consumption is probably driven by respiration and chemical reduction of sulfide.

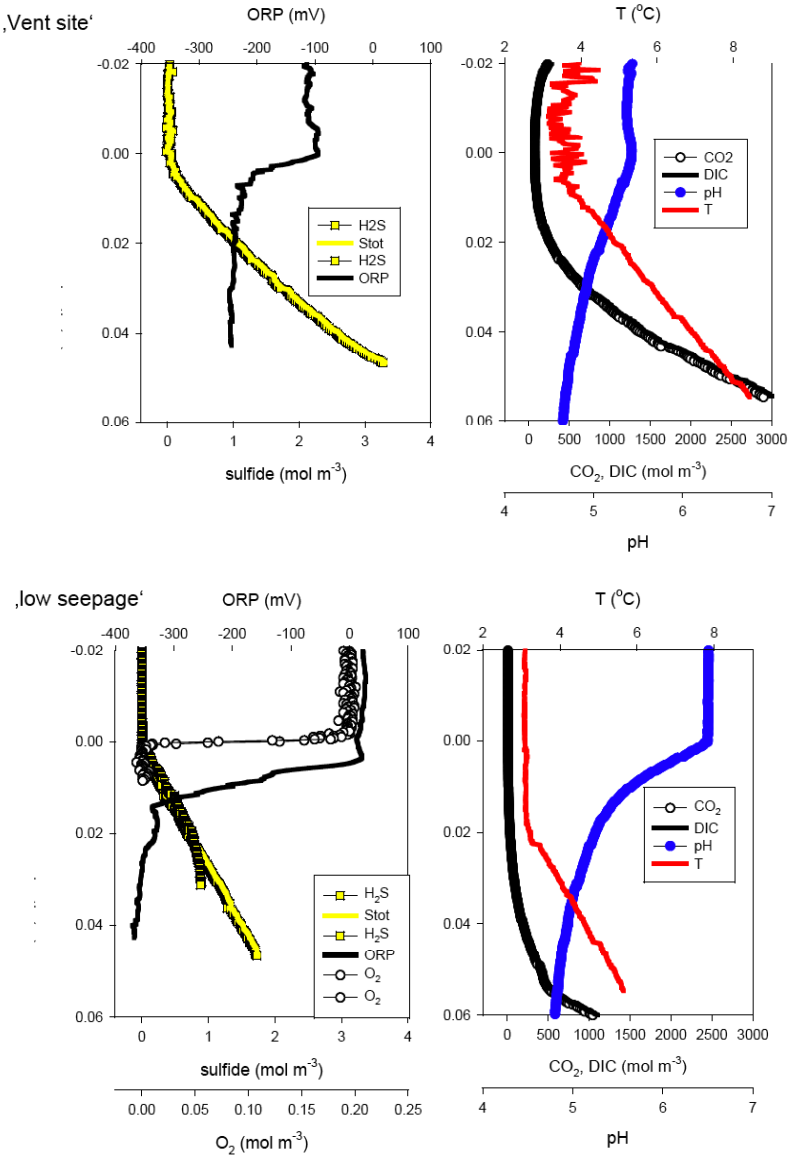

Fig. 6.27: In situ microsensor measurements at the Abyss vent and 150 NE of the vent

<u>Ex situ profiles</u>

Ex situ profiling of retrieved pushcores was carried out to quickly assess the level of CO_2 venting through the sediments on board. However, as some of the seep sediments contain an equivalent of 60 atm of CO_2, they will almost completely degas during the depressurization. Per liter of sediment ca 20 liter of CO_2 will be produced, stripping the porewater from almost all gases, including sulfide. Indeed in the retrieved cores we found some H_2S in the overlaying water, but never in the sediments. The sediments will of course be strongly mixed by the bubbling. Another artifact is that the porewater pH will rise rapidly, and due to the high DIC levels, carbonates precipitate. Calcium carbonates effectively buffer the pH. Upon aeration of the overlaying water of a freshly retrieved pushcore, the pH rapidly

increases to ca 8, but inside the sediments remains between 6.5 and 7. Results of an experiment are shown in Fig. 6.28. Here, 12 profiles were measured within 1 hour interval after start of aeration. Upon sparging the overlaying water with CO_2, the pH in the water decreases to 5, but inside the sediments remains ca 6.5. The profiles are measured in 75 minutes interval after start of CO_2 bubbling.

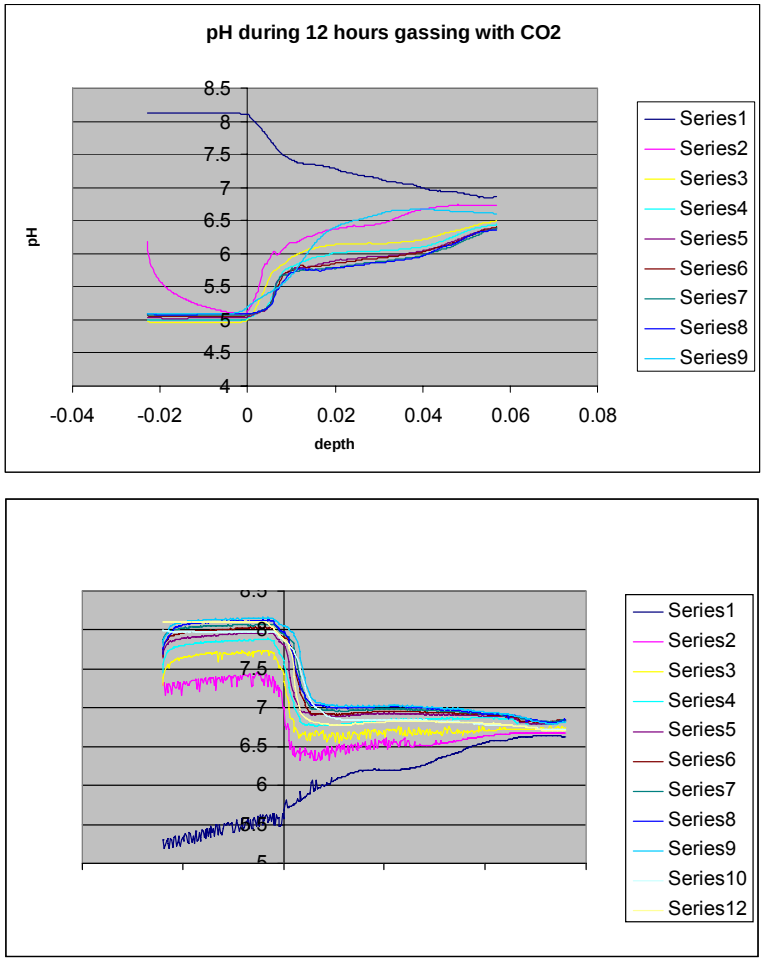

Fig. 6.28: Changes in pH profiles after retrieval of a pushcore from abyss seep. Above: bubbling with oxygen. Below: bubbling with CO_2

Interestingly, as during CO_2 bubbling the sedimentary pH is higher than in the water column the CO_2 concentrations inside the sediments are below saturation, leading to a CO_2 influx. Retrieval has turned CO_2 producing sediments into CO_2 absorbers. The core retrieval has increased the sediment pH by 2 units, and reduced the CO_2 concentrations by a factor of at least 60, leading to precipitation of calcite. Hence quantitative and functional analyses are hardly possible on retrieved sediments.

The microsensor profiles show little evidence for microbial activity directly at the sedimentary CO_2 vent “Abyss”. Here, oxygen was likely consumed by chemical processes, and the sulfide profile showed transport rather than sulfide production by sulfate reduction. However, we could show, by using a N_2O microsensor, some microbial activity to be present at sediment surface. In a retrieved core a small peak of N_2O was present upon acetylene inhibition, indicating a small denitrification potential. When the nitrate concentration was enhanced to

200 µM no further increase in the peak was observed. Denitrification could be coupled to sulfide or methane oxidation, and (in retrieved cores) be limited by electron donor availability.

In situ bottom water measurements by a profiler mounted to a TV MUC

The profiler was mounted on the MUC and trawled at 2 m above seafloor along a transect from the reference site outside the vent influenced area in the SW, through the valley for CO_2 vents up the Yonaguni Knoll IV. No H_2S was detected in the bottom waters. The signals clearly showing the effect of CO_2 venting on the water chemistry were the reduced pH, lowered redox, increasing T and especially CO_2, even at 2 m above the seafloor. Oxygen concentrations were low in the reference area (80 µM) but did not change in the vent area.

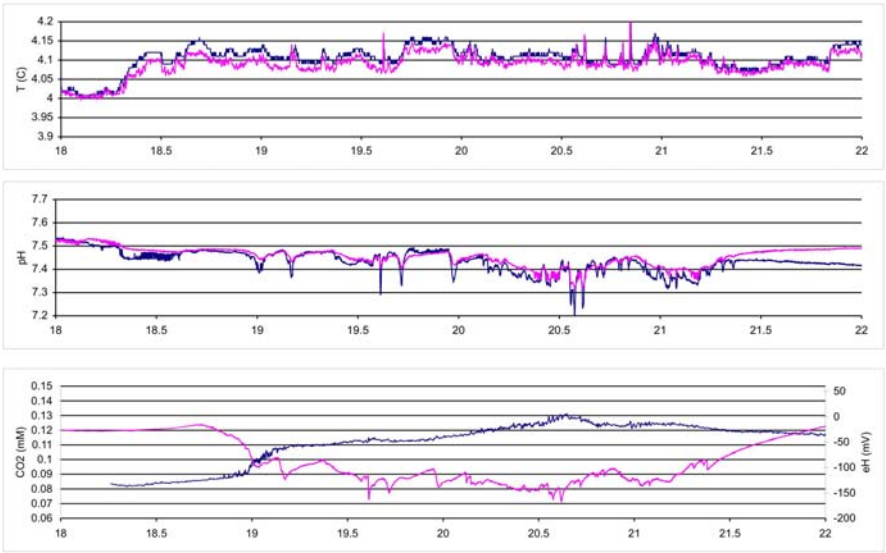

Fig. 6.29: pH and CO_2 variations in the Yonaguni basin. For the transect see Fig. 6.30. The y-axis is UTC time of the transect. The seep zone is reached at 18:30, and left at 21:15

Fig. 6.29 shows that the increase in CO_2 and decrease in pH in the vent area has a dramatic effect on echinoderm megafauna (Fig. 6.30, vents are marked with red triangles). Echinoderms are absent in all of the vent area

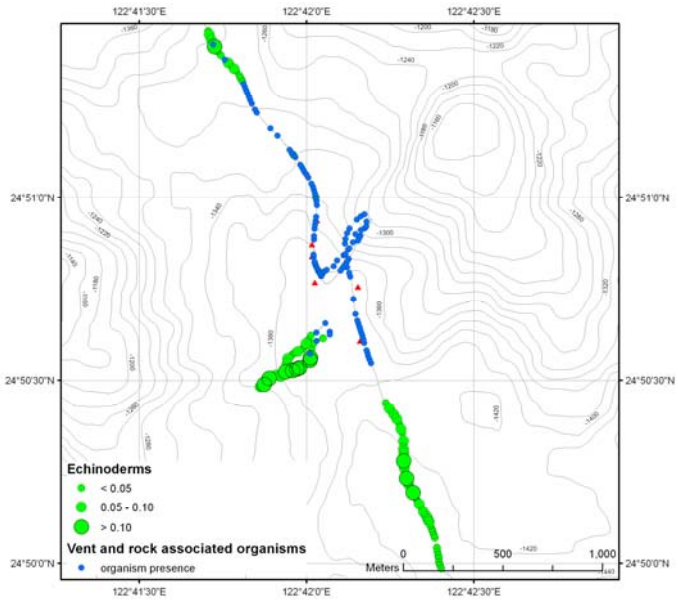

Fig. 6.30: Distribution of megafauna in the area with and without CO_2 influence. The S-N transet was carried out by the TV-MUC profiling, the W-E transects by the ROV

6.4.4 Biogeochemistry and Microbiology

(A. Boetius, F. Inagaki)

The recovery of the sediment samples from the target sites was done by deploying either the ROV (sampling with pushcores), the gravity corer (GC or the multiple corer). The sampling focused on the Yonaguni Knoll IV area. At Yonaguni, sediment samples for biogeochemistry and microbiology were taken at different distances to the Abyss and Swallow vents. In total 2 pushcores, 4 GC and 15 multicore samples were taken for biological and biogeochemical analyses during the SUMSUN cruise (see core description list).

Directly after the cores arrived on board, they were stored in a cold room at 4°C. The subcores were then split into different layers for rate measurements (AOM/SRR), biomarker analysis, total bacterial counts, fluorescence in situ hybridization (FISH), porosity analysis, cultures, DNA/RNA molecular analyses and distribution of CH_4.

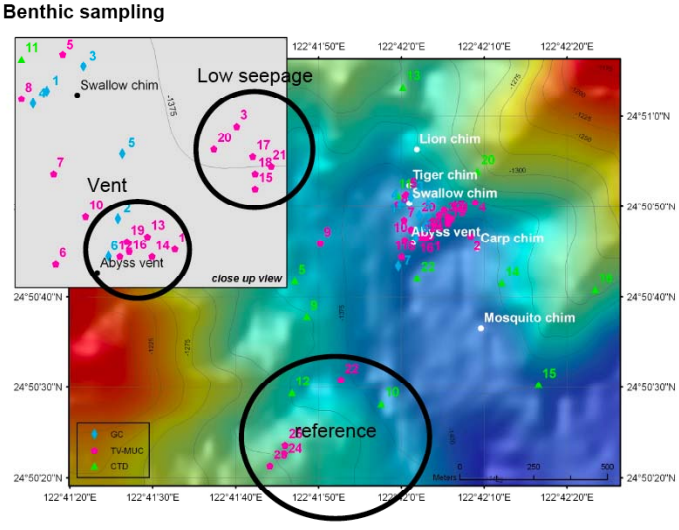

Fig. 6.31: Strategy for benthic sampling at Yonaguni Knoll IV. Three sites were sampled in replicate: an area of high seepage, low seepage and a reference site south of the vents

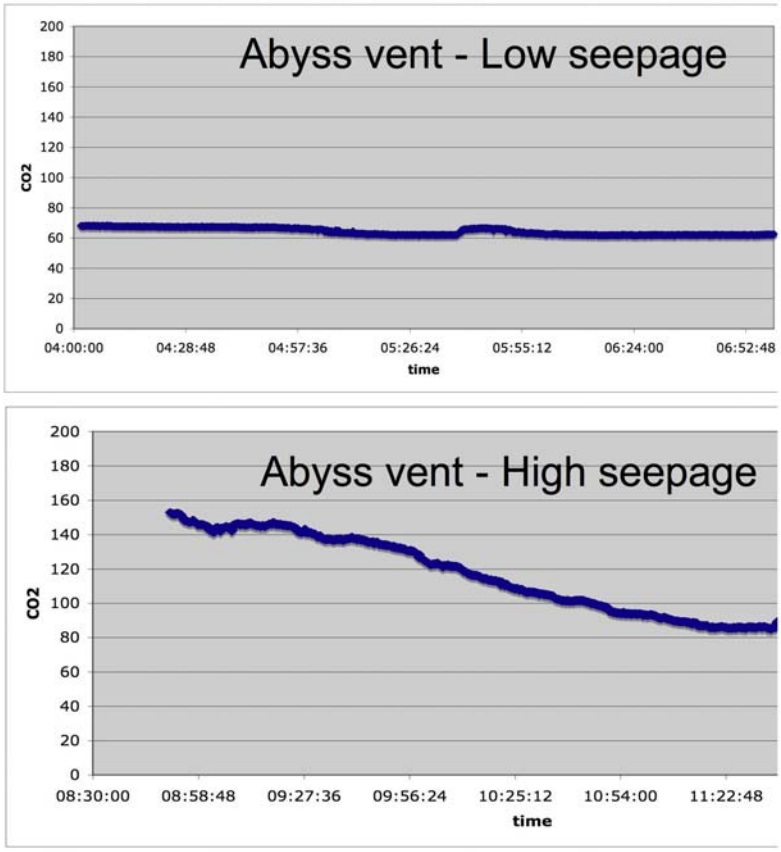

Fig. 6.32: Measurements of CO_2 concentrations over time in the benthic chamber deployed at two sites close to Abyss vent with high and low seepage activities. Note that smaller signals means higher CO_2 concentrations

Sulfate reduction and Anearobic Oxidation of Methane (AOM)

Sulfate reduction rates will be obtained from 2x4 replicate in situ incubations with the INSINC tool (Dive 201 and 203). INSINC (In situ incubator) is based on the established method to measure sulfate reduction by whole core injection. With INSINC, ^{35}S sulfate radiotracer is injected at the seafloor into a closed push core sediment sample. The sulfate reduction reaction is terminated on board by transferring the sediment to ZnAc similar as in the ex situ method. The conversion of $^{35}SO_4$ to $^{35}S^{--}$ is measured in the home laboratory.

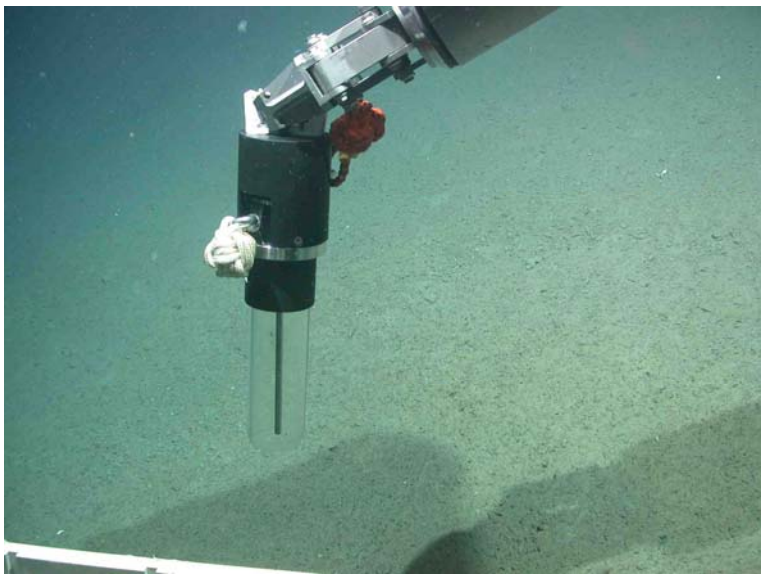

Fig. 6.33: Deployment at the low seepage area at Yonaguni

Sediment samples from multi cores, push cores as well as gravity cores were investigated for microbially mediated sulfate reduction and methane oxidation. 3 subcores (Ø 2.5cm) were taken from multicorer and pushcore samples immediately after recovery. Radio tracer labeled substrate was injected in 1cm intervals through small, silicon sealed holes. Sediments were incubated with either $^{14}CH_4$ or $^{35}SO_4^{2-}$ for 12 hours at in situ temperature under anaerobic conditions and then fixed in NaOH and Zn-Ac, respectively, for further measurements of remaining substrate and product activity. From the gravity core samples 5ml of sediment slurry was sampled with 50 cm resolution and incubated in rubber stopper glass tubes. The ratio of product to substrate activity multiplied with substrate concentrations yields then actual rates. All samples will be analyzed in the home laboratory.

Microbial Community Analyses

The liquid CO_2-bearing marine sediment is one of the most extreme and harsh environment for any kinds of life on earth. Since the discovery of the hydrothermal vent fields, the environments have long been recognized as a commonsense as “oasis of life in deep-sea”. However, in the sediment-hosted hydrothermal system at the Yonaguni Knoll IV, once the sediments are influenced by vapor-rich fluids from the subsurface vent emission and cooled down near the seafloor, the condition turns out to be somehow extreme and severe for microbial life, where the liquid CO_2 acts as an organic solvent and drastically decreases the pH down to 4.5 (or less), which most likely prevents the metabolic functioning such as energy respirations. Given such extreme conditions, it is of great interest for microbiology and biogeochemistry to study the existence and nature of microbial life. Inagaki et al. (2006) reported the first results that some specific chemolithotrophic microbes that consume one-carbon compounds such as CO_2 and methane inhabit the unique environment although the resident population appeared to be two orders of magnitude lower than the seawater-sediment interface (Inagaki et al., 2006). It is postulated that the microbes detected as DNA or lipid molecular signals are taking advantage of the presence of water-hydrate interface as the niche of choice, where should provide some acceptable place for microbial life. Nevertheless, it is not clear that these one-carbon consumers are just preserved, survive, or are metabolically active in the liquid CO_2-bearing marine sediments. If they are active in situ and preferentially inhabit such an environment, the cultivation of acidphilic chemolithotrophs or methanotrophs will be of great interest for microbiologists and the public. For the better understanding of this unique and extreme marine environment as the follow-up study to the discovery of life signatures, we will intensively study the distribution of cell abundance and metabolic activities (both in situ and ex situ conditions) using a number of sediment samples collected during the SO196 expedition.

Samples from various pushcores, multiple corers as well as gravity cores were taken and preserved according the different protocols as below:

Bacterial counts:

2.5 ml of sediment volume were fixed in 9 ml of 2 % formalin in sea water for 2 – 4 h

Fluorescence in situ hybridization (FISH):

2 ml of the sediment-formalin suspension were centrifuged and supernatant was discarded. The pellet was washed two times in 3 ml 1*PBS-buffer (resuspension, centrifugation, discarding of supernatant). Finally, the pellet was fixed in 2 ml of a 1:1 (v:v) solution of Et-OH:1*PBS (50 % final concentrations) and kept at -20 °C until further analyses.

DNA/RNA:

Approximately 4 g of fresh sediment were frozen at -20 °C until DNA analysis in the home laboratory.

Biomarker:

Ca. 20 g of sediment were frozen at -20 °C in special glass bottles until further processing in the home laboratory.

Cultivation approach (Anaerobes)

Sediment from different layers was transferred to wide mouth glass bottles sealed with gas tight rubber stopper. The headspace of sampling bottles was replaced by a nitrogen atmosphere. The samples are kept at in situ temperature until further experiments.

Preliminary results

First results indicate a substantial change of microbial biomass, community structure and function from the reference site to the high seepage zone. Under the influence of CO_2, total cell numbers are substantially reduced by an order of magnitude. First analyses of community structure show a shift in the bacterial diversity below 4 cm sediment depth, at low pH.

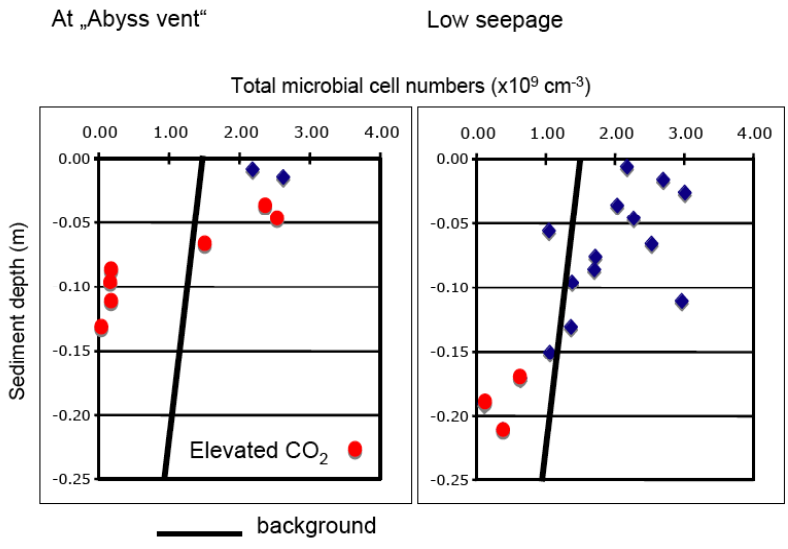

Fig. 6.34: Changes in total cell numbers with sediment depth under different CO_2 seepage regimes

Benthic ecosystem studies

To map the distribution of different megafauna habitats in relation to CO_2 concentrations in the bottom waters, we performed ROV-based (E-W) and TV-guided MUC (N-S) videotransects (N-S) at Yonaguni Knoll IV.

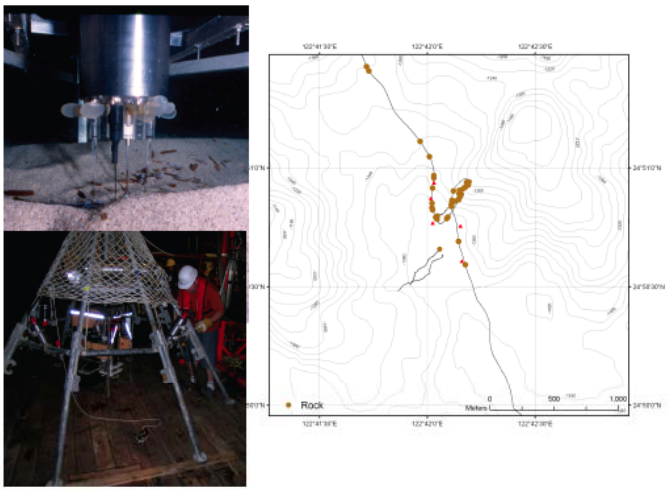

Fig. 6.35: Videoguided transects with the TV MUC (S-N) or ROV (SW-NE). A microprofiler was installed to measure CO_2 and pH during the visual monitoring of megafauna distribution

Roughly, the wider area around the Yonaguni seeps and vents is dominated by various species of echinoderms, including 2 types of starfish and 2 types of holothurians. Other abundant megafauna comprises 4 types of fish, some shrimps and sea anemones as well as different types of polychaetes with tubes sticking out of the sediment. Closer to the seep area, and inbetween the Northern vents, a striking transition zone can be observed, characterized by flat sedimentary seafloor without any traces of megafauna or their burrows or dwellings. This was observed in the southern, western and northern area of the Yonaguni Knoll IV seeps. At the Eastern part the transect was too short to reach the transition zone. The beginning of the seep and vent area is characterized by sulfur pavements in the west and the south. Here we observed sea spiders, 2 other types of fish (chimera and zoarces) as well as some octopus and an interesting pattern of holes indicating a yet unidentified burrowing animal. Sulfur pavements are visually similar to mats of giant sulfide oxidizing bacteria typical for hydrocarbon seeps, but in the whole Yonaguni Knoll IV area we could not observe any bacterial mats on the seafloor. The only microbial mats were found growing on previous established markers (Shinkai cruises), on some of the vent rocks emitting fluids and gases, as well as on the crabs inhabiting the active CO_2 vents. The vent fauna at Yonaguni Knoll IV is characterized by high abundances of white crabs and the mussel Bathymodiolus hosting methanotrophic symbionts, as well as some shrimps and snails. In the north and the east we observed vast stretches of hard grounds and extinct chimneys and vents inhabited by sponges, starfish, seaspiders and fish.

Fig. 6.36: Typical megafauna of the background area not affected by CO_2 leakage

Most interestingly, the correlation with the TV MUC – Profiler transect showed that the megafauna-missing transition zone is marked by a clear drop in pH and an increase in CO_2 compared to the reference regions. Both CO_2 and pH are highly variable inside of the vent and seep area of Yonaguni, and lowest pH is reached just above the vents releasing CO_2 droplets into the bottom water. Our results show that the distribution of benthic megafauna is related to CO_2 concentration in the bottom waters. In contrast, oxygen concentrations are similarly low with ca 90 µM across Yonaguni Knoll IV, including the reference areas. The mapping of habitats and megafauna of all ROV and TV MUC transects will be completed in the home laboratory.

Macrofauna and Meiofauna sampling

Quantitative sampling (3 habitats x 3 replicates) of macro and meiofauna was performed using the TV MUC. For macrofauna, 6-8 large MUC cores (10 cm diameter) were combined and sliced into sections [0-1cm], [1-5 cm], [5-10 cm], and sieved through a 1 mm sieve. The remaining material was fixed in 4% formalin for further analyses in the home laboratory. For small macrofauna and for meiofauna analyses, 2-3 subsamples (small cores of 6 cm diameter) per replicate station were sectioned into 1 cm layers down to 5 cm, and then the sections 5-7.5, 7.5-10 and 10-15 cm. Sediment was fixed in formalin for biomass estimation.
Briefly, first analysis of macrofauna showed echinoderm and polychaete dominated biomass at the reference site, low biomass of very few polychaetes in the transition zone, and pogonophora, cumacean, bivalve dominated biomass in the low CO_2 seep areas, and very low abundances of large polychaete worms characterized by red blood in the high CO_2 areas.

Table 6.6: Sample list, Biogeochemistry/ Microbiology

Device	Station	Macrofauna	Meiofauna	AOM/SRR	FISH	DNA	comments
MUC 3	15		x	x	x	x	NE of Abyss, low seepage
MUC 7	19		x	x	x	x	N of Abyss
MUC 8	20		x	x	x	x	W of swallow chimney
MUC 10	25		x	x	x	x	N of Abyss
MUC 11	36	x	x				NE of Abyss, low seepage, sulfur pavement
MUC 12	37	x	x			x	at Abyss (10 m), sulfidic
MUC 14	39	x	x			x	at Abyss (10 m)
MUC 15	40	x	x				NE of Abyss, low seepage
MUC 16	49	x	x			x	at Abyss (10 m), sulfidic
MUC 19	54	x	x			x	at Abyss (10 m), sulfidic
MUC 20	55	x	x			x	NE of Abyss, low seepage, sulfidic
MUC 23	65	x	x			x	reference
MUC 24	66	x	x			x	reference
MUC 25	67	x	x			x	reference
MUC 28	95	x	x			x	reference
ROV Dive 201	30		x	x (PC21, INSINK)	x (PC7)	x (PC7, PC20)	at Abyss vent (1 m)
ROV Dive 203	44			x (PC29)	x (PC14)	x (PC14)	few meters away from Abyss vent
GC1	34			x			Swallow Chimney (10 m)
GC3	43			x			Swallow Chimney (10 m)
GC6	61					x	at Abyss (10 m), sulfidic
GC8	85			x			reference
GC9	88			x	x		at Abyss (10 m), sulfidic

6.5 Gas endmember characterization at Hatoma Knoll

(G. Rehder, K.-i. Nakamura)

6.5.1 Overview

Several investigations were related to the characterization and understanding of the behavior of the condensed CO_2-enriched gas phase. Due to the logistical and metrological circumstances (see cruise narrative), pristine gas analysis were only performed in the Hatoma Knoll area. Investigations included the sampling of the droplets/bubbles in gas tight stainless steel samplers and subsequent analysis of the gas composition, rough determination of the P/T behavior of the sampled gases, video observation at the gas droplet sources to allow shore-based statistical evaluation of rise rates and size distribution, observation of phase behavior and latent heat dissipation during depressurization, and assessment of bubble dissolution rates based on video observation, following individual droplets during their ascent. The most exciting finding of these investigations was surely the existence of tremendous changes in the ratio of the two most dominant gases, CO_2 and CH_4, which had influence even on the state of the phase coexisting with the surrounding water (i.e. liquid or gaseous).

6.5.2 Gas sampling

The droplets/bubbles emanating from the seafloor were collected immediately at the source into gas tight samplers, which were closed by turning a quarter-turn valve. (Fig. 5.3) It turned out that sampling by collecting gas into a funnel attached to the inlet nozzle and subsequent transfer of the gas by suction into the evacuated sampler was not successful, because the hydrate-forming gas clogged to the wall of the funnel too tightly. Rather, the sampler was opened beforehand and the droplets were collected directly into the inlet nozzle until the entire device was filled. Then, the quarter-turn valve was closed to retain the pressure. Samples were successfully taken during dives 200 and 202, and a total of five samples could be sampled (Fig. 6.37). After resurfacing of the ROV, the samplers were immediately transferred into a water/ice bath to avoid pressure increase due to thermal expansion.

6.5.3 P/T – relations of collected gases

Immediately after transfer, an evacuated pressure gage with an internal volume of ~ 2 mL was attached to the samplers and the pressure was determined after allowing expansion into the gage. Though all samples were gathered at approximately similar water depths (~1500 m), it turned out that the evolving pressure was quite different, ranging from 160 bar (sample 202/2) to 70 bar (202/3). It turned out that there is a strong correlation between the ratio of CO_2 to CH_4 and the pressure in the samples, a consequence of the rise in the gas pressure over the liquid phase (in case of existence) with increasing CH_4 fraction. From the three samples collected during dive 202, a – rather crude – estimate of the P/T response was made by heating the sampler-gage assembly slowly from 0-30°C and noting the pressure reading on the gage.

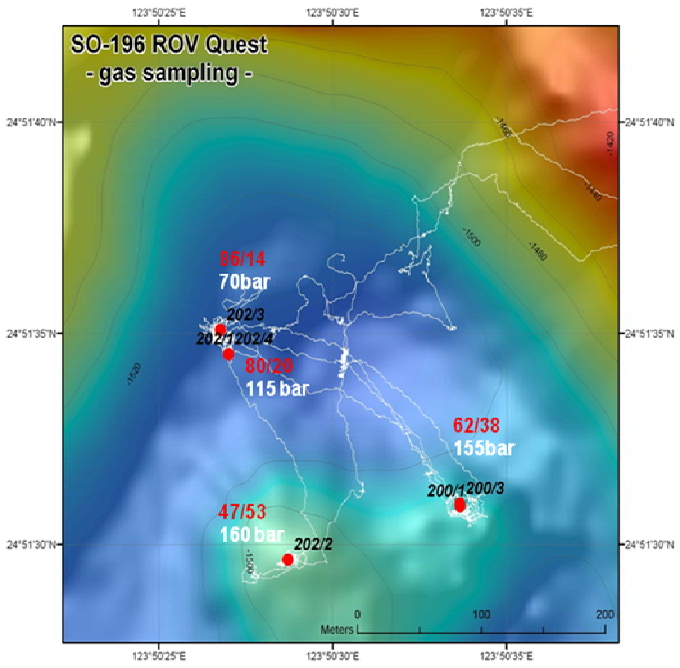

Fig. 6.37: Locations of samples of gases emanating from the seafloor. Red numbers indicate approximate CO_2/ CH_4 content of the samples. The initial pressure reading after attaching a pressure gage to the samples on deck is also given

6.5.4 Gas composition

The samples were transferred into several subsamples, including gas-tight 5.5 mL samples for storage and additional shore-based analysis, as well as into gas-tight syringes. The procedure was designed to avoid fractionation during the process, though it could not be avoided that CO2 was enriched in the water phase in the sampler due to the higher solubility of the CO2. However, due to the small volume fraction of the water and the moderate solubility, this effect can be neglected. It turned out that the CO2/CH4-ratio varied considerably, with the samples taken farther away from the main hydrothermal field being enriched in CO2 (with fractions similar to those observed by Konno et al.(2006) in the Yonaguni Knoll IV area). In the main hydrothermal area in the center of the caldera, the ratio of CO2/CH4 was near to one (see Fig. 6.37). At these sites, a slightly higher fraction of higher hydrocarbons could be detected as well (see TABLE 6.7).

6.5.5 Video observation of gas ascent

The behavior of the gases escaping from the different vent sites at Hatoma Knoll were thoroughly video-monitored, both directly and with the use of the backlit bubble imaging box. Though detailed video-analysis is pending, it was apparent that the droplets at two sites monitored out of the center of the main hydrothermal activity were more spherical, less oscillating and potentially slower than their counterparts in the main center. At one site, it appeared that the emanating gas phase collapsed after contact with the cool surrounding water, but detailed video analysis at shore is required to prove this observation. This will also allow determination of the size distribution, frequency of pulsation during emission, and ensemble effects of the rise velocity. The different observations made at the more CO_2-dominated vent sites and the gas vents with similar fractions of CO_2 and CH_4 are summarized in table 6.7 for the most representative end members.

Table 6.7: Comparison of the properties of the gas (or liquid) emanating from the sampling locations for Gas samplers 2 and 3 during dive 202. All observations and measurements hint to emission of a gas phase in the main hydrothermal field at Yonaguni Knoll IV (202-2), but a liquid phase at the vent site closer to the outer rim of the Caldera (202-3)

D-202-GS 3	**D202_GS 2**
CO_2- CH_4: 85.8 : 14.2	CO_2- CH_4: 47.4 : 52.6
C2/C1: 0.00117	C2/C1: 0.0060 and measureable C3, C4
Non oscillating, more spherical, slow	Oscillating
Gas pressure on deck ~ 70 bar	Gas pressure on deck ~ 150 bar
	

6.5.6 Droplet rise experiments

During two dives, it was attempted to monitor the size loss of individual droplets using the bubble imaging box (Fig. 5.6) The general outline of these experiments is to detect a droplet inside the imaging box and to follow it by adjusting the vertical speed of the ROV to the rise rate of the droplet, while at the same time trying to focus the HDTV camera on the droplet to enable a precise size measurement. Transfer of the gases can then be calculated from the size loss of the droplet. First experiments during dive 200 failed, as execution turned out to be hard, the box was apparently slightly tilted, which increased the turbulence, and the site chosen was apparently a gas-emitting rather than a liquid-emitting location. The higher end velocity and oscillation makes the experiment far more difficult for bubbles than for droplets.

However, during Dive 205, which was completely dedicated to the use of the imaging box due to a lack of options caused by the malfunction of the Orion arm, it was possible to perform some of the rise experiments. Individual droplets were followed during their vertical transit for up to 150 m. A total of four rise experiments could be performed before the end of the dive. Detailed video analysis ashore is mandatory to interpret the results of the rise experiments.

6.5.7 Observations of phase behavior and T-development

The observations described in the following were made by utilizing a device to take sediment cores simultaneously with temperature distribution in the core on the seafloor. Five Pt-resistance temperature probes are distributed in a 28-cm Ti probe located in the acrylic pipe. Temperature was logged by a data logger in the Ti pressure housing every two seconds. The ambient seawater temperature was also measured at the other end of the Ti housing, as well as X and Y component of tilt angle from the vertical. An inlay made from a mineral water bottle was used to avoid damage of the acrylic coring device by the liquid CO_2. The first attempt was made near the end of dive 199 at the CO_2 bubble site near the foot of the northern caldera wall of Hatoma Knoll. About two third of the pipe was filled by liquid CO_2 droplets and the pipe was kept vertical during the slow ascent of the ROV. The temperature record showed that the droplet temperature was ~ 1.5 °C higher than the ambient water temperature, which indicates that the CO_2 stored below the seafloor is significantly warmer than the seawater (Fig. 6.38).

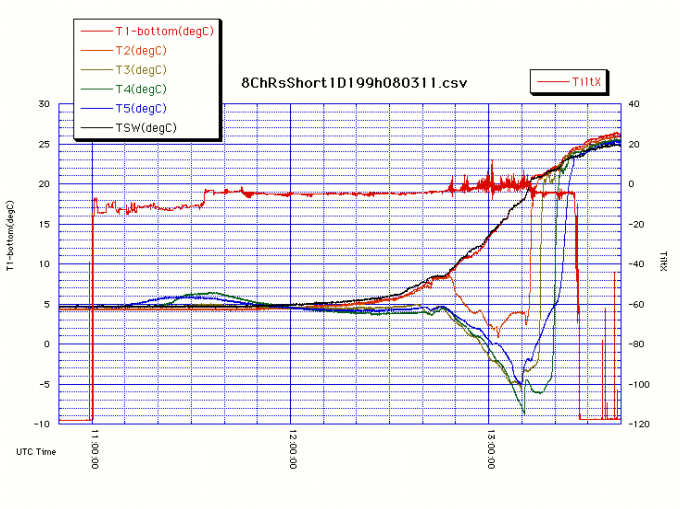

Fig. 6.38: Sampling, video observation on the front porch of the ROV during ascent, and T-record inside the CO_2-capturing rod during ascent at the end of dive 199

The second experiment was made in the middle of the dive 200 at the northern bubble site of the central mound in the Hatoma Knoll caldera. Although the sealing at the top of the pipe was broken, some gas was stored at the top of the core, which showed a temperature of about 40 °C, similar to the temperature of the outflowing hydrothermal fluid.

The third experiment was made in the main active chimney area in the Hatoma Knoll caldera near the end of the dive 202. The formation of a mass of liquid CO_2 out of the originally captured styrofoam-like hydrate/droplet mixture was observed, and confirmed by the formation of hydrate tails as well as floating behavior of the escaping liquid CO_2 from the pipe. More shore-based analyses will be necessary to interpret this exclusion of the liquid out of the originally captured gas mixture.

7. ROV operation

During SO196, a total of 11 dives to depths between 1300 and 1560 m was performed using the ROV Quest. Except for two dives, the operations allowed successful scientific sampling and observation at two different sites, though some of the other dives had to be resumed early due to the weather and current situation or due to technical problems. Unfortunately, the main hydraulic manipulator had to be switched off for the last 3 deployments due to a severe malfunction, which could not be repaired at sea. Thus the remaining Rigmaster arm was used for instrument deployment and recovery (Benthic Chamber) instead, or dives were dedicated to tasks which could be performed without manipulator use (bubble imaging box etc.). However, the amount of working time and sampling opportunity was less than anticipated. Care was taken that for the interesting scientific “stories” developing during the cruise, enough data were gathered to support later publication.

From the 11 dives, dives 197, 198, 201, 203, and 206 took place in the Yonaguni Knoll IV area, while dives 199, 200, 202, and 205 targeted on the Hatoma Knoll area. Dive 204 (Hatoma Knoll) only allowed recovery of the lost bubble chamber before reoccurrence of

problems with the 7-function manipulator arm, and Dive 207 (Yonaguni Knoll IV) had to be finished before bottom sight.

The original dive mission plans and the dive summaries, which were edited using the Alamer software package, are given in the electronic Appendix to allow easy identification of the tasks performed. This information is however too voluminous to be incorporated in the printed form of this report.

8. Summary and Outlook

During SO196, it was possible to investigate in depth two of the few known sites from which the occurrence of liquid CO_2 has been reported. Though station time, in particular time to deploy the ROV, was less than expected due to the wind and swell situation and some technical problems with the ROV at the end of the mission, it was possible to tackle most of the scientific questions on impact and behaviour of liquid CO_2 in the marine environment. Looking at these natural emission sites to narrow down the uncertainties in connection to potential CO_2 injection scenarios in the marine environment proved to be a powerful approach. However, it also is evident that all natural sites emitting liquid CO_2 deviate from these scenarios mainly due to the simultaneous propagation of heat and the occurrence of other – in particular reduced – gases, which allow the establishment of classical H_2S and CH_4 based habitats. As at least as many new scientific questions occurred than have been answered during this expedition, the submission of another proposal with a similar focus is anticipated after interpretation/publication of the results of this cruise.

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APPENDIX

- **Abbreviations**
- **Stationlist**
- **Supplemental material (electronic version only)**
    - **T-Lance data**
    - **Sample list microbiology**
    - **ROV protocols**

Device List SO196 RV SONNE

Ship based toos

BC	SAM	Box corer
COLOSSOS	MOOR	Large lift Colossos
CTD	MES	CTD/Rosette
GC	SAM	Gravity corer
MB	MES	Multibeam Echosounder (depth)
PS	MES	Parasound Sediment Echosounder (depth)
ROVQ	MES	Remotely Operated Vehicle Quest 5
TV-MUC	SAM	TV-Multicorer
TV-MICP	SAM	TV-Microsensor profiler

ROV based tools

BCROV	SAM	Blade corer (Biology)
BMB	MES	Bubble monitoring box (Geology)
CO_HH	MES	CO2, pH, T Sensor handheld (Geochemistry)
COC	MES	CO2 Sensor Contros (Geochemistry)
INSINC	SAM	INSINC corer (Geochemistry)
KIPS2	SAM	KIPS tubes (Water)
NET	SAM	ROV Net (Biology)
NIS_5L	SAM	Niskin bottle 5 litre volume (Water)
PRGS	SAM	Pressure retaining gas sampler (Geology)
PUC	SAM	Pushcore (Geochemistry)
ROV_B	SAM	ROV basket (Biology)
SG	SAM	Slurp gun bottle (Biology)
SO_HH	MES	Sulfide O2 ph Sensor handheld (Geochemistry)
TST	MES	T-Stick (Continuous m.: Temperature)
TSTO	MES	T-Stick online (Continuous m.: Temperature)
TLA	MES	T lance corer assembly
TIB	SAM	Titanium bottle (Water)

In situ Instruments

ADCP	MOOR	Acoustic Doppler Current Profiler
CHAM	MOOR	Benthic chamber (MES)
MRK	POS	Passive marker (Marker x, Description)
MICP2	MOOR	Microsensor profiler 2 (MES)
MICP5	MOOR	Microsensor profiler 5 (MES)
PEE	MOOR	Peeper (SAM)
SUB_ROV	MOOR	Subprofiler ROV (MES)

Stationlist of Meteor Leg M72/2						Start Station/Gear on bottom								
Cruise	Station	Area	Gear	Gear-#	Operator	Date/Time		Latitude [N]		Longitude [E]		Depth	Remarks	PANGAEA-ID
						[UTC]		DEG	MIN	DEG	MIN	[meter]		
SO196	1	Transit	CTD	1	Mertens	05.03.08	00:31	20	50.670	130	21.640	5575	test CTD/Rosette; pCO2 Sensor; pH Sensor 1; pH Sensor 2; Posi	SO196_1
SO196	2	Yonaguni Knoll	CTD	2	Mertens	06.03.08	17:55	24	49.580	122	44.150	1463	no USBL sub position; 20 samples	SO196_2
SO196	3	Yonaguni Knoll	POS	1	Angermann	06.03.08	19:51	24	49.470	122	44.010	1452	Test of Posidonia Releaser	SO196_3
SO196	4	Yonaguni Knoll	POS	2	Angermann	06.03.08	21:17	24	49.620	122	44.150	1455	Calibration of USBL Posidonia Antenna	SO196_4
SO196	5	Yonaguni Knoll	ROVQ	197	Rathmeyer	07.03.08	05:35	24	50.550	122	42.150	1390		SO196_5
SO196	6	Yonaguni Knoll	CTD	3	Mertens	07.03.08	14:16	24	51.365	122	40.893	1349	USBL sub position; 20 samples	SO196_6
SO196	7	Yonaguni Knoll	CTD	4	Mertens	07.03.08	16:01	24	50.812	122	40.791	972	USBL sub position; 9 samples	SO196_7
SO196	8	Yonaguni Knoll	CTD	5	Mertens	07.03.08	17:29	24	50.695	122	41.784	1340	USBL sub position; 15 samples	SO196_8
SO196	9	Yonaguni Knoll	CTD	6	Mertens	07.03.08	19:10	24	50.126	122	41.910	1385	USBL sub position; 14 samples	SO196_9
SO196	10	Yonaguni Knoll	CTD	7	Mertens	07.03.08	21:05	24	50.091	122	42.162	1429	USBL sub position; 16 samples	SO196_10
SO196	11	Yonaguni Knoll	ROVQ	198	Rathmeyer	08.03.08	02:18	24	50.770	122	42.140	1398		SO196_11
SO196	12	Yonaguni Knoll	PS	1	Schneider	08.03.08	14:02	24	51.600	122	42.340	1130		SO196_12
SO196	13	Yonaguni Knoll	TV-MUC	1	Boetius	09.03.08	01:48	24	50.778	122	42.059	1397	USBL sub position; MUC did not closed liners	SO196_13
SO196	14	Yonaguni Knoll	TV-MUC	2	Haeckel	09.03.08	04:35	24	50.780	122	42.140	1391	USBL sub position; MUC did not closed liners	SO196_14
SO196	15	Yonaguni Knoll	TV-MUC	3	Boetius	09.03.08	07:22	24	50.827	122	42.086	1372	no USBL sub position available; 12 cores recovered	SO196_15
SO196	16	Yonaguni Knoll	TV-MUC	4	Haeckel	09.03.08	10:11	24	50.841	122	42.149	1408	MUC did not closed liners	SO196_16
SO196	17	Yonaguni Knoll	TV-MUC	5	Haeckel	09.03.08	12:00	24	50.856	122	42.010	1307	aborted	SO196_17
SO196	18	Yonaguni Knoll	TV-MUC	6	Haeckel	09.03.08	18:15	24	50.772	122	42.007	1385	USBL sub position	SO196_18
SO196	19	Yonaguni Knoll	TV-MUC	7	Haeckel	09.03.08	20:45	24	50.808	122	42.006	1392	CO2 seep; USBL sub position; 6 cores recovered	SO196_19
SO196	20	Yonaguni Knoll	TV-MUC	8	Haeckel	09.03.08	23:07	24	50.838	122	41.992	1362	CO2 seep; USBL sub position; 8 cores recovered	SO196_20
SO196	21	Yonaguni Knoll	POS	3	Angermann	10.03.08	00:09	24	50.300	122	44.300	1512	USBL Posidonia calibration	SO196_21
SO196	22	Yonaguni Knoll	POS	4	Angermann	10.03.08	01:45	24	50.260	122	44.450	1521	USBL transponder recovering	SO196_22
SO196	23	Yonaguni Knoll	CTD	8	Mertens	10.03.08	03:19	24	50.170	122	40.980	1260	Tow-yo CTD transect; aborted	SO196_23
SO196	24	Yonaguni Knoll	TV-MUC	9	Boetius	10.03.08	05:10	24	50.766	122	41.837	1381	USBL sub position; sulphur pavement; no samples	SO196_24
SO196	25	Yonaguni Knoll	TV-MUC	10	Boetius	10.03.08	08:40	24	50.791	122	42.020	1397	USBL sub position; gas flare; 12 cores recovered	SO196_25
SO196	26	Yonaguni Knoll	CTD	8	Mertens	10.03.08	10:13	24	49.880	122	41.120	1247	Tow-yo CTD transect, no USBL sub position; 20 samples	SO196_26
SO196	27	Hatoma Knoll	ROVQ	199	Rathmeyer	10.03.08	23:43	24	51.410	123	50.380	1529		SO196_27
SO196	28	Hatoma Knoll	MB/PS	1/2	Gauger	11.03.08	15:00	24	49.700	123	45.820	2005		SO196_28
SO196	29	Hatoma Knoll	ROVQ	200	Rathmeyer	12.03.08	00:10	24	51.570	123	50.610	1436		SO196_29
SO196	30	Yonaguni Knoll	ROVQ	201	Rathmeyer	13.03.08	00:00	24	50.690	122	42.040	1395		SO196_30
SO196	31	Yonaguni Knoll	CTD	9	Mertens	13.03.08	12:09	24	50.630	122	41.810	1339	Tow-yo CTD transect with USBL sub position; no sample	SO196_31
SO196	32	Yonaguni Knoll	CTD	10	Mertens	13.03.08	14:07	24	50.470	122	41.960	1222	Tow-yo CTD transect with USBL sub position; 6 samples	SO196_32
SO196	33	Yonaguni Knoll	CTD	11	Mertens	13.03.08	17:32	24	50.859	122	41.989	1379	USBL sub position; 22 samples	SO196_33
SO196	34	Yonaguni Knoll	GC	1	Haeckel	13.03.08	20:24	24	50.841	122	42.003	1382	USBL sub position; CO2 seep/hydrates	SO196_34
SO196	35	Yonaguni Knoll	GC	2	Haeckel	13.03.08	22:16	24	50.790	122	42.034	1385	USBL sub position; CO2 seep	SO196_35
SO196	36	Yonaguni Knoll	TV-MUC	11	Boetius	14.03.08	01:07	24	50.741	122	42.001	1379	USBL sub position; CO2 seep; sulphur pavement	SO196_36
SO196	37	Yonaguni Knoll	TV-MUC	12	Boetius	14.03.08	03:14	24	50.775	122	42.035	1385	USBL sub position; CO2 seep	SO196_37
SO196	38	Yonaguni Knoll	TV-MUC	13	Boetius	14.03.08	05:07	24	50.783	122	42.047	1347	USBL sub position; MUC did not closed liners; no samples	SO196_38
SO196	39	Yonaguni Knoll	TV-MUC	14	Boetius	14.03.08	08:04	24	50.775	122	42.049	1385	USBL sub position; CO2 seep; gas ebullition	SO196_39
SO196	40	Yonaguni Knoll	TV-MUC	15	Boetius	14.03.08	10:06	24	50.802	122	42.094	1382	USBL sub position; reference site	SO196_40
SO196	41	Yonaguni Knoll	CTD	12	Mertens	14.03.08	11:31	24	50.490	122	41.780	1361	Tow-yo CTD transect with USBL sub position; 22 samples	SO196_41
SO196	42	Hatoma Knoll	ROVQ	202	Rathmeyer	15.03.08	00:07	24	51.750	123	50.680	1491		SO196_42
SO196	43	Yonaguni Knoll	GC	3	Haeckel	16.03.08	01:02	24	50.851	122	42.019	1383	USBL sub position; CO2 sediment	SO196_43
SO196	44	Yonaguni Knoll	ROVQ	203	Rathmeyer	16.03.08	02:05	24	50.530	122	41.850	1371		SO196_44
SO196	45	Yonaguni Knoll	CTD	13	Mertens	16.03.08	15:15	24	51.053	122	42.003	1293	USBL sub position; 22 samples	SO196_45
SO196	46	Yonaguni Knoll	CTD	14	Mertens	16.03.08	17:08	24	50.692	122	42.202	1224	USBL sub position; 22 samples	SO196_46
SO196	47	Yonaguni Knoll	CTD	15	Mertens	16.03.08	19:04	24	50.505	122	42.276	1203	USBL sub position; 12 samples	SO196_47
SO196	48	Yonaguni Knoll	CTD	16	Mertens	16.03.08	20:36	24	50.680	122	42.390	1330	Tow-yo CTD transect with USBL sub position; 13 samples	SO196_48
SO196	49	Yonaguni Knoll	TV-MUC	16	Boetius	17.03.08	01:31	24	50.777	122	42.039	1365	USBL sub position; WP1; gas	SO196_49
SO196	50	Yonaguni Knoll	GC	4	Haeckel	17.03.08	03:36	24	50.836	122	41.997	1386	no USBL sub position available - 40 m NNE of ships position inste	SO196_50
SO196	51	Yonaguni Knoll	GC	5	Haeckel	17.03.08	04:52	24	50.816	122	42.036	1383	USBL sub position; sulphur pavement sample	SO196_51
SO196	52	Yonaguni Knoll	TV-MUC	17	Boetius	17.03.08	06:37	24	50.815	122	42.093	1321	USBL sub position; not released, no sample	SO196_52
SO196	53	Yonaguni Knoll	TV-MUC	18	Boetius	17.03.08	08:33	24	50.808	122	42.094	1393	USBL sub position; not released, no sample	SO196_53
SO196	54	Yonaguni Knoll	TV-MUC	19	Boetius	17.03.08	10:05	24	50.781	122	42.038	1387	USBL sub position; WP1 CO2 seep; no gas	SO196_54
SO196	55	Yonaguni Knoll	TV-MUC	20	Boetius	17.03.08	11:51	24	50.818	122	42.076	1356	USBL sub position; reference site WP16	SO196_55
SO196	56-1	Yonaguni Knoll	CTD	17	Mertens	17.03.08	14:07	24	51.041	122	40.995	1115	USBL sub position; no sample	SO196_56-1
SO196	56-2	Yonaguni Knoll	CTD	18	Mertens	17.03.08	15:29	24	51.518	122	41.286	1217	USBL sub position; 22 samples	SO196_56-2
SO196	57	Yonaguni Knoll	CTD	19	Mertens	17.03.08	16:58	24	51.705	122	42.634	1071	USBL sub position; 20 samples	SO196_57
SO196	58	Yonaguni Knoll	CTD	20	Mertens	17.03.08	18:38	24	50.892	122	42.155	1343	USBL sub position; 22 samples	SO196_58
SO196	59	Yonaguni Knoll	CTD	21	Mertens	17.03.08	20:23	24	51.353	122	42.234	1252	USBL sub position; 20 samples	SO196_59
SO196	60	Yonaguni Knoll	CTD	22	Mertens	17.03.08	22:08	24	50.701	122	42.032	1350	USBL sub position; 22 samples	SO196_60
SO196	61	Yonaguni Knoll	GC	6	Haeckel	18.03.08	00:03	24	50.775	122	42.030	1395	USBL sub position; no sample	SO196_61
SO196	62	Yonaguni Knoll	GC	7	Haeckel	18.03.08	01:31	24	50.724	122	41.994	1395	no USBL sub position available; 20 cm sample	SO196_62
SO196	63	Yonaguni Knoll	TV-MUC	21	Boetius	18.03.08	02:59	24	50.811	122	42.101	1393	USBL sub position; not released, no sample	SO196_63
SO196	64	Yonaguni Knoll	TV-MUC	22	Boetius	18.03.08	06:02	24	50.514	122	41.879	1345	USBL sub position; not released, no sample	SO196_64
SO196	65	Yonaguni Knoll	TV-MUC	23	Boetius	18.03.08	07:33	24	50.355	122	41.736	1324	USBL sub position	SO196_65
SO196	66	Yonaguni Knoll	TV-MUC	24	Boetius	18.03.08	08:59	24	50.378	122	41.765	1319	USBL sub position	SO196_66
SO196	67	Yonaguni Knoll	TV-MUC	25	Boetius	18.03.08	10:16	24	50.394	122	41.766	1318	USBL sub position	SO196_67
SO196	68	Yonaguni Knoll	CTD	23	Mertens	18.03.08	13:26	24	50.573	122	41.877	1366	USBL sub position; 22 samples	SO196_68
SO196	69	Yonaguni Knoll	CTD	24	Mertens	18.03.08	15:31	24	50.607	122	46.426	1654	USBL sub position; 22 samples	SO196_69
SO196	70	Hatoma Knoll	CTD	25	Mertens	19.03.08	01:36	24	50.805	123	50.439	1810	USBL sub position; 22 samples	SO196_70
SO196	71	Hatoma Knoll	CTD	26	Mertens	19.03.08	03:43	24	51.117	123	50.472	1524	USBL sub position; 22 samples	SO196_71
SO196	72	Hatoma Knoll	CTD	27	Mertens	19.03.08	06:05	24	51.580	123	50.505	1462	USBL sub position; 22 samples	SO196_72
SO196	73	Hatoma Knoll	CTD	28	Mertens	19.03.08	07:55	24	51.411	123	50.510	1512	USBL sub position; 22 samples	SO196_73
SO196	74	Hatoma Knoll	CTD	29	Mertens	19.03.08	09:40	24	51.601	123	50.357	1482	USBL sub position; 22 samples	SO196_74
SO196	75	Hatoma Knoll	CTD	30	Mertens	19.03.08	11:25	24	51.491	123	50.488	1510	USBL sub position; 22 samples	SO196_75
SO196	76	Hatoma Knoll	CTD	31	Mertens	19.03.08	13:50	24	53.999	123	45.992	1947	USBL sub position; Reference	SO196_76
SO196	77	Hatoma Knoll	CTD	32	Mertens	19.03.08	16:00	24	51.457	123	50.374	1528	USBL sub position;	SO196_77
SO196	78	Hatoma Knoll	CTD	33	Mertens	19.03.08	17:54	24	51.267	123	50.511	1526	USBL sub position;	SO196_78
SO196	79	Hatoma Knoll	CTD	34	Mertens	19.03.08	19:52	24	51.215	123	50.571	1547	USBL sub position;	SO196_79
SO196	80	Hatoma Knoll	CTD	35	Mertens	19.03.08	21:41	24	51.515	123	50.626	1518	USBL sub position;	SO196_80
SO196	81	Hatoma Knoll	CTD	36	Mertens	19.03.08	23:46	24	51.899	123	50.469	1601	USBL sub position; 21 samples	SO196_81
SO196	82	Hatoma Knoll	ROVQ	204	Rathmeyer	20.03.08	01:47	24	51.390	123	50.500	1529	aborted because of technical problems	SO196_82
SO196	83	Hatoma Knoll	PS	3	Schneider	20.03.08	06:09	24	51.560	123	50.380	1462		SO196_83
SO196	84	Hatoma Knoll	ROVQ	205	Rathmeyer	20.03.08	09:34	24	51.530	123	50.460	1475		SO196_84
SO196	85	Yonaguni Knoll	GC	8	Haeckel	21.03.08	01:59	24	50.341	122	41.726	1320	USBL sub position; reference core	SO196_85
SO196	86	Yonaguni Knoll	ROVQ	206	Rathmeyer	21.03.08	03:42	24	50.240	122	41.790	1346		SO196_86
SO196	87	Yonaguni Knoll	TV-MICP	1	de Beer	21.03.08	17:18	24	49.770	122	42.500	1420	USBL sub position; Microprofiler used as OFOS like observation t	SO196_87
SO196	88	Yonaguni Knoll	GC	9	Haeckel	21.03.08	23:48	24	50.774	122	42.043	1399	USBL sub position; Abyss vent	SO196_88
SO196	89	Yonaguni Knoll	GC	10	Haeckel	22.03.08	01:13	24	51.660	122	43.534	1418	USBL sub position	SO196_89
SO196	90	Yonaguni Knoll	GC	11	Haeckel	22.03.08	02:47	24	50.863	122	42.030	1344	USBL sub position; CO2 hydrates	SO196_90
SO196	91	Yonaguni Knoll	GC	12	Haeckel	22.03.08	04:22	24	50.850	122	42.026	1384	USBL sub position; CO2 hydrates	SO196_91
SO196	92	Yonaguni Knoll	ROVQ	207	Rathmeyer	21.03.08	05:22	24	49.620	122	41.430	1333	aborted because of technical problems	SO196_92
SO196	93	Yonaguni Knoll	TV-MUC	26	Haeckel	22.03.08	09:37	24	50.846	122	42.019	1386	USBL sub position; Swallow chimney; CO2 hydrates; no samples;	SO196_93
SO196	94	Yonaguni Knoll	TV-MUC	27	Haeckel	22.03.08	11:03	24	50.780	122	42.041	1392	USBL sub position; Abyss vent; no sample; not released	SO196_94
SO196	95	Yonaguni Knoll	TV-MUC	28	Haeckel	22.03.08	13:45	24	50.779	122	42.060	1394	USBL sub position; Abyss vent; gassy sample	SO196_95
SO196	96	Yonaguni Knoll	TV-MUC	29	Boetius	22.03.08	15:25	24	50.661	122	42.071	1388	USBL sub position; no samples; seafloor too hard (pavement)	SO196_96
SO196	97	Yonaguni Knoll	TV-MUC	30	Boetius	22.03.08	17:18	24	50.519	122	42.201	1310	USBL sub position; no samples; seafloor too hard (pavement)	SO196_97
SO196	98	Yonaguni Knoll	CTD	37	Mertens	22.03.08	18:55	24	51.466	122	41.421	1364	USBL sub position; 22 samples	SO196_98
SO196	99	Yonaguni Knoll	CTD	38	Mertens	22.03.08	20:41	24	50.955	122	41.716	1321	USBL sub position	SO196_99

Device- and stationlist SO196 RV SONNE

Ship based tools

BC	SAM	Box corer
COLOSSOS	MOOR	Large lift Colossos
CTD	MES	CTD/Rosette
GC	SAM	Gravity corer
MB	MES	Multibeam Echosounder (depth)
PS	MES	Parasound Sediment Echosounder (depth)
ROVQ	MES	Remotely Operated Vehicle Quest 5
TV-MUC	SAM	TV-Multicorer
TV-MICP	SAM	TV-Microsensor profiler

ROV based tools

BCROV	SAM	Blade corer (Biology)
BMB	MES	Bubble monitoring box (Geology)
CO_HH	MES	CO2, pH, T Sensor handheld (Geochemistry)
COC	MES	CO2 Sensor Contros (Geochemistry)
INSINC	SAM	INSINC corer (Geochemistry)
KIPS2	SAM	KIPS tubes (Water)
NET	SAM	ROV Net (Biology)
NIS_5L	SAM	Niskin bottle 5 litre volume (Water)
PRGS	SAM	Pressure retaining gas sampler (Geology)
PUC	SAM	Pushcore (Geochemistry)
ROV_B	SAM	ROV basket (Biology)
SG	SAM	Slurp gun bottle (Biology)
SO_HH	MES	Sulfide O2 ph Sensor handheld (Geochemistry)
TST	MES	T-Stick (Continuous m.: Temperature)
TSTO	MES	T-Stick online (Continuous m.: Temperature)
TLA	MES	T lance corer assembly
TIB	SAM	Titanium bottle (Water)

In situ Instruments

ADCP	MOOR	Acoustic Doppler Current Profiler
CHAM	MOOR	Benthic chamber (MES)
MRK	POS	Passive marker (Marker x, Description)
MICP2	MOOR	Microsensor profiler 2 (MES)
MICP5	MOOR	Microsensor profiler 5 (MES)
PEE	MOOR	Peeper (SAM)
SUB_ROV	MOOR	Subprofiler ROV (MES)

Stationlist of Meteor Leg M72/2						Start Station/Gear on bottom								
Cruise	Station	Area	Gear	Gear-#	Operator	Date/Time		Latitude [N]		Longitude [E]		Depth	Remarks	PANGAEA-ID
						[UTC]		DEG	MIN	DEG	MIN	[meter]		
SO196	1	Transit	CTD	1	Mertens	05.03.08	00:31	20	50.670	130	21.640	5575	test CTD/Rosette; pCO2 Sensor; pH Sensor 1; pH Sensor 2; Posi	SO196_1
SO196	2	Yonaguni Knoll	CTD	2	Mertens	06.03.08	17:55	24	49.580	122	44.150	1463	no USBL sub position; 20 samples	SO196_2
SO196	3	Yonaguni Knoll	POS	1	Angermann	06.03.08	19:51	24	49.470	122	44.010	1452	Test of Posidonia Releaser	SO196_3
SO196	4	Yonaguni Knoll	POS	2	Angermann	06.03.08	21:17	24	49.620	122	44.150	1455	Calibration of USBL Posidonia Antenna	SO196_4
SO196	5	Yonaguni Knoll	ROVQ	197	Rathmeyer	07.03.08	05:35	24	50.550	122	42.150	1390		SO196_5
SO196	6	Yonaguni Knoll	CTD	3	Mertens	07.03.08	14:16	24	51.365	122	40.893	1349	USBL sub position; 20 samples	SO196_6
SO196	7	Yonaguni Knoll	CTD	4	Mertens	07.03.08	16:01	24	50.812	122	40.791	972	USBL sub position; 9 samples	SO196_7
SO196	8	Yonaguni Knoll	CTD	5	Mertens	07.03.08	17:29	24	50.695	122	41.784	1340	USBL sub position; 15 samples	SO196_8
SO196	9	Yonaguni Knoll	CTD	6	Mertens	07.03.08	19:10	24	50.126	122	41.910	1385	USBL sub position; 14 samples	SO196_9
SO196	10	Yonaguni Knoll	CTD	7	Mertens	07.03.08	21:05	24	50.091	122	42.162	1429	USBL sub position; 16 samples	SO196_10
SO196	11	Yonaguni Knoll	ROVQ	198	Rathmeyer	08.03.08	02:18	24	50.770	122	42.140	1398		SO196_11
SO196	12	Yonaguni Knoll	PS	1	Schneider	08.03.08	14:02	24	51.600	122	42.340	1130		SO196_12
SO196	13	Yonaguni Knoll	TV-MUC	1	Boetius	09.03.08	01:48	24	50.778	122	42.059	1397	USBL sub position; MUC did not closed liners	SO196_13
SO196	14	Yonaguni Knoll	TV-MUC	2	Haeckel	09.03.08	04:35	24	50.780	122	42.140	1391	USBL sub position; MUC did not closed liners	SO196_14
SO196	15	Yonaguni Knoll	TV-MUC	3	Boetius	09.03.08	07:22	24	50.827	122	42.086	1372	no USBL sub position available; 12 cores recovered	SO196_15
SO196	16	Yonaguni Knoll	TV-MUC	4	Haeckel	09.03.08	10:11	24	50.841	122	42.149	1408	MUC did not closed liners	SO196_16
SO196	17	Yonaguni Knoll	TV-MUC	5	Haeckel	09.03.08	12:00	24	50.856	122	42.010	1307	aborted	SO196_17
SO196	18	Yonaguni Knoll	TV-MUC	6	Haeckel	09.03.08	18:15	24	50.772	122	42.007	1385	USBL sub position	SO196_18
SO196	19	Yonaguni Knoll	TV-MUC	7	Haeckel	09.03.08	20:45	24	50.808	122	42.006	1392	CO2 seep; USBL sub position; 6 cores recovered	SO196_19
SO196	20	Yonaguni Knoll	TV-MUC	8	Haeckel	09.03.08	23:07	24	50.838	122	41.992	1362	CO2 seep; USBL sub position; 8 cores recovered	SO196_20
SO196	21	Yonaguni Knoll	POS	3	Angermann	10.03.08	00:09	24	50.300	122	44.300	1512	USBL Posidonia calibration	SO196_21
SO196	22	Yonaguni Knoll	POS	4	Angermann	10.03.08	01:45	24	50.260	122	44.450	1521	USBL transponder recovering	SO196_22
SO196	23	Yonaguni Knoll	CTD	8	Mertens	10.03.08	03:19	24	50.170	122	40.980	1260	Tow-yo CTD transect; aborted	SO196_23
SO196	24	Yonaguni Knoll	TV-MUC	9	Boetius	10.03.08	05:10	24	50.766	122	41.837	1381	USBL sub position; sulphur pavement; no samples	SO196_24
SO196	25	Yonaguni Knoll	TV-MUC	10	Boetius	10.03.08	08:40	24	50.791	122	42.020	1397	USBL sub position; gas flare; 12 cores recovered	SO196_25
SO196	26	Yonaguni Knoll	CTD	8	Mertens	10.03.08	10:13	24	49.880	122	41.120	1247	Tow-yo CTD transect, no USBL sub position; 20 samples	SO196_26
SO196	27	Hatoma Knoll	ROVQ	199	Rathmeyer	10.03.08	23:43	24	51.410	123	50.380	1529		SO196_27
SO196	28	Hatoma Knoll	MB/PS	1/2	Gauger	11.03.08	15:00	24	49.700	123	45.820	2005		SO196_28
SO196	29	Hatoma Knoll	ROVQ	200	Rathmeyer	12.03.08	00:10	24	51.570	123	50.610	1436		SO196_29
SO196	30	Yonaguni Knoll	ROVQ	201	Rathmeyer	13.03.08	00:00	24	50.690	122	42.040	1395		SO196_30
SO196	31	Yonaguni Knoll	CTD	9	Mertens	13.03.08	12:09	24	50.630	122	41.810	1339	Tow-yo CTD transect with USBL sub position; no sample	SO196_31
SO196	32	Yonaguni Knoll	CTD	10	Mertens	13.03.08	14:07	24	50.470	122	41.960	1222	Tow-yo CTD transect with USBL sub position; 6 samples	SO196_32
SO196	33	Yonaguni Knoll	CTD	11	Mertens	13.03.08	17:32	24	50.859	122	41.989	1379	USBL sub position; 22 samples	SO196_33
SO196	34	Yonaguni Knoll	GC	1	Haeckel	13.03.08	20:24	24	50.841	122	42.003	1382	USBL sub position; CO2 seep/hydrates	SO196_34
SO196	35	Yonaguni Knoll	GC	2	Haeckel	13.03.08	22:16	24	50.790	122	42.034	1385	USBL sub position; CO2 seep	SO196_35
SO196	36	Yonaguni Knoll	TV-MUC	11	Boetius	14.03.08	01:07	24	50.741	122	42.001	1379	USBL sub position; CO2 seep; sulphur pavement	SO196_36
SO196	37	Yonaguni Knoll	TV-MUC	12	Boetius	14.03.08	03:14	24	50.775	122	42.035	1385	USBL sub position; CO2 seep	SO196_37
SO196	38	Yonaguni Knoll	TV-MUC	13	Boetius	14.03.08	05:07	24	50.783	122	42.047	1347	USBL sub position; MUC did not closed liners; no samples	SO196_38
SO196	39	Yonaguni Knoll	TV-MUC	14	Boetius	14.03.08	08:04	24	50.775	122	42.049	1385	USBL sub position; CO2 seep; gas ebullition	SO196_39
SO196	40	Yonaguni Knoll	TV-MUC	15	Boetius	14.03.08	10:06	24	50.802	122	42.094	1382	USBL sub position; reference site	SO196_40
SO196	41	Yonaguni Knoll	CTD	12	Mertens	14.03.08	11:31	24	50.490	122	41.780	1361	Tow-yo CTD transect with USBL sub position; 22 samples	SO196_41
SO196	42	Hatoma Knoll	ROVQ	202	Rathmeyer	15.03.08	00:07	24	51.750	123	50.680	1491		SO196_42
SO196	43	Yonaguni Knoll	GC	3	Haeckel	16.03.08	01:02	24	50.851	122	42.019	1383	USBL sub position; CO2 sediment	SO196_43
SO196	44	Yonaguni Knoll	ROVQ	203	Rathmeyer	16.03.08	02:05	24	50.530	122	41.850	1371		SO196_44
SO196	45	Yonaguni Knoll	CTD	13	Mertens	16.03.08	15:15	24	51.053	122	42.003	1293	USBL sub position; 22 samples	SO196_45
SO196	46	Yonaguni Knoll	CTD	14	Mertens	16.03.08	17:08	24	50.692	122	42.202	1224	USBL sub position; 22 samples	SO196_46
SO196	47	Yonaguni Knoll	CTD	15	Mertens	16.03.08	19:04	24	50.505	122	42.276	1203	USBL sub position; 12 samples	SO196_47
SO196	48	Yonaguni Knoll	CTD	16	Mertens	16.03.08	20:36	24	50.680	122	42.390	1330	Tow-yo CTD transect with USBL sub position; 13 samples	SO196_48
SO196	49	Yonaguni Knoll	TV-MUC	16	Boetius	17.03.08	01:31	24	50.777	122	42.039	1365	USBL sub position; WP1; gas	SO196_49
SO196	50	Yonaguni Knoll	GC	4	Haeckel	17.03.08	03:36	24	50.836	122	41.997	1386	no USBL sub position available - 40 m NNE of ships position inste	SO196_50
SO196	51	Yonaguni Knoll	GC	5	Haeckel	17.03.08	04:52	24	50.816	122	42.036	1383	USBL sub position; sulphur pavement sample	SO196_51
SO196	52	Yonaguni Knoll	TV-MUC	17	Boetius	17.03.08	06:37	24	50.815	122	42.093	1321	USBL sub position; not released, no sample	SO196_52
SO196	53	Yonaguni Knoll	TV-MUC	18	Boetius	17.03.08	08:33	24	50.808	122	42.094	1393	USBL sub position; not released, no sample	SO196_53
SO196	54	Yonaguni Knoll	TV-MUC	19	Boetius	17.03.08	10:05	24	50.781	122	42.038	1387	USBL sub position; WP1 CO2 seep; no gas	SO196_54
SO196	55	Yonaguni Knoll	TV-MUC	20	Boetius	17.03.08	11:51	24	50.818	122	42.076	1356	USBL sub position; reference site WP16	SO196_55
SO196	56-1	Yonaguni Knoll	CTD	17	Mertens	17.03.08	14:07	24	51.041	122	40.995	1115	USBL sub position; no sample	SO196_56-1
SO196	56-2	Yonaguni Knoll	CTD	18	Mertens	17.03.08	15:29	24	51.518	122	41.286	1217	USBL sub position; 22 samples	SO196_56-2
SO196	57	Yonaguni Knoll	CTD	19	Mertens	17.03.08	16:58	24	51.705	122	42.634	1071	USBL sub position; 20 samples	SO196_57
SO196	58	Yonaguni Knoll	CTD	20	Mertens	17.03.08	18:38	24	50.892	122	42.155	1343	USBL sub position; 22 samples	SO196_58
SO196	59	Yonaguni Knoll	CTD	21	Mertens	17.03.08	20:23	24	51.353	122	42.234	1252	USBL sub position; 20 samples	SO196_59
SO196	60	Yonaguni Knoll	CTD	22	Mertens	17.03.08	22:08	24	50.701	122	42.032	1350	USBL sub position; 22 samples	SO196_60
SO196	61	Yonaguni Knoll	GC	6	Haeckel	18.03.08	00:03	24	50.775	122	42.030	1395	USBL sub position; no sample	SO196_61
SO196	62	Yonaguni Knoll	GC	7	Haeckel	18.03.08	01:31	24	50.724	122	41.994	1395	no USBL sub position available; 20 cm sample	SO196_62
SO196	63	Yonaguni Knoll	TV-MUC	21	Boetius	18.03.08	02:59	24	50.811	122	42.101	1393	USBL sub position; not released, no sample	SO196_63
SO196	64	Yonaguni Knoll	TV-MUC	22	Boetius	18.03.08	06:02	24	50.514	122	41.879	1345	USBL sub position; not released, no sample	SO196_64
SO196	65	Yonaguni Knoll	TV-MUC	23	Boetius	18.03.08	07:33	24	50.355	122	41.736	1324	USBL sub position	SO196_65
SO196	66	Yonaguni Knoll	TV-MUC	24	Boetius	18.03.08	08:59	24	50.378	122	41.765	1319	USBL sub position	SO196_66
SO196	67	Yonaguni Knoll	TV-MUC	25	Boetius	18.03.08	10:16	24	50.394	122	41.766	1318	USBL sub position	SO196_67
SO196	68	Yonaguni Knoll	CTD	23	Mertens	18.03.08	13:26	24	50.573	122	41.877	1366	USBL sub position; 22 samples	SO196_68
SO196	69	Yonaguni Knoll	CTD	24	Mertens	18.03.08	15:31	24	50.607	122	46.426	1654	USBL sub position; 22 samples	SO196_69
SO196	70	Hatoma Knoll	CTD	25	Mertens	19.03.08	01:36	24	50.805	123	50.439	1810	USBL sub position; 22 samples	SO196_70
SO196	71	Hatoma Knoll	CTD	26	Mertens	19.03.08	03:43	24	51.117	123	50.472	1524	USBL sub position; 22 samples	SO196_71
SO196	72	Hatoma Knoll	CTD	27	Mertens	19.03.08	06:05	24	51.580	123	50.505	1462	USBL sub position; 22 samples	SO196_72
SO196	73	Hatoma Knoll	CTD	28	Mertens	19.03.08	07:55	24	51.411	123	50.510	1512	USBL sub position; 22 samples	SO196_73
SO196	74	Hatoma Knoll	CTD	29	Mertens	19.03.08	09:40	24	51.601	123	50.357	1482	USBL sub position; 22 samples	SO196_74
SO196	75	Hatoma Knoll	CTD	30	Mertens	19.03.08	11:25	24	51.491	123	50.488	1510	USBL sub position; 22 samples	SO196_75
SO196	76	Hatoma Knoll	CTD	31	Mertens	19.03.08	13:50	24	53.999	123	45.992	1947	USBL sub position; Reference	SO196_76
SO196	77	Hatoma Knoll	CTD	32	Mertens	19.03.08	16:00	24	51.457	123	50.374	1528	USBL sub position;	SO196_77
SO196	78	Hatoma Knoll	CTD	33	Mertens	19.03.08	17:54	24	51.267	123	50.511	1526	USBL sub position;	SO196_78
SO196	79	Hatoma Knoll	CTD	34	Mertens	19.03.08	19:52	24	51.215	123	50.571	1547	USBL sub position;	SO196_79
SO196	80	Hatoma Knoll	CTD	35	Mertens	19.03.08	21:41	24	51.515	123	50.626	1518	USBL sub position;	SO196_80
SO196	81	Hatoma Knoll	CTD	36	Mertens	19.03.08	23:46	24	51.899	123	50.469	1601	USBL sub position; 21 samples	SO196_81
SO196	82	Hatoma Knoll	ROVQ	204	Rathmeyer	20.03.08	01:47	24	51.390	123	50.500	1529	aborted because of technical problems	SO196_82
SO196	83	Hatoma Knoll	PS	3	Schneider	20.03.08	06:09	24	51.560	123	50.380	1462		SO196_83
SO196	84	Hatoma Knoll	ROVQ	205	Rathmeyer	20.03.08	09:34	24	51.530	123	50.460	1475		SO196_84
SO196	85	Yonaguni Knoll	GC	8	Haeckel	21.03.08	01:59	24	50.341	122	41.726	1320	USBL sub position; reference core	SO196_85
SO196	86	Yonaguni Knoll	ROVQ	206	Rathmeyer	21.03.08	03:42	24	50.240	122	41.790	1346		SO196_86
SO196	87	Yonaguni Knoll	TV-MICP	1	de Beer	21.03.08	17:18	24	49.770	122	42.500	1420	USBL sub position; Microprofiler used as OFOS like observation t	SO196_87
SO196	88	Yonaguni Knoll	GC	9	Haeckel	21.03.08	23:48	24	50.774	122	42.043	1399	USBL sub position; Abyss vent	SO196_88
SO196	89	Yonaguni Knoll	GC	10	Haeckel	22.03.08	01:13	24	51.660	122	43.534	1418	USBL sub position	SO196_89
SO196	90	Yonaguni Knoll	GC	11	Haeckel	22.03.08	02:47	24	50.863	122	42.030	1344	USBL sub position; CO2 hydrates	SO196_90
SO196	91	Yonaguni Knoll	GC	12	Haeckel	22.03.08	04:22	24	50.850	122	42.026	1384	USBL sub position; CO2 hydrates	SO196_91
SO196	92	Yonaguni Knoll	ROVQ	207	Rathmeyer	21.03.08	05:22	24	49.620	122	41.430	1333	aborted because of technical problems	SO196_92
SO196	93	Yonaguni Knoll	TV-MUC	26	Haeckel	22.03.08	09:37	24	50.846	122	42.019	1386	USBL sub position; Swallow chimney; CO2 hydrates; no samples;	SO196_93
SO196	94	Yonaguni Knoll	TV-MUC	27	Haeckel	22.03.08	11:03	24	50.780	122	42.041	1392	USBL sub position; Abyss vent; no sample; not released	SO196_94
SO196	95	Yonaguni Knoll	TV-MUC	28	Haeckel	22.03.08	13:45	24	50.779	122	42.060	1394	USBL sub position; Abyss vent; gassy sample	SO196_95
SO196	96	Yonaguni Knoll	TV-MUC	29	Boetius	22.03.08	15:25	24	50.661	122	42.071	1388	USBL sub position; no samples; seafloor too hard (pavement)	SO196_96
SO196	97	Yonaguni Knoll	TV-MUC	30	Boetius	22.03.08	17:18	24	50.519	122	42.201	1310	USBL sub position; no samples; seafloor too hard (pavement)	SO196_97
SO196	98	Yonaguni Knoll	CTD	37	Mertens	22.03.08	18:55	24	51.466	122	41.421	1364	USBL sub position; 22 samples	SO196_98
SO196	99	Yonaguni Knoll	CTD	38	Mertens	22.03.08	20:41	24	50.955	122	41.716	1321	USBL sub position	SO196_99

T-Lance measurements

Divenr	Gridpoint	Penetration	max. temp. [°C]	beginn penetration	lance removal	Lat (Posidonia)	Long (Posidonia)
198	P1	weak	4,9	08:41:02	08:44:42	24 50.8368	122 42.0175
	P2	medium	16,40	10:29:14	10:37:00	24 50.8581	122 42.0110
	P3	weak	3,82	11:17:31	11:21:39	24 50.8515	122 42.0067
	P4	full	18,00	11:35:42	11:41:20	24 50.8463	122 42.0058
199	P1	medium	4,97	01:23:57	01:29:47	24 51.4061	123 50.3790
	P2	weak	3,83	01:39:35	01:41:47	24 51.4091	123 50.3843
	P3	weak	4,00	01:45:23	01:49:16	24 51.4093	123 50.3826
	P4	weak	3,97	01:50:12	01:52:53	24 51.4095	123 50.3838
	P5	medium	10,27	02:12:57	02:24:23	24 51.4268	123 50.4062
	P6a	full	10,61	02:24:37	02:27:53	24 51.4263	123 50.4058
	P6b	full	13,33	02:27:53	02:36:24	24 51.4263	123 50.4058
	P7	medium	3,87	02:38:30	02:41:18	24 51.4269	123 50.4061
	P8	medium	6,89	03:09:53	03:11:03	24 51.4445	123 50.4038
	P9	medium	7,90	03:11:38	03:25:45	24 51.4448	123 50.4025
		no		03:33:24		24 51.4509	123 50.3896
		no		03:49:31		24 51.4546	123 50.3837
		no		04:05:18		24 51.4507	123 50.3799
	P10	medium	14,80	04:08:13	04:28:45	24 51.4523	123 50.3792
	P11	no	22,11	04:32:50	04:34:28	24 51.4545	123 50.3777
	P12	full	7,26	09:01:10	09:10:30	24 51.5666	123 50.4688
	P13	weak	4,52	09:53:05	09:59:58	24 51.5923	123 50.4912
200	Test wc			01:20:41	11:46:08		
	P1		4,27	03:48:43	05:47:08		
201	P1	full	14,43	03:48:20	04:11:26	24 50.7820	122 42.0247
	P2	full	16,12	05:26:20	05:38:07	24 50.7799	122 42.0328
			4,43	05:51:32	05:56:54		
	P3	full	91,77	06:24:26	06:34:42	24 50.7848	122 42.0273
	P4	full	39,30	06:35:38	06:37:44	24 50.7830	122 42.0260
	P5	medium	12,99	06:38:26	06:39:50	24 50.7822	122 42.0238
	P6	full	29,57	06:39:57	06:51:09	24 50.7820	122 42.0238
	P7	full	22,40	07:37:28	07:45:24	24 50.7702	122 42.0377
	P8	full	12,60	08:13:03	08:30:05	24 50.8258	122 42.0834
	P9	medium	7,16	08:56:48	09:04:16	24 50.8088	122 42.1019
	P10	full	12,07	09:20:08	09:25:44	24 50.7973	122 42.0676
	P11	full	7,00	09:36:56	09:42:25	24 50.8221	122 42.0820
202	P1			03:06:31	03:10:19	24 51.5750	123 50.4499
	P2		5,40	04:10:20	04:20:57	24 51.5757	123 50.4505
	P3		5,20	04:38:34	04:44:45	24 51.5771	123 50.4507
	P4		8,91	11:02:38	11:03:41	24 51.4938	123 50.4793
	P5		13,37	11:06:08	11:08:35	24 51.4939	123 50.4786
	P6a		43,42	11:09:38	11:11:44	24 51.4950	123 50.4795
	P6b		61,10	11:12:54	11:17:34	24 51.4943	123 50.4796
203	P1	full	4,69	05:17:51	05:46:19	24 50.7837	122 42.0347
	P2	full	47,77	06:15:08	06:24:56	24 50.7800	122 42.0290
	P3	full	55,90	06:27:37	06:34:37	24 50.7807	122 42.0288
	P4	medium	7,01	06:59:14	07:10:26	24 50.8362	122 41.9952
	P5	full	20,39	07:10:54	07:20:00	24 50.8372	122 41.9965
	P6	full	44,27	07:32:22	07:41:35	24 50.8520	122 42.0231
	P7	full	40,83	07:43:55	07:53:15	24 50.8512	122 42.0229
	P8	full	5,19	09:50:44	10:03:06	24 50.7989	122 42.0951
	P9	full	4,84	10:29:00	10:53:58	24 50.7685	122 42.1037

Samplelist microbiology

Sample no.	date of sampling	device	Study site	sampling location	core information	Core No.(Dive No.)	Top depth (cmbsf)	Bottom depth (cmbsf)	Sample depth (cmbsf)	DNA	RNA	FISH (20% v/v)	Anaero vial for activity (5cm3)	Anaero slurry in 20cc vial(5cc)	Anaero vial	other	Remarks
1	09.03.2008	TV-MUC	Yonaguni knoll	NE area of Abyss vent	Reference core. No H2S odor. But this core is disputable as real reference core.	MUC3 St.15-4	0	2	1	○	○	○	○○				
2							2	6	4	○	○	○	○○				
3							6	10	8	○	○	○	○○				
4							10	14	12	○	○	○	○○				
5							14	18	16	○	○	○	○○				
6							18	22	20	○	○	○	○○				
7							22	26	24	○	○	○	○○				
8							26	30	28	○	○	○	○○				turn black. This may indicate SR zone.
9	10.03.2008	TV-MUC	Yonaguni knoll	western area of Swallow chimney	CO2seep area. Slight smell of H2S. Sulfur crust. Gas bubbling was opbserved onboard.	MUC8 St.20	ca25	ca35		○	○○	○	○○	○	○		anticipation of liquid CO2
10							0	4	2	○	○	○	○○	○			
11							4	8	6	○	○	○	○○	○	○		
12							8	12	10	○	○	○	○○	○	○		anticipation of liquid CO2
13							12	16	14	○	○	○	○○	○	○		
14							16	20	18	○	○	○	○○	○	○		
15							20	24	22	○	○	○	○○	○	○		
16	10.03.2008	TV-MUC	Yonaguni knoll	middle position between Abyss vent and Swallow chimney	CO2 seep area	MUC7 St.19	ca0	ca9		○		○	○○	○			
17	10.03.2008	TV-MUC	Yonaguni knoll	Northern area of Abyss vent	Anticipation of liquid CO2. Gas bubbling. Sulfur crust in upper 10cm sediments. Included blackish organic materials (product of shark?)	MUC10-2 St.25	0	4	2	○	○	○	○○	○	○		
18							4	8	6	○	○	○	○○	○	○		
19							8	12	10	○	○○	○	○○	○	○		
20							12	16	14	○	○○	○	○○	○	○		void
21							16	20	18	○	○	○	○○	○	○		
22							20	24	22	○	○	○	○○	○	○		
23							24	26-28		○	○	○	○○	○	○		
24	13.03.2008	ROV,Push core	Yonaguni knoll	around Abyss vent?	A few bubbles from hole after push coring. Gas bubbling onboard. Void.	201PC28 St.30	0	4	2	○	○	○	○○	○	○(20cc vial)		
25							4	8	6	○	○	○	○○	○	○(20cc vial)		
26							8	12	10	○	○	○	○○	○	○(20cc vial)		
27							12	16	14	○	○	○	○○	○	○(20cc vial)		
28	14.03.2008	gravity core	Yonaguni knoll	western area of Swallow chimney	A number of voids. Especially There was huge void between 108cm and 170cm. 3m long	GC1 St34			10			○					Regardless of upper sediment, less water content
29									20			○					
30									30			○					
31									40			○					
32									60			○					
33									70			○					
34									80			○					
35									105			○					
36									170			○					
37									180			○					
38									190			○					
39									210			○					
40									220			○					
41									230			○					
42									240			○					
43									245			○					Sulfur layter
44									260			○					
45									280			○					
46									290			○					
47							45	53	49	○○	○	○	○○	○	○(20cc vial)		
48							92	100	96	○○	○	○	○○	○	○(20cc vial)		
49							195	200	197,5	○	○	○	○○	○	○(20cc vial)		
50							245	500	372,5	○	○	○	○○	○	○(20cc vial)		
51							367	374	370,5	○	○	○	○○	○	○(20cc vial)		
52	14.03.2008	TV-MUC	Yonaguni knoll	SW area of Abyss vent	Sulfur crust. Pavement.	MUC11 St.36			surface	○	○	○	○○	○	○(20cc vial)		
53	14.03.2008	gravity core	Yonaguni knoll	Northern area of Abyss vent	1m long. Smell of H2S. Core was collapsed	GC2 St.35			0			○					
54									10			○					
55									20			○					
56									30			○					
57									40			○					
58									50			○					
59									60			○					
60									70			○					
61									80			○					
62							5	15	10	○	○	○	○○	○	○(20cc vial)		Sulfur crust
63							25	35	30	○	○	○	○○	○	○(20cc vial)		Sulfur crust
64							55	65	60	○	○	○	○○	○	○(20cc vial)		
65	16.03.2008	ROV,Push core	Yonaguni knoll	around Abyss vent	Real reference without thermal gradient. Oxidative core because of red color through whole core.	203 St.44 PC8	0	4	2	○	○	○	○○	○	○(20cc vial)		
66							4	8	6	○		○	○○	○	○(20cc vial)		
67							8	12	10	○	○	○	○○	○	○(20cc vial)		
68							12	16	14	○		○	○○	○	○(20cc vial)		
69							16	20	18	○	○	○	○○	○	○(20cc vial)		
70	17.03.2008	TV-MUC	Yonaguni knoll	Northern area of Abyss vent	ooze included elemental sulfur. Gas bubbling. Smells of	MUC16 St.49	ca10	20		○	○	○			○(200cc for activity,	Anaero slurry without Na2S	
71							ca20	30		○	○	○			○(200cc for activity,	in200ccvial	
72	17.03.2008	TV-MUC	Yonaguni knoll	Northern area of Abyss vent	High SRR is expected because of intense smells of H2S	MUC19 St.54	0	4	2	○	○(mainly	○(mainly	○○		○(20cc vial)	blackish surface in 20cc vial	surface is blackish. Iron sulfide?
73							4	8	6	○		○	○○		○(20cc vial)		
74							8	12	10	○	○	○	○○		○(20cc vial)		
75							12	16	14	○		○	○○		○(20cc vial)		
76							16	20	18	○	○	○	○○		○(20cc vial)		
77							20	24	22	○		○	○○		○(20cc vial)		
78							24	28	26	○		○	○○		○(20cc vial)		less sulfur compound
79	17.03.2008	TV-MUC	Yonaguni knoll	NE area of Abyss vent	reference. Entire core was red. No smells of H2S. A few sulfur.	MUC20 St.55	0	4	2	○		○	○○		○(20cc vial)		
80							4	8	6	○		○	○○		○(20cc vial)		
81							8	12	10	○		○	○○		○(20cc vial)		
82							12	16	14	○		○	○○		○(20cc vial)		lair formed by crab?
83							16	20	18	○		○	○○		○(20cc vial)		
84							20	24	22	○		○	○○		○(20cc vial)		
85	18.03.2008	TV-MUC	Yonaguni knoll	SW area of Yonaguni knoll	reference. Surface is red. No smells of H2S.	MUC23 St.65	0	4	2	○		○	○○		○(20cc vial)		
86							4	8	6	○	○	○	○○		○(200cc vial)		
87							8	12	10	○		○	○○		○(20cc vial)		
88							12	16	14	○	○	○	○○		○(200cc vial)		
89							16	20	18	○		○	○○		○(20cc vial)		
90							20	24	22	○		○	○○		○(20cc vial)		
91							24	28	26	○		○			○(20cc vial)		

ROV protocol

Appendix

Dive 197
ALAMER : Operation list
Dive summaries Alamere

ALAMER : Operation list

Cruise : **SO196 - SUMSUN**
Dive : 197 SO196_005
Operation list :

Equipment	Num	Date	Hour	Latitude	Longitude	Depth	Altitude	Location	Biology	Water	Geochem.	Measure	Pict.	File	Comments
CO2 Sensor Contros	1	07/03/2008	09:03:47	N 24 50.6163	E 122 42.1665	1393	0	Yonaguni knoll					49	X	pCO2 measurement no. 1 off
CO2 pH T Sensor handheld	1	07/03/2008	07:09:18	N 24 50.7276	E 122 42.3019	1323	0	Yonaguni knoll					8	X	10 min calib of CO2 handheld and pCO2 CONTROS No1
CO2 pH T Sensor handheld	2	07/03/2008	09:22:35	N 24 50.6156	E 122 42.1659	1394	0	Yonaguni knoll					55	X	HAND HELD No 2 finished
HDTV camera	1	07/03/2008	08:21:27	N 24 50.6159	E 122 42.1660	1393	0	Yonaguni knoll					32	X	HDTV No 1 off tape 1
HDTV camera	2	07/03/2008	08:58:52	N 24 50.6161	E 122 42.1652	1393	0	Yonaguni knoll					47	X	HDTV No 2 off tape 1
HDTV camera	3	07/03/2008	09:15:27	N 24 50.6163	E 122 42.1664	1392	0	Yonaguni knoll					53	X	HDTV No 3 off tape 1
KIPS bottle	33	07/03/2008	10:20:17	N 24 50.7962	E 122 42.0737	1250	0	Yonaguni knoll		X			69		KIPS33 stopped
KIPS bottle	34	07/03/2008	10:15:22	N 24 50.7939	E 122 42.0722	1330	0	Yonaguni knoll		X			66		KIPS 34 stopped
KIPS bottle	35	07/03/2008	08:45:05	N 24 50.6158	E 122 42.1660	1393	0	Yonaguni knoll		X			41		KIPS Sample 35 T=150-170
KIPS bottle	36	07/03/2008	08:40:12	N 24 50.6149	E 122 42.1663	1393	0	Yonaguni knoll		X			39		KIPS Sample 36 Tmax=246
Push Corer	14	07/03/2008	09:57:04	N 24 50.7456	E 122 42.0656	1390	0	Yonaguni knoll			X		61		push core no. 14 no bubbles normal sediment
T Lance online	1	07/03/2008	10:07:03	N 24 50.7558	E 122 42.0695	1385	2	Yonaguni knoll					64	X	T-probe 1 recovered QUEST leave the bottom

Dive summary

ROV Quest - Dive: 197- 1

SUMSUN (Sonne)

Date: **07/03/2008**
Observers: **REHDER Gregor**
Station: **Yonaguni knoll**
Position: **N 24 50.7077 E 122 42.0005**

Dive duration:

Start: **07/03/2008 05:35:00**
At bottom: **07/03/2008 06:53:00**
Leave bottom: **07/03/2008 10:07:00**
End: **07/03/2008 11:55:00**

Explored sites:

Dive objectives:

Objectives:
1. Reconnaissance orientation / filming of relevant sites
2. Marker Deployment
3. Defining potential sampling sites
4. In situ measurements
5. T-Stick probing
6. Sensor test / measurements
7. Observation of phase transition during ascent

ROV Shifts (2 hours):
15:00 to17:00 Boetius, Rehder
17:00 to 19:00 Boetius, Inagaki
19:00 to 21:00 Inagaki, Nakamura

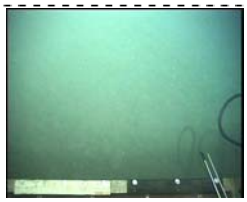
Operations synthesis:

Sampling operations
Water :
KIPS bottle : 4 samples,
Sediment :
Carottier tube : 1 sample,
Measures
7 continue measures were realised,

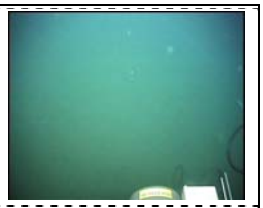
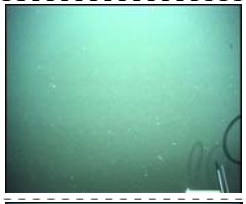
69 pictures captured,
1 new locality defined: Marker 5.

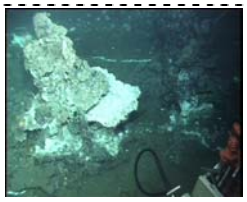
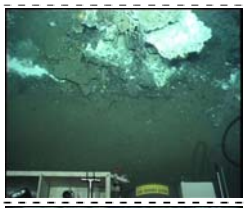
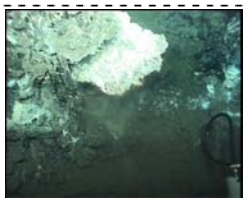
Dive summary:

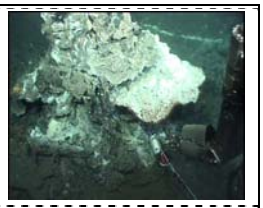
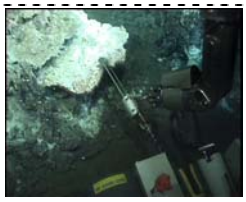
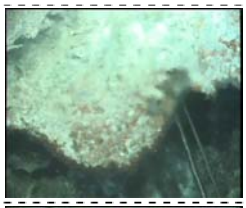
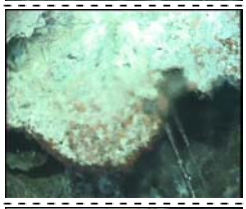
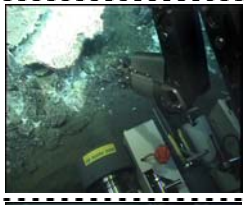
Dive report:

Date	Hour	Location	Latitude Longitude	Immersion Altitude	Comments	Picture
07/03/2008	06:30:19	Yonaguni knoll	N 24 50.7641 E 122 42.3532	733.8 0.0	start of Alamer at 817	
07/03/2008	06:53:37	Yonaguni knoll	N 24 50.7264 E 122 42.3015	1319.0 4.3	at bottom	
07/03/2008	06:55:08	Yonaguni knoll	N 24 50.7289 E 122 42.3002	1324.2 0.9	Start Tape A1, start Tape B1	
07/03/2008	06:57:33	Yonaguni knoll	N 24 50.7286 E 122 42.2996	1323.3 0.9	start Adelie Minifilm on both cameras	
07/03/2008	07:00:03	Yonaguni knoll	N 24 50.7276 E 122 42.3014	1322.8 0.9	Standing for 10 min, use for sensor calibration	
07/03/2008	07:07:50	Yonaguni knoll	N 24 50.7285 E 122 42.3009	1323.4 0.9	still standing because Doppler log not working	
07/03/2008	07:09:18	Yonaguni knoll	N 24 50.7276 E 122 42.3019	1323.5 0.9	10 min calib of CO2 handheld and pCO2 CONTROS No1	

07/03/2008	07:13:08	Yonaguni knoll	N 24 50.7286 E 122 42.3011	1322.8 0.9	Start heading SSW towards MoskitoChimney	
07/03/2008	07:16:42	Yonaguni knoll	N 24 50.7207 E 122 42.2831	1330.4 0.9	Crater like structure	
07/03/2008	07:17:56	Yonaguni knoll	N 24 50.7204 E 122 42.2832	1330.4 0.9	Frame grab taken on crater	
07/03/2008	07:19:16	Yonaguni knoll	N 24 50.7196 E 122 42.2826	1331.3 0.9	Continue heading SSW, ther were some fishes	
07/03/2008	07:22:03	Yonaguni knoll	N 24 50.7148 E 122 42.2662	1335.4 3.5	hard ground, folded	
07/03/2008	07:28:32	Yonaguni knoll	N 24 50.7160 E 122 42.2417	1344.0 1.6	First Picture Photo C	
07/03/2008	07:32:53	Yonaguni knoll	N 24 50.7031 E 122 42.2238	1353.0 1.6	white patches at seafloor	
07/03/2008	07:35:15	Yonaguni knoll	N 24 50.6937 E 122 42.2161	1355.1 1.3	white patches and strong signal in sonal	
07/03/2008	07:36:25	Yonaguni knoll	N 24 50.6862 E 122 42.2154	1355.8 1.5	rocky area, in sonar elevated	

07/03/2008	07:38:27	Yonaguni knoll	N 24 50.6679 E 122 42.2130	1355.5 2.0	crab or sea spider	
07/03/2008	07:43:54	Yonaguni knoll	N 24 50.6388 E 122 42.1986	1381.4 1.0	sonar reflection in sonar , not visited, passed on port side 20 m	
07/03/2008	07:49:30	Yonaguni knoll	N 24 50.6244 E 122 42.1680	1391.4 0.9	sonar reflection on port side	
07/03/2008	07:50:44	Yonaguni knoll	N 24 50.6208 E 122 42.1642	1392.9 1.0	Tape change, Tape A2, Tape B2	
07/03/2008	07:51:23	Yonaguni knoll	N 24 50.6202 E 122 42.1647	1392.5 1.0	HD-Tape recording on, white mats	
07/03/2008	07:54:11	Yonaguni knoll	N 24 50.6184 E 122 42.1673	1393.3 1.3	2structues, 5 fishes, tocuh floor for sonar screen shot	
07/03/2008	07:55:54	Yonaguni knoll	N 24 50.6188 E 122 42.1678	1392.5 1.0	screen dive 197-1 , most likely Moskito chimney	
07/03/2008	07:58:07	Yonaguni knoll	N 24 50.6169 E 122 42.1676	1392.9 0.9	shimmering water, sulfur , shrimp, snails, whie mats	
07/03/2008	07:59:30	Yonaguni knoll	N 24 50.6174 E 122 42.1659	1392.1 1.0	T-excurion , about 3m ahead	

07/03/2008	08:01:18	Yonaguni knoll	N 24 50.6164 E 122 42.1671	1391.1 1.0	still photo scorpio of whole structure	
07/03/2008	08:05:48	Yonaguni knoll	N 24 50.6169 E 122 42.1667	1392.0 0.9	positioning to T- -test and KIPS-sampling	
07/03/2008	08:07:11	Yonaguni knoll	N 24 50.6165 E 122 42.1661	1392.9 1.0	photo-C-photo before, photo with Scorpio before, 453S5216.dcr	
07/03/2008	08:10:52	Yonaguni knoll	N 24 50.6154 E 122 42.1664	1392.8 0.7	more Photo-C-camera, 5217, 5218 10min approx	
07/03/2008	08:17:43	Yonaguni knoll	N 24 50.6159 E 122 42.1658	1393.2 0.0	Fumio in, Gregor out	
07/03/2008	08:21:27	Yonaguni knoll	N 24 50.6159 E 122 42.1660	1393.0 0.0	HDTV No 1 off, tape 1	
07/03/2008	08:25:47	Yonaguni knoll	N 24 50.6151 E 122 42.1654	1393.7 0.0	KIPS T measurement	
07/03/2008	08:27:29	Yonaguni knoll	N 24 50.6148 E 122 42.1662	1393.7 0.0	KIPS T=243	
07/03/2008	08:29:41	Yonaguni knoll	N 24 50.6160 E 122 42.1665	1394.0 0.0	T240 deg	

07/03/2008	08:31:34	Yonaguni knoll	N 24 50.6161 E 122 42.1662	1393.1 0.0	Tmax=248	
07/03/2008	08:33:11	Yonaguni knoll	N 24 50.6156 E 122 42.1661	1393.4 0.0	temperature on frange structure is between 20 and 25	
07/03/2008	08:37:56	Yonaguni knoll	N 24 50.6162 E 122 42.1647	1393.4 0.0	Sample 36 KIPS	
07/03/2008	08:40:12	Yonaguni knoll	N 24 50.6149 E 122 42.1663	1393.7 0.0	KIPS Sample 36, Tmax=246	
07/03/2008	08:42:38	Yonaguni knoll	N 24 50.6170 E 122 42.1655	1393.6 0.0	KIPS Sample 35 open, T=100	
07/03/2008	08:45:05	Yonaguni knoll	N 24 50.6158 E 122 42.1660	1393.3 0.0	KIPS Sample 35, T=150-170	
07/03/2008	08:46:03	Yonaguni knoll	N 24 50.6158 E 122 42.1651	1393.6 0.0	pump off	
07/03/2008	08:48:03	Yonaguni knoll	N 24 50.6152 E 122 42.1655	1393.4 0.0	tape changed to 3	
07/03/2008	08:53:29	Yonaguni knoll	N 24 50.6148 E 122 42.1652	1393.4 0.0	pCO2 sensor on	

07/03/2008	08:55:12	Yonaguni knoll	N 24 50.6166 E 122 42.1655	1393.9 0.0	HDTV start	
07/03/2008	08:56:35	Yonaguni knoll	N 24 50.6156 E 122 42.1652	1393.9 0.0	ray	
07/03/2008	08:58:52	Yonaguni knoll	N 24 50.6161 E 122 42.1652	1393.3 0.0	HDTV No 2 off, tape 1	
07/03/2008	09:00:10	Yonaguni knoll	N 24 50.6160 E 122 42.1662	1393.8 0.0	photo C 219	
07/03/2008	09:03:47	Yonaguni knoll	N 24 50.6163 E 122 42.1665	1393.2 0.0	pCO2 measurement no. 1 off	
07/03/2008	09:10:56	Yonaguni knoll	N 24 50.6156 E 122 42.1666	1394.5 0.0	HAND HELD CO2	
07/03/2008	09:12:54	Yonaguni knoll	N 24 50.6161 E 122 42.1660	1393.5 0.0	HAND HELD on, no. 1 measurement	
07/03/2008	09:13:37	Yonaguni knoll	N 24 50.6165 E 122 42.1656	1393.6 0.0	HTDV on	
07/03/2008	09:15:27	Yonaguni knoll	N 24 50.6163 E 122 42.1664	1392.8 0.0	HDTV No 3 off, tape 1	

07/03/2008	09:15:59	Yonaguni knoll	N 24 50.6151 E 122 42.1651	1392.8 0.0	change HDTV tape to no. 2	
07/03/2008	09:22:35	Yonaguni knoll	N 24 50.6156 E 122 42.1659	1394.2 0.0	HAND HELD No 2 finished	
07/03/2008	09:27:26	Yonaguni knoll	N 24 50.6161 E 122 42.1654	1393.8 0.0	Marker no. 5 set	
07/03/2008	09:27:49	Yonaguni knoll	N 24 50.6163 E 122 42.1657	1393.6 0.0	leave this site and head to Abyss vent	
07/03/2008	09:35:51	Yonaguni knoll	N 24 50.6671 E 122 42.1254	1392.2 1.1	head NW to Abyss vent, flat seafloor, no bubbles	
07/03/2008	09:46:50	Yonaguni knoll	N 24 50.7253 E 122 42.0814	1389.2 1.2	change tape to no. 4	
07/03/2008	09:53:34	Yonaguni knoll	N 24 50.7448 E 122 42.0610	1386.8 2.5	ROV landed, try to get a push core from normal sediment	
07/03/2008	09:57:04	Yonaguni knoll	N 24 50.7456 E 122 42.0656	1390.4 0.0	push core no. 14, no bubbles, normal sediment	
07/03/2008	09:58:21	Yonaguni knoll	N 24 50.7448 E 122 42.0640	1389.6 0.0	T-probe measurement	

07/03/2008	10:02:34	Yonaguni knoll	N 24 50.7490 E 122 42.0649	1389.4 0.6	very soft sediment	
07/03/2008	10:07:03	Yonaguni knoll	N 24 50.7558 E 122 42.0695	1385.7 2.5	T-probe 1 recovered, QUEST leave the bottom	
07/03/2008	10:13:49	Yonaguni knoll	N 24 50.7925 E 122 42.0688	1360.2 14.3	KIPS no. 34 on	
07/03/2008	10:15:22	Yonaguni knoll	N 24 50.7939 E 122 42.0722	1330.7 0.0	KIPS 34 stopped	
07/03/2008	10:18:24	Yonaguni knoll	N 24 50.7908 E 122 42.0665	1287.6 0.0	KIPS no. 33 on	
07/03/2008	10:19:31	Yonaguni knoll	N 24 50.7945 E 122 42.0698	1267.5 0.0	tape no. 4 off	
07/03/2008	10:20:17	Yonaguni knoll	N 24 50.7962 E 122 42.0737	1250.8 0.0	KIPS33 stopped	
07/03/2008	10:22:20	Yonaguni knoll	N 24 50.8032 E 122 42.0706	1207.1 0.0	fumioa and antje out	

created Mon Mar 24 14:40:28 JST 2008

Appendix

Dive 198
ALAMER : Operation list
Dive summaries Alamere

Cruise : **SO196 - SUMSUN**
Dive : 198 SO196_011

Operation list :

Equipment	Num	Date	Hour	Latitude	Longitude	Depth	Altitude	Location	Biology	Water	Geochem.	Measure	Pict.	File	Comments
CO2 pH T Sensor handheld	1	08/03/2008	03:57:30	N 24 51.4932	E 122 42.4118	1181	0	Yonaguni knoll					7	X	end of handheld calib (No 1) way out of area but bottom contact
CO2 pH T Sensor handheld	2	08/03/2008	08:21:55	N 24 50.8368	E 122 42.0201	1376	1	Yonaguni knoll					39	X	handheld No 2 off
CO2 pH T Sensor handheld	3	08/03/2008	10:54:48	N 24 50.8601	E 122 42.0115	1380	0	Yonaguni knoll					67	X	handheld No 3 stopped
Geological Basket	1	08/03/2008	08:58:57	N 24 50.8365	E 122 42.0208	1377	1	Yonaguni knoll			X		44		one piece of rock sampled from the frange structure
HDTV camera	1	08/03/2008	06:48:23	N 24 50.8442	E 122 42.0216	1378	1	Yonaguni knoll					18	X	HDTV 1 off tape 1
HDTV camera	4	08/03/2008	08:21:21	N 24 50.8361	E 122 42.0207	1377	1	Yonaguni knoll					38	X	HDTV No 2-4 stop tape 1 (HDTV on 3x missing times for HDTV off)
HDTV camera	5	08/03/2008	09:41:20	N 24 50.8599	E 122 42.0108	1379	0	Yonaguni knoll					5	X	HDTV 5 off tape 1
KIPS bottle	21	08/03/2008	07:41:55	N 24 50.8387	E 122 42.0185	1376	1	Yonaguni knoll		X			26		KIPS no. 21 off
KIPS bottle	22	08/03/2008	07:42:20	N 24 50.8389	E 122 42.0185	1376	1	Yonaguni knoll		X			27		KIPS no. 22 off not inside the bubble aggregate
KIPS bottle	23	08/03/2008	07:47:27	N 24 50.8384	E 122 42.0185	1375	1	Yonaguni knoll		X			3		no. 23 off
KIPS bottle	24	08/03/2008	07:52:08	N 24 50.8384	E 122 42.0195	1376	1	Yonaguni knoll		X			32		KIPS 24 off
KIPS bottle	25	08/03/2008	07:56:13	N 24 50.8378	E 122 42.0187	1376	1	Yonaguni knoll	X				35		KIPS no. 25 off

KIPS bottle	26	08/03/2008	10:03:40	N 24 50.8575	E 122 42.0104	1380	0	Yonaguni knoll		X			53		no. 26 off
KIPS bottle	27	08/03/2008	10:09:54	N 24 50.8580	E 122 42.0110	1378	0	Yonaguni knoll		X			55		no. 27 off
KIPS bottle	28	08/03/2008	10:17:38	N 24 50.8592	E 122 42.0105	1379	0	Yonaguni knoll	X				57		no. 28 off
KIPS bottle	29	08/03/2008	10:23:04	N 24 50.8596	E 122 42.0101	1378	0	Yonaguni knoll	X				59		no. 29 off
T Lance online	1	08/03/2008	03:26:31	N 24 51.5629	E 122 42.4345	1043	0	Yonaguni knoll					4	X	T-lance No 1 (test) ended
T Lance online	2	08/03/2008	08:46:55	N 24 50.8388	E 122 42.0204	1376	1	Yonaguni knoll					43	X	T-lance No 2 off
T Lance online	3	08/03/2008	10:36:55	N 24 50.8600	E 122 42.0081	1379	0	Yonaguni knoll					62	X	T-lance No 3 off max bottom 16C
T Lance online	4	08/03/2008	11:38:47	N 24 50.8463	E 122 42.0058	1380	0	Yonaguni knoll					76	X	T-lance No 4 fell stop

Dive summary

ROV Quest - Dive: 198- 2

SUMSUN (Sonne)

Date: **08/03/2008**
Observers: **INAGAKI Fumio**
Station: **Yonaguni knoll**
Position: **N 24 50.7077 E 122 42.0005**

Dive duration:

Start: **08/03/2008 02:10:00**
At bottom: **08/03/2008 06:38:17**
Leave bottom: **08/03/2008 11:48:11**
End: **08/03/2008 13:05:00**

Explored sites:

Dive objectives:

Objectives:
1. Start with reconnaissance, head to Swallow vent
2. Assure CO2 layered area by T-probe net or section, 4 KIPS whenver used,
3. Put marker on potential sites for push core sampling, in situ instrument deployment, and elevator positions
4. In situ measurements with handheld an pCO2 sensor
5. Further reconnaissance of “lake” and swallow chimney area
6. Do-T-Grid around lake
7. Return to push core sampling site, core sampling, handheld and pCO2 sensor
8. Fill gas tight sampler / fill T-lance puhcore array, film phase behaviour during ascent

Dive schedule (11 hours bottom time)
Dive start 11:00
ROV on deck 06:00 next day

ROV Shifts (2 hours):
12:00 to 14:00 Inagaki, Rehder
14:00 to 16:00 Haeckel, still transit
16:00 to 18:00 Inagaki, Haeckel
18:00 to 20:00 Nakamura, Inagaki
20:00 to 22:00 de Beer, Nakamura
22:00 to 00:00 Boetius, Haeckel
00:00 to 03:00 Rehder, Schneider
23:00 to 05:00 Nakamura, Rehder
lift of at 5:00

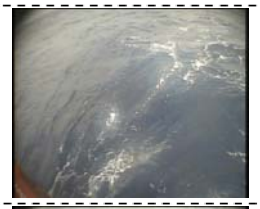
Operations synthesis:

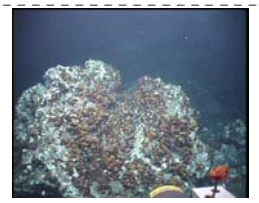
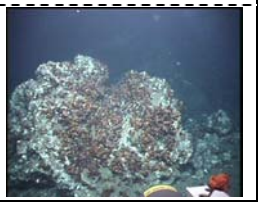
Sampling operations
Biology :
KIPS bottle : 3 samples,
Water :
KIPS bottle : 6 samples,
Sediment :
Panier geologie : 1 sample,
Measures
10 continue measures were realised,

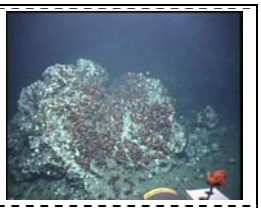
78 pictures captured,
2 news localities defined: marker 4 and Shinkai 88.

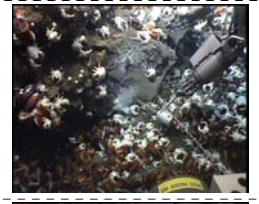
Dive summary:

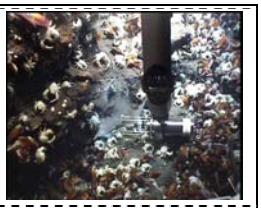
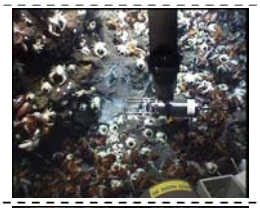
Dive report:

Date	Hour	Location	Latitude Longitude	Immersion Altitude	Comments	Picture
08/03/2008	03:12:21	Yonaguni knoll	N 24 51.6029 E 122 42.4868	912.8 0.0	start alamer, 913 m water depth	
08/03/2008	03:16:29	Yonaguni knoll	N 24 51.5854 E 122 42.4622	971.1 0.0	start T-lance test, file 198_test	
08/03/2008	03:26:31	Yonaguni knoll	N 24 51.5629 E 122 42.4345	1043.1 0.0	T-lance No 1 (test) ended	
08/03/2008	03:27:23	Yonaguni knoll	N 24 51.5604 E 122 42.4352	1052.0 0.0	stay at 1050 m water depth, start handheld calbration, though moving through water	
08/03/2008	03:35:19	Yonaguni knoll	N 24 51.5402 E 122 42.4477	1080.3 0.0	heading further towards SE, one mile to go because of position change during the launch	
08/03/2008	03:57:30	Yonaguni knoll	N 24 51.4932 E 122 42.4118	1181.6 0.9	end of handheld calib (No 1), way out of area, but bottom contact	
08/03/2008	03:58:19	Yonaguni knoll	N 24 51.4935 E 122 42.4107	1181.1 1.1	start Tape A1, start Tape B1	
08/03/2008	03:59:21	Yonaguni knoll	N 24 51.4887 E 122 42.4062	1180.9 1.1	Framegrabcamera switched to Pegasus	

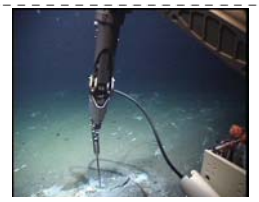
08/03/2008	04:26:41	Yonaguni knoll	N 24 51.3690 E 122 42.3155	1081.8 0.0	stop Tape A1 and B1	
08/03/2008	05:33:08	Yonaguni knoll	N 24 51.0789 E 122 42.1834	1170.1 0.0	Start Creating Adelie Minifilms both cameras	
08/03/2008	06:14:53	Yonaguni knoll	N 24 50.9513 E 122 42.0925	1185.9 0.0	sonar reflector in 1285 m water depth at 24 deg 50.9590'N/122 deg 42.1052'E, particle cloud on screen, sonar recording on for ~5 min.	
08/03/2008	06:38:17	Yonaguni knoll	N 24 50.8440 E 122 42.0188	1369.3 8.7	see the bottom, close to the site swallow chimney	
08/03/2008	06:38:49	Yonaguni knoll	N 24 50.8434 E 122 42.0180	1369.8 9.4	start Tape A1 and B1	
08/03/2008	06:43:32	Yonaguni knoll	N 24 50.8466 E 122 42.0221	1377.7 1.8	Bathymodiolus colony	
08/03/2008	06:46:55	Yonaguni knoll	N 24 50.8444 E 122 42.0222	1379.1 1.0	HDTV on	
08/03/2008	06:47:25	Yonaguni knoll	N 24 50.8445 E 122 42.0202	1378.1 1.0	small CO2 droplets	

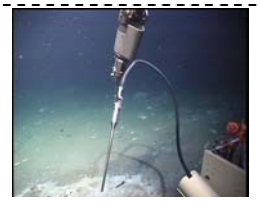
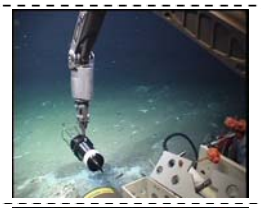
08/03/2008	06:48:23	Yonaguni knoll	N 24 50.8442 E 122 42.0216	1378.4 1.0	HDTV 1 off, tape 1	
08/03/2008	06:51:25	Yonaguni knoll	N 24 50.8432 E 122 42.0167	1377.1 1.0	Bathymodiolus, Garatheide, fish	
08/03/2008	07:00:20	Yonaguni knoll	N 24 50.8402 E 122 42.0154	1376.3 2.7	HDTV on	
08/03/2008	07:07:13	Yonaguni knoll	N 24 50.8396 E 122 42.0190	1374.8 4.4	CO2 hydrate accumulation	
08/03/2008	07:14:27	Yonaguni knoll	N 24 50.8377 E 122 42.0191	1377.2 1.9	veacle landed in front of CO2 hydrate accmulation	
08/03/2008	07:26:11	Yonaguni knoll	N 24 50.8385 E 122 42.0190	1376.6 1.3	observation of CO2 bubbles	
08/03/2008	07:36:13	Yonaguni knoll	N 24 50.8386 E 122 42.0186	1376.3 1.3	KIPS no. 21	
08/03/2008	07:39:14	Yonaguni knoll	N 24 50.8384 E 122 42.0186	1377.0 1.3	tape change A and B	
08/03/2008	07:41:55	Yonaguni knoll	N 24 50.8387 E 122 42.0185	1376.1 1.3	KIPS no. 21 off	

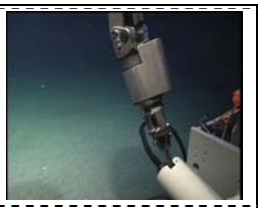
08/03/2008	07:42:20	Yonaguni knoll	N 24 50.8389 E 122 42.0185	1376.4 1.5	KIPS no. 22 off, not inside the bubble aggregate	
08/03/2008	07:45:58	Yonaguni knoll	N 24 50.8389 E 122 42.0185	1376.3 1.5	KIPS no. 23 on	
08/03/2008	07:46:22	Yonaguni knoll	N 24 50.8401 E 122 42.0168	1376.3 1.5	HDTV started	
08/03/2008	07:47:27	Yonaguni knoll	N 24 50.8384 E 122 42.0185	1375.9 1.5	no. 23 off	
08/03/2008	07:49:28	Yonaguni knoll	N 24 50.8388 E 122 42.0185	1376.5 1.4	KIPS no. 24 on	
08/03/2008	07:52:08	Yonaguni knoll	N 24 50.8384 E 122 42.0195	1376.9 1.5	KIPS 24 off	
08/03/2008	07:52:49	Yonaguni knoll	N 24 50.8372 E 122 42.0193	1376.6 1.6	KIPS no. 25 on	
08/03/2008	07:55:25	Yonaguni knoll	N 24 50.8373 E 122 42.0191	1375.9 1.6	temperature outside 4.0C, bubble inside 5.6C	
08/03/2008	07:56:13	Yonaguni knoll	N 24 50.8378 E 122 42.0187	1376.4 1.5	KIPS no. 25 off	

08/03/2008	08:11:54	Yonaguni knoll	N 24 50.8371 E 122 42.0190	1376.1 1.6	HANDHELD on	
08/03/2008	08:12:39	Yonaguni knoll	N 24 50.8371 E 122 42.0184	1376.1 1.7	HDTV on	
08/03/2008	08:21:21	Yonaguni knoll	N 24 50.8361 E 122 42.0207	1377.0 1.4	HDTV No 2-4 stop, tape 1 (HDTV on 3x, missing times for HDTV off)	
08/03/2008	08:21:55	Yonaguni knoll	N 24 50.8368 E 122 42.0201	1376.8 1.3	handheld No 2 off	
08/03/2008	08:36:51	Yonaguni knoll	N 24 50.8368 E 122 42.0175	1376.9 1.2	T-probe 2 start	
08/03/2008	08:39:49	Yonaguni knoll	N 24 50.8367 E 122 42.0179	1376.6 1.1	tape changed to no. 3	
08/03/2008	08:43:20	Yonaguni knoll	N 24 50.8356 E 122 42.0176	1377.0 1.2	photoC	
08/03/2008	08:46:55	Yonaguni knoll	N 24 50.8388 E 122 42.0204	1376.9 1.1	T-lance No 2 off	
08/03/2008	08:58:57	Yonaguni knoll	N 24 50.8365 E 122 42.0208	1377.0 1.1	one piece of rock sampled from the frange structure	

08/03/2008	09:02:51	Yonaguni knoll	N 24 50.8377 E 122 42.0184	1377.4 1.1	veacle leave off and move to another spot	
08/03/2008	09:16:51	Yonaguni knoll	N 24 50.8349 E 122 42.0212	1380.9 0.0	veacle landed on the bubbling area	
08/03/2008	09:17:11	Yonaguni knoll	N 24 50.8345 E 122 42.0226	1379.9 0.2	photos	
08/03/2008	09:23:24	Yonaguni knoll	N 24 50.8340 E 122 42.0215	1379.8 0.2	leave the bottom, and head to NW	
08/03/2008	09:34:15	Yonaguni knoll	N 24 50.8591 E 122 42.0129	1379.4 0.0	veacle land the pavement area	
08/03/2008	09:41:20	Yonaguni knoll	N 24 50.8599 E 122 42.0108	1379.4 0.0	HDTV 5 off, tape 1	
08/03/2008	09:41:46	Yonaguni knoll	N 24 50.8589 E 122 42.0109	1379.4 0.0	change tapes to no. 4	
08/03/2008	09:57:31	Yonaguni knoll	N 24 50.8586 E 122 42.0102	1378.9 0.0	KIPS no. 26 on	
08/03/2008	10:03:40	Yonaguni knoll	N 24 50.8575 E 122 42.0104	1380.6 0.0	no. 26 off	

08/03/2008	10:03:53	Yonaguni knoll	N 24 50.8581 E 122 42.0090	1379.6 0.0	KIPS no. 27 on	
08/03/2008	10:09:54	Yonaguni knoll	N 24 50.8580 E 122 42.0110	1378.8 0.0	no. 27 off	
08/03/2008	10:10:13	Yonaguni knoll	N 24 50.8589 E 122 42.0110	1380.2 0.0	KIPS no. 28 on	
08/03/2008	10:17:38	Yonaguni knoll	N 24 50.8592 E 122 42.0105	1379.3 0.0	no. 28 off	
08/03/2008	10:19:29	Yonaguni knoll	N 24 50.8596 E 122 42.0093	1379.7 0.3	KIPS no. 29 on	
08/03/2008	10:23:04	Yonaguni knoll	N 24 50.8596 E 122 42.0101	1378.8 0.0	no. 29 off	
08/03/2008	10:30:18	Yonaguni knoll	N 24 50.8581 E 122 42.0110	1379.8 0.0	T-probe 3 on, temp at bottom is 12C	
08/03/2008	10:34:08	Yonaguni knoll	N 24 50.8588 E 122 42.0100	1379.2 0.0	bottom temp >15C	
08/03/2008	10:36:55	Yonaguni knoll	N 24 50.8600 E 122 42.0081	1379.0 0.0	T-lance No 3 off, max bottom 16C	

08/03/2008	10:37:31	Yonaguni knoll	N 24 50.8598 E 122 42.0088	1380.0 0.0	try to stick other part	
08/03/2008	10:39:54	Yonaguni knoll	N 24 50.8586 E 122 42.0103	1379.6 0.0	change tapes to no. 5	
08/03/2008	10:44:44	Yonaguni knoll	N 24 50.8602 E 122 42.0102	1379.3 0.0	HANDHELD on	
08/03/2008	10:54:24	Yonaguni knoll	N 24 50.8600 E 122 42.0109	1379.6 0.0	HANDHELD measurement 3	
08/03/2008	10:54:48	Yonaguni knoll	N 24 50.8601 E 122 42.0115	1380.0 0.0	handheld No 3 stopped	
08/03/2008	10:58:40	Yonaguni knoll	N 24 50.8602 E 122 42.0108	1379.9 0.0	Antje in Fumio out, discussion on progress with dive	
08/03/2008	11:02:54	Yonaguni knoll	N 24 50.8594 E 122 42.0091	1379.5 0.0	hand held handle loose, trying to fix	
08/03/2008	11:08:29	Yonaguni knoll	N 24 50.8607 E 122 42.0101	1380.0 0.0	marker 4 set	
08/03/2008	11:10:17	Yonaguni knoll	N 24 50.8607 E 122 42.0100	1380.0 0.0	still foto of marker 4	

08/03/2008	11:17:31	Yonaguni knoll	N 24 50.8517 E 122 42.0061	1379.4 0.0	went 10 m sw on to sediments for T lance test of sediment softness	
08/03/2008	11:21:39	Yonaguni knoll	N 24 50.8515 E 122 42.0067	1379.5 0.0	hard ground just 1 cm penetration	
08/03/2008	11:26:16	Yonaguni knoll	N 24 50.8470 E 122 42.0022	1379.2 1.1	Shinkai marker 8-8	
08/03/2008	11:35:51	Yonaguni knoll	N 24 50.8464 E 122 42.0058	1380.4 0.0	T-lance till 18 cm depth, no CO2, stron T effect	
08/03/2008	11:38:47	Yonaguni knoll	N 24 50.8463 E 122 42.0058	1380.2 0.0	T-lance No 4 fell, stop	
08/03/2008	11:41:09	Yonaguni knoll	N 24 50.8462 E 122 42.0041	1380.3 0.0	tapechange to nr. 6	
08/03/2008	11:46:29	Yonaguni knoll	N 24 50.8469 E 122 42.0056	1380.1 0.0	stop mission	
08/03/2008	11:48:11	Yonaguni knoll	N 24 50.8496 E 122 42.0059	1372.5 6.7	return to surface	

created Mon Mar 24 14:40:41 JST 2008

Appendix

Dive 199
ALAMER : Operation list
Dive summaries Alamere

ALAMER : Operation list

Cruise : **SO196 - SUMSUN**
Dive : 199 SO196_027
Operation list :

Equipment	Num	Date	Hour	Latitude	Longitude	Depth	Altitude	Location	Biology	Water	Geochem.	Measure	Pict.	File	Comments
CO2 pH T Sensor handheld	1	11/03/2008	01:00:20	N 24 51.4158	E 123 50.3703	1302	0	Hatoma knoll					6	X	Finish sensor calibaration handheld No 1 and start descending (start 00:47)
CO2 pH T Sensor handheld	2	11/03/2008	05:07:42	N 24 51.4539	E 123 50.3793	1528	0	Hatoma knoll					125	X	hand held No 2 finished (start 04:52)
CO2 pH T Sensor handheld	3	11/03/2008	07:43:21	N 24 51.5816	E 123 50.4428	1524	1	Hatoma knoll					172	X	handheld measurement No 3 stop (start 07:32)
Gas sampler	1	11/03/2008	08:33:38	N 24 51.5807	E 123 50.4414	1524	1	Hatoma knoll			X		188		Turn handle cunterclockwise
HDTV camera	1	11/03/2008	01:47:58	N 24 51.4098	E 123 50.3841	1529	0	Hatoma knoll					3	X	HDTV recording stop 001 (start 01:38)
HDTV camera	2	11/03/2008	02:15:37	N 24 51.4270	E 123 50.4055	1526	0	Hatoma knoll					49	X	HDTV No 2 stop (start 02:06)
HDTV camera	3	11/03/2008	03:39:30	N 24 51.4517	E 123 50.3888	1528	0	Hatoma knoll					88	X	HDTV No 3 stop (start 03:36)
HDTV camera	4	11/03/2008	04:15:55	N 24 51.4523	E 123 50.3794	1528	0	Hatoma knoll					11	X	HDTV No 4 stop (start 04:10)
HDTV camera	5	11/03/2008	04:34:16	N 24 51.4546	E 123 50.3777	1527	0	Hatoma knoll					117	X	HDTV No 5 off (start 04:32) low temperature fluid ca 22 deg T
HDTV camera	6	11/03/2008	05:07:24	N 24 51.4550	E 123 50.3795	1527	0	Hatoma knoll					124	X	HDTV No 6 off (start 04:51) Volker and Ralf out Christian and Klaus in
HDTV camera	7	11/03/2008	05:42:24	N 24 51.4595	E 123 50.4200	1526	0	Hatoma knoll					136	X	HDTV No 7 off (start 05:35)
HDTV camera	8	11/03/2008	05:54:16	N 24 51.4815	E 123 50.4115	1526	1	Hatoma knoll					14	X	HDTV No 8 off (start 05:47)

HDTV camera	11	11/03/2008	07:22:09	N 24 51.5825	E 123 50.4418	1524	1	Hatoma knoll					164	X	HDTV No 9 - 11 stop (start 06:36)
HDTV camera	12	11/03/2008	08:40:06	N 24 51.5791	E 123 50.4417	1524	1	Hatoma knoll					193	X	HDTV No 12 record off (start 07:28)
HDTV camera	13	11/03/2008	09:08:52	N 24 51.5670	E 123 50.4685	1532	0	Hatoma knoll					29	X	HDTV rec No 13 ended before (start 08:56) no recording currently change HDTV tape to no.7
HDTV camera	14	11/03/2008	13:25:32	N 24 51.5747	E 123 50.2659	149	0	Hatoma knoll					282	X	HDTV No 14 stop recording (start 11:03)
Push Corer	10	11/03/2008	09:35:23	N 24 51.5674	E 123 50.4695	1532	0	Hatoma knoll			X		214		PC 10 sheath came loose take it anyway
Push Corer	15	11/03/2008	10:16:02	N 24 51.5908	E 123 50.4922	1523	0	Hatoma knoll			X		223		PC15 taken crust penetated still taken
Push Corer	22	11/03/2008	09:18:34	N 24 51.5659	E 123 50.4693	1531	0	Hatoma knoll			X		212		take PC 22 at target 3
Push Corer	25	11/03/2008	10:08:59	N 24 51.5922	E 123 50.4917	1523	0	Hatoma knoll			X		221		PC 25 taken stills
T Lance online	1	11/03/2008	01:29:45	N 24 51.4067	E 123 50.3796	1530	0	Hatoma knoll					18	X	Take off T probe TL 01 (start 01:25)
T Lance online	2	11/03/2008	01:41:47	N 24 51.4095	E 123 50.3838	1527	3	Hatoma knoll					26	X	ROV shifted and stop TL 02 (start 01:40)
T Lance online	3	11/03/2008	01:53:24	N 24 51.4102	E 123 50.3847	1530	0	Hatoma knoll					35	X	End TL03 measure. Hard to see the difference of temp by 1 deg franctuation (start 01:50)
T Lance online	4	11/03/2008	02:27:43	N 24 51.4262	E 123 50.4055	1525	0	Hatoma knoll					52	X	end TL04 removing from sediment (start 02:24)
T Lance online	5	11/03/2008	02:35:29	N 24 51.4256	E 123 50.4056	1525	0	Hatoma knoll					55	X	end TL05 removing T Lance from sediment (start 02:28)
T Lance online	6	11/03/2008	02:41:43	N 24 51.4269	E 123 50.4060	1525	0	Hatoma knoll					58	X	end TL06 T Lance removed from cave (start 02:38)
T Lance online	7	11/03/2008	03:26:03	N 24 51.4445	E 123 50.4028	1528	0	Hatoma knoll					8	X	T Lance 07 removed from sed (start 03:12)
T Lance online	8	11/03/2008	04:28:54	N 24 51.4515	E 123 50.3789	1528	0	Hatoma knoll					115	X	TL 08 end T lance measure sulfur spot (start 04:08)
T Lance online	9	11/03/2008	09:10:45	N 24 51.5670	E 123 50.4688	1531	0	Hatoma knoll					21	X	Take out T probe No 9 (start 09:02)
T Lance online	10	11/03/2008	10:00:05	N 24 51.5911	E 123 50.4919	1523	0	Hatoma knoll					219	X	T lance measure No 10 end (start 09:53)
T Lance online	0	11/03/2008	13:30:19	N 24 51.5354	E 123 50.2415	128	0	Hatoma knoll					286	X	Stop T-lance logger determines end of total data logging file TL 00 (start 00:38)
Tlance-corer assembly	1	11/03/2008	13:27:18	N 24 51.5691	E 123 50.2599	147	0	Hatoma knoll					284	X	Store T corere in the drawer Stop Tlance/corer measurement 01 (start 11:01)

ROV Quest - Dive: 199- 3

SUMSUN (Sonne)

Date: **10/03/2008**
Observers: **NAKAMURA Koichi**
Station: **Hatoma knoll**
Position: **N 24 51.5079 E 123 50.4998**

Dive duration:

Start: **10/03/2008 23:50:00**
At bottom: **11/03/2008 01:14:00**
Leave bottom: **11/03/2008 11:36:00**
End: **11/03/2008 13:50:00**

Explored sites:

Dive objectives:

Objectives, Mission and Time Plan
1.Start Dive at landing position, staying in “valley”, heading NNE
2.Investigate area around Iri Vent, handheld, T-probe, divers T-lance measurements in sediments around
3.Find promising gas venting sites, set marker and assure notation in Mimosa
4.Intensive use of T-lance on way NNW to define potential areas for MUC, Chambers and Elevator, set markers and assure notation in Mimosa
5.Take 8 pushcores at promising site
6.Return to gas sampling venting site
7.Collect bubbling gas with gas-tight sampler
8.Fill Pushcore/T-probe assembly and fly up to surface with additional time for monitoring
9.Return with time allowance for phase transition monitoring, end of dive

Dive schedule (10 hours bottom time)
Dive start 9:00
ROV on deck 21:00

ROV Shifts (2 hours):
start to11:00 Rehder,Nakamura (reconnaissance)
11:00 to 13:00 Schneider,Rehder (reconnaissance/T-probes/handheld)
13:00 to 15:00 Inagaki,Boetius (reconnaissance/Push coring)
15:00 to 17:00 Haeckel,Inagaki (push coring/T-probing)
17:00 to end Nakamura,Rehder (reconnaissance/handheld/gas sampling,return)

End of Dive with phase transition monitoring

Operations synthesis:

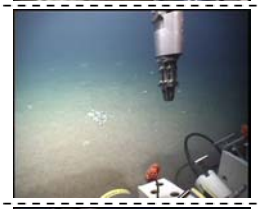
Sampling operations
Sediment :
Gas sampler : 1 sample,
Carottier tube : 4 samples,
Measures
27 continue measures were realised,

285 pictures captured,
2 news localities defined: Marker 184 M1 and Marker 1.

Dive summary:

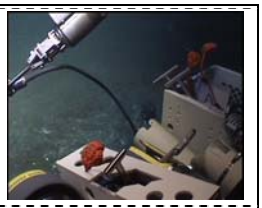
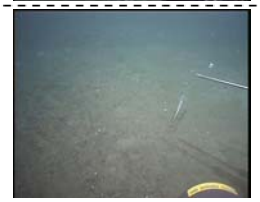
Dive report:

Date	Hour	Location	Latitude Longitude	Immersion Altitude	Comments	Picture
11/03/2008	00:28:59	Hatoma knoll	N 24 51.4189 E 123 50.3166	898.3 0.0	Alamer file opened	
11/03/2008	00:38:17	Hatoma knoll	N 24 51.4142 E 123 50.3481	1106.4 0.0	StarteT-lance logging in File 196_26_01, determines start of T logging, TL 00	
11/03/2008	00:40:29	Hatoma knoll	N 24 51.4151 E 123 50.3478	1152.0 0.0	T-lance shows 1 degee fluctuation - bad	
11/03/2008	00:47:22	Hatoma knoll	N 24 51.4138 E 123 50.3660	1302.8 0.0	stand for 10 min at 1300 m for sensor calibration	
11/03/2008	01:00:20	Hatoma knoll	N 24 51.4158 E 123 50.3703	1302.8 0.0	Finish sensor calibaration handheld No 1 and start descending (start 00:47)	
11/03/2008	01:06:07	Hatoma knoll	N 24 51.4112 E 123 50.3723	1417.3 0.0	Start recording the 1st mini´DV tapes	
11/03/2008	01:09:49	Hatoma knoll	N 24 51.4127 E 123 50.3731	1482.1 0.0	Start tape A1 and 1	
11/03/2008	01:14:29	Hatoma knoll	N 24 51.4072 E 123 50.3732	1528.7 2.8	Bottom in sight	

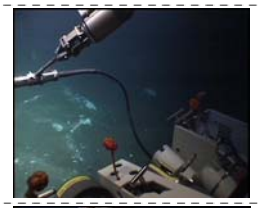
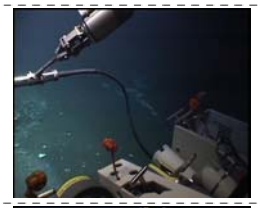
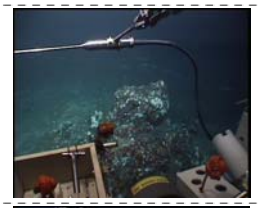
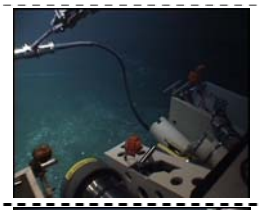
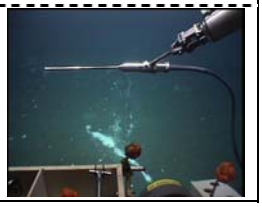
11/03/2008	01:15:37	Hatoma knoll	N 24 51.4072 E 123 50.3721	1529.4 2.2	Deep sea mud	
11/03/2008	01:17:26	Hatoma knoll	N 24 51.4068 E 123 50.3788	1528.7 2.1	A rock in sediments	
11/03/2008	01:19:44	Hatoma knoll	N 24 51.4075 E 123 50.3809	1530.3 0.2	Sit on the seafloor D=1530m	
11/03/2008	01:21:40	Hatoma knoll	N 24 51.4069 E 123 50.3807	1530.4 0.2	Sporadic distribution of cobble to bouder size rosk	
11/03/2008	01:22:06	Hatoma knoll	N 24 51.4086 E 123 50.3811	1530.4 0.3	Start picking up T probe	
11/03/2008	01:24:04	Hatoma knoll	N 24 51.4066 E 123 50.3798	1530.3 0.3	Tprobe sticked into sediments	
11/03/2008	01:25:59	Hatoma knoll	N 24 51.4061 E 123 50.3790	1530.4 0.2	T lance 01 measure, only the tip is in sediments	
11/03/2008	01:26:56	Hatoma knoll	N 24 51.4061 E 123 50.3805	1530.4 0.2	About 1 deg higher in sediments than in SW	
11/03/2008	01:29:45	Hatoma knoll	N 24 51.4067 E 123 50.3796	1530.4 0.2	Take off T probe TL 01 (start 01:25)	

11/03/2008	01:30:21	Hatoma knoll	N 24 51.4062 E 123 50.3806	1530.4 0.2	Keep T probe in manup- and moving to 'WHITE' site in NE direction	
11/03/2008	01:33:01	Hatoma knoll	N 24 51.4098 E 123 50.3827	1529.3 1.3	Bacterial mats? in sediments	
11/03/2008	01:37:45	Hatoma knoll	N 24 51.4095 E 123 50.3841	1530.0 0.2	White mat surrounded by small muscles	
11/03/2008	01:38:29	Hatoma knoll	N 24 51.4091 E 123 50.3839	1530.3 0.2	Start HDTV recording	
11/03/2008	01:39:16	Hatoma knoll	N 24 51.4088 E 123 50.3835	1529.8 0.2	Observing mats filament	
11/03/2008	01:40:06	Hatoma knoll	N 24 51.4091 E 123 50.3841	1530.1 0.2	T probe sticking into sediments, TL02	
11/03/2008	01:41:08	Hatoma knoll	N 24 51.4091 E 123 50.3843	1529.9 0.2	Very hard to penetrate	
11/03/2008	01:41:47	Hatoma knoll	N 24 51.4095 E 123 50.3838	1527.2 3.0	ROV shifted and stop TL 02 (start 01:40)	
11/03/2008	01:44:20	Hatoma knoll	N 24 51.4090 E 123 50.3842	1530.0 0.2	Trying to stablize the ROV	

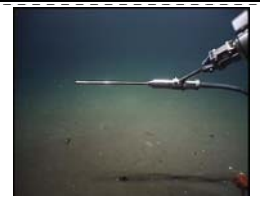
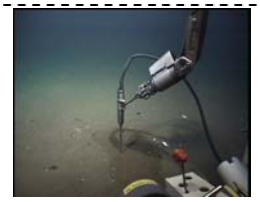
11/03/2008	01:45:23	Hatoma knoll	N 24 51.4089 E 123 50.3829	1529.6 0.2	T probe sticking in again into white mat	
11/03/2008	01:46:34	Hatoma knoll	N 24 51.4093 E 123 50.3826	1530.3 0.0	Again hard to stick in	
11/03/2008	01:47:58	Hatoma knoll	N 24 51.4098 E 123 50.3841	1529.9 0.0	HDTV recording stop 001 (start 01:38)	
11/03/2008	01:49:33	Hatoma knoll	N 24 51.4096 E 123 50.3835	1529.8 0.0	Nothing different from SW temp	
11/03/2008	01:50:12	Hatoma knoll	N 24 51.4094 E 123 50.3831	1530.0 0.0	Start TL 03 outside of a mat between pipes from burried moluscs	
11/03/2008	01:51:27	Hatoma knoll	N 24 51.4095 E 123 50.3838	1529.7 0.0	Just several cm of T probe in sed	
11/03/2008	01:52:20	Hatoma knoll	N 24 51.4103 E 123 50.3843	1529.6 0.0	Pilot change Volker and Stef	
11/03/2008	01:53:24	Hatoma knoll	N 24 51.4102 E 123 50.3847	1530.4 0.0	End TL03 measure. Hard to see the difference of temp by 1 deg franctuation (start 01:50)	
11/03/2008	01:54:22	Hatoma knoll	N 24 51.4099 E 123 50.3836	1529.5 0.5	Start moving	

11/03/2008	01:55:52	Hatoma knoll	N 24 51.4119 E 123 50.3861	1528.0 1.1	Fissure like distribution of bacterial mats	
11/03/2008	01:57:54	Hatoma knoll	N 24 51.4164 E 123 50.3925	1527.4 1.2	Dig still taken for small bac mat	
11/03/2008	01:58:35	Hatoma knoll	N 24 51.4181 E 123 50.3941	1527.0 1.2	dig still	
11/03/2008	02:00:12	Hatoma knoll	N 24 51.4209 E 123 50.3981	1526.8 1.1	a fish	
11/03/2008	02:00:53	Hatoma knoll	N 24 51.4227 E 123 50.4015	1526.7 1.1	White hard pave, Dig Still	
11/03/2008	02:02:32	Hatoma knoll	N 24 51.4270 E 123 50.4055	1524.6 2.0	Overhanging sulfur crust	
11/03/2008	02:05:29	Hatoma knoll	N 24 51.4272 E 123 50.4063	1525.7 0.3	Observing crust	
11/03/2008	02:06:24	Hatoma knoll	N 24 51.4267 E 123 50.4061	1526.2 0.3	HDTV recording on	
11/03/2008	02:08:19	Hatoma knoll	N 24 51.4267 E 123 50.4059	1526.2 0.4	gh def HiDigital still of crust cave	

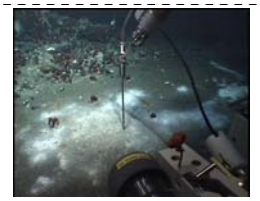
11/03/2008	02:11:25	Hatoma knoll	N 24 51.4264 E 123 50.4059	1526.1 0.4	Change tape A and B to 2	
11/03/2008	02:13:25	Hatoma knoll	N 24 51.4266 E 123 50.4056	1525.8 0.4	T probe sticking into sed in front of the crust cave	
11/03/2008	02:14:17	Hatoma knoll	N 24 51.4268 E 123 50.4062	1525.8 0.3	Half of the T probe is in sed	
11/03/2008	02:15:37	Hatoma knoll	N 24 51.4270 E 123 50.4055	1526.0 0.3	HDTV No 2 stop (start 02:06)	
11/03/2008	02:24:42	Hatoma knoll	N 24 51.4263 E 123 50.4058	1525.8 0.3	T Lance free from Orion	
11/03/2008	02:25:17	Hatoma knoll	N 24 51.4263 E 123 50.4053	1525.8 0.3	still foto	
11/03/2008	02:27:43	Hatoma knoll	N 24 51.4262 E 123 50.4055	1525.8 0.3	end TL04, removing from sediment (start 02:24)	
11/03/2008	02:28:20	Hatoma knoll	N 24 51.4257 E 123 50.4052	1526.0 0.4	T Lance dropped back into the sediment while removing, full penetration	
11/03/2008	02:29:18	Hatoma knoll	N 24 51.4260 E 123 50.4054	1525.5 0.3	still foto	

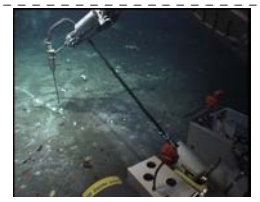
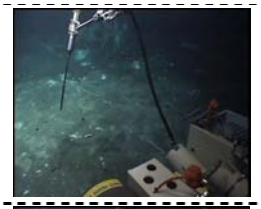
11/03/2008	02:35:29	Hatoma knoll	N 24 51.4256 E 123 50.4056	1525.8 0.3	end TL05, removing T Lance from sediment (start 02:28)	
11/03/2008	02:38:40	Hatoma knoll	N 24 51.4269 E 123 50.4061	1525.8 0.3	T Lance horizontally stuck into the crust cave , half of the Lance inside the cave	
11/03/2008	02:40:07	Hatoma knoll	N 24 51.4256 E 123 50.4052	1526.2 0.3	still foto Lance	
11/03/2008	02:41:43	Hatoma knoll	N 24 51.4269 E 123 50.4060	1525.9 0.3	end TL06, T Lance removed from cave (start 02:38)	
11/03/2008	02:43:34	Hatoma knoll	N 24 51.4270 E 123 50.4068	1524.5 1.3	ROV flying towards W	
11/03/2008	02:44:46	Hatoma knoll	N 24 51.4267 E 123 50.4093	1524.2 1.3	Chimney with crabs, mussels, white patches	
11/03/2008	02:48:52	Hatoma knoll	N 24 51.4260 E 123 50.4122	1523.6 1.3	still foto	
11/03/2008	02:49:48	Hatoma knoll	N 24 51.4245 E 123 50.4144	1523.3 1.3	white narrow line of sulphur	
11/03/2008	02:52:02	Hatoma knoll	N 24 51.4229 E 123 50.4128	1524.9 1.3	still foto	

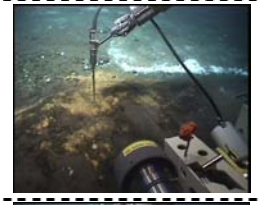
11/03/2008	02:52:54	Hatoma knoll	N 24 51.4230 E 123 50.4140	1524.7 1.3	still foto	
11/03/2008	02:54:24	Hatoma knoll	N 24 51.4196 E 123 50.4151	1524.5 1.3	white mat	
11/03/2008	02:56:00	Hatoma knoll	N 24 51.4208 E 123 50.4165	1524.3 1.3	white narrow line and clusters of mussels	
11/03/2008	02:57:28	Hatoma knoll	N 24 51.4250 E 123 50.4137	1524.0 1.3	passing a chimney	
11/03/2008	02:58:05	Hatoma knoll	N 24 51.4269 E 123 50.4141	1523.7 1.3	flight path change towards WNW Marker 184-1M	
11/03/2008	02:58:48	Hatoma knoll	N 24 51.4299 E 123 50.4127	1523.0 1.3	clustered hard rock peaces	
11/03/2008	02:59:32	Hatoma knoll	N 24 51.4327 E 123 50.4117	1522.9 1.3	passing an instrument weight of a former deployment (red trapezoidal, with reflectors)	
11/03/2008	03:05:45	Hatoma knoll	N 24 51.4388 E 123 50.4098	1525.3 1.1	white Maker from prev deployment (No 1)	

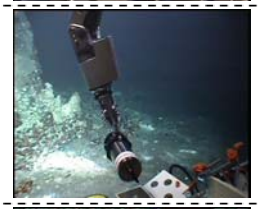
11/03/2008	03:08:41	Hatoma knoll	N 24 51.4440 E 123 50.4029	1528.5 0.0	ROV on bottom	
11/03/2008	03:09:57	Hatoma knoll	N 24 51.4445 E 123 50.4038	1528.6 0.0	T Lance pentration half length	
11/03/2008	03:11:15	Hatoma knoll	N 24 51.4450 E 123 50.4021	1528.2 0.4	Lance removed accidently, sediment cloud	
11/03/2008	03:12:56	Hatoma knoll	N 24 51.4448 E 123 50.4025	1528.5 0.0	Lance back into sed, half penetration	
11/03/2008	03:14:24	Hatoma knoll	N 24 51.4448 E 123 50.4027	1528.8 0.0	Tape change, new: A3 B3	
11/03/2008	03:16:13	Hatoma knoll	N 24 51.4448 E 123 50.4025	1528.6 0.0	still foto	
11/03/2008	03:16:45	Hatoma knoll	N 24 51.4446 E 123 50.4032	1528.9 0.0	still foto	
11/03/2008	03:24:52	Hatoma knoll	N 24 51.4445 E 123 50.4018	1528.5 0.0	shark!	
11/03/2008	03:26:03	Hatoma knoll	N 24 51.4445 E 123 50.4028	1528.3 0.0	T Lance 07 removed from sed (start 03:12)	

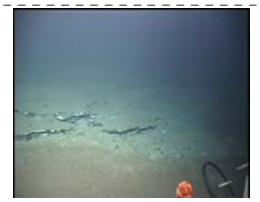
11/03/2008	03:30:05	Hatoma knoll	N 24 51.4494 E 123 50.3936	1527.6 1.1	bacterial mats	
11/03/2008	03:30:45	Hatoma knoll	N 24 51.4511 E 123 50.3927	1528.0 1.1	white patches and lines of sulphur	
11/03/2008	03:31:25	Hatoma knoll	N 24 51.4511 E 123 50.3907	1527.7 0.7	ROV on bottom next to white patches	
11/03/2008	03:33:24	Hatoma knoll	N 24 51.4509 E 123 50.3896	1528.4 0.0	T Lance attemp to pentrate sediment, but too hard	
11/03/2008	03:34:53	Hatoma knoll	N 24 51.4518 E 123 50.3886	1528.1 0.9	a few mussels and several huge 20cm crabs white sulphur patches	
11/03/2008	03:36:22	Hatoma knoll	N 24 51.4523 E 123 50.3874	1528.3 0.9	HDTV Video start	
11/03/2008	03:37:10	Hatoma knoll	N 24 51.4534 E 123 50.3872	1527.8 0.9	crab filtrates sediment	
11/03/2008	03:39:30	Hatoma knoll	N 24 51.4517 E 123 50.3888	1528.1 0.6	HDTV No 3 stop (start 03:36)	
11/03/2008	03:40:02	Hatoma knoll	N 24 51.4527 E 123 50.3871	1528.0 0.6	crust, white patches, tiny yellow spots	

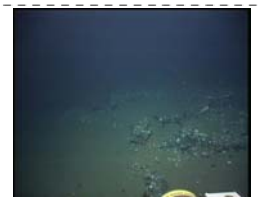
11/03/2008	03:41:17	Hatoma knoll	N 24 51.4535 E 123 50.3843	1527.6 0.6	achieving Iri chimney: densely populated mussels, white crabs, white patches, huge crabs	
11/03/2008	03:44:35	Hatoma knoll	N 24 51.4532 E 123 50.3840	1528.1 0.6	surrounduing chimney in order to find Marker 184-M1 with HD	
11/03/2008	03:45:04	Hatoma knoll	N 24 51.4520 E 123 50.3835	1527.7 0.6	still foto	
11/03/2008	03:45:47	Hatoma knoll	N 24 51.4535 E 123 50.3837	1527.9 0.6	reddish shrimps	
11/03/2008	03:46:15	Hatoma knoll	N 24 51.4555 E 123 50.3832	1527.8 0.6	Markers appears	
11/03/2008	03:47:19	Hatoma knoll	N 24 51.4551 E 123 50.3843	1527.6 0.3	bacterial mats, elemental sulphur, shimmering water	
11/03/2008	03:49:31	Hatoma knoll	N 24 51.4546 E 123 50.3837	1528.0 0.3	attemp to penetrate with T Lance , but sed too hard	
11/03/2008	03:53:07	Hatoma knoll	N 24 51.4554 E 123 50.3827	1528.1 0.6	Photo Sea: Marker 184 M1	

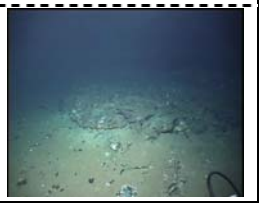
11/03/2008	03:55:24	Hatoma knoll	N 24 51.4551 E 123 50.3798	1528.1 0.6	white hard rock or covered hard rock	
11/03/2008	03:56:08	Hatoma knoll	N 24 51.4545 E 123 50.3798	1527.8 0.6	shimmering water	
11/03/2008	03:56:43	Hatoma knoll	N 24 51.4546 E 123 50.3791	1527.8 0.6	shimmering water	
11/03/2008	03:57:01	Hatoma knoll	N 24 51.4544 E 123 50.3789	1528.0 0.6	single fluid escape spot visible as circular funnel on the seafloor	
11/03/2008	04:01:11	Hatoma knoll	N 24 51.4516 E 123 50.3828	1527.9 0.6	still foto	
11/03/2008	04:02:02	Hatoma knoll	N 24 51.4506 E 123 50.3826	1527.8 0.6	surface hummocky, white alligned sulphur filled cracks	
11/03/2008	04:05:18	Hatoma knoll	N 24 51.4507 E 123 50.3799	1528.2 0.3	T Lace attempt to penetrate, but sed too hard	
11/03/2008	04:06:15	Hatoma knoll	N 24 51.4511 E 123 50.3804	1527.9 0.3	crust, elemental sulphur, at the crust border white	
11/03/2008	04:08:14	Hatoma knoll	N 24 51.4511 E 123 50.3784	1528.5 0.5	T Lance penetration into elemental sulphur, less then one quarter penetration	

11/03/2008	04:10:42	Hatoma knoll	N 24 51.4523 E 123 50.3792	1528.9 0.4	HD video start	
11/03/2008	04:11:11	Hatoma knoll	N 24 51.4523 E 123 50.3793	1528.9 0.4	T Lance is slightly moving by caused by ROV movement	
11/03/2008	04:14:11	Hatoma knoll	N 24 51.4523 E 123 50.3793	1528.8 0.4	change video tape, new: A4 B4	
11/03/2008	04:15:55	Hatoma knoll	N 24 51.4523 E 123 50.3794	1528.8 0.4	HDTV No 4 stop (start 04:10)	
11/03/2008	04:20:13	Hatoma knoll	N 24 51.4522 E 123 50.3795	1528.7 0.4	ship positioning failure, waiting for repair	
11/03/2008	04:23:52	Hatoma knoll	N 24 51.4535 E 123 50.3811	1528.4 0.4	15 deg C achieved at thermistor 1	
11/03/2008	04:24:57	Hatoma knoll	N 24 51.4532 E 123 50.3787	1528.2 0.4	still photo	
11/03/2008	04:28:45	Hatoma knoll	N 24 51.4518 E 123 50.3787	1528.4 0.4	Jens out Antje in	
11/03/2008	04:28:54	Hatoma knoll	N 24 51.4515 E 123 50.3789	1528.4 0.4	TL 08 end T lance measure sulfur spot (start 04:08)	

11/03/2008	04:32:14	Hatoma knoll	N 24 51.4545 E 123 50.3777	1528.0 0.4	moved to 2 fluid flow spots, short T measure, HDTV on	
11/03/2008	04:34:16	Hatoma knoll	N 24 51.4546 E 123 50.3777	1527.7 0.4	HDTV No 5 off (start 04:32), low temperature fluid, ca 22 deg T	
11/03/2008	04:43:16	Hatoma knoll	N 24 51.4539 E 123 50.3789	1527.6 0.4	tries to take hand held	
11/03/2008	04:48:34	Hatoma knoll	N 24 51.4542 E 123 50.3781	1527.4 0.4	hand held out of the box	
11/03/2008	04:51:18	Hatoma knoll	N 24 51.4553 E 123 50.3782	1527.8 0.4	HDTV on	
11/03/2008	04:52:56	Hatoma knoll	N 24 51.4535 E 123 50.3803	1527.5 0.4	Handheld measurement start	
11/03/2008	04:54:23	Hatoma knoll	N 24 51.4532 E 123 50.3789	1527.7 0.4	change HDTV tape 3	
11/03/2008	05:05:28	Hatoma knoll	N 24 51.4535 E 123 50.3805	1527.9 0.4	still image of hand held	
11/03/2008	05:07:24	Hatoma knoll	N 24 51.4550 E 123 50.3795	1527.5 0.4	HDTV No 6 off (start 04:51), Volker and Ralf out, Christian and Klaus in	

11/03/2008	05:07:42	Hatoma knoll	N 24 51.4539 E 123 50.3793	1528.0 0.4	hand held No 2 finished (start 04:52)	
11/03/2008	05:10:07	Hatoma knoll	N 24 51.4533 E 123 50.3774	1527.9 0.4	hand held in box	
11/03/2008	05:12:35	Hatoma knoll	N 24 51.4554 E 123 50.3785	1527.3 0.3	start transect to east, ca 40 m	
11/03/2008	05:18:33	Hatoma knoll	N 24 51.4531 E 123 50.3813	1527.0 1.0	change to videotape 5	
11/03/2008	05:22:02	Hatoma knoll	N 24 51.4553 E 123 50.4054	1527.7 1.0	flat bottom, couple of stills taken	
11/03/2008	05:24:28	Hatoma knoll	N 24 51.4559 E 123 50.4164	1527.0 1.0	cracks on seafloor, pavement standing our above seafloor	
11/03/2008	05:25:21	Hatoma knoll	N 24 51.4564 E 123 50.4185	1526.6 1.1	seafloor before crust is brownish with some traces of organisms, lots of remnants of shark eggs	
11/03/2008	05:27:58	Hatoma knoll	N 24 51.4569 E 123 50.4180	1526.5 1.0	structure goes north north east	
11/03/2008	05:32:13	Hatoma knoll	N 24 51.4570 E 123 50.4201	1525.9 1.0	white mats on seafloor w of fault structure	

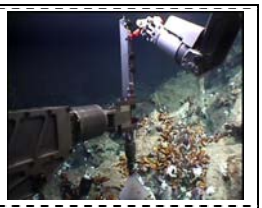
11/03/2008	05:35:19	Hatoma knoll	N 24 51.4574 E 123 50.4206	1525.8 1.1	HDTV on	
11/03/2008	05:41:03	Hatoma knoll	N 24 51.4599 E 123 50.4197	1526.3 0.5	trying if the bottom is hard by landing and poking witht the arm, still foto taken	
11/03/2008	05:42:24	Hatoma knoll	N 24 51.4595 E 123 50.4200	1526.0 0.5	HDTV No 7 off (start 05:35)	
11/03/2008	05:47:48	Hatoma knoll	N 24 51.4639 E 123 50.4196	1523.9 1.1	follow fault structure, it is populated by crabs, HDTV on	
11/03/2008	05:52:49	Hatoma knoll	N 24 51.4750 E 123 50.4136	1525.0 1.1	leaving fault structure, going towards 187M	
11/03/2008	05:53:46	Hatoma knoll	N 24 51.4782 E 123 50.4119	1525.8 1.1	rocks and stones on the seafloor, some single batyhmodiolus	
11/03/2008	05:54:16	Hatoma knoll	N 24 51.4815 E 123 50.4115	1526.0 1.1	HDTV No 8 off (start 05:47)	
11/03/2008	05:57:06	Hatoma knoll	N 24 51.4926 E 123 50.4079	1526.2 1.0	more crusts coming up	
11/03/2008	06:01:50	Hatoma knoll	N 24 51.5013 E 123 50.4071	1525.9 1.1	arrived at point 187, turn to point 365. 187 is hard with many crusts and rocks	

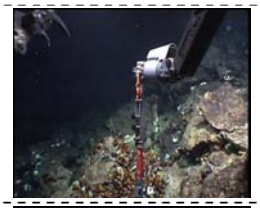
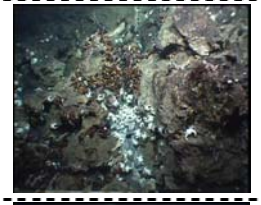
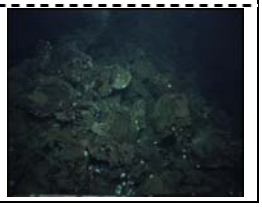
11/03/2008	06:03:58	Hatoma knoll	N 24 51.5032 E 123 50.4123	1525.1 1.3	old chimney	
11/03/2008	06:07:35	Hatoma knoll	N 24 51.5074 E 123 50.4143	1525.0 1.2	more old chimneys	
11/03/2008	06:10:47	Hatoma knoll	N 24 51.5082 E 123 50.4252	1523.6 3.0	chimney forest	
11/03/2008	06:11:55	Hatoma knoll	N 24 51.5125 E 123 50.4287	1517.3 7.9	chimney and rock, very turbit water	
11/03/2008	06:14:07	Hatoma knoll	N 24 51.5181 E 123 50.4406	1508.7 7.8	dead chimneys	
11/03/2008	06:15:26	Hatoma knoll	N 24 51.5214 E 123 50.4521	1500.3 7.8	reached 365-1, only old chimneys and massive rock	
11/03/2008	06:19:56	Hatoma knoll	N 24 51.5264 E 123 50.4512	1507.5 5.1	M365 heading towards bubble site	
11/03/2008	06:22:43	Hatoma knoll	N 24 51.5359 E 123 50.4420	1521.5 2.0	back in basin	
11/03/2008	06:29:37	Hatoma knoll	N 24 51.5652 E 123 50.4348	1527.4 0.8	rocks	

11/03/2008	06:31:09	Hatoma knoll	N 24 51.5673 E 123 50.4363	1526.5 0.8	many rocks sticking out of seafloor	
11/03/2008	06:36:09	Hatoma knoll	N 24 51.5785 E 123 50.4392	1525.1 1.0	fully rocky, with sulfur and many dead Bathymodiolus, HDTV No 9 on	
11/03/2008	06:39:06	Hatoma knoll	N 24 51.5793 E 123 50.4420	1522.6 3.6	living bathymodiolus, bubbles and hydrate	
11/03/2008	06:49:43	Hatoma knoll	N 24 51.5810 E 123 50.4418	1523.7 0.7	ROV landed in front of the bubbling site	
11/03/2008	06:51:05	Hatoma knoll	N 24 51.5815 E 123 50.4414	1523.3 0.7	liquid CO2 accmulation	
11/03/2008	06:57:02	Hatoma knoll	N 24 51.5821 E 123 50.4419	1524.2 1.2	HDTV No 10 on, perfect position to see the bubbles	
11/03/2008	06:57:54	Hatoma knoll	N 24 51.5820 E 123 50.4417	1523.8 1.0	Photo Sea image left of bubble site	
11/03/2008	07:02:45	Hatoma knoll	N 24 51.5811 E 123 50.4428	1523.8 1.2	HDTV No 11 on	
11/03/2008	07:03:19	Hatoma knoll	N 24 51.5820 E 123 50.4431	1523.9 1.2	CO2 hydrates forming a very labile pipe for droplets	

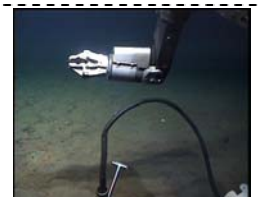
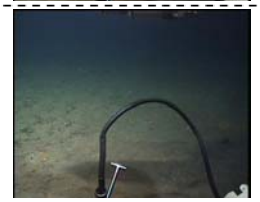
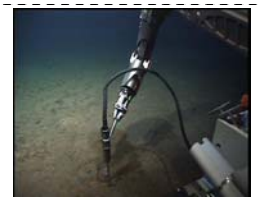
11/03/2008	07:12:38	Hatoma knoll	N 24 51.5820 E 123 50.4431	1523.8 1.3	droplet rise measurements start	
11/03/2008	07:14:14	Hatoma knoll	N 24 51.5830 E 123 50.4430	1524.0 1.2	tape A and B end	
11/03/2008	07:14:45	Hatoma knoll	N 24 51.5830 E 123 50.4431	1524.1 1.2	tape A and B on	
11/03/2008	07:22:09	Hatoma knoll	N 24 51.5825 E 123 50.4418	1524.0 1.2	HDTV No 9 - 11 stop (start 06:36)	
11/03/2008	07:22:21	Hatoma knoll	N 24 51.5826 E 123 50.4426	1524.0 1.2	droplet measurement stop	
11/03/2008	07:22:39	Hatoma knoll	N 24 51.5824 E 123 50.4421	1524.0 1.2	handheld out of box	
11/03/2008	07:28:31	Hatoma knoll	N 24 51.5823 E 123 50.4429	1524.3 1.3	hdtv on	
11/03/2008	07:30:16	Hatoma knoll	N 24 51.5815 E 123 50.4431	1523.7 1.3	handheld measurement start	
11/03/2008	07:32:01	Hatoma knoll	N 24 51.5819 E 123 50.4425	1523.7 1.3	handheld measurement begin 7:32	

11/03/2008	07:39:31	Hatoma knoll	N 24 51.5814 E 123 50.4429	1523.8 1.3	bubbling stopped below handheld	
11/03/2008	07:41:45	Hatoma knoll	N 24 51.5814 E 123 50.4424	1524.2 1.3	bubbling below handheld again	
11/03/2008	07:43:21	Hatoma knoll	N 24 51.5816 E 123 50.4428	1524.0 1.3	handheld measurement No 3 stop (start 07:32)	
11/03/2008	07:46:27	Hatoma knoll	N 24 51.5798 E 123 50.4427	1523.0 1.2	start putting handheld back in box	
11/03/2008	07:54:13	Hatoma knoll	N 24 51.5816 E 123 50.4419	1523.8 1.3	handheld back in box	
11/03/2008	07:59:04	Hatoma knoll	N 24 51.5803 E 123 50.4421	1524.4 1.2	Change PIs to Gregor and Koichi	
11/03/2008	08:01:05	Hatoma knoll	N 24 51.5797 E 123 50.4424	1523.9 1.3	HDTV tape 5 start	
11/03/2008	08:06:59	Hatoma knoll	N 24 51.5801 E 123 50.4422	1524.3 1.3	Start glubbing Gas sampler	
11/03/2008	08:10:29	Hatoma knoll	N 24 51.5807 E 123 50.4428	1523.8 1.4	Took out gas sampler	

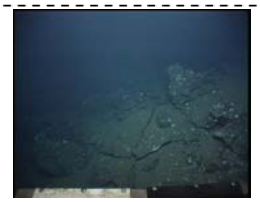
11/03/2008	08:12:10	Hatoma knoll	N 24 51.5793 E 123 50.4425	1523.9 1.3	Glub gas sampler by left manipulator	
11/03/2008	08:14:18	Hatoma knoll	N 24 51.5805 E 123 50.4420	1523.8 1.3	Change miniDV tape to no.8	
11/03/2008	08:15:12	Hatoma knoll	N 24 51.5805 E 123 50.4423	1524.4 1.4	Bubble site is 10 cm off from the funnel	
11/03/2008	08:17:33	Hatoma knoll	N 24 51.5796 E 123 50.4417	1524.2 1.3	Glub gas sampler by the right manipulator	
11/03/2008	08:19:56	Hatoma knoll	N 24 51.5798 E 123 50.4425	1524.0 1.4	Taking bubbles	
11/03/2008	08:23:42	Hatoma knoll	N 24 51.5808 E 123 50.4429	1524.1 1.4	Take still photos	
11/03/2008	08:26:16	Hatoma knoll	N 24 51.5808 E 123 50.4432	1523.8 1.4	70% of funnel was filled with bubbles	
11/03/2008	08:29:58	Hatoma knoll	N 24 51.5798 E 123 50.4423	1523.5 1.4	Glub the sampler by the left manup	
11/03/2008	08:31:50	Hatoma knoll	N 24 51.5797 E 123 50.4414	1524.0 1.3	Sampler in the left manup	

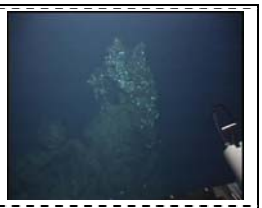
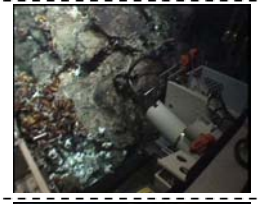
11/03/2008	08:33:38	Hatoma knoll	N 24 51.5807 E 123 50.4414	1524.0 1.3	Turn handle cunterclockwise	
11/03/2008	08:35:42	Hatoma knoll	N 24 51.5798 E 123 50.4431	1523.8 1.3	Bubbles do not let in the sampler	
11/03/2008	08:37:21	Hatoma knoll	N 24 51.5805 E 123 50.4436	1524.5 1.3	Take the sampler y the right manup	
11/03/2008	08:37:55	Hatoma knoll	N 24 51.5800 E 123 50.4423	1524.2 1.4	Take out drawer	
11/03/2008	08:39:12	Hatoma knoll	N 24 51.5792 E 123 50.4431	1524.1 1.4	Store gas sampler in drawer	
11/03/2008	08:40:06	Hatoma knoll	N 24 51.5791 E 123 50.4417	1524.3 1.3	HDTV No 12 record off (start 07:28)	
11/03/2008	08:43:57	Hatoma knoll	N 24 51.5798 E 123 50.4415	1524.4 1.3	Store drawer	
11/03/2008	08:47:37	Hatoma knoll	N 24 51.5793 E 123 50.4416	1524.0 1.2	Leave the bubble site for 189-2M	
11/03/2008	08:49:28	Hatoma knoll	N 24 51.5789 E 123 50.4412	1520.5 4.9	Crossing sulfide terrace	

11/03/2008	08:49:53	Hatoma knoll	N 24 51.5783 E 123 50.4437	1518.3 6.1	Dead chimney	
11/03/2008	08:50:25	Hatoma knoll	N 24 51.5765 E 123 50.4480	1512.3 12.2	Flying over chimenys	
11/03/2008	08:50:55	Hatoma knoll	N 24 51.5756 E 123 50.4515	1525.3 2.0	sulphide terrace	
11/03/2008	08:52:20	Hatoma knoll	N 24 51.5720 E 123 50.4615	1527.4 1.6	Sedimets floor	
11/03/2008	08:55:33	Hatoma knoll	N 24 51.5672 E 123 50.4690	1531.5 0.0	Coarse sediments floor	
11/03/2008	08:56:27	Hatoma knoll	N 24 51.5662 E 123 50.4687	1531.5 0.0	Take out T probe	
11/03/2008	08:56:46	Hatoma knoll	N 24 51.5671 E 123 50.4676	1531.6 0.0	HD record on	
11/03/2008	08:58:21	Hatoma knoll	N 24 51.5666 E 123 50.4685	1531.4 0.0	get the T probe	
11/03/2008	09:02:01	Hatoma knoll	N 24 51.5666 E 123 50.4688	1531.3 0.0	Stick T probe in sed	

11/03/2008	09:02:46	Hatoma knoll	N 24 51.5682 E 123 50.4693	1531.7 0.0	ca 8 cm in sed	
11/03/2008	09:04:41	Hatoma knoll	N 24 51.5676 E 123 50.4679	1531.3 0.0	Half of the probr is in. Leave it alone	
11/03/2008	09:06:36	Hatoma knoll	N 24 51.5671 E 123 50.4686	1531.5 0.0	About 2 deg higher at the tip than SW temp	
11/03/2008	09:08:52	Hatoma knoll	N 24 51.5670 E 123 50.4685	1532.2 0.0	HDTV rec No 13 ended before (start 08:56), no recording currently, change HDTV tape to no.7	
11/03/2008	09:10:45	Hatoma knoll	N 24 51.5670 E 123 50.4688	1531.3 0.0	Take out T probe No 9 (start 09:02)	
11/03/2008	09:16:10	Hatoma knoll	N 24 51.5669 E 123 50.4679	1531.5 0.0	Change miniDV tape to no.8, Matthias and Antje in, Gregor and Koichi out	
11/03/2008	09:18:34	Hatoma knoll	N 24 51.5659 E 123 50.4693	1531.9 0.0	take PC 22 at target 3	
11/03/2008	09:28:27	Hatoma knoll	N 24 51.5661 E 123 50.4704	1532.2 0.0	still foto of PC 22 site	

11/03/2008	09:35:23	Hatoma knoll	N 24 51.5674 E 123 50.4695	1532.2 0.0	PC 10 sheath came loose, take it anyway	
11/03/2008	09:40:14	Hatoma knoll	N 24 51.5665 E 123 50.4689	1531.5 0.0	going north east to basin center	
11/03/2008	09:43:16	Hatoma knoll	N 24 51.5824 E 123 50.4806	1530.4 1.1	landed on seafloor, is soft but not too soft	
11/03/2008	09:47:25	Hatoma knoll	N 24 51.5908 E 123 50.4887	1523.6 1.6	reach depression in the center of basin, small crusts	
11/03/2008	09:53:28	Hatoma knoll	N 24 51.5923 E 123 50.4912	1523.4 0.0	t lance measure start, still foto	
11/03/2008	10:00:05	Hatoma knoll	N 24 51.5911 E 123 50.4919	1523.3 0.0	T lance measure No 10 end (start 09:53)	
11/03/2008	10:04:12	Hatoma knoll	N 24 51.5923 E 123 50.4909	1522.7 0.0	PC 25, still taken	
11/03/2008	10:08:59	Hatoma knoll	N 24 51.5922 E 123 50.4917	1523.5 0.0	PC 25 taken, stills	
11/03/2008	10:11:22	Hatoma knoll	N 24 51.5927 E 123 50.4911	1523.2 0.0	take PC 15	

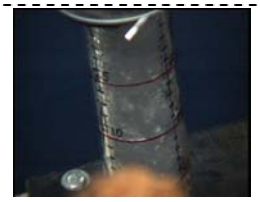
11/03/2008	10:16:02	Hatoma knoll	N 24 51.5908 E 123 50.4922	1523.1 0.0	PC15 taken, crust penetated , still taken	
11/03/2008	10:17:59	Hatoma knoll	N 24 51.5921 E 123 50.4925	1523.6 0.0	change to tape 10	
11/03/2008	10:24:12	Hatoma knoll	N 24 51.5942 E 123 50.4900	1522.6 1.1	Koichi in, Antje out	
11/03/2008	10:27:42	Hatoma knoll	N 24 51.5952 E 123 50.4547	1524.4 3.5	Crust pavemented	
11/03/2008	10:28:43	Hatoma knoll	N 24 51.5965 E 123 50.4489	1523.0 3.0	Sulphide mound with pavement and crust	
11/03/2008	10:29:38	Hatoma knoll	N 24 51.5921 E 123 50.4464	1521.4 4.0	Sulphide mound	
11/03/2008	10:30:16	Hatoma knoll	N 24 51.5896 E 123 50.4445	1517.6 6.2	Reaching to the bubble site	
11/03/2008	10:33:23	Hatoma knoll	N 24 51.5818 E 123 50.4467	1519.7 5.1	On the sulphide mound	
11/03/2008	10:33:56	Hatoma knoll	N 24 51.5803 E 123 50.4465	1518.9 5.4	Dead chimney	

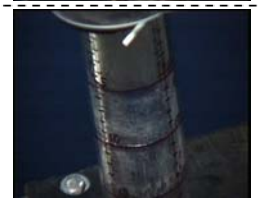
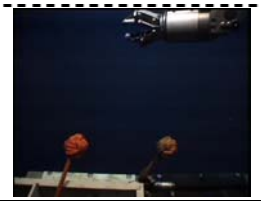
11/03/2008	10:34:53	Hatoma knoll	N 24 51.5777 E 123 50.4450	1517.9 5.7	Same dead chimney	
11/03/2008	10:47:22	Hatoma knoll	N 24 51.5808 E 123 50.4423	1523.5 2.0	Go back to the bubble site again	
11/03/2008	10:48:08	Hatoma knoll	N 24 51.5806 E 123 50.4432	1524.5 1.3	Try to stay on the site	
11/03/2008	10:52:37	Hatoma knoll	N 24 51.5793 E 123 50.4435	1524.4 0.8	Parking at the bubble site	
11/03/2008	10:53:11	Hatoma knoll	N 24 51.5805 E 123 50.4429	1524.1 0.9	Get the marker no.1	
11/03/2008	10:54:17	Hatoma knoll	N 24 51.5794 E 123 50.4429	1524.5 0.7	Take out no.1 marker	
11/03/2008	10:55:09	Hatoma knoll	N 24 51.5785 E 123 50.4428	1524.5 1.1	Deploy no.1 marker	
11/03/2008	10:55:45	Hatoma knoll	N 24 51.5798 E 123 50.4432	1524.1 1.1	Get the T probe corer	
11/03/2008	10:57:03	Hatoma knoll	N 24 51.5801 E 123 50.4420	1524.5 2.1	Marker no.1	

11/03/2008	10:58:22	Hatoma knoll	N 24 51.5802 E 123 50.4435	1524.3 0.8	Reparked and get the T corer out	
11/03/2008	10:59:31	Hatoma knoll	N 24 51.5802 E 123 50.4429	1524.5 1.0	Glub the corer	
11/03/2008	11:01:47	Hatoma knoll	N 24 51.5809 E 123 50.4446	1524.6 0.9	Getting the bubbles in the corer, start Tlance-corer experiment 01	
11/03/2008	11:03:33	Hatoma knoll	N 24 51.5801 E 123 50.4430	1524.1 0.9	HDTV recording	
11/03/2008	11:11:21	Hatoma knoll	N 24 51.5791 E 123 50.4430	1523.9 0.9	Filled up to 12cm	
11/03/2008	11:15:46	Hatoma knoll	N 24 51.5800 E 123 50.4427	1524.1 0.8	Filled up to 16 cm in average	
11/03/2008	11:22:03	Hatoma knoll	N 24 51.5803 E 123 50.4439	1524.4 0.8	Filling the backside of the core	
11/03/2008	11:24:09	Hatoma knoll	N 24 51.5808 E 123 50.4430	1524.4 0.8	Change miniDV tapes to no.11	
11/03/2008	11:24:43	Hatoma knoll	N 24 51.5804 E 123 50.4429	1524.4 0.5	Continue to fill up the back side	

11/03/2008	11:32:13	Hatoma knoll	N 24 51.5795 E 123 50.4427	1524.1 0.7	End of sampling	
11/03/2008	11:36:47	Hatoma knoll	N 24 51.5791 E 123 50.4431	1524.3 0.4	Leave the site	
11/03/2008	11:45:54	Hatoma knoll	N 24 51.6115 E 123 50.4224	1401.3 0.0	1400m	
11/03/2008	11:53:00	Hatoma knoll	N 24 51.6187 E 123 50.4230	1301.6 0.0	1300m	
11/03/2008	11:57:05	Hatoma knoll	N 24 51.6234 E 123 50.4169	1251.7 0.0	1250m	
11/03/2008	12:02:23	Hatoma knoll	N 24 51.6269 E 123 50.4154	1179.8 0.0	1176m	
11/03/2008	12:04:35	Hatoma knoll	N 24 51.6291 E 123 50.4175	1151.6 0.0	1150m	
11/03/2008	12:08:02	Hatoma knoll	N 24 51.6278 E 123 50.4143	1101.8 0.0	1100m	
11/03/2008	12:11:29	Hatoma knoll	N 24 51.6252 E 123 50.4052	1052.4 0.0	1050m	

11/03/2008	12:15:07	Hatoma knoll	N 24 51.6229 E 123 50.4002	1001.4 0.0	1000m	
11/03/2008	12:18:41	Hatoma knoll	N 24 51.6178 E 123 50.3987	952.6 0.0	950m	
11/03/2008	12:22:09	Hatoma knoll	N 24 51.6190 E 123 50.3905	901.7 0.0	900m	
11/03/2008	12:25:08	Hatoma knoll	N 24 51.6129 E 123 50.3862	862.6 0.0	change tape to 12	
11/03/2008	12:25:47	Hatoma knoll	N 24 51.6110 E 123 50.3837	852.8 0.0	850m	
11/03/2008	12:29:59	Hatoma knoll	N 24 51.6047 E 123 50.3813	802.3 0.0	800m	
11/03/2008	12:30:47	Hatoma knoll	N 24 51.6056 E 123 50.3830	790.6 0.0	Change HDTV tape to 9	
11/03/2008	12:33:53	Hatoma knoll	N 24 51.5977 E 123 50.3878	752.9 0.0	750m	
11/03/2008	12:37:27	Hatoma knoll	N 24 51.5859 E 123 50.3812	701.3 0.0	700m	

11/03/2008	12:41:29	Hatoma knoll	N 24 51.5699 E 123 50.3691	651.8 0.0	650m	
11/03/2008	12:45:42	Hatoma knoll	N 24 51.5479 E 123 50.3564	640.3 0.0	Stay 640m gas	
11/03/2008	12:46:21	Hatoma knoll	N 24 51.5448 E 123 50.3552	639.3 0.0	Start going up	
11/03/2008	12:49:18	Hatoma knoll	N 24 51.5387 E 123 50.3461	602.6 0.0	600m	
11/03/2008	12:53:26	Hatoma knoll	N 24 51.5205 E 123 50.3481	550.9 0.0	550m	
11/03/2008	12:57:37	Hatoma knoll	N 24 51.4987 E 123 50.3414	502.8 0.0	500m	
11/03/2008	13:00:36	Hatoma knoll	N 24 51.4986 E 123 50.3379	452.0 0.0	450m	
11/03/2008	13:04:04	Hatoma knoll	N 24 51.4957 E 123 50.3359	400.2 0.0	400m	
11/03/2008	13:06:52	Hatoma knoll	N 24 51.4922 E 123 50.3378	352.8 0.0	350m	

11/03/2008	13:10:03	Hatoma knoll	N 24 51.5112 E 123 50.3356	301.9 0.0	300m	
11/03/2008	13:14:04	Hatoma knoll	N 24 51.5350 E 123 50.3470	230.4 0.0	HDTV tape 10 start	
11/03/2008	13:16:46	Hatoma knoll	N 24 51.5426 E 123 50.3457	200.9 0.0	200m	
11/03/2008	13:22:06	Hatoma knoll	N 24 51.5630 E 123 50.3028	166.3 0.0	165m	
11/03/2008	13:24:32	Hatoma knoll	N 24 51.5727 E 123 50.2722	151.1 0.0	150m	
11/03/2008	13:25:32	Hatoma knoll	N 24 51.5747 E 123 50.2659	149.7 0.0	HDTV No 14 stop recording (start 11:03)	
11/03/2008	13:26:45	Hatoma knoll	N 24 51.5689 E 123 50.2617	147.2 0.0	Stop mini DV recording	
11/03/2008	13:27:18	Hatoma knoll	N 24 51.5691 E 123 50.2599	147.1 0.0	Store T corere in the drawer, Stop Tlance/corer measurement 01 (start 11:01)	
11/03/2008	13:27:47	Hatoma knoll	N 24 51.5727 E 123 50.2561	148.9 0.0	Drawer positioned	

11/03/2008	13:30:19	Hatoma knoll	N 24 51.5354 E 123 50.2415	128.2 0.0	Stop T-lance logger, determines end of total data logging file, TL 00 (start 00:38)	

created Tue Mar 25 12:49:24 PHT 2008

Appendix

Dive 200
ALAMER : Operation list
Dive summaries Alamere

ALAMER : Operation list

Cruise : **SO196 - SUMSUN**
Dive : 200 SO196_029
Operation list :

Equipment	Num	Date	Hour	Latitude	Longitude	Depth	Altitude	Location	Biology	Water	Geochem.	Measure	Pict.	File	Comments
Bubble Box	1	12/03/2008	09:39:31	N 24 51.5838	E 123 50.4446	1521	1	Hatoma knoll						X	End Bubble rise experiment 01 (start 09:35); Bubble Box
Bubble Box	2	12/03/2008	10:11:32	N 24 51.5869	E 123 50.4463	1488	0	Hatoma knoll					159	X	end of Bubble rise experiment 02; BB (start 10:09)
CO2 pH T Sensor handheld	1	12/03/2008	05:12:42	N 24 51.5158	E 123 50.5612	1490	3	Hatoma knoll						X	end handheld measurement No 1 (start 04:54)
Gas sampler	1	12/03/2008	04:11:50	N 24 51.5149	E 123 50.5611	1492	2	Hatoma knoll			X		38		sampler closed; but got mostly water
Gas sampler	3	12/03/2008	05:46:51	N 24 51.5164	E 123 50.5616	1491	2	Hatoma knoll			X		59		valve closed
HDTV camera	1	12/03/2008	02:18:48	N 24 51.5723	E 123 50.5110	1531	1	Hatoma knoll					13	X	stop HDTV No 1 (start 02:10); head towards bubble site 189-2m
HDTV camera	2	12/03/2008	03:16:07	N 24 51.5186	E 123 50.5575	1493	7	Hatoma knoll					31	X	change to HDTV tape 2; HDTV No 2 (start 03:05)
HDTV camera	3	12/03/2008	04:36:56	N 24 51.5165	E 123 50.5612	1491	2	Hatoma knoll					44	X	stop HDTV No 3 (start 03:25); stop sample KIPS 21; start sample 22
HDTV camera	4	12/03/2008	05:12:42	N 24 51.5158	E 123 50.5612	1490	3	Hatoma knoll					48	X	HDTV No 4 end (start 04:49)
HDTV camera	5	12/03/2008	05:42:53	N 24 51.5154	E 123 50.5601	1492	2	Hatoma knoll					56	X	HDTV No 5 end (start 05:35); tape 3 full
HDTV camera	7	12/03/2008	06:10:25	N 24 51.5152	E 123 50.5606	1491	2	Hatoma knoll					8	X	HDTV No 6-7 stop (start 05:43)
HDTV camera	8	12/03/2008	08:03:45	N 24 51.5118	E 123 50.5645	1493	5	Hatoma knoll					115	X	HDTV No 8 stop (start 07:52)

HDTV camera	9	12/03/2008	08:12:47	N 24 51.5124	E 123 50.5632	1478	20	Hatoma knoll					12	X	HDTV No 9 stop (start 08:09)
HDTV camera	10	12/03/2008	08:36:23	N 24 51.5112	E 123 50.5736	1461	0	Hatoma knoll					135	X	descending towards seafloor; HDTV No 10 stoped before (start 08:31)
HDTV camera	11	12/03/2008	08:46:50	N 24 51.5150	E 123 50.5631	1476	22	Hatoma knoll					14	X	HDTV No 11 stop (start 08:43)
HDTV camera	12	12/03/2008	08:55:33	N 24 51.5150	E 123 50.5629	1484	12	Hatoma knoll					145	X	HDTV No 12 off (start 08:51)
HDTV camera	13	12/03/2008	09:39:31	N 24 51.5838	E 123 50.4446	1521	1	Hatoma knoll					151	X	HDTV No 13 off (start 09:35)
KIPS bottle	21	12/03/2008	04:30:39	N 24 51.5159	E 123 50.5609	1491	2	Hatoma knoll		X			43		start KIPS sample 21; change tape o A4 B4
Tlance-corer assembly	1	12/03/2008	06:10:07	N 24 51.5150	E 123 50.5603	1491	2	Hatoma knoll					79	X	no hydrate forming during sampling; end Tlance-corer assembly 01 (start 05:59)

Dive summary

ROV Quest - Dive: 200- 4

SUMSUN (Sonne)

Date: **12/03/2008**
Observers: **REHDER Gregor**
Station: **Hatoma knoll**
Position: **N 24 51.5079 E 123 50.4998**

Dive duration:

Start: **12/03/2008 00:10:00**
At bottom: **12/03/2008 01:20:00**
Leave bottom: **12/03/2008 10:25:00**
End: **12/03/2008 11:33:00**

Explored sites:

Dive objectives:

Objectives, Mission and Time Plan
1. Start T-lance logger on downcast
2. Place Bubble box at well reachable area, place marker
3. Proceed toward marker 189-2M and find bubble site.
4. If it is useful site, monitor natural rising behaviour on scale.
5. Place handheld close to bubbling site to be left there for several hours
6. Take gas sampler of
a. Escaping gas
b. Existing hydrate (if there is)
c. Bubble stream some 50 m above
d. Bubble stream some 200 m above with large funnel
7. Grab backlight monitoring box at marker position
a. Position as turbulence free as possible, practise upward movement with box
b. Proceed to site, do bubble monitoring backlit
c. Do rise rate experiments by flying up, best with single droplet in view
8. If time remaining, place box at marker side, recollect handheld
9. Do reconnaissance of most active area
10. Return to bubble site, fill T-probe core assembly
11. If possible, move to Riggmaster arm and position KIPS nozzle below within lower end of core
12. Head towards surface, regularly taking KIPS-Samples and monitoring behavior
13. End of dive
ROV Shifts (2 hours):
Start to12:00 Rehder,Inagaki
12:00 to 14:00 Rehder,Nakamura
14:00 to 16:00 Schneider,Rehder
16:00 to 18:00 Boetius,Haeckel
18:00 to 20:00 Nakamura,Rehder

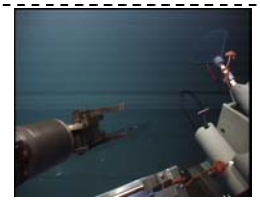
Operations synthesis:

Sampling operations
Water :
KIPS bottle : 1 sample,
Sediment :
Gas sampler : 2 samples,
Measures
16 continue measures were realised,

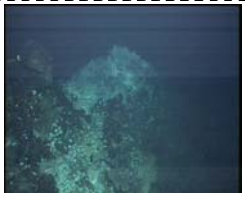
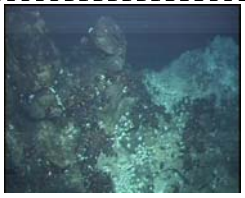
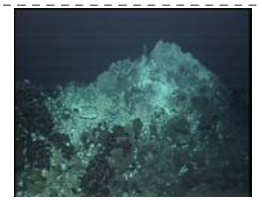
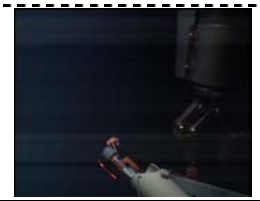
162 pictures captured,
1 new locality defined: Marker 2.

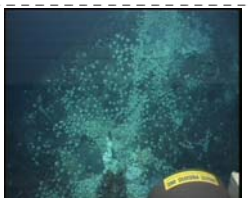
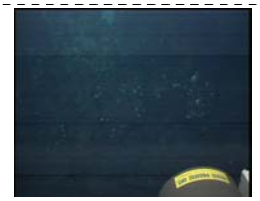
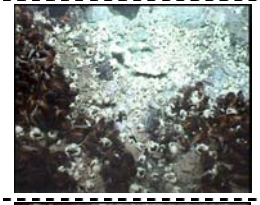
Dive summary:

Dive report:

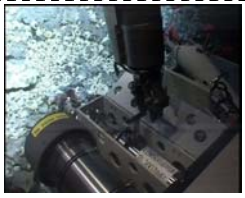
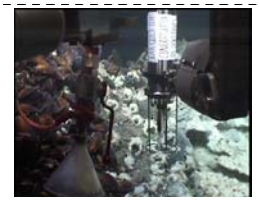
Date	Hour	Location	Latitude Longitude	Immersion Altitude	Comments	Picture
12/03/2008	01:17:59	Hatoma knoll	N 24 51.6127 E 123 50.5429	1444.3 0.0	Alamer started	
12/03/2008	01:20:27	Hatoma knoll	N 24 51.6176 E 123 50.5470	1498.0 18.7	bottom in sight	
12/03/2008	01:27:00	Hatoma knoll	N 24 51.6054 E 123 50.5448	1514.4 12.6	start Tape 200 A and B1	
12/03/2008	01:29:30	Hatoma knoll	N 24 51.5992 E 123 50.5496	1521.8 5.2	landed too far north, heading south, water is cloudy, enhanced turbidity, T-lance data log better	
12/03/2008	01:39:13	Hatoma knoll	N 24 51.5917 E 123 50.5379	1528.8 1.6	too rocky for placing bubble box, heading west towards sedimentary flat	
12/03/2008	01:46:28	Hatoma knoll	N 24 51.5899 E 123 50.5016	1525.4 4.5	reached middle of basin, but now slope from north, so we head south	
12/03/2008	01:51:18	Hatoma knoll	N 24 51.5748 E 123 50.5051	1531.3 2.5	start putting down box	

12/03/2008	01:55:51	Hatoma knoll	N 24 51.5764 E 123 50.5051	1533.7 0.0	deploying bublble box	
12/03/2008	02:09:15	Hatoma knoll	N 24 51.5753 E 123 50.5054	1533.8 0.0	bubble box lay down, now handling practise	
12/03/2008	02:10:26	Hatoma knoll	N 24 51.5744 E 123 50.5055	1534.1 0.0	HDTV on	
12/03/2008	02:15:00	Hatoma knoll	N 24 51.5743 E 123 50.5050	1533.7 0.0	picture looks good, but unfortun	No picture
12/03/2008	02:18:48	Hatoma knoll	N 24 51.5723 E 123 50.5110	1531.8 1.4	stop HDTV No 1 (start 02:10), head towards bubble site 189-2m	
12/03/2008	02:22:36	Hatoma knoll	N 24 51.5476 E 123 50.5324	1527.6 1.4	heading SE towards 189-2	
12/03/2008	02:24:46	Hatoma knoll	N 24 51.5388 E 123 50.5391	1521.8 1.4	transit covered with unspectular sediment	
12/03/2008	02:27:37	Hatoma knoll	N 24 51.5282 E 123 50.5481	1511.7 1.5	Bouldery structure on the left	
12/03/2008	02:31:11	Hatoma knoll	N 24 51.5279 E 123 50.5464	1511.4 1.7	No pictures because flashlight will not work	

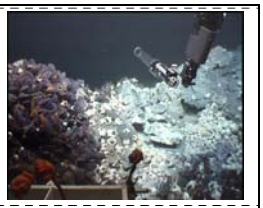
12/03/2008	02:34:13	Hatoma knoll	N 24 51.5264 E 123 50.5460	1509.8 1.7	chimera on film	
12/03/2008	02:37:10	Hatoma knoll	N 24 51.5181 E 123 50.5526	1496.8 4.6	reach chimney position, huge!	
12/03/2008	02:43:07	Hatoma knoll	N 24 51.5199 E 123 50.5602	1491.1 8.7	Monitor chimney	
12/03/2008	02:45:46	Hatoma knoll	N 24 51.5132 E 123 50.5559	1490.3 8.5	large white area on old chimney, yellow as well, sulfur species most likely	
12/03/2008	02:48:44	Hatoma knoll	N 24 51.5129 E 123 50.5574	1491.1 7.2	first droplet site near large white area, crab and shrimp	
12/03/2008	02:52:22	Hatoma knoll	N 24 51.5138 E 123 50.5576	1491.4 6.3	actually two bubbling sites	
12/03/2008	02:54:48	Hatoma knoll	N 24 51.5127 E 123 50.5595	1490.2 6.0	lots of shimmering water going with the bubles, but also on its own	
12/03/2008	02:57:56	Hatoma knoll	N 24 51.5162 E 123 50.5610	1489.9 5.2	hot fluid funnel on top of structure	
12/03/2008	03:02:20	Hatoma knoll	N 24 51.5125 E 123 50.5681	1489.3 9.4	repositioning to access bubbling around the area	

12/03/2008	03:04:39	Hatoma knoll	N 24 51.5112 E 123 50.5583	1491.4 8.1	deployed marker 2	
12/03/2008	03:05:47	Hatoma knoll	N 24 51.5125 E 123 50.5590	1491.9 7.0	start HDTV go around structure	
12/03/2008	03:10:16	Hatoma knoll	N 24 51.5180 E 123 50.5667	1491.8 5.9	more shimmering water in NE corner	
12/03/2008	03:14:06	Hatoma knoll	N 24 51.5185 E 123 50.5651	1492.8 5.7	much shimmeing water on crest	
12/03/2008	03:16:07	Hatoma knoll	N 24 51.5186 E 123 50.5575	1493.6 7.3	change to HDTV tape 2, HDTV No 2 (start 03:05)	
12/03/2008	03:25:57	Hatoma knoll	N 24 51.5127 E 123 50.5620	1493.4 4.5	HDTV on, change to tapes A3 and B3	
12/03/2008	03:33:17	Hatoma knoll	N 24 51.5150 E 123 50.5611	1492.1 3.1	parked in to start buble imaging work	
12/03/2008	03:36:55	Hatoma knoll	N 24 51.5147 E 123 50.5609	1492.7 2.5	parked in set laser ointer for calibration of rise behavior	
12/03/2008	03:42:49	Hatoma knoll	N 24 51.5150 E 123 50.5593	1491.8 2.8	start procdure for first gas sampler	

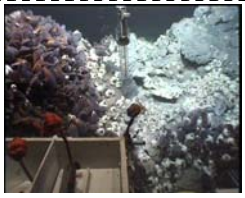
12/03/2008	03:54:29	Hatoma knoll	N 24 51.5155 E 123 50.5613	1491.0 2.9	gas sampling of gas sampler 1	
12/03/2008	04:04:55	Hatoma knoll	N 24 51.5143 E 123 50.5609	1491.7 2.3	stil samling, on HDTV sequence with shrimp hidden by lasers	
12/03/2008	04:11:50	Hatoma knoll	N 24 51.5149 E 123 50.5611	1492.0 2.3	sampler closed, but got mostly water	
12/03/2008	04:16:11	Hatoma knoll	N 24 51.5143 E 123 50.5621	1491.9 2.9	scaling of HDTV with pictures	
12/03/2008	04:21:51	Hatoma knoll	N 24 51.5161 E 123 50.5610	1491.2 2.9	scaling again, take t-probe	
12/03/2008	04:25:15	Hatoma knoll	N 24 51.5170 E 123 50.5610	1491.8 2.7	start T-probing	
12/03/2008	04:27:14	Hatoma knoll	N 24 51.5160 E 123 50.5608	1492.3 2.9	to Tprobe with max 50deg	
12/03/2008	04:30:39	Hatoma knoll	N 24 51.5159 E 123 50.5609	1491.8 2.9	start KIPS sample 21, change tape o A4 B4	
12/03/2008	04:36:56	Hatoma knoll	N 24 51.5165 E 123 50.5612	1491.4 2.9	stop HDTV No 3 (start 03:25), stop sample KIPS 21, start sample 22	

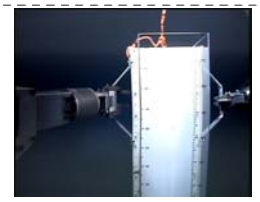
12/03/2008	04:43:17	Hatoma knoll	N 24 51.5151 E 123 50.5606	1492.0 2.9	stop Kips, not working properly	
12/03/2008	04:49:20	Hatoma knoll	N 24 51.5159 E 123 50.5612	1491.1 3.0	prepare handheld measurement	
12/03/2008	04:54:56	Hatoma knoll	N 24 51.5162 E 123 50.5611	1491.1 3.0	start Handheld measurments	
12/03/2008	05:12:42	Hatoma knoll	N 24 51.5158 E 123 50.5612	1490.9 3.0	HDTV No 4 end (start 04:49)	
12/03/2008	05:12:42	Hatoma knoll	N 24 51.5158 E 123 50.5612	1490.9 3.0	end handheld measurement No 1 (start 04:54)	No picture
12/03/2008	05:18:25	Hatoma knoll	N 24 51.5159 E 123 50.5614	1491.4 2.9	gas sampler storage	
12/03/2008	05:27:12	Hatoma knoll	N 24 51.5159 E 123 50.5612	1492.5 2.7	gas sampler deployment	
12/03/2008	05:29:30	Hatoma knoll	N 24 51.5150 E 123 50.5617	1490.6 2.8	tape change, new A5 B5	
12/03/2008	05:32:26	Hatoma knoll	N 24 51.5148 E 123 50.5611	1491.1 2.9	valve opening	

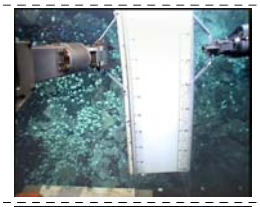
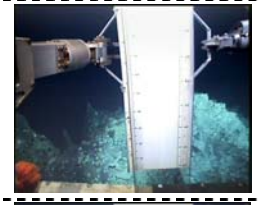
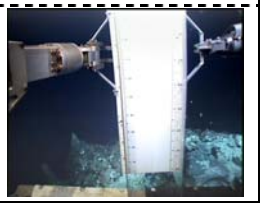
12/03/2008	05:35:34	Hatoma knoll	N 24 51.5153 E 123 50.5605	1491.6 3.0	HD start	
12/03/2008	05:35:49	Hatoma knoll	N 24 51.5174 E 123 50.5610	1491.9 2.9	Orion holding gas sampler directly above bubbling vent	
12/03/2008	05:38:56	Hatoma knoll	N 24 51.5157 E 123 50.5608	1492.2 2.8	bubbles have been observed entering the sampler	
12/03/2008	05:42:53	Hatoma knoll	N 24 51.5154 E 123 50.5601	1492.6 2.8	HDTV No 5 end (start 05:35), tape 3 full	
12/03/2008	05:43:41	Hatoma knoll	N 24 51.5160 E 123 50.5609	1492.3 2.8	HDTV start, tape 4	
12/03/2008	05:45:06	Hatoma knoll	N 24 51.5159 E 123 50.5609	1492.1 2.9	gas sampler is full, no hydrate forming	
12/03/2008	05:46:51	Hatoma knoll	N 24 51.5164 E 123 50.5616	1491.5 2.8	valve closed	
12/03/2008	05:51:56	Hatoma knoll	N 24 51.5155 E 123 50.5610	1491.4 2.7	gas sampler stored into garadge	
12/03/2008	05:56:30	Hatoma knoll	N 24 51.5149 E 123 50.5610	1491.4 2.7	preparing T-Probe Corer	

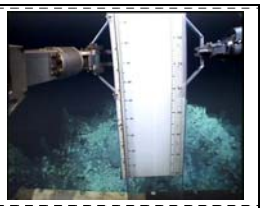
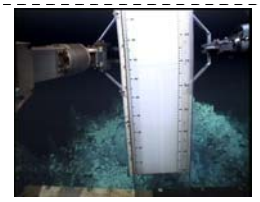
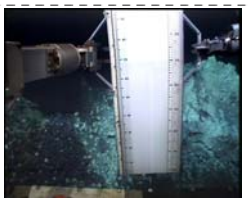
12/03/2008	05:57:45	Hatoma knoll	N 24 51.5151 E 123 50.5608	1491.4 2.8	HD start	
12/03/2008	05:58:12	Hatoma knoll	N 24 51.5151 E 123 50.5608	1491.3 2.8	deployment above same vent as previous gas sampler position	
12/03/2008	05:59:18	Hatoma knoll	N 24 51.5154 E 123 50.5602	1491.5 2.8	gas bubbles entering the probe, start Tlance-corer assembly 01	
12/03/2008	06:00:10	Hatoma knoll	N 24 51.5158 E 123 50.5605	1491.2 2.8	first burst stop	
12/03/2008	06:00:35	Hatoma knoll	N 24 51.5159 E 123 50.5601	1491.5 2.8	second burst start	
12/03/2008	06:01:27	Hatoma knoll	N 24 51.5149 E 123 50.5611	1491.4 2.8	second burst stop	
12/03/2008	06:02:06	Hatoma knoll	N 24 51.5150 E 123 50.5609	1491.3 2.9	3rd burst start	
12/03/2008	06:03:01	Hatoma knoll	N 24 51.5158 E 123 50.5602	1491.3 2.9	3rd burst stop	
12/03/2008	06:03:36	Hatoma knoll	N 24 51.5155 E 123 50.5613	1491.2 2.3	4th burst start	

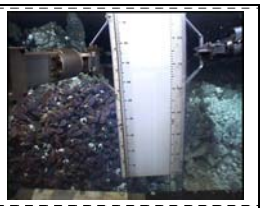
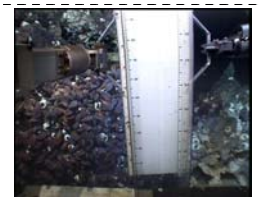
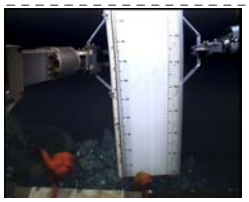
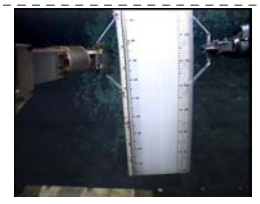
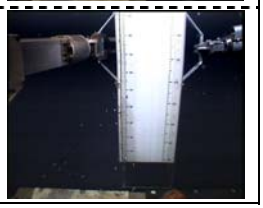
12/03/2008	06:04:20	Hatoma knoll	N 24 51.5160 E 123 50.5605	1491.3 2.2	4th burst stop	
12/03/2008	06:04:41	Hatoma knoll	N 24 51.5155 E 123 50.5604	1491.2 2.3	fluid still permanently escaping	
12/03/2008	06:05:02	Hatoma knoll	N 24 51.5162 E 123 50.5606	1491.3 2.3	5th burst start	
12/03/2008	06:06:04	Hatoma knoll	N 24 51.5155 E 123 50.5600	1491.6 2.2	stop	
12/03/2008	06:06:19	Hatoma knoll	N 24 51.5156 E 123 50.5604	1491.0 2.3	6th start	
12/03/2008	06:08:20	Hatoma knoll	N 24 51.5156 E 123 50.5613	1491.3 2.3	6th burst stop	
12/03/2008	06:08:45	Hatoma knoll	N 24 51.5160 E 123 50.5612	1491.3 2.2	7th burst start	
12/03/2008	06:09:50	Hatoma knoll	N 24 51.5146 E 123 50.5606	1491.2 2.2	7th burst stop	
12/03/2008	06:10:07	Hatoma knoll	N 24 51.5150 E 123 50.5603	1491.4 2.3	no hydrate forming during sampling, end Tlance-corer assembly 01 (start 05:59)	

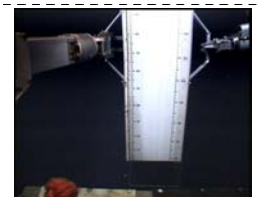
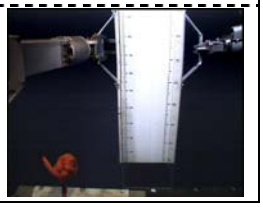
12/03/2008	06:10:25	Hatoma knoll	N 24 51.5152 E 123 50.5606	1491.3 2.2	HDTV No 6-7 stop (start 05:43)	
12/03/2008	06:10:43	Hatoma knoll	N 24 51.5149 E 123 50.5608	1491.2 2.3	T- Corer is lifted in order to achieve hydrate forming conditions	
12/03/2008	06:13:28	Hatoma knoll	N 24 51.5149 E 123 50.5607	1491.3 2.8	T-Probe Corer catches a few bubbles some approx. 10cm higher in the water column	
12/03/2008	06:14:54	Hatoma knoll	N 24 51.5149 E 123 50.5603	1491.4 2.8	T-Probe Corer storage	
12/03/2008	06:18:54	Hatoma knoll	N 24 51.5158 E 123 50.5601	1491.1 3.2	ROV take off	
12/03/2008	06:19:09	Hatoma knoll	N 24 51.5146 E 123 50.5607	1488.8 8.4	ROV heading towards bubble box for recovery	
12/03/2008	06:22:14	Hatoma knoll	N 24 51.5157 E 123 50.5663	1489.7 6.9	further heading towards NW	
12/03/2008	06:28:24	Hatoma knoll	N 24 51.5269 E 123 50.5668	1500.4 2.7	white sulphur patches	
12/03/2008	06:29:58	Hatoma knoll	N 24 51.5317 E 123 50.5616	1505.7 1.0	small white sulphur patches	

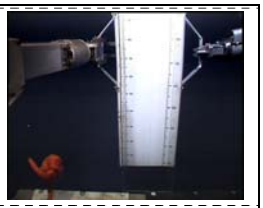
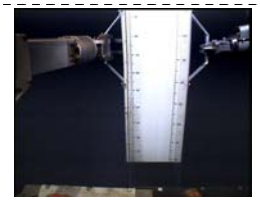
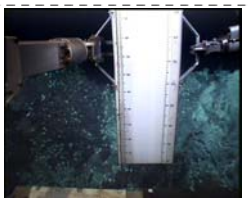
12/03/2008	06:30:37	Hatoma knoll	N 24 51.5330 E 123 50.5592	1508.3 1.0	change tapes to number 6	
12/03/2008	06:31:21	Hatoma knoll	N 24 51.5365 E 123 50.5561	1511.1 1.0	continuous oil leakage of ROV	
12/03/2008	06:37:55	Hatoma knoll	N 24 51.5619 E 123 50.5291	1528.0 1.9	bubble box visible 60m in front, Posidonia match exactly with Sonar	
12/03/2008	06:40:23	Hatoma knoll	N 24 51.5690 E 123 50.5199	1528.2 2.2	HD start	
12/03/2008	06:47:10	Hatoma knoll	N 24 51.5734 E 123 50.5043	1533.0 0.0	ROV on bottom	
12/03/2008	06:47:32	Hatoma knoll	N 24 51.5734 E 123 50.5050	1530.5 2.2	BBox recovery	
12/03/2008	07:05:05	Hatoma knoll	N 24 51.5738 E 123 50.5054	1528.8 3.6	bubblebox fixed, pilot change	
12/03/2008	07:05:32	Hatoma knoll	N 24 51.5739 E 123 50.5057	1529.4 3.6	light checks aus	
12/03/2008	07:06:50	Hatoma knoll	N 24 51.5738 E 123 50.5054	1528.3 3.6	shutter 1/60, blende 1.7, 6db gain	

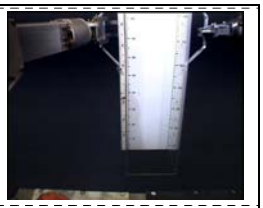
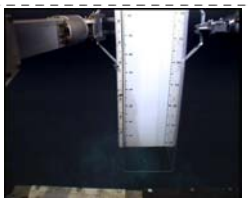
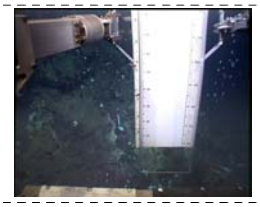
12/03/2008	07:09:58	Hatoma knoll	N 24 51.5733 E 123 50.5044	1528.9 3.6	blende 4, gain 12 dB, used for study	
12/03/2008	07:29:00	Hatoma knoll	N 24 51.5096 E 123 50.5648	1496.7 3.6	heading towards bubble site for bbox deployment	
12/03/2008	07:30:13	Hatoma knoll	N 24 51.5108 E 123 50.5634	1496.3 4.2	change tapes to number A7 B7	
12/03/2008	07:33:05	Hatoma knoll	N 24 51.5153 E 123 50.5559	1493.6 4.5	arriving at chimney	
12/03/2008	07:35:30	Hatoma knoll	N 24 51.5219 E 123 50.5594	1496.1 4.9	looking for bubbling spot	
12/03/2008	07:44:58	Hatoma knoll	N 24 51.5156 E 123 50.5611	1490.8 6.0	found a droplet releasing point source	
12/03/2008	07:47:37	Hatoma knoll	N 24 51.5153 E 123 50.5601	1490.6 5.9	Marker visible	
12/03/2008	07:49:09	Hatoma knoll	N 24 51.5158 E 123 50.5602	1488.8 6.6	fluid venting spot	
12/03/2008	07:51:10	Hatoma knoll	N 24 51.5168 E 123 50.5605	1488.9 3.1	bubble caught, test	

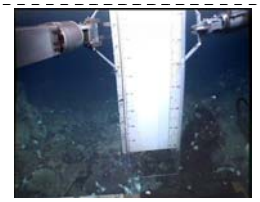
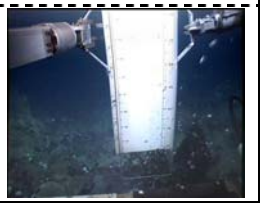
12/03/2008	07:52:39	Hatoma knoll	N 24 51.5165 E 123 50.5605	1488.8 6.3	HD start	
12/03/2008	07:52:53	Hatoma knoll	N 24 51.5164 E 123 50.5605	1489.1 6.2	Bbox positioned over bubbling spot	
12/03/2008	07:54:43	Hatoma knoll	N 24 51.5160 E 123 50.5602	1489.5 6.0	trying adjacent venting spot	
12/03/2008	07:57:39	Hatoma knoll	N 24 51.5158 E 123 50.5611	1489.7 0.0	bubbles caught, test	
12/03/2008	07:59:29	Hatoma knoll	N 24 51.5157 E 123 50.5607	1489.8 0.5	bubbles caught, test	
12/03/2008	08:00:25	Hatoma knoll	N 24 51.5161 E 123 50.5607	1490.2 2.0	bubbles caught	
12/03/2008	08:00:44	Hatoma knoll	N 24 51.5156 E 123 50.5622	1483.2 0.0	ascending with bubbles	
12/03/2008	08:01:50	Hatoma knoll	N 24 51.5140 E 123 50.5625	1477.9 20.0	bubbles lost	
12/03/2008	08:03:45	Hatoma knoll	N 24 51.5118 E 123 50.5645	1493.8 5.8	HDTV No 8 stop (start 07:52)	

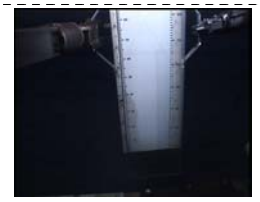
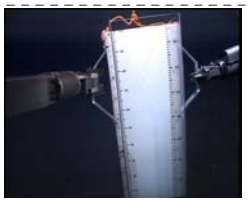
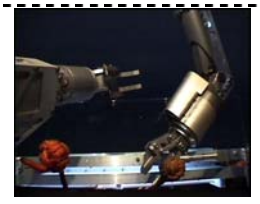
12/03/2008	08:09:17	Hatoma knoll	N 24 51.5162 E 123 50.5608	1490.0 0.4	HD start	
12/03/2008	08:10:33	Hatoma knoll	N 24 51.5163 E 123 50.5614	1490.5 1.5	bubbles caught	
12/03/2008	08:10:48	Hatoma knoll	N 24 51.5167 E 123 50.5611	1489.0 1.6	rising	
12/03/2008	08:11:09	Hatoma knoll	N 24 51.5163 E 123 50.5617	1483.0 13.2	lost	
12/03/2008	08:12:47	Hatoma knoll	N 24 51.5124 E 123 50.5632	1478.9 20.4	HDTV No 9 stop (start 08:09)	
12/03/2008	08:14:06	Hatoma knoll	N 24 51.5071 E 123 50.5654	1485.0 17.2	still a bubble inside BBox at 20m	
12/03/2008	08:17:13	Hatoma knoll	N 24 51.5133 E 123 50.5603	1491.2 6.9	little correction for better BBox position in order to minimize turbulence	
12/03/2008	08:21:31	Hatoma knoll	N 24 51.5168 E 123 50.5601	1489.0 2.2	bubbles caught	
12/03/2008	08:21:49	Hatoma knoll	N 24 51.5164 E 123 50.5605	1485.5 6.9	rising with bubble	

12/03/2008	08:22:09	Hatoma knoll	N 24 51.5160 E 123 50.5606	1478.4 19.1	still inside	
12/03/2008	08:22:38	Hatoma knoll	N 24 51.5150 E 123 50.5622	1467.2 31.8	lost at around 30m, bubbles too fast	
12/03/2008	08:24:35	Hatoma knoll	N 24 51.5110 E 123 50.5663	1462.5 0.0	back downwards	
12/03/2008	08:29:06	Hatoma knoll	N 24 51.5158 E 123 50.5602	1490.6 3.0	tape changed to A8 B8	
12/03/2008	08:30:50	Hatoma knoll	N 24 51.5152 E 123 50.5610	1490.8 1.9	bubbles caught	
12/03/2008	08:31:08	Hatoma knoll	N 24 51.5167 E 123 50.5615	1488.6 3.2	HD start	
12/03/2008	08:31:19	Hatoma knoll	N 24 51.5164 E 123 50.5605	1486.2 4.8	in at 13 m	
12/03/2008	08:31:46	Hatoma knoll	N 24 51.5165 E 123 50.5598	1479.6 17.5	in at 20m	
12/03/2008	08:32:00	Hatoma knoll	N 24 51.5160 E 123 50.5597	1475.0 24.0	in at 27m	

12/03/2008	08:32:17	Hatoma knoll	N 24 51.5160 E 123 50.5602	1467.3 31.8	too much turbulence in the box	
12/03/2008	08:36:23	Hatoma knoll	N 24 51.5112 E 123 50.5736	1461.3 0.0	descending towards seafloor, HDTV No 10 stoped before (start 08:31)	
12/03/2008	08:42:25	Hatoma knoll	N 24 51.5150 E 123 50.5610	1489.5 6.4	re-adjusting Bbox: change tilt angle	
12/03/2008	08:43:47	Hatoma knoll	N 24 51.5155 E 123 50.5612	1490.3 1.6	caught bubbles, HD start	
12/03/2008	08:44:12	Hatoma knoll	N 24 51.5153 E 123 50.5607	1486.2 6.8	in at 15m	
12/03/2008	08:44:36	Hatoma knoll	N 24 51.5152 E 123 50.5600	1477.8 19.7	lost at 25m, less turbulent	
12/03/2008	08:46:50	Hatoma knoll	N 24 51.5150 E 123 50.5631	1476.0 22.0	HDTV No 11 stop (start 08:43)	
12/03/2008	08:47:49	Hatoma knoll	N 24 51.5144 E 123 50.5624	1487.6 8.3	ROV back to seafloor	
12/03/2008	08:51:19	Hatoma knoll	N 24 51.5160 E 123 50.5609	1490.3 2.7	HDTV start, bubbles in	

12/03/2008	08:51:49	Hatoma knoll	N 24 51.5177 E 123 50.5614	1487.0 0.0	in at 10m	
12/03/2008	08:52:13	Hatoma knoll	N 24 51.5167 E 123 50.5605	1480.2 17.0	lost at 15m	
12/03/2008	08:55:33	Hatoma knoll	N 24 51.5150 E 123 50.5629	1484.9 12.2	HDTV No 12 off (start 08:51)	
12/03/2008	09:06:10	Hatoma knoll	N 24 51.5216 E 123 50.5526	1489.0 11.7	Transit to bubble site Marker no.1	
12/03/2008	09:29:51	Hatoma knoll	N 24 51.5804 E 123 50.4466	1519.3 5.4	Change Tape A9 9	
12/03/2008	09:33:04	Hatoma knoll	N 24 51.5822 E 123 50.4424	1521.3 1.1	Bubble side found	
12/03/2008	09:33:41	Hatoma knoll	N 24 51.5827 E 123 50.4435	1522.1 1.2	Prepare for rise experiment	
12/03/2008	09:35:07	Hatoma knoll	N 24 51.5824 E 123 50.4441	1521.9 1.1	Start Bubble rise experiment 01, Bubble Box	No picture
12/03/2008	09:35:07	Hatoma knoll	N 24 51.5824 E 123 50.4441	1521.9 1.1	HDTV recording on, rise speed measurement for 5 minutes	
12/03/2008	09:39:31	Hatoma	N 24	1521.6	End Bubble	No picture

		knoll	51.5838 E 123 50.4446	1.2	rise experiment 01 (start 09:35), Bubble Box	
12/03/2008	09:39:31	Hatoma knoll	N 24 51.5838 E 123 50.4446	1521.6 1.2	HDTV No 13 off (start 09:35)	
12/03/2008	09:45:14	Hatoma knoll	N 24 51.5830 E 123 50.4470	1519.5 6.0	side lost	
12/03/2008	09:47:19	Hatoma knoll	N 24 51.5831 E 123 50.4430	1520.0 3.3	marker 1 found	
12/03/2008	09:48:16	Hatoma knoll	N 24 51.5828 E 123 50.4423	1520.1 3.2	bubble site found	
12/03/2008	09:51:33	Hatoma knoll	N 24 51.5812 E 123 50.4419	1522.5 0.9	Prepare for rise experiment	
12/03/2008	09:53:46	Hatoma knoll	N 24 51.5820 E 123 50.4428	1520.8 3.0	bubble, rise of ROV	
12/03/2008	10:06:47	Hatoma knoll	N 24 51.5808 E 123 50.4430	1521.0 2.7	marker	
12/03/2008	10:09:04	Hatoma knoll	N 24 51.5821 E 123 50.4431	1522.1 1.4	rise experiment, Start Bubble rise experiment 02, BB	

12/03/2008	10:11:32	Hatoma knoll	N 24 51.5869 E 123 50.4463	1488.2 0.0	end of Bubble rise experiment 02, BB (start 10:09)	
12/03/2008	10:14:10	Hatoma knoll	N 24 51.5823 E 123 50.4514	1517.5 10.0	heading east to store bubble box	
12/03/2008	10:15:45	Hatoma knoll	N 24 51.5817 E 123 50.4503	1524.7 3.1	Minifilm framegrab on one of the videos seems to be misfunctioning	
12/03/2008	10:17:34	Hatoma knoll	N 24 51.5819 E 123 50.4519	1524.4 3.1	storing box for dive up	
12/03/2008	10:24:36	Hatoma knoll	N 24 51.5813 E 123 50.4513	1512.6 14.1	leaving bottom	
12/03/2008	10:32:44	Hatoma knoll	N 24 51.5800 E 123 50.4483	1317.6 0.0	end video recording tape A tape B	

created Tue Mar 25 12:49:48 PHT 2008

Appendix

Dive 201
ALAMER : Operation list
Dive summaries Alamere

ALAMER : Operation list

Cruise : **SO196 - SUMSUN**
Dive : 201 SO196_030

Operation list :

Equipment	Num	Date	Hour	Latitude	Longitude	Depth	Altitude	Location	Biology	Water	Geochem.	Measure	Pict.	File	Comments
CO2 pH T Sensor handheld	1	13/03/2008	01:22:44	N 24 50.8582	E 122 42.0528	1135	0	Yonaguni knoll					3	X	calibration handheld 1 finished
CO2 pH T Sensor handheld	2	13/03/2008	07:05:39	N 24 50.7823	E 122 42.0266	1381	0	Yonaguni knoll					76	X	handheld No 2 in flare of abyss vent done
HDTV camera	1	13/03/2008	03:56:57	N 24 50.7810	E 122 42.0274	1382	0	Yonaguni knoll					35	X	start KIPS 22 HDTV 1 off tape 1
HDTV camera	2	13/03/2008	04:29:37	N 24 50.7863	E 122 42.0265	1382	0	Yonaguni knoll					46	X	HDTV 2 off tape 1
HDTV camera	3	13/03/2008	06:02:39	N 24 50.7817	E 122 42.0241	1382	0	Yonaguni knoll					6	X	HDTV No 3 off tape 1
HDTV camera	4	13/03/2008	06:38:29	N 24 50.7832	E 122 42.0258	1381	0	Yonaguni knoll					69	X	HDTV No 4 off hdtv new tape 2 Antje in Matthias out
HDTV camera	5	13/03/2008	06:53:51	N 24 50.7883	E 122 42.0245	1381	0	Yonaguni knoll					74	X	HDTV No 5 off tape 2
HDTV camera	6	13/03/2008	07:41:35	N 24 50.7697	E 122 42.0411	1385	0	Yonaguni knoll					81	X	change to tape 7 HDTV 6 off HDTV tape 2
HDTV camera	7	13/03/2008	08:16:03	N 24 50.8263	E 122 42.0839	1365	0	Yonaguni knoll					94	X	kips 25 flushed HDTV 7 tape 2 off
HDTV camera	8	13/03/2008	08:21:18	N 24 50.8266	E 122 42.0840	1365	0	Yonaguni knoll					98	X	fishes HDTV 8 tape 3 off

HDTV camera	9	13/03/2008	09:07:55	N 24 50.8097	E 122 42.1031	1375	0	Yonaguni knoll					113	X	HDTV 9 tape 3 off
HDTV camera	10	13/03/2008	09:29:55	N 24 50.8012	E 122 42.0728	1369	2	Yonaguni knoll					12	X	HDTV No 10 end tape 3 change to tape 4
HDTV camera	11	13/03/2008	09:33:29	N 24 50.8193	E 122 42.0672	1361	3	Yonaguni knoll					124	X	HDTV 11 tape 4 off
INSINC Corer (MPI)	1	13/03/2008	03:37:20	N 24 50.7841	E 122 42.0258	1382	0	Yonaguni knoll	X				3		X1 started fluid release
INSINC Corer (MPI)	2	13/03/2008	03:20:53	N 24 50.7829	E 122 42.0261	1382	0	Yonaguni knoll	X				28		insink 2 still taken
INSINC Corer (MPI)	3	13/03/2008	03:16:44	N 24 50.7824	E 122 42.0277	1382	0	Yonaguni knoll	X				27		insink 3 started
INSINC Corer (MPI)	4	13/03/2008	03:06:12	N 24 50.7836	E 122 42.0251	1382	0	Yonaguni knoll	X				25		insink 4 started
KIPS bottle	21	13/03/2008	03:56:43	N 24 50.7811	E 122 42.0277	1383	0	Yonaguni knoll		X			34		stop KIPS 21
KIPS bottle	22	13/03/2008	04:00:03	N 24 50.7809	E 122 42.0287	1382	0	Yonaguni knoll		X			36		KIPS 22 stop
KIPS bottle	23	13/03/2008	04:05:02	N 24 50.7797	E 122 42.0298	1382	0	Yonaguni knoll	X	X			38		KIPS 23 stop
KIPS bottle	25	13/03/2008	04:09:04	N 24 50.7857	E 122 42.0251	1382	0	Yonaguni knoll		X			4		KIPS 24 Stop
KIPS bottle	25	13/03/2008	08:18:59	N 24 50.8253	E 122 42.0846	1366	0	Yonaguni knoll		X			96		kips 25 taken
KIPS bottle	26	13/03/2008	08:22:20	N 24 50.8263	E 122 42.0830	1365	0	Yonaguni knoll		X			99		kips 26 taken
KIPS bottle	27	13/03/2008	08:27:12	N 24 50.8264	E 122 42.0846	1365	0	Yonaguni knoll		X			11		KIPS 27 finished
KIPS bottle	28	13/03/2008	08:33:28	N 24 50.8288	E 122 42.0832	1365	0	Yonaguni knoll	X				13		KIPS 28 end
Profiler 201	1	13/03/2008	02:30:09	N 24 50.7812	E 122 42.0307	1382	0	Yonaguni knoll					17		started profiler 201 1
Profiler 201	1	13/03/2008	05:46:12	N 24 50.7775	E 122 42.0282	1382	0	Yonaguni knoll					57		profiler up move to marker 8
Profiler 201	2	13/03/2008	06:08:05	N 24 50.7829	E 122 42.0251	1381	0	Yonaguni knoll					62		profiler 201 no2 started
Profiler 201	2	13/03/2008	07:57:39	N 24 50.7802	E 122 42.0301	1380	1	Yonaguni knoll					84		picked up profiler 2 go to WP2 (MUC 3 reference site)
Profiler 201	3	13/03/2008	08:09:42	N 24 50.8266	E 122 42.0842	1365	0	Yonaguni knoll					91		profiler 3 started still
Profiler 201	3	13/03/2008	10:01:53	N 24 50.8311	E 122 42.0166	1376	2	Yonaguni knoll					129		end of dive pack profiler and surface
Push Corer	1	13/03/2008	04:25:29	N 24 50.7811	E 122 42.0273	1382	0	Yonaguni knoll			X				PC1

Push Corer	5	13/03/2008	04:25:29	N 24 50.7811	E 122 42.0273	1382	0	Yonaguni knoll			X				PC5
Push Corer	7	13/03/2008	04:25:29	N 24 50.7811	E 122 42.0273	1382	0	Yonaguni knoll			X				PC7
Push Corer	9	13/03/2008	04:25:29	N 24 50.7811	E 122 42.0273	1382	0	Yonaguni knoll			X				PC9
Push Corer	20	13/03/2008	04:25:29	N 24 50.7811	E 122 42.0273	1382	0	Yonaguni knoll			X				PC20
Push Corer	21	13/03/2008	04:25:29	N 24 50.7811	E 122 42.0273	1382	0	Yonaguni knoll			X				PC21
Push Corer	23	13/03/2008	04:25:29	N 24 50.7811	E 122 42.0273	1382	0	Yonaguni knoll			X				PC23
Push Corer	28	13/03/2008	04:25:29	N 24 50.7811	E 122 42.0273	1382	0	Yonaguni knoll			X				PC28
T Lance online	1	13/03/2008	04:12:48	N 24 50.7820	E 122 42.0269	1381	0	Yonaguni knoll					41	X	T lance 1end
T Lance online	2	13/03/2008	05:37:14	N 24 50.7793	E 122 42.0312	1382	0	Yonaguni knoll					54	X	T-lance 2 end
T Lance online	3	13/03/2008	06:34:46	N 24 50.7837	E 122 42.0267	1382	0	Yonaguni knoll					67	X	end T-Lance 3 in fluid hole
T Lance online	4	13/03/2008	06:38:00	N 24 50.7830	E 122 42.0260	1381	0	Yonaguni knoll						X	t lance 4 above seep end
T Lance online	5	13/03/2008	06:40:18	N 24 50.7820	E 122 42.0238	1381	0	Yonaguni knoll						X	T Lance 5 0.5 from seep out
T Lance online	6	13/03/2008	06:50:25	N 24 50.7885	E 122 42.0245	1382	0	Yonaguni knoll					73	X	T-lance 6 on hard rock out
T Lance online	7	13/03/2008	07:46:23	N 24 50.7684	E 122 42.0395	1385	0	Yonaguni knoll					82	X	gas escape when recovering the T lance 7
T Lance online	8	13/03/2008	08:33:41	N 24 50.8281	E 122 42.0835	1366	0	Yonaguni knoll					14	X	T lance 8 end no gas bubbles
T Lance online	9	13/03/2008	09:05:23	N 24 50.8089	E 122 42.1021	1374	0	Yonaguni knoll					112	X	measurement T9 end no gas bubbles
T Lance online	10	13/03/2008	09:25:24	N 24 50.7977	E 122 42.0684	1373	0	Yonaguni knoll					118	X	T 10 measurement end
T Lance online	11	13/03/2008	09:42:39	N 24 50.8230	E 122 42.0830	1367	0	Yonaguni knoll					127	X	no gas bubbles emerging end of T lance 11

Dive summary

ROV Quest - Dive: 201- 5

SUMSUN (Sonne)

Date: **13/03/2008**
Observers: **BOETIUS Antje**
Station: **Yonaguni knoll**
Position: **N 24 50.7077 E 122 42.0005**

Dive duration:

Start: **13/03/2008 00:00:00**
At bottom: **13/03/2008 01:41:44**
Leave bottom: **13/03/2008 10:01:53**
End: **13/03/2008 11:10:00**

Explored sites:

Dive objectives:

Objectives:
1. Profiler measurements at seep sites and reference
2. KIPS, Handheld and T lance at profiler positions
3. 4 INSINKS and 8 Pushcores at seep site
4. T lance measurements along the transect T1-T17

ROV Shifts (2 hours):
09:00 to 11:00 DeBeer, Boetius
11:00 to 13:00 Boetius, Haeckel
13:00 to 15:00 DeBeer, Haeckel
15:00 to 18:00 DeBeer, Boetius
18:00 to 20:00 Inagaki, Boetius
20:00 to 22:00 DeBeer,Inagaki

Operations synthesis:

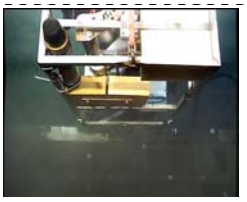
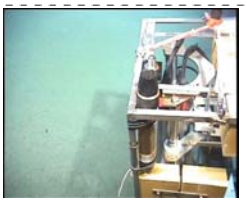
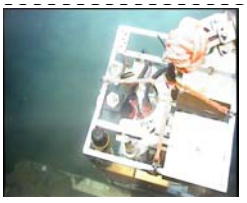
Sampling operations
Biology :
INSINC Corer (MPI) : 4 samples,
KIPS bottle : 2 samples,
Water :
KIPS bottle : 6 samples,
Sediment :
Carottier tube : 8 samples,
Measures
24 continue measures were realised,
Moorings
3 moorings were placed.
3 moorings were recovered.

124 pictures captured,
2 news localities defined: 8 and 9.

Dive summary:

Dive report:

Date	Hour	Location	Latitude Longitude	Immersion Altitude	Comments	Picture
13/03/2008	01:13:17	Yonaguni knoll	N 24 50.9259 E 122 42.0672	1149.3 0.0	Antje in, Dirk in, 200 m above ground for hand held calibration	
13/03/2008	01:22:44	Yonaguni knoll	N 24 50.8582 E 122 42.0528	1135.4 0.0	calibration handheld 1 finished	
13/03/2008	01:41:44	Yonaguni knoll	N 24 50.7848 E 122 42.0225	1382.7 0.9	bacterial mat at starting point	
13/03/2008	01:44:02	Yonaguni knoll	N 24 50.7806 E 122 42.0244	1382.2 1.4	landed at Shinkai marker, abyss vent	
13/03/2008	01:44:47	Yonaguni knoll	N 24 50.7798 E 122 42.0295	1380.2 1.6	few mat patches	
13/03/2008	01:48:06	Yonaguni knoll	N 24 50.7749 E 122 42.0397	1384.7 1.5	more mat patches	
13/03/2008	01:52:38	Yonaguni knoll	N 24 50.7755 E 122 42.0363	1384.0 1.1	look around - flat bottom with slight angle, will sit down for profiler	

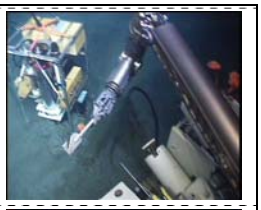
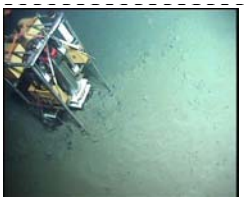
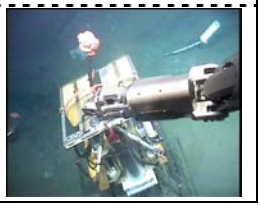
13/03/2008	01:56:52	Yonaguni knoll	N 24 50.7747 E 122 42.0363	1384.3 0.4	sit down, no bubbles	
13/03/2008	02:12:41	Yonaguni knoll	N 24 50.7722 E 122 42.0380	1383.5 1.3	lifted off again to go 10 m south	
13/03/2008	02:14:09	Yonaguni knoll	N 24 50.7739 E 122 42.0386	1383.8 0.4	brownish seafloor, no sign of animal traces or borrows	
13/03/2008	02:22:29	Yonaguni knoll	N 24 50.7738 E 122 42.0293	1382.5 1.3	slope was too deep, the profiler started sliding, we have to go to new position	
13/03/2008	02:25:44	Yonaguni knoll	N 24 50.7797 E 122 42.0288	1382.5 0.3	land on small bacterial mat	
13/03/2008	02:27:48	Yonaguni knoll	N 24 50.7786 E 122 42.0292	1382.4 0.3	fluid emerges	
13/03/2008	02:30:09	Yonaguni knoll	N 24 50.7812 E 122 42.0307	1382.2 0.3	started profiler 201 1	
13/03/2008	02:30:51	Yonaguni knoll	N 24 50.7829 E 122 42.0290	1382.0 0.6	obviously the whitish material on top is correlated with fluids in the sediment	

13/03/2008	02:32:59	Yonaguni knoll	N 24 50.7822 E 122 42.0282	1381.1 0.4	beacon tested, on 16	
13/03/2008	02:33:41	Yonaguni knoll	N 24 50.7832 E 122 42.0272	1380.5 0.4	Volker sets WP6 on T1, change to tape 2	
13/03/2008	02:36:46	Yonaguni knoll	N 24 50.7846 E 122 42.0253	1377.4 2.7	see shinkai marker	
13/03/2008	02:48:44	Yonaguni knoll	N 24 50.7817 E 122 42.0244	1382.7 0.6	landed close to fluid outlet	
13/03/2008	02:51:44	Yonaguni knoll	N 24 50.7815 E 122 42.0290	1383.0 0.6	start with insink X 4, still taken	
13/03/2008	02:55:13	Yonaguni knoll	N 24 50.7820 E 122 42.0263	1382.5 0.6	fluid came out	
13/03/2008	03:06:12	Yonaguni knoll	N 24 50.7836 E 122 42.0251	1382.7 0.5	insink 4 started	
13/03/2008	03:07:06	Yonaguni knoll	N 24 50.7838 E 122 42.0255	1383.1 0.5	insink 3, still	
13/03/2008	03:16:44	Yonaguni knoll	N 24 50.7824 E 122 42.0277	1382.7 0.6	insink 3 started	

13/03/2008	03:20:53	Yonaguni knoll	N 24 50.7829 E 122 42.0261	1382.9 0.5	insink 2, still taken	
13/03/2008	03:37:20	Yonaguni knoll	N 24 50.7841 E 122 42.0258	1382.6 0.5	X1 started, fluid release	
13/03/2008	03:40:26	Yonaguni knoll	N 24 50.7845 E 122 42.0261	1382.8 0.5	change to tape 3	
13/03/2008	03:49:00	Yonaguni knoll	N 24 50.7820 E 122 42.0247	1383.0 0.6	Tlance No 1 started, 15 deg C	
13/03/2008	03:54:00	Yonaguni knoll	N 24 50.7834 E 122 42.0247	1382.3 0.5	start pumping KIPS bottle 21, HDTV on	
13/03/2008	03:56:43	Yonaguni knoll	N 24 50.7811 E 122 42.0277	1383.1 0.6	stop KIPS 21	
13/03/2008	03:56:57	Yonaguni knoll	N 24 50.7810 E 122 42.0274	1382.7 0.5	start KIPS 22, HDTV 1 off, tape 1	
13/03/2008	04:00:03	Yonaguni knoll	N 24 50.7809 E 122 42.0287	1382.7 0.6	KIPS 22 stop	
13/03/2008	04:02:22	Yonaguni knoll	N 24 50.7799 E 122 42.0300	1382.8 0.6	KIPS 23 start pumping	

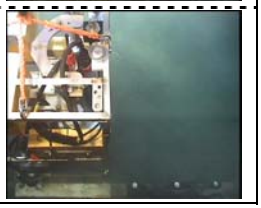
13/03/2008	04:05:02	Yonaguni knoll	N 24 50.7797 E 122 42.0298	1382.9 0.6	KIPS 23 stop	
13/03/2008	04:06:45	Yonaguni knoll	N 24 50.7838 E 122 42.0276	1383.2 0.6	KIPS 24 start	
13/03/2008	04:09:04	Yonaguni knoll	N 24 50.7857 E 122 42.0251	1382.7 0.5	KIPS 24 Stop	
13/03/2008	04:12:48	Yonaguni knoll	N 24 50.7820 E 122 42.0269	1381.9 0.5	T lance 1end	
13/03/2008	04:18:56	Yonaguni knoll	N 24 50.7822 E 122 42.0257	1383.2 0.6	start push coring, all in one spot	
13/03/2008	04:22:25	Yonaguni knoll	N 24 50.7867 E 122 42.0240	1382.7 0.6	Fish swimming around	
13/03/2008	04:25:29	Yonaguni knoll	N 24 50.7811 E 122 42.0273	1382.7 0.6	PC9	No picture
13/03/2008	04:25:29	Yonaguni knoll	N 24 50.7811 E 122 42.0273	1382.7 0.6	PC28	No picture
13/03/2008	04:25:29	Yonaguni knoll	N 24 50.7811 E 122 42.0273	1382.7 0.6	PC20	No picture
13/03/2008	04:25:29	Yonaguni knoll	N 24 50.7811 E 122 42.0273	1382.7 0.6	PC23	No picture
13/03/2008	04:25:29	Yonaguni knoll	N 24 50.7811 E 122 42.0273	1382.7 0.6	PC7	No picture

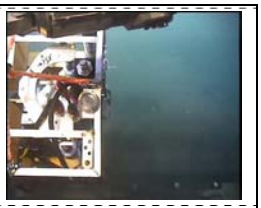
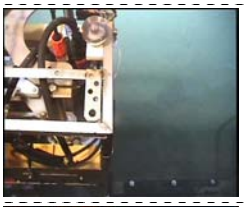
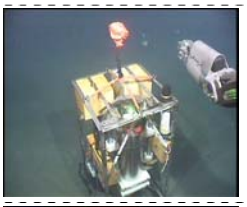
13/03/2008	04:25:29	Yonaguni knoll	N 24 50.7811 E 122 42.0273	1382.7 0.6	PC21	No picture
13/03/2008	04:25:29	Yonaguni knoll	N 24 50.7811 E 122 42.0273	1382.7 0.6	PC1	No picture
13/03/2008	04:25:29	Yonaguni knoll	N 24 50.7811 E 122 42.0273	1382.7 0.6	PC5	No picture
13/03/2008	04:25:29	Yonaguni knoll	N 24 50.7811 E 122 42.0273	1382.7 0.6	fluid release while pushcoring	
13/03/2008	04:27:35	Yonaguni knoll	N 24 50.7796 E 122 42.0277	1382.4 0.6	still of all pushcores, HDTV 2 on	
13/03/2008	04:29:37	Yonaguni knoll	N 24 50.7863 E 122 42.0265	1382.8 0.6	HDTV 2 off, tape 1	
13/03/2008	04:40:00	Yonaguni knoll	N 24 50.7844 E 122 42.0257	1382.5 0.6	cores recovered	
13/03/2008	04:41:15	Yonaguni knoll	N 24 50.7839 E 122 42.0273	1382.4 0.6	changed tapes to #4	
13/03/2008	04:44:23	Yonaguni knoll	N 24 50.7845 E 122 42.0262	1382.9 0.5	marker 8	
13/03/2008	05:01:57	Yonaguni knoll	N 24 50.7812 E 122 42.0292	1381.1 0.0	arrived at profiler, avalanche against sensors	

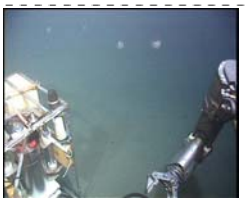
13/03/2008	05:05:43	Yonaguni knoll	N 24 50.7804 E 122 42.0327	1381.1 0.0	reference opened	
13/03/2008	05:21:55	Yonaguni knoll	N 24 50.7786 E 122 42.0289	1382.3 0.5	pilot change	
13/03/2008	05:25:45	Yonaguni knoll	N 24 50.7799 E 122 42.0328	1382.6 0.6	t-lance 2 start	
13/03/2008	05:37:14	Yonaguni knoll	N 24 50.7793 E 122 42.0312	1382.2 0.5	T-lance 2 end	
13/03/2008	05:38:33	Yonaguni knoll	N 24 50.7776 E 122 42.0299	1382.3 0.5	bubbles during retraction	
13/03/2008	05:40:23	Yonaguni knoll	N 24 50.7785 E 122 42.0293	1382.2 0.5	change tape to #5	
13/03/2008	05:46:12	Yonaguni knoll	N 24 50.7775 E 122 42.0282	1382.5 0.5	profiler up, move to marker 8	
13/03/2008	05:58:22	Yonaguni knoll	N 24 50.7793 E 122 42.0255	1381.6 0.5	profiler at new spot, next to hot seep	
13/03/2008	06:00:44	Yonaguni knoll	N 24 50.7808 E 122 42.0255	1382.1 0.5	hdtv 3 on	

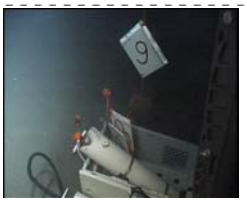
13/03/2008	06:02:39	Yonaguni knoll	N 24 50.7817 E 122 42.0241	1382.0 0.4	HDTV No 3 off, tape 1	
13/03/2008	06:08:05	Yonaguni knoll	N 24 50.7829 E 122 42.0251	1381.7 0.7	profiler 201 no2 started	
13/03/2008	06:10:20	Yonaguni knoll	N 24 50.7834 E 122 42.0272	1382.2 0.5	HDTV No 4 on	
13/03/2008	06:20:18	Yonaguni knoll	N 24 50.7843 E 122 42.0241	1381.9 0.7	ROV 1/2 m to the left	
13/03/2008	06:26:15	Yonaguni knoll	N 24 50.7848 E 122 42.0273	1381.9 0.5	T-lance 3 in hole	
13/03/2008	06:28:00	Yonaguni knoll	N 24 50.7839 E 122 42.0284	1381.9 0.5	start T.alnce	
13/03/2008	06:34:46	Yonaguni knoll	N 24 50.7837 E 122 42.0267	1382.0 0.5	end T-Lance 3 in fluid hole	
13/03/2008	06:35:44	Yonaguni knoll	N 24 50.7830 E 122 42.0260	1381.6 0.5	T-lance 4 above seep	
13/03/2008	06:38:00	Yonaguni knoll	N 24 50.7830 E 122 42.0260	1381.6 0.5	t lance 4 above seep end	No picture

13/03/2008	06:38:29	Yonaguni knoll	N 24 50.7832 E 122 42.0258	1381.9 0.5	HDTV No 4 off, hdtv new tape 2, Antje in Matthias out	
13/03/2008	06:39:49	Yonaguni knoll	N 24 50.7822 E 122 42.0238	1381.6 0.5	hdtv 5 on, lance in sediment, 0.5 m from seep	
13/03/2008	06:39:50	Yonaguni knoll	N 24 50.7822 E 122 42.0238	1381.6 0.5	T Lance 5 0,5 m from seep	No picture
13/03/2008	06:40:18	Yonaguni knoll	N 24 50.7820 E 122 42.0238	1381.8 0.5	T Lance 5, 0.5 from seep out	No picture
13/03/2008	06:40:19	Yonaguni knoll	N 24 50.7820 E 122 42.0238	1381.8 0.5	T-lance 6 on hard rock	
13/03/2008	06:43:17	Yonaguni knoll	N 24 50.7834 E 122 42.0250	1381.6 0.5	tape 6	
13/03/2008	06:50:25	Yonaguni knoll	N 24 50.7885 E 122 42.0245	1382.2 0.5	T-lance 6 on hard rock out	
13/03/2008	06:53:51	Yonaguni knoll	N 24 50.7883 E 122 42.0245	1381.7 0.5	HDTV No 5 off, tape 2	
13/03/2008	07:00:43	Yonaguni knoll	N 24 50.7889 E 122 42.0247	1381.7 0.5	handheld No 2 in flare of seep	

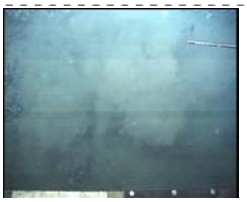
13/03/2008	07:05:39	Yonaguni knoll	N 24 50.7823 E 122 42.0266	1381.7 0.5	handheld No 2 in flare of abyss vent done	
13/03/2008	07:12:18	Yonaguni knoll	N 24 50.7827 E 122 42.0261	1381.7 0.4	go to WP1, see lots of old dead chimneys	
13/03/2008	07:27:54	Yonaguni knoll	N 24 50.7714 E 122 42.0385	1385.2 1.1	HDTV 6 on	
13/03/2008	07:35:20	Yonaguni knoll	N 24 50.7705 E 122 42.0378	1385.9 0.5	T lance measure no 7 at WP1 (Muc 10 station, however we see no traces thereof)	
13/03/2008	07:37:35	Yonaguni knoll	N 24 50.7702 E 122 42.0377	1386.1 0.6	T lance measure 7 start	
13/03/2008	07:41:35	Yonaguni knoll	N 24 50.7697 E 122 42.0411	1385.9 0.6	change to tape 7, HDTV 6 off, HDTV tape 2	
13/03/2008	07:46:23	Yonaguni knoll	N 24 50.7684 E 122 42.0395	1385.7 0.6	gas escape when recovering the T lance 7	
13/03/2008	07:51:56	Yonaguni knoll	N 24 50.7689 E 122 42.0395	1385.3 1.0	fish on sediment	
13/03/2008	07:57:39	Yonaguni knoll	N 24 50.7802 E 122 42.0301	1380.9 1.6	picked up profiler 2, go to WP2 (MUC 3 reference site)	

13/03/2008	07:58:44	Yonaguni knoll	N 24 50.7815 E 122 42.0323	1377.6 2.6	crabs on the seafloor	
13/03/2008	08:01:02	Yonaguni knoll	N 24 50.7957 E 122 42.0504	1365.8 4.9	vents with Bathymodiolus	
13/03/2008	08:04:44	Yonaguni knoll	N 24 50.8261 E 122 42.0805	1365.6 1.0	fish with big eyes	
13/03/2008	08:05:43	Yonaguni knoll	N 24 50.8261 E 122 42.0851	1365.6 0.7	more fish (eels) sediment color lighter	
13/03/2008	08:06:27	Yonaguni knoll	N 24 50.8265 E 122 42.0851	1365.8 0.4	trails of animals visible	
13/03/2008	08:07:43	Yonaguni knoll	N 24 50.8269 E 122 42.0852	1365.8 0.0	reach WP2 (target 7), set down profiler	
13/03/2008	08:09:42	Yonaguni knoll	N 24 50.8266 E 122 42.0842	1365.8 0.0	profiler 3 started, still	
13/03/2008	08:10:25	Yonaguni knoll	N 24 50.8261 E 122 42.0845	1365.9 0.0	HDTV 7, tape 2 on	
13/03/2008	08:13:56	Yonaguni knoll	N 24 50.8258 E 122 42.0834	1365.9 0.0	take t lance measure 8, stills	

13/03/2008	08:16:03	Yonaguni knoll	N 24 50.8263 E 122 42.0839	1365.9 0.0	kips 25 flushed, HDTV 7 tape 2 off	
13/03/2008	08:18:19	Yonaguni knoll	N 24 50.8260 E 122 42.0847	1366.4 0.0	hdtv tape change 3, hdtv 8 tape 3 on	
13/03/2008	08:18:59	Yonaguni knoll	N 24 50.8253 E 122 42.0846	1366.0 0.0	kips 25 taken	
13/03/2008	08:19:06	Yonaguni knoll	N 24 50.8256 E 122 42.0843	1366.0 0.0	kips 26 flushed	
13/03/2008	08:21:18	Yonaguni knoll	N 24 50.8266 E 122 42.0840	1365.9 0.0	fishes, HDTV 8 tape 3 off	
13/03/2008	08:22:20	Yonaguni knoll	N 24 50.8263 E 122 42.0830	1365.9 0.0	kips 26 taken	
13/03/2008	08:22:46	Yonaguni knoll	N 24 50.8269 E 122 42.0842	1365.8 0.0	KIPS 27 open flushed	
13/03/2008	08:27:12	Yonaguni knoll	N 24 50.8264 E 122 42.0846	1365.7 0.0	KIPS 27 finished	
13/03/2008	08:27:27	Yonaguni knoll	N 24 50.8272 E 122 42.0839	1366.0 0.0	KIPS 28 open	

13/03/2008	08:33:28	Yonaguni knoll	N 24 50.8288 E 122 42.0832	1365.9 0.0	KIPS 28 end	
13/03/2008	08:33:41	Yonaguni knoll	N 24 50.8281 E 122 42.0835	1366.0 0.0	T lance 8 end, no gas bubbles	
13/03/2008	08:36:42	Yonaguni knoll	N 24 50.8280 E 122 42.0842	1366.0 0.0	marker 9	
13/03/2008	08:40:48	Yonaguni knoll	N 24 50.8279 E 122 42.0856	1366.0 0.0	go to WP16 for next T lance measure	
13/03/2008	08:41:19	Yonaguni knoll	N 24 50.8269 E 122 42.0860	1364.8 1.3	tape 8 in	
13/03/2008	08:44:35	Yonaguni knoll	N 24 50.8148 E 122 42.0976	1367.1 2.4	HDTV 9 tape 3 on, will rewind to save tape	
13/03/2008	08:46:46	Yonaguni knoll	N 24 50.8055 E 122 42.0924	1372.4 1.3	reach WP16, target 11	
13/03/2008	08:54:20	Yonaguni knoll	N 24 50.8083 E 122 42.1014	1375.5 0.0	Tlance no 9 , it sank into the sediment til the top handle	
13/03/2008	08:56:36	Yonaguni knoll	N 24 50.8088 E 122 42.1019	1375.5 0.4	measurement TL9 start, stills	

13/03/2008	09:05:23	Yonaguni knoll	N 24 50.8089 E 122 42.1021	1374.9 0.3	measurement T9 end, no gas bubbles	
13/03/2008	09:07:55	Yonaguni knoll	N 24 50.8097 E 122 42.1031	1375.3 0.3	HDTV 9 tape 3 off	
13/03/2008	09:15:58	Yonaguni knoll	N 24 50.7970 E 122 42.0675	1370.5 2.6	arrived at WP11, target 12	
13/03/2008	09:18:31	Yonaguni knoll	N 24 50.7973 E 122 42.0676	1372.9 0.3	start T measure no 10	
13/03/2008	09:19:54	Yonaguni knoll	N 24 50.7978 E 122 42.0690	1372.7 0.3	HDTV 10 tape 3 on	
13/03/2008	09:20:35	Yonaguni knoll	N 24 50.7970 E 122 42.0692	1372.9 0.2	lance slides into sediment, stills taken	
13/03/2008	09:25:24	Yonaguni knoll	N 24 50.7977 E 122 42.0684	1373.0 0.2	T 10 measurement end	
13/03/2008	09:28:38	Yonaguni knoll	N 24 50.7970 E 122 42.0667	1372.9 0.4	go to WP15, target 13	
13/03/2008	09:29:55	Yonaguni knoll	N 24 50.8012 E 122 42.0728	1369.9 2.5	HDTV No 10 end tape 3, change to tape 4	

13/03/2008	09:30:23	Yonaguni knoll	N 24 50.8102 E 122 42.0727	1367.6 1.3	approaching rocks	
13/03/2008	09:30:59	Yonaguni knoll	N 24 50.8204 E 122 42.0717	1363.5 3.3	crossing rocks, old chimneys	
13/03/2008	09:32:45	Yonaguni knoll	N 24 50.8189 E 122 42.0654	1361.7 2.6	HDTV 11 tape 4 on while crossing rocks	
13/03/2008	09:33:29	Yonaguni knoll	N 24 50.8193 E 122 42.0672	1361.6 3.3	HDTV 11 tape 4 off	
13/03/2008	09:34:16	Yonaguni knoll	N 24 50.8225 E 122 42.0812	1365.7 2.0	soft sediment again	
13/03/2008	09:37:38	Yonaguni knoll	N 24 50.8221 E 122 42.0820	1367.6 0.0	t measure 11 start, again sinking in to th e handle, still	
13/03/2008	09:42:39	Yonaguni knoll	N 24 50.8230 E 122 42.0830	1367.5 0.0	no gas bubbles emerging, end of T lance 11	
13/03/2008	09:48:44	Yonaguni knoll	N 24 50.8308 E 122 42.0881	1362.4 3.3	antje out, dirk in	
13/03/2008	10:01:53	Yonaguni knoll	N 24 50.8311 E 122 42.0166	1376.2 2.5	end of dive, pack profiler and surface	

created Mon Mar 24 14:40:54 JST 2008

Appendix

Dive 202
ALAMER : Operation list
Dive summaries Alamere

ALAMER : Operation list

Cruise : **SO196 - SUMSUN**
Dive : 202 SO196_042

Operation list :

Equipment	Num	Date	Hour	Latitude	Longitude	Depth	Altitude	Location	Biology	Water	Geochem.	Measure	Pict.	File	Comments
CO2 Sensor Contros	1	15/03/2008	04:03:52	N 24 51.5747	E 123 50.4501	1526	2	Hatoma knoll					55	X	removing CONTROS from venting site; end No 1 and storage (start 03:49)
CO2 Sensor Contros	2	15/03/2008	08:41:41	N 24 51.5839	E 123 50.4460	1523	0	Hatoma knoll					127	X	pCO2 CONTROS sensor No 2 off (start 08:31)
CO2 Sensor Contros	3	15/03/2008	12:41:39	N 24 51.4950	E 123 50.4781	1474	1	Hatoma knoll					191	X	stop pCO2 CONTROS No 3 (start 12:31)
CO2 pH T Sensor handheld	1	15/03/2008	03:37:26	N 24 51.5747	E 123 50.4507	1525	2	Hatoma knoll					45	X	storage of handheld after measurement No 1 (start 03:25)
CO2 pH T Sensor handheld	2	15/03/2008	08:23:00	N 24 51.5830	E 123 50.4458	1523	1	Hatoma knoll					12	X	CO2 HHS No 2 off bubble screen (start 08:11)
CO2 pH T Sensor handheld	3	15/03/2008	12:24:14	N 24 51.4934	E 123 50.4777	1474	1	Hatoma knoll					185	X	stop HH-measurement No 3 (start 12:13)
Gas sampler	1	15/03/2008	05:36:02	N 24 51.5766	E 123 50.4505	1526	1	Hatoma knoll			X		77		gassampler 1 closed
Gas sampler	2	15/03/2008	11:52:30	N 24 51.4939	E 123 50.4790	1474	1	Hatoma knoll			X		181		closing sampler; HDTV off
Gas sampler	3	15/03/2008	07:58:38	N 24 51.5846	E 123 50.4462	1524	1	Hatoma knoll			X		114		sampler closed
Gas sampler	4	15/03/2008	06:14:17	N 24 51.5743	E 123 50.4495	1525	1	Hatoma knoll			X		88		sampler seems to be full; stop sampling
HDTV camera	1	15/03/2008	02:10:51	N 24	E 123 50.4672	1530	1	Hatoma					2	X	stop HDTV No 1 (02:08)

				51.5865				knoll							
HDTV camera	2	15/03/2008	02:18:10	N 24 51.5822	E 123 50.4526	1519	7	Hatoma knoll					25	X	stop HDTV No 2 (02:11)
HDTV camera	3	15/03/2008	03:12:12	N 24 51.5754	E 123 50.4502	1525	1	Hatoma knoll					38	X	HDTV No 3 off (02:22)
HDTV camera	4	15/03/2008	03:38:50	N 24 51.5746	E 123 50.4510	1525	2	Hatoma knoll					46	X	HDTV No 4 stop (start 03:28)
HDTV camera	5	15/03/2008	04:03:31	N 24 51.5747	E 123 50.4508	1525	2	Hatoma knoll					54	X	HDTV No 5 stop (start 03:45)
HDTV camera	6	15/03/2008	05:39:20	N 24 51.5757	E 123 50.4496	1525	1	Hatoma knoll					78	X	change to tape HD 4; HDTV No 6 (start 04:16)
HDTV camera	7	15/03/2008	06:16:11	N 24 51.5748	E 123 50.4497	1526	1	Hatoma knoll					91	X	HDTV No 7 stop (start 06:03)
HDTV camera	8	15/03/2008	07:02:27	N 24 51.5799	E 123 50.4460	1525	1	Hatoma knoll					11	X	HDTV No 8 stop (start 06:57)
HDTV camera	9	15/03/2008	07:15:45	N 24 51.5847	E 123 50.4438	1524	0	Hatoma knoll					14	X	HDTV No 9 off (start 07:12)
HDTV camera	10	15/03/2008	07:20:43	N 24 51.5861	E 123 50.4458	1524	0	Hatoma knoll					16	X	HDTV scaling - HDTV No 10 off - Position for next gassampling (start 07:17)
HDTV camera	11	15/03/2008	08:03:49	N 24 51.5842	E 123 50.4457	1523	1	Hatoma knoll					115	X	HDTV No 11 off (start 07:24)
HDTV camera	12	15/03/2008	08:25:40	N 24 51.5842	E 123 50.4455	1523	1	Hatoma knoll					121	X	HDTV No 12 off (start 08:09)
HDTV camera	13	15/03/2008	08:45:19	N 24 51.5844	E 123 50.4450	1523	0	Hatoma knoll					128	X	pCO2 sensor stored / HDTV No 13 off (start 08:38)
HDTV camera	14	15/03/2008	09:08:28	N 24 51.5113	E 123 50.4869	1479	5	Hatoma knoll					132	X	HDTV No 14 off; change HD-tape; new: tape 6 (start 09:04)
HDTV camera	15	15/03/2008	10:00:00	N 24 51.4893	E 123 50.4623	1489	2	Hatoma knoll					149	X	HDTV No 15 off; change HD-tape; new: 7 (start 09:15)
HDTV camera	16	15/03/2008	10:11:37	N 24 51.4850	E 123 50.4633	1488	1	Hatoma knoll					153	X	HDTV No 16 off (start 10:01)
HDTV camera	17	15/03/2008	10:29:14	N 24 51.4956	E 123 50.4824	1471	8	Hatoma knoll					158	X	HDTV No 17 off (start 10:25)
HDTV camera	18	15/03/2008	10:48:06	N 24 51.4938	E 123 50.4818	1474	1	Hatoma knoll					163	X	HDTV No 18 off (start 10:30)
HDTV camera	20	15/03/2008	11:55:21	N 24 51.4955	E 123 50.4787	1473	1	Hatoma knoll					182	X	storing of gas sampler; end of HDTV No 19-20 before (start 11:00)
HDTV camera	21	15/03/2008	12:36:15	N 24 51.4945	E 123 50.4792	1474	1	Hatoma knoll					19	X	HDTV No 21 off (start 12:33)
HDTV camera	22	15/03/2008	13:48:53	N 24 51.5668	E 123 50.5036	1526	5	Hatoma knoll					21	X	stop HDTV No 22 (start 13:22)
T Lance online	1	15/03/2008	03:10:19	N 24	E 123 50.4505	1525	1	Hatoma					37	X	begin temp-measurement No 1; no

				51.5748				knoll							change of temperature (start 03:07)
T Lance online	2	15/03/2008	04:21:04	N 24 51.5760	E 123 50.4495	1525	1	Hatoma knoll					61	X	Stop temp measurement No 2 (start 04:10)
T Lance online	3	15/03/2008	04:45:01	N 24 51.5761	E 123 50.4504	1525	1	Hatoma knoll					66	X	T max 5.2 T lance No 3 (start 04:35)
T Lance online	4	15/03/2008	11:08:23	N 24 51.4931	E 123 50.4789	1474	1	Hatoma knoll					17	X	T lance No 4 temperature around 10 deg C (start 11:05)
T Lance online	5	15/03/2008	11:17:40	N 24 51.4930	E 123 50.4786	1474	1	Hatoma knoll					174	X	stop T lance measurement No 5 (start 11:09)
T Lance online	0	15/03/2008	14:06:29	N 24 51.5720	E 123 50.5043	1472	0	Hatoma knoll					28	X	Stop video recording ; captureing etc.; stop T-lance logging TL 00 (start 01:11)
Tlance-corer assembly	1	15/03/2008	13:48:53	N 24 51.5668	E 123 50.5036	1526	5	Hatoma knoll						X	Stop Tlance-corer assembly 01 (start 12:54)

Dive summary

ROV Quest - Dive: 202- 6

SUMSUN (Sonne)

Date: **15/03/2008**
Observers: **NAKAMURA Koichi**
Station: **Hatoma knoll**
Position: **N 24 51.5079 E 123 50.4998**

Dive duration:

Start: **15/03/2008 00:05:00**
At bottom: **15/03/2008 01:13:50**
Leave bottom: **15/03/2008 14:03:00**
End: **15/03/2008 15:00:00**

Explored sites:

Dive objectives:

Objectives, Mission and Time Plan
1. Start T-lance logger on downcast
2. Place Bubble box at WP “Bubble Chamber Dive 200
3. Proceed toward bubble site heading WNW (1h)
a. Take gas sample of CO2 droplets, if necessary heat gas before closing on hydrothermal site.
b. Take gas sample of CO2 droplets by new coring device, heat up, allow cooling and screen phase transition
4. pCO2 online, take handheld
5. look for decent site for rise experiment, notate angle and orientation, exact point on subpositioning
6. Get bubble box (2h- total 3h)
7. Try bubble chase experiments (3h total 6h)
8. Dispose bubble box, Head towards 189-2 M, use T-Probe occasionally, look for pCO2 gradient with pCO2-sensor (1h- total 7h)
9. Get gas from seep at target 6 position, take under warmth, move up and monitor phase transition HD (1h, total 8h)
10. Head forward to main hydrothermal sites 189-1M, 103-1 etc
10a. Take gas /liquid CO2 samples at all visual gas sites (4 gas samplers in total) with pCO2 measurments and handheld
10b. Take additional gas for Ko-Ichi sampler and monitor cooling behaviour
11. Head back tot pick up bubble box (2h, total 10h)
12. End of dive

ROV Shifts (2 hours):
Start to12:00 Rehder, Thomas
12:00 to 14:00 Nakamura, Schneider
14:00 to 16:00 Rehder, Schneider
16:00 to 18:00 Rehder/Nakamura, Lage
18:00 to 20:00 Nakamura/Rehder, Thomas

Operations synthesis:

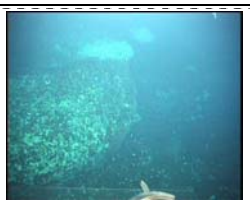
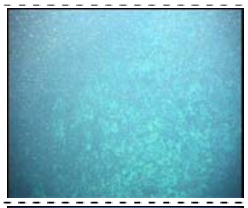
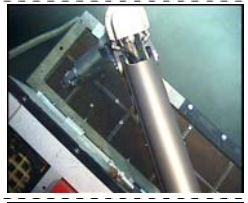
Sampling operations
Sediment :
Gas sampler : 4 samples,
Measures
34 continue measures were realised,

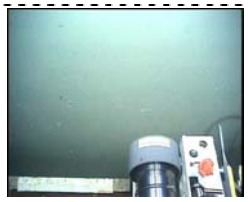
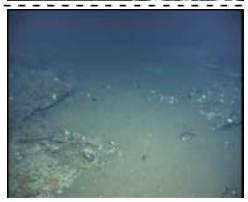
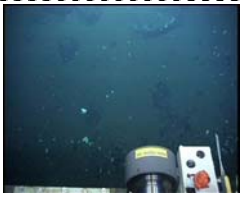
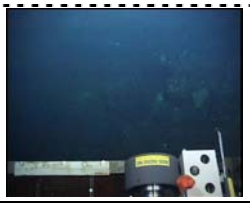
207 pictures captured,
1 new locality defined: Marker 7.

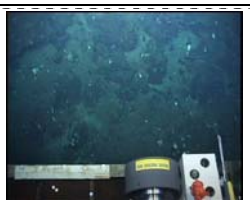
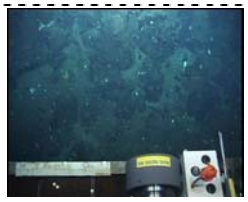
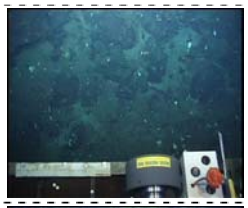
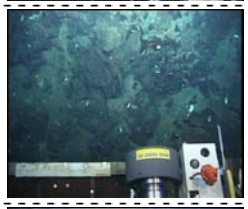
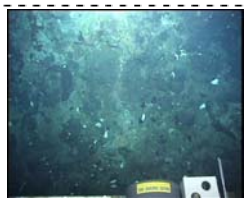
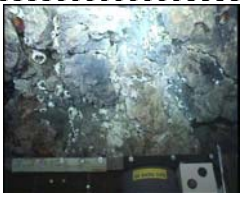
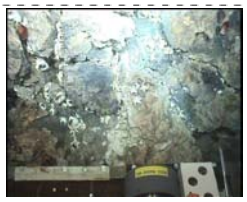
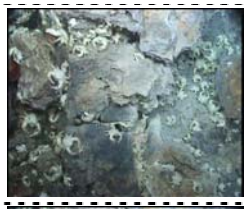
Dive summary:

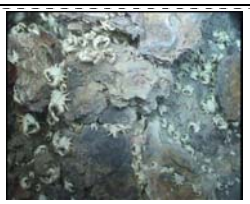
Dive report:

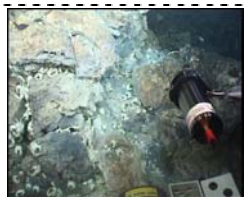
Date	Hour	Location	Latitude Longitude	Immersion Altitude	Comments	Picture
15/03/2008	01:07:37	Hatoma knoll	N 24 51.6752 E 123 50.6442	1319.5 0.0	Alamer starts	
15/03/2008	01:08:08	Hatoma knoll	N 24 51.6743 E 123 50.6402	1329.4 0.0	start position 400m NE of target position, target 5 bubble chamber dive 200	
15/03/2008	01:11:39	Hatoma knoll	N 24 51.6675 E 123 50.6165	1395.6 14.8	T-lance data logger started in file 202_01.dat	
15/03/2008	01:13:50	Hatoma knoll	N 24 51.6654 E 123 50.6042	1425.0 1.8	reach bottom	
15/03/2008	01:14:13	Hatoma knoll	N 24 51.6660 E 123 50.6013	1425.2 3.5	start adelie frame	
15/03/2008	01:14:38	Hatoma knoll	N 24 51.6640 E 123 50.5961	1424.6 6.1	start tape A1 B1	
15/03/2008	01:15:10	Hatoma knoll	N 24 51.6630 E 123 50.5918	1426.8 6.1	heading SW towards target position	

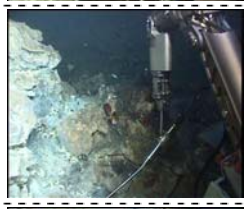
15/03/2008	01:22:30	Hatoma knoll	N 24 51.6496 E 123 50.5614	1479.2 4.2	large rocks	
15/03/2008	01:23:29	Hatoma knoll	N 24 51.6433 E 123 50.5581	1485.1 3.9	big chimneys	
15/03/2008	01:30:06	Hatoma knoll	N 24 51.6350 E 123 50.5574	1486.7 7.7	near to big rock (granit maybe)	
15/03/2008	01:33:34	Hatoma knoll	N 24 51.6312 E 123 50.5523	1493.9 4.0	some chimneys	
15/03/2008	01:42:36	Hatoma knoll	N 24 51.6146 E 123 50.5257	1523.6 5.8	drive to target position to deposite bubble box	
15/03/2008	01:51:33	Hatoma knoll	N 24 51.5757 E 123 50.5065	1531.0 2.3	deposite bubble box	
15/03/2008	01:59:33	Hatoma knoll	N 24 51.5762 E 123 50.5067	1532.4 1.1	repair front of ROV	
15/03/2008	02:01:19	Hatoma knoll	N 24 51.5756 E 123 50.5062	1532.5 1.1	heading towards marker 2 droplet side	
15/03/2008	02:04:39	Hatoma knoll	N 24 51.5810 E 123 50.4898	1532.7 1.2	heading 276, still sediment cover	

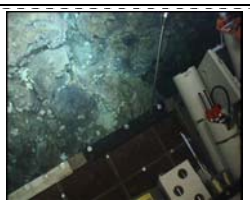
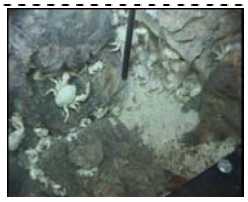
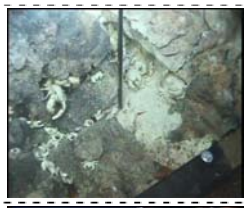
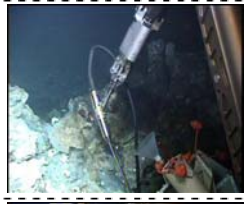
15/03/2008	02:06:42	Hatoma knoll	N 24 51.5850 E 123 50.4769	1532.0 1.2	still sediment cover	
15/03/2008	02:08:30	Hatoma knoll	N 24 51.5852 E 123 50.4721	1530.8 1.2	start HD, film sponge, still sediment cover	
15/03/2008	02:10:51	Hatoma knoll	N 24 51.5865 E 123 50.4672	1530.3 1.2	stop HDTV No 1 (02:08)	
15/03/2008	02:11:35	Hatoma knoll	N 24 51.5865 E 123 50.4643	1528.8 1.2	stop sediment cover, some small rocks	
15/03/2008	02:11:57	Hatoma knoll	N 24 51.5862 E 123 50.4624	1528.2 1.1	start HD, rocks	
15/03/2008	02:13:26	Hatoma knoll	N 24 51.5851 E 123 50.4553	1526.2 3.1	near droplet side (20m)	
15/03/2008	02:16:10	Hatoma knoll	N 24 51.5833 E 123 50.4483	1517.3 7.4	HD still on, still of dead chimney	
15/03/2008	02:18:10	Hatoma knoll	N 24 51.5822 E 123 50.4526	1519.9 7.1	stop HDTV No 2 (02:11)	
15/03/2008	02:19:13	Hatoma knoll	N 24 51.5810 E 123 50.4523	1522.3 4.6	marker 364, JAMSTEC	

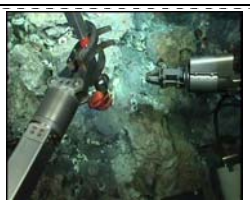
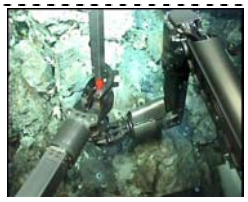
15/03/2008	02:19:59	Hatoma knoll	N 24 51.5782 E 123 50.4512	1524.9 2.8	change tape A2 B2	
15/03/2008	02:20:43	Hatoma knoll	N 24 51.5776 E 123 50.4508	1524.4 2.8	rising bubbles	
15/03/2008	02:22:06	Hatoma knoll	N 24 51.5779 E 123 50.4509	1525.3 2.8	HD on	
15/03/2008	02:25:48	Hatoma knoll	N 24 51.5774 E 123 50.4510	1525.8 2.3	start flying aroung bubbling site over starbord side	
15/03/2008	02:30:22	Hatoma knoll	N 24 51.5751 E 123 50.4483	1525.4 2.7	bubbles	
15/03/2008	02:37:11	Hatoma knoll	N 24 51.5765 E 123 50.4484	1525.3 2.0	landing at droplet site	
15/03/2008	02:39:18	Hatoma knoll	N 24 51.5742 E 123 50.4491	1525.5 1.8	laser pointer for 10 min	
15/03/2008	02:53:33	Hatoma knoll	N 24 51.5744 E 123 50.4509	1525.6 1.8	just filming	
15/03/2008	02:55:32	Hatoma knoll	N 24 51.5765 E 123 50.4506	1525.8 1.8	change HD-tape, new: tape 2	

15/03/2008	03:07:05	Hatoma knoll	N 24 51.5750 E 123 50.4499	1526.5 1.9	use t-lance	
15/03/2008	03:10:19	Hatoma knoll	N 24 51.5748 E 123 50.4505	1525.9 1.9	begin temp-measurement No 1, no change of temperature (start 03:07)	
15/03/2008	03:12:12	Hatoma knoll	N 24 51.5754 E 123 50.4502	1525.6 1.9	HDTV No 3 off (02:22)	
15/03/2008	03:22:57	Hatoma knoll	N 24 51.5757 E 123 50.4509	1526.0 1.9	deploying handheld sensor	
15/03/2008	03:23:45	Hatoma knoll	N 24 51.5762 E 123 50.4503	1525.5 2.0	tape change, new: tape 3	
15/03/2008	03:25:29	Hatoma knoll	N 24 51.5757 E 123 50.4512	1525.6 2.0	handheld measurement start, located directly above cold fluid venting and droplet site	
15/03/2008	03:28:37	Hatoma knoll	N 24 51.5754 E 123 50.4513	1525.9 2.0	HD start	
15/03/2008	03:29:52	Hatoma knoll	N 24 51.5769 E 123 50.4493	1525.3 2.0	shimmering water and droplet escape is pulsating	
15/03/2008	03:35:15	Hatoma knoll	N 24 51.5765 E 123 50.4514	1525.6 2.0	laser pointer	

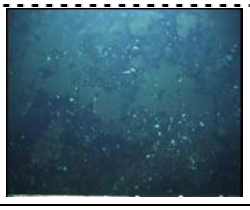
15/03/2008	03:37:26	Hatoma knoll	N 24 51.5747 E 123 50.4507	1525.7 2.0	storage of handheld after measurement No 1 (start 03:25)	
15/03/2008	03:38:50	Hatoma knoll	N 24 51.5746 E 123 50.4510	1525.7 2.0	HDTV No 4 stop (start 03:28)	
15/03/2008	03:45:34	Hatoma knoll	N 24 51.5767 E 123 50.4510	1525.8 1.9	hd start	
15/03/2008	03:47:54	Hatoma knoll	N 24 51.5745 E 123 50.4509	1525.3 1.9	deploying CONTROS pCO2	
15/03/2008	03:49:17	Hatoma knoll	N 24 51.5740 E 123 50.4499	1525.4 2.0	start measurement appr. half meter away from droplets	
15/03/2008	03:51:06	Hatoma knoll	N 24 51.5741 E 123 50.4501	1525.7 2.0	moving closer to venting site approx. 10cm, but position is upstream	
15/03/2008	03:55:28	Hatoma knoll	N 24 51.5745 E 123 50.4499	1525.7 2.0	zooming HD on small bubble string	
15/03/2008	03:55:57	Hatoma knoll	N 24 51.5740 E 123 50.4496	1526.0 2.0	laser pointer	
15/03/2008	03:57:16	Hatoma knoll	N 24 51.5737 E 123 50.4495	1525.7 2.0	laser pointer shift	

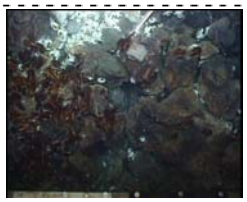
15/03/2008	04:03:31	Hatoma knoll	N 24 51.5747 E 123 50.4508	1525.6 2.0	HDTV No 5 stop (start 03:45)	
15/03/2008	04:03:52	Hatoma knoll	N 24 51.5747 E 123 50.4501	1526.5 2.0	removing CONTROS from venting site, end No 1 and storage (start 03:49)	
15/03/2008	04:07:30	Hatoma knoll	N 24 51.5757 E 123 50.4497	1526.4 1.9	deploying T-Lance	
15/03/2008	04:09:41	Hatoma knoll	N 24 51.5758 E 123 50.4490	1525.7 2.0	HD tape no.3	
15/03/2008	04:10:36	Hatoma knoll	N 24 51.5757 E 123 50.4505	1525.2 2.0	T probe inserted into vent	
15/03/2008	04:11:41	Hatoma knoll	N 24 51.5754 E 123 50.4480	1525.8 2.0	5 deg C at the moment, try to locate the ROV for better position to measure temp	
15/03/2008	04:16:00	Hatoma knoll	N 24 51.5769 E 123 50.4484	1526.0 1.9	HD recording start	
15/03/2008	04:21:04	Hatoma knoll	N 24 51.5760 E 123 50.4495	1525.5 1.2	Stop temp measurement No 2 (start 04:10)	
15/03/2008	04:28:58	Hatoma knoll	N 24 51.5766 E 123 50.4502	1526.1 2.0	minDV no.4 start	

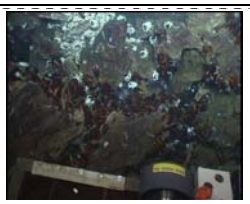
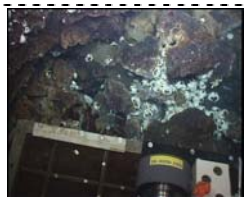
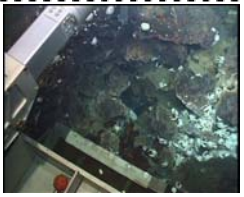
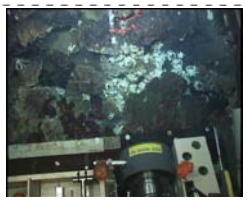
15/03/2008	04:35:25	Hatoma knoll	N 24 51.5762 E 123 50.4512	1525.4 2.6	ROV pulled away so that we try to relocate the ROV	
15/03/2008	04:38:16	Hatoma knoll	N 24 51.5771 E 123 50.4507	1525.6 1.7	Try to measure temp of small bubble vent	
15/03/2008	04:42:23	Hatoma knoll	N 24 51.5762 E 123 50.4490	1526.0 1.7	T is 5 deg and frame glub	
15/03/2008	04:45:01	Hatoma knoll	N 24 51.5761 E 123 50.4504	1525.7 1.7	T max 5.2 T lance No 3 (start 04:35)	
15/03/2008	04:52:10	Hatoma knoll	N 24 51.5762 E 123 50.4503	1525.8 1.6	Take out gas sampler no.1	
15/03/2008	04:56:16	Hatoma knoll	N 24 51.5755 E 123 50.4505	1525.8 1.8	Try to glub the gas sampler 1 by the left manup	
15/03/2008	04:59:01	Hatoma knoll	N 24 51.5771 E 123 50.4491	1525.7 1.7	Vent is to far to reach so that reposition the ROV	
15/03/2008	05:05:52	Hatoma knoll	N 24 51.5750 E 123 50.4501	1525.8 1.6	Hydrate is forming in the funnel	
15/03/2008	05:07:28	Hatoma knoll	N 24 51.5745 E 123 50.4498	1525.8 1.6	Funnel hydrate was removed.	

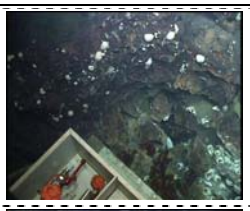
15/03/2008	05:10:25	Hatoma knoll	N 24 51.5751 E 123 50.4509	1525.7 1.6	handle opened to take gas bubble	
15/03/2008	05:16:46	Hatoma knoll	N 24 51.5740 E 123 50.4504	1525.8 1.6	remove funnel to allow single bubble capturing without hydrate formation	
15/03/2008	05:26:17	Hatoma knoll	N 24 51.5739 E 123 50.4488	1525.9 1.7	since 5 mn capturing single bubbles	
15/03/2008	05:31:34	Hatoma knoll	N 24 51.5746 E 123 50.4510	1526.0 1.7	gassampler 1 iscompletely full	
15/03/2008	05:32:37	Hatoma knoll	N 24 51.5746 E 123 50.4486	1525.8 1.7	changetape, A5 andB5	
15/03/2008	05:36:02	Hatoma knoll	N 24 51.5766 E 123 50.4505	1526.1 1.7	gassampler 1 closed	
15/03/2008	05:39:20	Hatoma knoll	N 24 51.5757 E 123 50.4496	1525.7 1.6	change to tape HD 4, HDTV No 6 (start 04:16)	
15/03/2008	05:40:58	Hatoma knoll	N 24 51.5753 E 123 50.4496	1526.1 1.6	gassampler 1 safely stored	
15/03/2008	05:46:13	Hatoma knoll	N 24 51.5754 E 123 50.4489	1525.8 1.5	getting ready for sampling gas from vent 20 cm back	

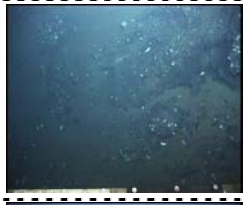
15/03/2008	05:49:11	Hatoma knoll	N 24 51.5754 E 123 50.4500	1526.0 1.7	getting gas sampler 4 from drawer	
15/03/2008	05:51:22	Hatoma knoll	N 24 51.5743 E 123 50.4511	1525.8 1.7	funnel removed by Orion	
15/03/2008	05:52:11	Hatoma knoll	N 24 51.5748 E 123 50.4509	1525.6 1.7	funnel is bouyant and block camera view	
15/03/2008	05:56:03	Hatoma knoll	N 24 51.5745 E 123 50.4500	1525.7 1.7	Orion takes over gas sampler from Riggmaster	
15/03/2008	05:58:50	Hatoma knoll	N 24 51.5750 E 123 50.4489	1525.7 1.7	Orion is opening the valve	
15/03/2008	06:03:22	Hatoma knoll	N 24 51.5748 E 123 50.4500	1525.9 1.7	HD start	
15/03/2008	06:03:56	Hatoma knoll	N 24 51.5746 E 123 50.4490	1525.8 1.7	start sampling from adjacent vent with larger bubbles and broader bubble size distribution. This vent is pulsating	
15/03/2008	06:14:17	Hatoma knoll	N 24 51.5743 E 123 50.4495	1525.9 1.7	sampler seems to be full, stop sampling	

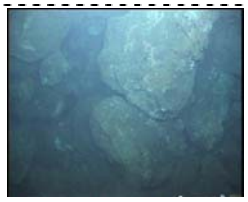
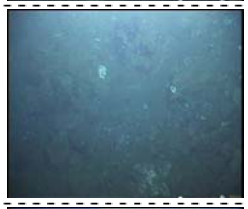
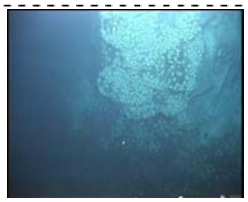
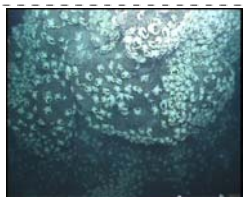
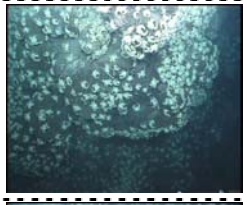
15/03/2008	06:14:40	Hatoma knoll	N 24 51.5753 E 123 50.4502	1525.6 1.7	still photo	
15/03/2008	06:15:03	Hatoma knoll	N 24 51.5757 E 123 50.4500	1525.3 1.7	still photo	
15/03/2008	06:16:11	Hatoma knoll	N 24 51.5748 E 123 50.4497	1526.4 1.7	HDTV No 7 stop (start 06:03)	
15/03/2008	06:20:32	Hatoma knoll	N 24 51.5750 E 123 50.4494	1525.5 1.7	gas sampler closed	
15/03/2008	06:24:06	Hatoma knoll	N 24 51.5758 E 123 50.4504	1526.0 1.6	gas sampler 4 safely stored into backbord drawer	
15/03/2008	06:33:17	Hatoma knoll	N 24 51.5751 E 123 50.4485	1524.9 2.6	transit towards next potential bubble site towards WNW appr. 20m	
15/03/2008	06:35:01	Hatoma knoll	N 24 51.5760 E 123 50.4519	1525.4 2.2	tape change, new A6 B6	
15/03/2008	06:41:16	Hatoma knoll	N 24 51.5886 E 123 50.4384	1519.0 6.0	looking for bubbles	
15/03/2008	06:52:17	Hatoma knoll	N 24 51.5794 E 123 50.4432	1524.1 3.0	bubbles detected, activity is very low, small bubbles, white crabs surrounding	

					the releasing spot and further away brownish mussels	
15/03/2008	06:57:16	Hatoma knoll	N 24 51.5818 E 123 50.4450	1525.4 2.0	HD start	
15/03/2008	06:59:43	Hatoma knoll	N 24 51.5814 E 123 50.4444	1524.8 1.9	set Marker #7	
15/03/2008	07:01:18	Hatoma knoll	N 24 51.5811 E 123 50.4446	1525.2 1.5	still photo	
15/03/2008	07:02:27	Hatoma knoll	N 24 51.5799 E 123 50.4460	1525.4 1.6	HDTV No 8 stop (start 06:57)	
15/03/2008	07:05:36	Hatoma knoll	N 24 51.5830 E 123 50.4425	1523.4 3.1	Found Marker 1	
15/03/2008	07:12:09	Hatoma knoll	N 24 51.5849 E 123 50.4450	1525.0 0.9	HD on	
15/03/2008	07:15:45	Hatoma knoll	N 24 51.5847 E 123 50.4438	1524.2 0.8	HDTV No 9 off (start 07:12)	
15/03/2008	07:17:04	Hatoma knoll	N 24 51.5843 E 123 50.4441	1524.1 0.8	HD on	

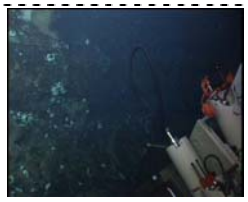
15/03/2008	07:20:43	Hatoma knoll	N 24 51.5861 E 123 50.4458	1524.2 0.9	HDTV scaling - HDTV No 10 off - Position for next gassampling (start 07:17)	
15/03/2008	07:24:37	Hatoma knoll	N 24 51.5854 E 123 50.4458	1524.4 0.9	HD on	
15/03/2008	07:32:59	Hatoma knoll	N 24 51.5862 E 123 50.4447	1524.2 1.0	start handling gassampler	
15/03/2008	07:34:37	Hatoma knoll	N 24 51.5849 E 123 50.4458	1524.0 1.0	change tape A7 - B7	
15/03/2008	07:39:52	Hatoma knoll	N 24 51.5850 E 123 50.4459	1523.9 1.0	funnel in front of trouster	
15/03/2008	07:42:15	Hatoma knoll	N 24 51.5849 E 123 50.4456	1523.9 1.1	gassampler3 open	
15/03/2008	07:46:34	Hatoma knoll	N 24 51.5848 E 123 50.4458	1524.2 1.1	sampling	
15/03/2008	07:54:30	Hatoma knoll	N 24 51.5843 E 123 50.4443	1524.2 1.1	stop samlpling -	
15/03/2008	07:58:38	Hatoma knoll	N 24 51.5846 E 123 50.4462	1524.0 1.1	sampler closed	

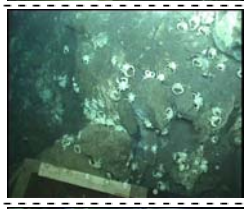
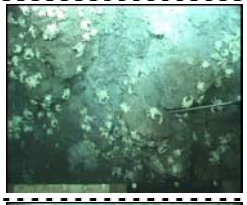
15/03/2008	08:03:49	Hatoma knoll	N 24 51.5842 E 123 50.4457	1523.5 1.0	HDTV No 11 off (start 07:24)	
15/03/2008	08:06:00	Hatoma knoll	N 24 51.5846 E 123 50.4458	1523.6 1.0	CO2 HHS	
15/03/2008	08:09:05	Hatoma knoll	N 24 51.5849 E 123 50.4446	1524.0 0.9	HD on	
15/03/2008	08:11:19	Hatoma knoll	N 24 51.5841 E 123 50.4458	1523.8 1.0	08:11 start	
15/03/2008	08:17:46	Hatoma knoll	N 24 51.5849 E 123 50.4452	1524.1 1.0	sensor better into bubble center	
15/03/2008	08:23:00	Hatoma knoll	N 24 51.5830 E 123 50.4458	1523.3 1.0	CO2 HHS No 2 off bubble screen (start 08:11)	
15/03/2008	08:25:40	Hatoma knoll	N 24 51.5842 E 123 50.4455	1523.9 1.0	HDTV No 12 off (start 08:09)	
15/03/2008	08:29:39	Hatoma knoll	N 24 51.5839 E 123 50.4453	1523.7 0.9	take P CO2 CONTROS sensor out	
15/03/2008	08:30:23	Hatoma knoll	N 24 51.5842 E 123 50.4455	1523.8 1.0	placing pCO2 Sensor in bubble screen	

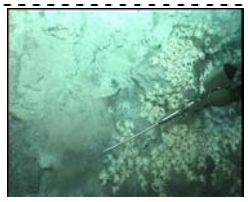
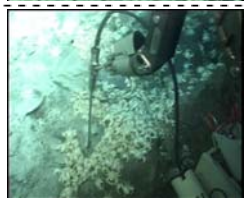
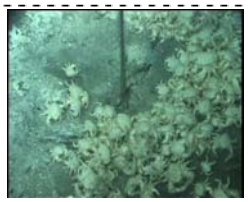
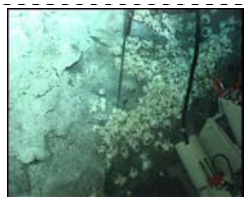
15/03/2008	08:31:28	Hatoma knoll	N 24 51.5842 E 123 50.4455	1524.1 1.0	pCo2 sensor on	
15/03/2008	08:35:06	Hatoma knoll	N 24 51.5832 E 123 50.4458	1523.9 1.0	change tape - 8A+B	
15/03/2008	08:38:13	Hatoma knoll	N 24 51.5835 E 123 50.4461	1523.6 0.9	HD on	
15/03/2008	08:41:41	Hatoma knoll	N 24 51.5839 E 123 50.4460	1523.5 0.9	pCO2 CONTROS sensor No 2 off (start 08:31)	
15/03/2008	08:45:19	Hatoma knoll	N 24 51.5844 E 123 50.4450	1523.5 0.9	pCO2 sensor stored / HDTV No 13 off (start 08:38)	
15/03/2008	08:53:46	Hatoma knoll	N 24 51.5832 E 123 50.4431	1523.7 2.0	drive to SE 200m	
15/03/2008	09:02:00	Hatoma knoll	N 24 51.5417 E 123 50.4734	1512.2 8.3	hugh rocks	
15/03/2008	09:04:36	Hatoma knoll	N 24 51.5293 E 123 50.4824	1496.7 2.7	HD on	
15/03/2008	09:08:28	Hatoma knoll	N 24 51.5113 E 123 50.4869	1479.5 5.0	HDTV No 14 off, change HD-tape, new: tape 6 (start 09:04)	

15/03/2008	09:13:45	Hatoma knoll	N 24 51.4931 E 123 50.4975	1492.6 2.0	reach area	
15/03/2008	09:14:33	Hatoma knoll	N 24 51.4931 E 123 50.4949	1488.7 4.7	big chimney	
15/03/2008	09:15:29	Hatoma knoll	N 24 51.4925 E 123 50.4916	1487.4 4.1	HD on	
15/03/2008	09:15:44	Hatoma knoll	N 24 51.4921 E 123 50.4907	1486.0 4.4	drive to SW, meanwhile looking for bubbles	
15/03/2008	09:17:57	Hatoma knoll	N 24 51.4940 E 123 50.4801	1469.9 9.3	high chimney with heat site and bubbles	
15/03/2008	09:21:30	Hatoma knoll	N 24 51.4955 E 123 50.4818	1473.7 3.4	source of bubbles	
15/03/2008	09:24:33	Hatoma knoll	N 24 51.4940 E 123 50.4785	1472.2 6.0	searching for other sources	
15/03/2008	09:25:28	Hatoma knoll	N 24 51.4931 E 123 50.4784	1471.9 0.0	go back to first source	
15/03/2008	09:32:18	Hatoma knoll	N 24 51.4957 E 123 50.4804	1472.6 5.8	preparing for measuring the temp at the bubble source	

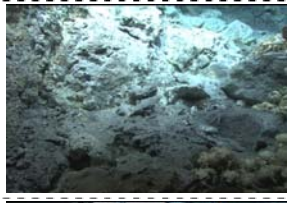
15/03/2008	09:35:15	Hatoma knoll	N 24 51.4949 E 123 50.4798	1475.5 1.1	change tape, # 9, no measurement of temperature	
15/03/2008	09:37:36	Hatoma knoll	N 24 51.4943 E 123 50.4796	1475.4 2.0	Site with gas hydrates and bubblesfloating upwards	
15/03/2008	09:40:31	Hatoma knoll	N 24 51.4946 E 123 50.4796	1475.2 2.1	Correction, no gas hydrates	
15/03/2008	09:46:43	Hatoma knoll	N 24 51.4913 E 123 50.4792	1476.6 3.6	turn to next hydrothermal site at 277 M	
15/03/2008	09:50:32	Hatoma knoll	N 24 51.4875 E 123 50.4648	1485.1 5.8	arriving 277M	
15/03/2008	09:51:49	Hatoma knoll	N 24 51.4869 E 123 50.4631	1482.3 8.2	heat and bubble source	
15/03/2008	09:56:45	Hatoma knoll	N 24 51.4889 E 123 50.4627	1488.5 2.7	gas hydrate, bubble site	
15/03/2008	10:00:00	Hatoma knoll	N 24 51.4893 E 123 50.4623	1489.0 2.2	HDTV No 15 off, change HD-tape, new: 7 (start 09:15)	
15/03/2008	10:01:19	Hatoma knoll	N 24 51.4929 E 123 50.4617	1490.3 1.2	HD on	

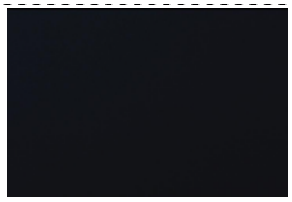
15/03/2008	10:07:09	Hatoma knoll	N 24 51.4946 E 123 50.4605	1487.4 4.9	other side of chimney, hot fluid	
15/03/2008	10:11:14	Hatoma knoll	N 24 51.4852 E 123 50.4623	1488.4 4.1	go back to last area (gas hydrate bubbling site)	
15/03/2008	10:11:37	Hatoma knoll	N 24 51.4850 E 123 50.4633	1488.1 1.4	HDTV No 16 off (start 10:01)	
15/03/2008	10:18:14	Hatoma knoll	N 24 51.4960 E 123 50.4850	1480.5 3.4	arrive gas hydrate bubbling site	
15/03/2008	10:20:56	Hatoma knoll	N 24 51.4917 E 123 50.4822	1472.6 8.8	found bublbling site again, appraoch	
15/03/2008	10:25:20	Hatoma knoll	N 24 51.4939 E 123 50.4819	1475.9 5.1	HD on	
15/03/2008	10:26:04	Hatoma knoll	N 24 51.4937 E 123 50.4823	1476.3 5.1	Monitoring of gas hydrates with overhang	
15/03/2008	10:29:14	Hatoma knoll	N 24 51.4956 E 123 50.4824	1471.8 8.1	HDTV No 17 off (start 10:25)	
15/03/2008	10:30:29	Hatoma knoll	N 24 51.4956 E 123 50.4812	1473.2 4.5	HD on	

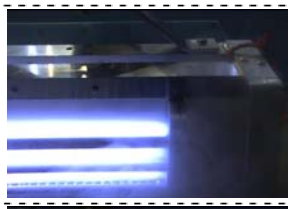
15/03/2008	10:35:25	Hatoma knoll	N 24 51.4935 E 123 50.4813	1475.0 1.6	Main bubble site	
15/03/2008	10:41:47	Hatoma knoll	N 24 51.4953 E 123 50.4796	1475.0 1.6	Change Tape AB 10	
15/03/2008	10:46:19	Hatoma knoll	N 24 51.4936 E 123 50.4799	1474.7 1.6	Repositioning to get gear in place	
15/03/2008	10:48:06	Hatoma knoll	N 24 51.4938 E 123 50.4818	1474.9 1.8	HDTV No 18 off (start 10:30)	
15/03/2008	10:56:11	Hatoma knoll	N 24 51.4928 E 123 50.4794	1474.2 2.1	prepare for t-measurement (take t-lance) while diving	
15/03/2008	10:59:15	Hatoma knoll	N 24 51.4931 E 123 50.4796	1474.1 3.9	t-lance in the hand of ROV	
15/03/2008	11:00:18	Hatoma knoll	N 24 51.4930 E 123 50.4790	1474.4 2.9	HD on	
15/03/2008	11:01:55	Hatoma knoll	N 24 51.4938 E 123 50.4793	1474.7 1.8	start temp-measurement at bubbling source	
15/03/2008	11:03:34	Hatoma knoll	N 24 51.4943 E 123 50.4791	1474.6 1.3	temperature starts to increase, stops at about 5 deg	

15/03/2008	11:05:30	Hatoma knoll	N 24 51.4939 E 123 50.4786	1474.7 1.3	start temp-measurement at the hot fluid	
15/03/2008	11:08:23	Hatoma knoll	N 24 51.4931 E 123 50.4789	1474.0 1.5	T lance No 4 temperature around 10 deg C (start 11:05)	
15/03/2008	11:09:34	Hatoma knoll	N 24 51.4950 E 123 50.4795	1474.3 1.4	start temp-measurement in a small vent, very hot (up to 43 deg C)	
15/03/2008	11:13:33	Hatoma knoll	N 24 51.4943 E 123 50.4796	1473.9 1.3	new try t-measurement (up to 66 deg)	
15/03/2008	11:16:59	Hatoma knoll	N 24 51.4925 E 123 50.4793	1474.2 1.6	change HDTV-tape, new: 8	
15/03/2008	11:17:40	Hatoma knoll	N 24 51.4930 E 123 50.4786	1474.1 1.6	stop T lance measurement No 5 (start 11:09)	
15/03/2008	11:19:44	Hatoma knoll	N 24 51.4946 E 123 50.4801	1474.2 1.6	prepare for gas sampling	
15/03/2008	11:22:44	Hatoma knoll	N 24 51.4940 E 123 50.4790	1474.1 1.4	prepare for sampling without funnel (sampler 2)	
15/03/2008	11:35:23	Hatoma knoll	N 24 51.4959 E 123 50.4792	1474.3 1.4	open sampler	

15/03/2008	11:38:54	Hatoma knoll	N 24 51.4925 E 123 50.4787	1474.0 1.6	change tape, A11 B11	
15/03/2008	11:39:59	Hatoma knoll	N 24 51.4932 E 123 50.4792	1473.9 1.8	HD on, start sampling	
15/03/2008	11:48:23	Hatoma knoll	N 24 51.4938 E 123 50.4779	1474.2 1.4	sampler is completely filled	
15/03/2008	11:52:30	Hatoma knoll	N 24 51.4939 E 123 50.4790	1474.3 1.6	closing sampler, HDTV off	
15/03/2008	11:55:21	Hatoma knoll	N 24 51.4955 E 123 50.4787	1473.9 1.6	storing of gas sampler, end of HDTV No 19-20 before (start 11:00)	
15/03/2008	12:03:40	Hatoma knoll	N 24 51.4960 E 123 50.4806	1474.1 1.8	prepare for HH	
15/03/2008	12:13:39	Hatoma knoll	N 24 51.4921 E 123 50.4782	1474.0 1.4	start measurement with HH for 10 min	
15/03/2008	12:24:14	Hatoma knoll	N 24 51.4934 E 123 50.4777	1474.1 1.4	stop HH-measurement No 3 (start 12:13)	
15/03/2008	12:27:50	Hatoma knoll	N 24 51.4942 E 123 50.4791	1474.3 1.6	prepare for pCO2	

15/03/2008	12:28:16	Hatoma knoll	N 24 51.4950 E 123 50.4791	1474.4 1.6	A-tape not recording until now, now on	
15/03/2008	12:31:21	Hatoma knoll	N 24 51.4945 E 123 50.4803	1474.5 1.6	start pCO2	
15/03/2008	12:33:34	Hatoma knoll	N 24 51.4952 E 123 50.4792	1474.4 1.6	HD on	
15/03/2008	12:36:15	Hatoma knoll	N 24 51.4945 E 123 50.4792	1474.4 1.6	HDTV No 21 off (start 12:33)	
15/03/2008	12:41:39	Hatoma knoll	N 24 51.4950 E 123 50.4781	1474.2 1.6	stop pCO2 CONTROS No 3 (start 12:31)	
15/03/2008	12:41:59	Hatoma knoll	N 24 51.4954 E 123 50.4784	1474.6 1.6	change tape A12 B12	
15/03/2008	12:48:01	Hatoma knoll	N 24 51.4954 E 123 50.4797	1474.0 1.6	set marker #3	
15/03/2008	12:51:47	Hatoma knoll	N 24 51.4948 E 123 50.4801	1474.4 1.6	Take out T probe installed corer (koichi's)	
15/03/2008	12:54:48	Hatoma knoll	N 24 51.4943 E 123 50.4789	1474.3 1.6	Getting the bubbles in the corer, start Tlance-corer assembly 01	

15/03/2008	13:11:43	Hatoma knoll	N 24 51.4922 E 123 50.4777	1474.5 1.6	Finish filled up	
15/03/2008	13:17:09	Hatoma knoll	N 24 51.4963 E 123 50.4782	1474.3 1.6	Get the video image of the corer	
15/03/2008	13:22:24	Hatoma knoll	N 24 51.4995 E 123 50.4953	1475.0 18.1	HD on, in 1470 m to bubble box	
15/03/2008	13:38:11	Hatoma knoll	N 24 51.5539 E 123 50.5023	1521.1 7.8	Change tape to 13 miniDV	
15/03/2008	13:47:00	Hatoma knoll	N 24 51.5661 E 123 50.5040	1526.2 5.5	Tilt down the bubble sampler and watch escaping liq CO2 droplet	
15/03/2008	13:48:53	Hatoma knoll	N 24 51.5668 E 123 50.5036	1526.0 5.5	Stop Tlance-corer assembly 01 (start 12:54)	No picture
15/03/2008	13:48:53	Hatoma knoll	N 24 51.5668 E 123 50.5036	1526.0 5.5	stop HDTV No 22 (start 13:22)	
15/03/2008	13:50:45	Hatoma knoll	N 24 51.5672 E 123 50.5044	1526.4 5.5	Store gas sampler	
15/03/2008	13:52:07	Hatoma knoll	N 24 51.5663 E 123 50.5039	1526.4 5.6	Getting closer to the bubble box	

15/03/2008	13:53:39	Hatoma knoll	N 24 51.5696 E 123 50.5059	1532.4 0.0	Glub bubble box	
15/03/2008	14:00:12	Hatoma knoll	N 24 51.5706 E 123 50.5051	1532.7 0.0	Recover bubble box	
15/03/2008	14:01:31	Hatoma knoll	N 24 51.5721 E 123 50.5051	1532.8 0.0	Bubble box was secured	
15/03/2008	14:03:00	Hatoma knoll	N 24 51.5711 E 123 50.5054	1532.6 0.0	leaving bottom	
15/03/2008	14:06:29	Hatoma knoll	N 24 51.5720 E 123 50.5043	1472.9 0.0	Stop video recording , captureing etc., stop T-lance logging TL 00 (start 01:11)	

created Tue Mar 25 12:50:00 PHT 2008

Appendix

Dive 203
ALAMER : Operation list
Dive summaries Alamere

ALAMER : Operation list

Cruise : **SO196 - SUMSUN**
Dive : 203 SO196_044

Operation list :

Equipment	Num	Date	Hour	Latitude	Longitude	Depth	Altitude	Location	Biology	Water	Geochem.	Measure	Pict.	File	Comments
Benthic chamber 203	1	16/03/2008	04:01:50	N 24 50.7831	E 122 42.0303	1380	0	Yonaguni knoll					12		chamber 203 no 1 started still taken lots of small worms most likely pogonophora
Benthic chamber 203	1	16/03/2008	08:38:01	N 24 50.7801	E 122 42.0327	1378	4	Yonaguni knoll					86		chamber 1 grabbed go to abyss vent
Benthic chamber 203	2	16/03/2008	08:51:44	N 24 50.7806	E 122 42.0266	1382	0	Yonaguni knoll					89		chamber 2 started
Benthic chamber 203	2	16/03/2008	12:11:22	N 24 50.7809	E 122 42.0289	1381	0	Yonaguni knoll					137		Chamber kept on porch dive end
HDTV camera	1	16/03/2008	07:31:42	N 24 50.8521	E 122 42.0226	1379	0	Yonaguni knoll					7	X	HDTV No 1 tape 1 off
HDTV camera	2	16/03/2008	10:33:06	N 24 50.7692	E 122 42.1036	1387	0	Yonaguni knoll					18	X	HDTV No 2 tape 1 stop
INSINC Corer (MPI)	1	16/03/2008	05:09:16	N 24 50.7816	E 122 42.0348	1380	0	Yonaguni knoll	X				22		Insink 1 started
INSINC Corer (MPI)	2	16/03/2008	05:10:38	N 24 50.7824	E 122 42.0339	1380	0	Yonaguni knoll	X				23		Insink 2 started
INSINC Corer (MPI)	3	16/03/2008	05:12:18	N 24 50.7822	E 122 42.0344	1379	0	Yonaguni knoll	X				24		Insink 3
INSINC Corer (MPI)	4	16/03/2008	05:15:08	N 24 50.7825	E 122 42.0354	1380	0	Yonaguni knoll	X				25		Insink 4 started
KIPS bottle	21	16/03/2008	05:31:16	N 24	E 122 42.0356	1380	0	Yonaguni		X			33		KIPS 21

				50.7840				knoll							
KIPS bottle	22	16/03/2008	05:36:17	N 24 50.7850	E 122 42.0362	1380	0	Yonaguni knoll		X			35		KIPS 22
KIPS bottle	23	16/03/2008	05:41:24	N 24 50.7842	E 122 42.0359	1380	0	Yonaguni knoll		X			36		KIPS 23
Push Corer	8	16/03/2008	05:27:11	N 24 50.7847	E 122 42.0361	1380	0	Yonaguni knoll			X		31		PC8
Push Corer	11	16/03/2008	05:19:09	N 24 50.7831	E 122 42.0347	1380	0	Yonaguni knoll			X		27		PC 11
Push Corer	13	16/03/2008	05:21:23	N 24 50.7828	E 122 42.0349	1380	1	Yonaguni knoll			X		28		PC 13
Push Corer	14	16/03/2008	05:24:32	N 24 50.7839	E 122 42.0360	1380	0	Yonaguni knoll			X		3		PC14 still
Push Corer	24	16/03/2008	06:18:58	N 24 50.7801	E 122 42.0285	1383	0	Yonaguni knoll			X		43		PC24 o5 m away from vent
Push Corer	29	16/03/2008	05:23:20	N 24 50.7849	E 122 42.0365	1380	0	Yonaguni knoll			X		29		PC 29 still
Push Corer	33	16/03/2008	06:30:00	N 24 50.7820	E 122 42.0290	1383	0	Yonaguni knoll			X				PC33
Push Corer	36	16/03/2008	05:28:21	N 24 50.7840	E 122 42.0359	1380	0	Yonaguni knoll			X		32		ROV moves during PC taking PC 36 taken
T Lance online	1	16/03/2008	05:49:19	N 24 50.7834	E 122 42.0352	1380	0	Yonaguni knoll					37	X	Tape 4 T lance 1 out
T Lance online	2	16/03/2008	06:27:06	N 24 50.7800	E 122 42.0274	1382	0	Yonaguni knoll					44	X	T lance 2 out go to 0.5 m away from vent
T Lance online	3	16/03/2008	06:35:45	N 24 50.7813	E 122 42.0284	1383	0	Yonaguni knoll					46	X	T lance 3 out
T Lance online	4	16/03/2008	07:09:20	N 24 50.8372	E 122 41.9961	1380	0	Yonaguni knoll					56	X	T-lance 4 off T=7.0C at bottom
T Lance online	5	16/03/2008	07:16:45	N 24 50.8367	E 122 41.9968	1380	0	Yonaguni knoll					61	X	T-lance 5 off T=20.4C at bottom
T Lance online	6	16/03/2008	07:41:43	N 24 50.8515	E 122 42.0222	1379	0	Yonaguni knoll					75	X	T-lance 6 off T=44C at bottom
T Lance online	7	16/03/2008	07:53:09	N 24 50.8510	E 122 42.0236	1379	0	Yonaguni knoll					79	X	Rescue T=lance end T lance No 7 40.8 °C
T Lance online	8	16/03/2008	10:02:50	N 24 50.7986	E 122 42.0949	1376	0	Yonaguni knoll					12	X	removing T-lance no 8 from sed.
T Lance online	9	16/03/2008	10:54:20	N 24 50.7699	E 122 42.1028	1387	0	Yonaguni knoll					111	X	removing T-Lance no. 9 from sed. holding the cable max temp 5 deg C

Dive summary

ROV Quest - Dive: 203- 7

SUMSUN (Sonne)

Date: **16/03/2008**
Observers: **DE BEER Dirk**
Station: **Yonaguni knoll**
Position: **N 24 50.7077 E 122 42.0005**

Dive duration:

Start: **16/03/2008 01:56:00**
At bottom: **16/03/2008 03:03:03**
Leave bottom: **16/03/2008 12:11:22**
End: **16/03/2008 13:09:00**

Explored sites:

Dive objectives:

Objectives:
1. chamber measurements at seep site and reference
2. KIPS, still fotos and T lance at chamber positions
3. 4 INSINKS and 8 Pushcores at target9 (Profiler1, Chamber1)
4. complete T lance measurements along the transect WP1-WP17

ROV Shifts (2 hours):
12:00 to 14:00 DeBeer, Boetius
14:00 to 16:00 Haeckel, Boetius
16:00 to 18:00 Inagaki, Boetius/Rehder
18:00 to 20:00 Schneider, Rehder
20:00 to 22:00 Schneider, Nakamura
22:00 to 24:00 Nakamura, Boetius

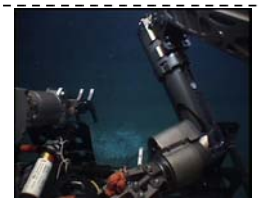
Operations synthesis:

Sampling operations
Biology :
INSINC Corer (MPI) : 4 samples,
Water :
KIPS bottle : 3 samples,
Sediment :
Carottier tube : 7 samples,
Measures
11 continue measures were realised,
Moorings
2 moorings were placed.
2 moorings were recovered.

134 pictures captured,
2 news localities defined: Marker 13 and Marker 11.

Dive summary:

Dive report:

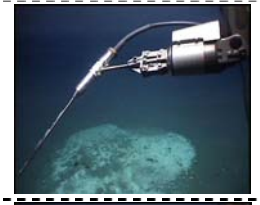
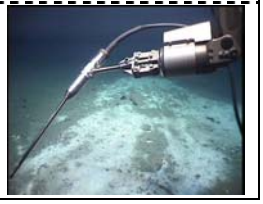
Date	Hour	Location	Latitude Longitude	Immersion Altitude	Comments	Picture
16/03/2008	03:03:03	Yonaguni knoll	N 24 50.8027 E 122 41.9613	1378.2 1.4	Start dive Antje Dirk	
16/03/2008	03:11:41	Yonaguni knoll	N 24 50.7843 E 122 42.0218	1381.5 1.7	found large white mat	
16/03/2008	03:14:44	Yonaguni knoll	N 24 50.7818 E 122 42.0249	1379.6 4.3	reach marker 8, onward to Profiler 1 at target 9	
16/03/2008	03:20:37	Yonaguni knoll	N 24 50.7795 E 122 42.0285	1381.1 3.0	sit down to put chamber	
16/03/2008	03:24:47	Yonaguni knoll	N 24 50.7801 E 122 42.0305	1382.5 0.8	bottom of slope, south of vent	
16/03/2008	03:40:26	Yonaguni knoll	N 24 50.7818 E 122 42.0296	1381.4 0.9	chamber does not sit level with the seafloor but is tilted, replace	
16/03/2008	03:56:15	Yonaguni knoll	N 24 50.7829 E 122 42.0319	1380.7 0.4	chamber placed close to rock	

16/03/2008	03:57:01	Yonaguni knoll	N 24 50.7821 E 122 42.0311	1381.2 0.3	chance to tape 2	
16/03/2008	03:58:11	Yonaguni knoll	N 24 50.7822 E 122 42.0307	1380.6 0.3	sank in to mark at ca 10 cm	
16/03/2008	04:01:50	Yonaguni knoll	N 24 50.7831 E 122 42.0303	1380.9 0.3	chamber 203 no 1 started, still taken, lots of small worms, most likely pogonophora	
16/03/2008	04:13:13	Yonaguni knoll	N 24 50.7806 E 122 42.0353	1381.1 0.7	had to move 7 m east of chamber to undisturbed site	
16/03/2008	04:17:57	Yonaguni knoll	N 24 50.7807 E 122 42.0367	1380.6 0.7	need to relocate because of current	
16/03/2008	04:27:18	Yonaguni knoll	N 24 50.7819 E 122 42.0357	1380.3 0.9	problems with manipulator	
16/03/2008	04:33:20	Yonaguni knoll	N 24 50.7819 E 122 42.0363	1380.2 0.9	start taking INSINK, still	
16/03/2008	04:34:33	Yonaguni knoll	N 24 50.7826 E 122 42.0376	1380.5 0.8	we do not see bubbles or fluids coming from the sediments while coring	
16/03/2008	04:58:31	Yonaguni knoll	N 24 50.7812 E 122 42.0342	1380.2 1.0	tape 3 in	

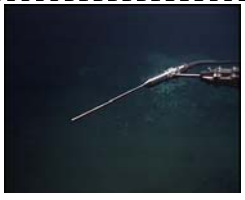
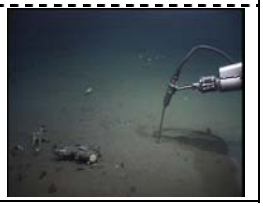
16/03/2008	04:58:53	Yonaguni knoll	N 24 50.7807 E 122 42.0336	1380.3 0.9	continue with INSINK, Matthias in	
16/03/2008	05:02:30	Yonaguni knoll	N 24 50.7817 E 122 42.0336	1380.4 0.9	INSINK 3 taken, still	
16/03/2008	05:05:46	Yonaguni knoll	N 24 50.7815 E 122 42.0345	1381.2 0.7	INSINK 1 taken, still	
16/03/2008	05:09:16	Yonaguni knoll	N 24 50.7816 E 122 42.0348	1380.3 0.8	Insink 1 started	
16/03/2008	05:10:38	Yonaguni knoll	N 24 50.7824 E 122 42.0339	1380.9 0.8	Insink 2 started	
16/03/2008	05:12:18	Yonaguni knoll	N 24 50.7822 E 122 42.0344	1379.6 0.8	Insink 3	
16/03/2008	05:15:08	Yonaguni knoll	N 24 50.7825 E 122 42.0354	1380.1 0.8	Insink 4 started	
16/03/2008	05:17:52	Yonaguni knoll	N 24 50.7837 E 122 42.0347	1380.4 0.9	Tprobe 1 measure, sinks in, still taken, small gradient of ca 4.5 deg at bottom	
16/03/2008	05:19:09	Yonaguni knoll	N 24 50.7831 E 122 42.0347	1380.5 0.9	PC 11	

16/03/2008	05:21:23	Yonaguni knoll	N 24 50.7828 E 122 42.0349	1380.1 1.0	PC 13	
16/03/2008	05:23:20	Yonaguni knoll	N 24 50.7849 E 122 42.0365	1380.2 0.9	PC 29, still	
16/03/2008	05:24:32	Yonaguni knoll	N 24 50.7839 E 122 42.0360	1380.4 0.9	PC14, still	
16/03/2008	05:27:11	Yonaguni knoll	N 24 50.7847 E 122 42.0361	1380.6 0.8	PC8	
16/03/2008	05:28:21	Yonaguni knoll	N 24 50.7840 E 122 42.0359	1380.3 0.8	ROV moves during PC taking, PC 36 taken	
16/03/2008	05:31:16	Yonaguni knoll	N 24 50.7840 E 122 42.0356	1380.5 0.9	KIPS 21	
16/03/2008	05:34:46	Yonaguni knoll	N 24 50.7844 E 122 42.0354	1380.4 0.8	set marker 13, ROV target 15	
16/03/2008	05:36:17	Yonaguni knoll	N 24 50.7850 E 122 42.0362	1380.3 0.8	KIPS 22	
16/03/2008	05:41:24	Yonaguni knoll	N 24 50.7842 E 122 42.0359	1380.2 0.6	KIPS 23	

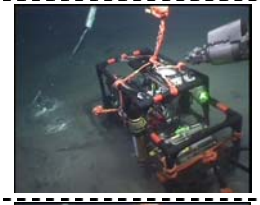
16/03/2008	05:49:19	Yonaguni knoll	N 24 50.7834 E 122 42.0352	1380.9 0.7	Tape 4, T lance 1 out	
16/03/2008	05:56:21	Yonaguni knoll	N 24 50.7828 E 122 42.0367	1379.6 1.6	Christian out, Volker in	
16/03/2008	06:02:38	Yonaguni knoll	N 24 50.7816 E 122 42.0286	1382.6 1.5	arrive at abyss vent, try to place us 2 m away from vent	
16/03/2008	06:04:02	Yonaguni knoll	N 24 50.7802 E 122 42.0280	1385.1 0.4	another fluid vent next to rock	
16/03/2008	06:07:02	Yonaguni knoll	N 24 50.7815 E 122 42.0282	1383.3 0.7	sit down 2 m away from vent	
16/03/2008	06:16:18	Yonaguni knoll	N 24 50.7800 E 122 42.0290	1383.3 0.5	T lance 2, measure T gradient high, bottom sensor 48 deg C	
16/03/2008	06:18:58	Yonaguni knoll	N 24 50.7801 E 122 42.0285	1383.3 0.6	PC24, o,5 m away from vent	
16/03/2008	06:27:06	Yonaguni knoll	N 24 50.7800 E 122 42.0274	1382.3 0.6	T lance 2 out, go to 0.5 m away from vent	
16/03/2008	06:28:03	Yonaguni knoll	N 24 50.7807 E 122 42.0288	1383.1 0.7	T lance 3 in, 55 deg bottom sensor	

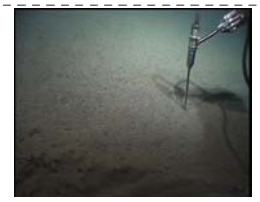
16/03/2008	06:30:00	Yonaguni knoll	N 24 50.7820 E 122 42.0290	1383.0 0.4	PC33	No picture
16/03/2008	06:35:45	Yonaguni knoll	N 24 50.7813 E 122 42.0284	1383.1 0.4	T lance 3 out	
16/03/2008	06:43:49	Yonaguni knoll	N 24 50.7904 E 122 42.0189	1381.2 2.0	go to target 8 (MUC 8)	
16/03/2008	06:44:34	Yonaguni knoll	N 24 50.7946 E 122 42.0149	1380.4 1.9	tape 5	
16/03/2008	06:46:40	Yonaguni knoll	N 24 50.8106 E 122 42.0086	1378.8 2.0	white patches	
16/03/2008	06:47:02	Yonaguni knoll	N 24 50.8120 E 122 42.0072	1378.8 2.0	rocks	
16/03/2008	06:49:37	Yonaguni knoll	N 24 50.8230 E 122 42.0030	1378.5 1.9	white patches	
16/03/2008	06:57:32	Yonaguni knoll	N 24 50.8370 E 122 41.9962	1379.5 1.1	ROV land on a white patchy area	
16/03/2008	06:58:37	Yonaguni knoll	N 24 50.8355 E 122 41.9953	1380.8 0.0	2 Shinkai balasts	

16/03/2008	07:01:08	Yonaguni knoll	N 24 50.8362 E 122 41.9952	1380.8 0.0	T-lance no . 4on	
16/03/2008	07:05:34	Yonaguni knoll	N 24 50.8370 E 122 41.9957	1381.0 0.0	T=6.8C	
16/03/2008	07:09:20	Yonaguni knoll	N 24 50.8372 E 122 41.9961	1380.7 0.0	T-lance 4 off, T=7.0C at bottom	
16/03/2008	07:10:19	Yonaguni knoll	N 24 50.8371 E 122 41.9959	1380.9 0.0	stick T-probe into the sediemnt to check	
16/03/2008	07:11:08	Yonaguni knoll	N 24 50.8372 E 122 41.9965	1380.7 0.0	T-lance no. 5 on	
16/03/2008	07:13:32	Yonaguni knoll	N 24 50.8370 E 122 41.9957	1380.9 0.0	Set marker 11	
16/03/2008	07:15:14	Yonaguni knoll	N 24 50.8367 E 122 41.9978	1381.0 0.0	marker 11	
16/03/2008	07:16:45	Yonaguni knoll	N 24 50.8367 E 122 41.9968	1380.6 0.0	T-lance 5 off, T=20.4C at bottom	
16/03/2008	07:21:26	Yonaguni knoll	N 24 50.8369 E 122 41.9974	1380.6 0.0	very black sediment, but no bubbles	

16/03/2008	07:23:31	Yonaguni knoll	N 24 50.8370 E 122 41.9970	1380.8 0.0	head to target GC3, noth of the Swalyow chimney	
16/03/2008	07:24:48	Yonaguni knoll	N 24 50.8393 E 122 41.9970	1379.7 1.2	whict patch again around marker 11	
16/03/2008	07:25:37	Yonaguni knoll	N 24 50.8405 E 122 42.0040	1378.9 1.5	so many hydrothermal events in sediemnts	
16/03/2008	07:27:18	Yonaguni knoll	N 24 50.8450 E 122 42.0144	1377.9 1.6	some liquid CO2 bubbles	
16/03/2008	07:29:07	Yonaguni knoll	N 24 50.8502 E 122 42.0186	1377.4 2.2	HD 1 tape 1 on	
16/03/2008	07:29:22	Yonaguni knoll	N 24 50.8512 E 122 42.0172	1376.5 2.3	Hydrothermal event, pavement, white shrimps, some Bathzmodiolus	
16/03/2008	07:30:19	Yonaguni knoll	N 24 50.8516 E 122 42.0203	1376.8 2.5	ROV landed	
16/03/2008	07:31:42	Yonaguni knoll	N 24 50.8521 E 122 42.0226	1379.7 0.0	HDTV No 1 tape 1 off	
16/03/2008	07:32:10	Yonaguni knoll	N 24 50.8520 E 122 42.0231	1379.4 0.0	T-lance no. 6 on	

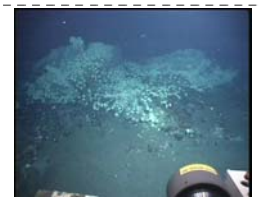
16/03/2008	07:33:45	Yonaguni knoll	N 24 50.8520 E 122 42.0224	1379.5 0.0	Here is target 16	
16/03/2008	07:36:38	Yonaguni knoll	N 24 50.8522 E 122 42.0233	1379.4 0.0	T=43.7C at bottom	
16/03/2008	07:38:20	Yonaguni knoll	N 24 50.8526 E 122 42.0239	1379.5 0.0	supposed to be very clone to the gravity core site	
16/03/2008	07:41:43	Yonaguni knoll	N 24 50.8515 E 122 42.0222	1379.4 0.0	T-lance 6 off, T=44C at bottom	
16/03/2008	07:44:08	Yonaguni knoll	N 24 50.8512 E 122 42.0229	1379.7 0.0	drop T-lance no 7	
16/03/2008	07:46:10	Yonaguni knoll	N 24 50.8522 E 122 42.0241	1379.7 0.0	some trouble on the arm	
16/03/2008	07:51:43	Yonaguni knoll	N 24 50.8523 E 122 42.0240	1379.6 0.0	T=40.8C at bottom	
16/03/2008	07:53:09	Yonaguni knoll	N 24 50.8510 E 122 42.0236	1379.2 0.0	Rescue T=lance, end T lance No 7, 40.8 deg C	
16/03/2008	07:56:17	Yonaguni knoll	N 24 50.8525 E 122 42.0229	1379.8 0.4	head to the abyss vent to recover the chamber	

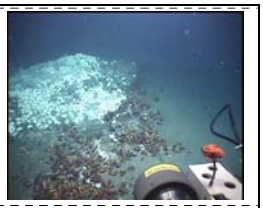
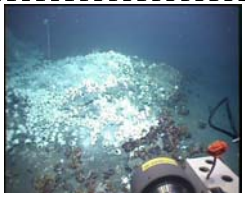
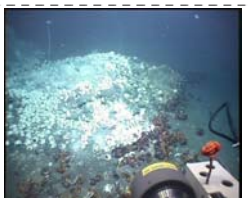
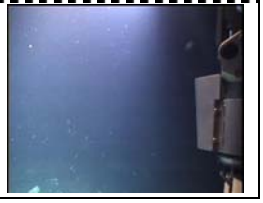
16/03/2008	07:58:06	Yonaguni knoll	N 24 50.8475 E 122 42.0312	1378.5 1.1	Head back to chamber	
16/03/2008	08:05:40	Yonaguni knoll	N 24 50.8149 E 122 42.0379	1371.4 5.4	cross rocks	
16/03/2008	08:27:34	Yonaguni knoll	N 24 50.7835 E 122 42.0388	1377.9 1.9	found chamber	
16/03/2008	08:31:33	Yonaguni knoll	N 24 50.7852 E 122 42.0326	1381.2 0.4	at chamber	
16/03/2008	08:34:37	Yonaguni knoll	N 24 50.7839 E 122 42.0339	1381.7 0.7	tape 7	
16/03/2008	08:38:01	Yonaguni knoll	N 24 50.7801 E 122 42.0327	1378.0 4.1	chamber 1 grabbed, go to abyss vent	
16/03/2008	08:47:17	Yonaguni knoll	N 24 50.7805 E 122 42.0281	1381.0 0.0	shinkai marker overgrown with filamentous bacteria	
16/03/2008	08:50:31	Yonaguni knoll	N 24 50.7809 E 122 42.0253	1382.6 0.3	chamber placed next to vent and shinkai marker	
16/03/2008	08:51:44	Yonaguni knoll	N 24 50.7806 E 122 42.0266	1382.2 0.3	chamber 2 started	

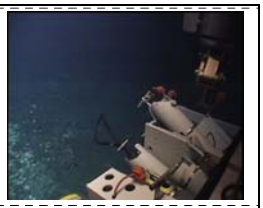
16/03/2008	08:53:07	Yonaguni knoll	N 24 50.7805 E 122 42.0269	1382.7 0.5	penetrated to 12 cm	
16/03/2008	09:22:51	Yonaguni knoll	N 24 50.7742 E 122 42.0422	1374.1 9.1	stand by, ROV Navigation data offset problem	
16/03/2008	09:32:47	Yonaguni knoll	N 24 50.7898 E 122 42.0884	1375.9 6.1	tape change, new: A8, B8	
16/03/2008	09:35:28	Yonaguni knoll	N 24 50.7983 E 122 42.0929	1376.1 1.2	testing Orion, flying to next target	
16/03/2008	09:36:10	Yonaguni knoll	N 24 50.7991 E 122 42.0927	1375.7 1.0	ROV on bottom, Target 17	
16/03/2008	09:46:32	Yonaguni knoll	N 24 50.7983 E 122 42.0939	1377.3 0.3	removing T-Lance from storage	
16/03/2008	09:51:04	Yonaguni knoll	N 24 50.7989 E 122 42.0951	1377.4 0.4	dropping T-Lance no 8	
16/03/2008	09:51:29	Yonaguni knoll	N 24 50.7981 E 122 42.0940	1377.9 0.3	full penetration, lance needs arm support to avoid sinking into sed.	
16/03/2008	09:52:46	Yonaguni knoll	N 24 50.7986 E 122 42.0961	1377.7 0.3	very soft sediment	

16/03/2008	09:58:15	Yonaguni knoll	N 24 50.7984 E 122 42.0939	1377.0 0.1	max. 5 deg C	
16/03/2008	09:58:56	Yonaguni knoll	N 24 50.7968 E 122 42.0958	1377.4 0.3	still photo	
16/03/2008	10:02:50	Yonaguni knoll	N 24 50.7986 E 122 42.0949	1376.9 0.3	removing T-lance no 8 from sed.	
16/03/2008	10:06:37	Yonaguni knoll	N 24 50.7990 E 122 42.0955	1377.5 0.3	ROV take off	
16/03/2008	10:09:10	Yonaguni knoll	N 24 50.7964 E 122 42.1001	1372.2 7.5	Orion holding T-lance while flying, strong spikes	
16/03/2008	10:21:37	Yonaguni knoll	N 24 50.7693 E 122 42.1004	1382.6 6.6	strong current ROV still flying to achieve next waypoint	
16/03/2008	10:29:04	Yonaguni knoll	N 24 50.7685 E 122 42.1037	1388.0 0.0	dropping T-Lance no 9 at Target 18, approx. 10m off position because off strong currents, full penetration,	
16/03/2008	10:30:05	Yonaguni knoll	N 24 50.7684 E 122 42.1036	1388.3 0.0	HD 2 tape 1 start	

16/03/2008	10:33:06	Yonaguni knoll	N 24 50.7692 E 122 42.1036	1387.5 0.0	HDTV No 2 tape 1 stop	
16/03/2008	10:34:24	Yonaguni knoll	N 24 50.7688 E 122 42.1027	1388.2 0.0	change Video tape, new A9, B9	
16/03/2008	10:40:46	Yonaguni knoll	N 24 50.7693 E 122 42.1026	1388.7 0.0	Orion test movements, claw can not be closed	
16/03/2008	10:54:20	Yonaguni knoll	N 24 50.7699 E 122 42.1028	1387.8 0.0	removing T-Lance no. 9 from sed. holding the cable, max temp 5 deg C	
16/03/2008	11:00:45	Yonaguni knoll	N 24 50.7694 E 122 42.1023	1388.1 0.0	T-lance safely stored	
16/03/2008	11:12:19	Yonaguni knoll	N 24 50.7702 E 122 42.1021	1387.4 1.2	change of dive schedule, because Orion is broken	
16/03/2008	11:12:43	Yonaguni knoll	N 24 50.7714 E 122 42.1014	1387.3 1.1	Heading towards Bubbly Chi	
16/03/2008	11:21:16	Yonaguni knoll	N 24 50.8020 E 122 42.0594	1367.0 1.2	change of seafloor from pure sediment to hard rock peaces covered sediment	
16/03/2008	11:32:51	Yonaguni knoll	N 24 50.8179 E 122 42.0200	1377.0 2.3	achieving bubbly chi	

16/03/2008	11:34:14	Yonaguni knoll	N 24 50.8188 E 122 42.0168	1375.0 4.5	marker	
16/03/2008	11:34:40	Yonaguni knoll	N 24 50.8186 E 122 42.0151	1376.3 2.7	bubbles	
16/03/2008	11:37:28	Yonaguni knoll	N 24 50.8172 E 122 42.0149	1377.4 1.6	bubbles heading 316	
16/03/2008	11:37:42	Yonaguni knoll	N 24 50.8168 E 122 42.0166	1377.6 1.5	tube worms	
16/03/2008	11:38:01	Yonaguni knoll	N 24 50.8186 E 122 42.0157	1377.1 1.6	hydrades hdg 280	
16/03/2008	11:38:30	Yonaguni knoll	N 24 50.8205 E 122 42.0164	1377.5 2.0	gas bubbles 270	
16/03/2008	11:39:12	Yonaguni knoll	N 24 50.8207 E 122 42.0155	1377.6 2.0	bubbles hdg 260	
16/03/2008	11:40:08	Yonaguni knoll	N 24 50.8214 E 122 42.0128	1377.8 1.6	bubble 245 and fluid , strong bubbling	
16/03/2008	11:40:45	Yonaguni knoll	N 24 50.8248 E 122 42.0148	1378.7 0.9	till foto	

16/03/2008	11:41:01	Yonaguni knoll	N 24 50.8232 E 122 42.0144	1378.0 0.9	strong fluid and bubble site heading 235	
16/03/2008	11:41:45	Yonaguni knoll	N 24 50.8225 E 122 42.0129	1378.8 0.7	still foto	
16/03/2008	11:42:11	Yonaguni knoll	N 24 50.8224 E 122 42.0128	1378.6 0.7	string fluid escap hdg 213, HD film	
16/03/2008	11:44:26	Yonaguni knoll	N 24 50.8230 E 122 42.0116	1378.8 0.0	worms crabs	
16/03/2008	11:45:53	Yonaguni knoll	N 24 50.8241 E 122 42.0145	1378.9 0.0	still foto, collapsing CO2 droplets	
16/03/2008	11:48:50	Yonaguni knoll	N 24 50.8230 E 122 42.0114	1377.9 1.3	heading 155, mussels crabs	
16/03/2008	11:49:15	Yonaguni knoll	N 24 50.8226 E 122 42.0114	1378.3 0.9	bubbles 125 Heading	
16/03/2008	11:51:22	Yonaguni knoll	N 24 50.8208 E 122 42.0107	1377.9 1.6	hot fluid, maybe with droplets heading 80	
16/03/2008	11:53:16	Yonaguni knoll	N 24 50.8195 E 122 42.0113	1377.6 1.3	fluid creeping hdg 58 deg	

16/03/2008	11:55:16	Yonaguni knoll	N 24 50.8176 E 122 42.0123	1376.8 2.6	heading back towards benthic chamber	
16/03/2008	12:04:04	Yonaguni knoll	N 24 50.7798 E 122 42.0291	1379.6 2.3	reached chamber, orion cannot be opened, try to grab with rig master	
16/03/2008	12:11:22	Yonaguni knoll	N 24 50.7809 E 122 42.0289	1381.0 0.0	Chamber kept on porch, dive end	

created Mon Mar 24 14:41:13 JST 2008

Appendix

Dive 204

Dive summaries Alamere

Dive summary

ROV Quest - Dive: 204- 8

SUMSUN (Sonne)

Date: **20/03/2008**
Observers: **REHDER Gregor**
Station: **Hatoma knoll**
Position: **N 24 51.5079 E 123 50.4998**

Dive duration:

Start: **20/03/2008 02:00:00**
At bottom: **20/03/2008 02:54:00**
Leave bottom: **20/03/2008 03:25:00**
End: **20/03/2008 04:45:00**

Explored sites:

Dive objectives:

Objectives, Mission and Time Plan
1. Start T-lance logger on downcast
2. Place Bubble box at WP “Bubble Chamber Dive 200
3. Proceed towards main chimney, 24° 51.5846, 123°50.4456, 1474 m, Marker 3
3a. Observe in detail if bubble show size collapsing, evtl T-probe
4. Look for other bubble sites at this vent, potentially 24° 51.4937, 123 50.4823, 1475 m
4a. Take bottom gas sampler at this additional site
4b. Do T-measurement, get sample gas into phase transition observing system, let cool down
5. Get He sampler at one of the prominent hot chimneys, store in drawer where Gas sampler has been positioned
6. Transfer to gas site with high CO2 content, 24° 51.5846, 123 ° 50.4456, 1524.2 m
7. If gas flow sufficient, get gas sampler filled,
7a. At bottom
7b. At 50 m above with funnel (go to hot site to melt collected gas into the sampler
7c. At maximum above with big funnel (go to hot site to melt collected gas into the sampler
7d. Do phase transition experiment of this gas
8a. Get bubble box, fly to bubble collapsing site (see 3)
8b. Monitor bubble collapsing with HD long enough for statistical picture
9a. Proceed with bubble box to highCO2 vent (see 6)
9b. Try bubble chasing as good as it gets
10. Find place to safely store bubble box, come up to surface
11. End of dive

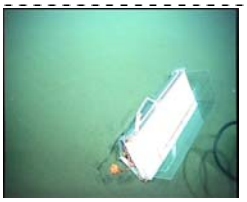
ROV Shifts (2 hours):
12:00 to 14:00 Nakamura, Rehder
14:00 to 16:00 Rehder, Nakamura
16:00 to 18:00 Rehder, Schneider
18:00 to 20:00 Schneider, Inagaki
20:00 to 22:00 Nakamura,Rehder,Thomas
22:00 to 24:00 Rehder,Schneider,Nakamura,Thomas

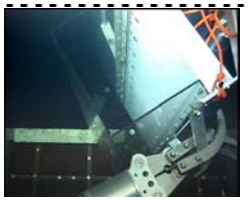
Operations synthesis:

8 pictures captured,

Dive summary:

Dive report:

Date	Hour	Location	Latitude Longitude	Immersion Altitude	Comments	Picture
20/03/2008	02:54:47	Hatoma knoll	N 24 51.2650 E 123 50.5001	1500.7 0.0	start Alamer, lost and found Bubble box, retrieve box	
20/03/2008	02:56:03	Hatoma knoll	N 24 51.2655 E 123 50.4989	1500.0 0.9	start to get box	
20/03/2008	02:59:09	Hatoma knoll	N 24 51.2645 E 123 50.4995	1499.9 0.9	arm out of conrol again	
20/03/2008	03:06:27	Hatoma knoll	N 24 51.2671 E 123 50.4991	1499.9 0.9	Discuss situation. Only dive tasks to be archieved are 1. grabbing box 2. monitor collapsing of bubbles with the box, more rise rates etc., bubble chasing if posible	
20/03/2008	03:13:27	Hatoma knoll	N 24 51.2655 E 123 50.4981	1500.2 1.3	try to manouvre to get arm in place	
20/03/2008	03:25:51	Hatoma knoll	N 24 51.2683 E 123 50.5029	1500.0 2.5	Leave the bottom with the bubble box for ROV recovery	
20/03/2008	03:28:44	Hatoma knoll	N 24 51.2662 E 123 50.5027	1493.8 9.5	resurfacing, premier plan is to do 2nd short dive just to try bubble chase experiment and potentially one	

					other tool	
20/03/2008	03:30:24	Hatoma knoll	N 24 51.2611 E 123 50.5016	1467.6 0.0	stop TapeA, StopTapeB	
20/03/2008	03:32:18	Hatoma knoll	N 24 51.2564 E 123 50.4999	1432.5 0.0	Stop tapes A1 and B1, stop adelieframegrabs	

created Sat Mar 22 15:49:37 JST 2008

Appendix

Dive 205
ALAMER : Operation list
Dive summaries Alamere

ALAMER : Operation list

Cruise : **SO196 - SUMSUN**
Dive : 205 SO196_084

Operation list :

Equipment	Num	Date	Hour	Latitude	Longitude	Depth	Altitude	Location	Biology	Water	Geochem.	Measure	Pict.	File	Comments
Bubble Box	1	20/03/2008	13:19:12	N 24 51.5881	E 123 50.4471	1477	0	Hatoma knoll					84	X	End bubble rise experiment 01 (start 13:16); 1475m BB
Bubble Box	2	20/03/2008	13:55:56	N 24 51.5740	E 123 50.4462	1456	0	Hatoma knoll					97	X	End bubble rise experiment 02 (start 13:52); 1456m; BB
Bubble Box	3	20/03/2008	14:29:27	N 24 51.5606	E 123 50.4643	1416	0	Hatoma knoll						X	End bubble rise experiment 03 (start 14:23); BB
Bubble Box	4	20/03/2008	15:17:44	N 24 51.5621	E 123 50.4588	1369	0	Hatoma knoll					121	X	lost in 1368; Stop Bubble rise experiment 04 (start 15:11); BB
Bubble Box	5	20/03/2008	15:38:54	N 24 51.5639	E 123 50.4648	1385	0	Hatoma knoll						X	End Bubble rise experiment 05 (start 15:32); BB
HDTV camera	1	20/03/2008	11:19:27	N 24 51.4966	E 123 50.4815	1476	1	Hatoma knoll					31	X	HDTV No 1 off (start 10:36); tape change HD
HDTV camera	2	20/03/2008	11:24:45	N 24 51.4929	E 123 50.4821	1469	13	Hatoma knoll					36	X	lost bubble stream ; HDTV No 2 off (start 11:20)
HDTV camera	3	20/03/2008	11:55:40	N 24 51.4958	E 123 50.4788	1464	15	Hatoma knoll					53	X	light on; HDTV No 3 off (start 11:35)
HDTV camera	13	20/03/2008	12:17:06	N 24 51.4937	E 123 50.4780	1471	9	Hatoma knoll					63	X	end of overview flight; End of HD sequence of hot vent Hatoma Knoll (start 11:59)
HDTV camera	4	20/03/2008	12:31:58	N 24 51.5020	E 123 50.4789	1459	20	Hatoma knoll					72	X	HDTV No 4 stop (start 12:25); Sonar stop

HDTV camera	5	20/03/2008	13:23:37	N 24 51.5873	E 123 50.4417	1511	11	Hatoma knoll					86	X	HDTV No 5 stop (start 13:02)
HDTV camera	6	20/03/2008	13:36:42	N 24 51.5845	E 123 50.4413	1520	4	Hatoma knoll					9	X	HDTV No 6 stop (start 13:30)
HDTV camera	7	20/03/2008	13:57:41	N 24 51.5681	E 123 50.4432	1453	0	Hatoma knoll					98	X	HD tape change; new HD tape 3 at HDTV No 7 (start 13:46)
HDTV camera	9	20/03/2008	14:29:27	N 24 51.5606	E 123 50.4643	1416	0	Hatoma knoll					16	X	HDTV No 8-9 off (start 14:15); Tape A5 B5
HDTV camera	10	20/03/2008	15:05:33	N 24 51.5769	E 123 50.4530	1508	18	Hatoma knoll					117	X	HDTV No 10 off (start 15:02)
HDTV camera	11	20/03/2008	15:18:08	N 24 51.5610	E 123 50.4583	1358	0	Hatoma knoll					122	X	HDTV No 11 off (start 15:10)
HDTV camera	12	20/03/2008	15:38:54	N 24 51.5639	E 123 50.4648	1385	0	Hatoma knoll					128	X	lost in 1390m; HDTV No 12 off (start 15:30)
T Lance online	0	20/03/2008	15:47:13	N 24 51.5453	E 123 50.4647	1167	0	Hatoma knoll					13	X	tape AB6 off; Stop Tlance logging; TL 00 (start 10:13)

Dive summary

ROV Quest - Dive: 205- 9

SUMSUN (Sonne)

Date: **20/03/2008**
Observers: **REHDER Gregor**
Station: **Hatoma knoll**
Position: **N 24 51.5079 E 123 50.4998**

Dive duration:

Start: **20/03/2008 09:40:00**
At bottom: **20/03/2008 10:30:00**
Leave bottom: **20/03/2008 15:47:00**
End: **20/03/2008 16:35:00**

Explored sites:

Dive objectives:

Objectives, Mission and Time Plan
1. Test arm on way to bottom
2. Reach starting point for orientation
3a. Proceed towards main chimney, 24° 51.5846, 123°50.4456, 1474 m, Marker 3
3b. Observe in detail if bubble show size collapsing, evtl T-probe
4a. Look for other bubble sites at this vent, potentially 24° 51.4937, 123 50.4823, 1475 m
4b. Take bottom gas sampler at this additional site
4c. Do T-measurement,
5a. Transfer to gas site with high CO2 content, 24° 51.5846, 123 ° 50.4456, 1524.2 m
5b. Try bubble chasing as good as it gets
6. End of dive

ROV Shifts (2 hours):
19:30 to 21:30 Nakamura, Rehder
21:30 to 23:30 Rehder, Schneider
23:30 to end Rehder, Thomas/Schneider

Operations synthesis:

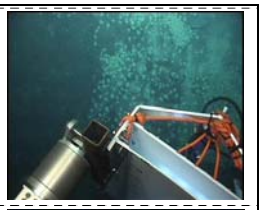
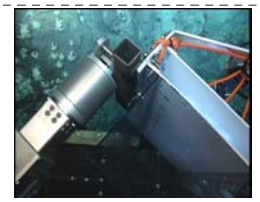
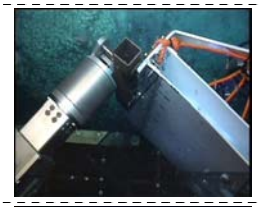
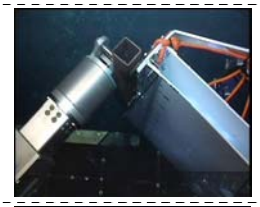
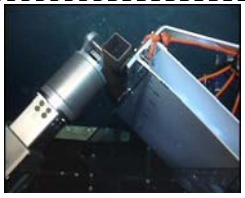
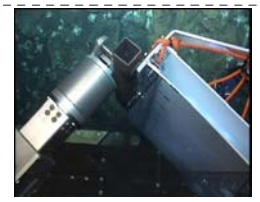
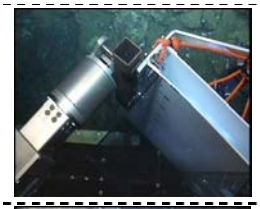
Measures
18 continue measures were realised,

129 pictures captured,

Dive summary:

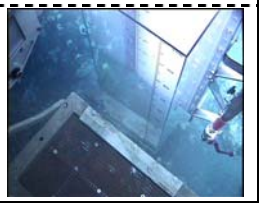
Dive report:

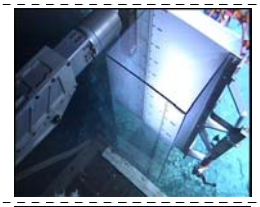
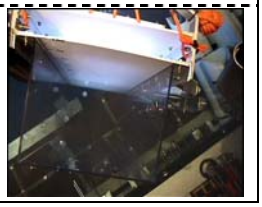
Date	Hour	Location	Latitude Longitude	Immersion Altitude	Comments	Picture
20/03/2008	09:58:38	Hatoma knoll	N 24 51.4992 E 123 50.5256	558.6 0.0	gregor in van testing	
20/03/2008	10:13:40	Hatoma knoll	N 24 51.5030 E 123 50.4794	1030.6 0.0	start -lance logging, TL00	
20/03/2008	10:23:46	Hatoma knoll	N 24 51.4845 E 123 50.4691	1368.9 0.0	arm misfunctioning again	
20/03/2008	10:28:19	Hatoma knoll	N 24 51.4839 E 123 50.4656	1475.3 18.3	Start A TV	
20/03/2008	10:29:43	Hatoma knoll	N 24 51.4879 E 123 50.4637	1480.9 10.2	Start mini film and frame grab	
20/03/2008	10:30:11	Hatoma knoll	N 24 51.4882 E 123 50.4648	1487.2 4.9	See seafloor	
20/03/2008	10:31:01	Hatoma knoll	N 24 51.4909 E 123 50.4678	1484.5 4.9	Landed near the last gas sampling psition	
20/03/2008	10:32:31	Hatoma knoll	N 24 51.4953 E 123 50.4745	1475.7 8.6	Foot of a big chimney	

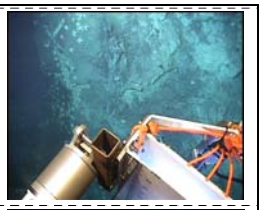
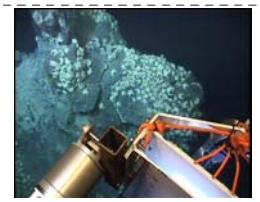
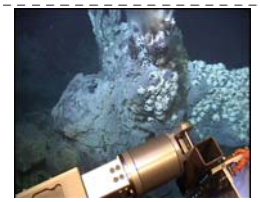
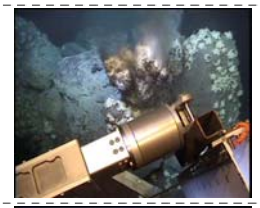
20/03/2008	10:33:40	Hatoma knoll	N 24 51.4948 E 123 50.4743	1475.5 7.0	Searching for gas bubbling site	
20/03/2008	10:36:24	Hatoma knoll	N 24 51.4940 E 123 50.4758	1477.6 4.0	HD recording ON	
20/03/2008	10:41:47	Hatoma knoll	N 24 51.4943 E 123 50.4793	1473.3 4.7	Active chimneys	
20/03/2008	10:42:14	Hatoma knoll	N 24 51.4950 E 123 50.4799	1471.8 7.7	Top of big chimney	
20/03/2008	10:42:49	Hatoma knoll	N 24 51.4938 E 123 50.4819	1473.5 1.7	Find our marker 3	
20/03/2008	10:43:20	Hatoma knoll	N 24 51.4940 E 123 50.4829	1473.9 7.0	Heading 290	
20/03/2008	10:47:56	Hatoma knoll	N 24 51.4955 E 123 50.4808	1475.3 3.7	Watch the bubbling on the left of the marker 3	
20/03/2008	10:52:58	Hatoma knoll	N 24 51.4953 E 123 50.4825	1476.1 3.1	Bubbles are emitting cracks of sulfides	
20/03/2008	10:54:26	Hatoma knoll	N 24 51.4959 E 123 50.4823	1475.8 2.2	Bubbles are small. Less han 5 mm in diameter?	

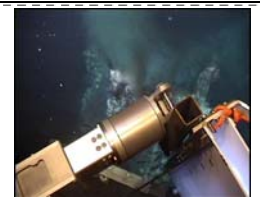
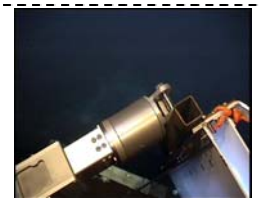
20/03/2008	11:00:00	Hatoma knoll	N 24 51.4955 E 123 50.4828	1477.7 0.0	Hydrate could be seen beneath blocks of sulfides	
20/03/2008	11:01:36	Hatoma knoll	N 24 51.4950 E 123 50.4821	1476.2 3.2	Large hydrate beneath blocks	
20/03/2008	11:03:52	Hatoma knoll	N 24 51.4952 E 123 50.4807	1475.6 2.3	Bubble box taken	
20/03/2008	11:04:44	Hatoma knoll	N 24 51.4941 E 123 50.4797	1476.4 1.7	Bubbles are passing in box	
20/03/2008	11:06:14	Hatoma knoll	N 24 51.4957 E 123 50.4805	1476.2 1.5	Tailed bubbles observed	
20/03/2008	11:06:42	Hatoma knoll	N 24 51.4960 E 123 50.4813	1476.0 1.5	Getting measurable images of bubbles	
20/03/2008	11:09:12	Hatoma knoll	N 24 51.4943 E 123 50.4799	1476.2 1.4	Bubbles are coming up among crabs	
20/03/2008	11:10:23	Hatoma knoll	N 24 51.4945 E 123 50.4805	1476.0 1.5	Monitor another 5 minutes and move to another fild	
20/03/2008	11:13:24	Hatoma knoll	N 24 51.4946 E 123 50.4808	1476.1 1.4	10 still photos on bottom of bubbles in B-box: 125tel blende 2.7	

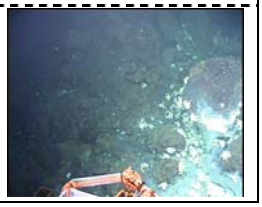
20/03/2008	11:15:38	Hatoma knoll	N 24 51.4940 E 123 50.4810	1476.0 1.4	still fotos end til 9887.jpeg	
20/03/2008	11:16:42	Hatoma knoll	N 24 51.4943 E 123 50.4798	1476.2 1.6	another 5 still fotots 9888, 1/1000tel F3.7	
20/03/2008	11:18:24	Hatoma knoll	N 24 51.4953 E 123 50.4817	1476.0 1.6	end still photos 9897	
20/03/2008	11:19:27	Hatoma knoll	N 24 51.4966 E 123 50.4815	1476.1 1.9	HDTV No 1 off (start 10:36), tape change HD	
20/03/2008	11:20:51	Hatoma knoll	N 24 51.4940 E 123 50.4816	1476.2 1.3	HD start	
20/03/2008	11:21:05	Hatoma knoll	N 24 51.4939 E 123 50.4822	1476.0 1.8	ROV off bottom	
20/03/2008	11:22:20	Hatoma knoll	N 24 51.4950 E 123 50.4816	1474.1 4.4	ROV 2 meters above seafloor, bubbles inside B-box	
20/03/2008	11:24:28	Hatoma knoll	N 24 51.4939 E 123 50.4818	1472.5 6.0	light on	
20/03/2008	11:24:45	Hatoma knoll	N 24 51.4929 E 123 50.4821	1469.4 13.6	lost bubble stream , HDTV No 2 off (start 11:20)	

20/03/2008	11:26:31	Hatoma knoll	N 24 51.4938 E 123 50.4835	1476.7 5.1	found bubbles HDG 280	
20/03/2008	11:27:12	Hatoma knoll	N 24 51.4940 E 123 50.4847	1476.4 7.2	tape change , new A2, B2	
20/03/2008	11:29:28	Hatoma knoll	N 24 51.4933 E 123 50.4843	1476.2 6.9	bubbles found HDG 260	
20/03/2008	11:35:09	Hatoma knoll	N 24 51.4933 E 123 50.4834	1476.8 3.3	HD start	
20/03/2008	11:35:35	Hatoma knoll	N 24 51.4942 E 123 50.4840	1476.6 2.1	found bubble site, trying to adjust ROV to catch bubbles inside B-box	
20/03/2008	11:37:49	Hatoma knoll	N 24 51.4956 E 123 50.4806	1473.6 3.7	found bubble site, some bubbles inside B-box	
20/03/2008	11:39:28	Hatoma knoll	N 24 51.4961 E 123 50.4825	1473.4 6.2	readjusting ROV 290 deg	
20/03/2008	11:40:04	Hatoma knoll	N 24 51.4955 E 123 50.4815	1473.7 4.0	light out	
20/03/2008	11:41:33	Hatoma knoll	N 24 51.4952 E 123 50.4802	1474.5 4.1	found requested bubble site at 1474m at Marker 3	

20/03/2008	11:42:25	Hatoma knoll	N 24 51.4940 E 123 50.4803	1475.2 2.2	light completly stut down	
20/03/2008	11:44:08	Hatoma knoll	N 24 51.4948 E 123 50.4807	1475.6 1.3	bubbles inside B-box	
20/03/2008	11:45:27	Hatoma knoll	N 24 51.4952 E 123 50.4790	1475.9 1.1	still Photo 1/250 F3.9	
20/03/2008	11:47:24	Hatoma knoll	N 24 51.4948 E 123 50.4797	1475.5 1.4	still photo	
20/03/2008	11:51:13	Hatoma knoll	N 24 51.4949 E 123 50.4808	1472.4 5.8	shimmering water with gas bubbles HDG 280	
20/03/2008	11:53:18	Hatoma knoll	N 24 51.4960 E 123 50.4786	1468.8 7.2	bubbles entering B-box	
20/03/2008	11:53:53	Hatoma knoll	N 24 51.4945 E 123 50.4793	1467.9 8.9	ROV adjusted in water at 1468 waiting for bubbles entering B-box	
20/03/2008	11:55:40	Hatoma knoll	N 24 51.4958 E 123 50.4788	1464.5 15.2	light on, HDTV No 3 off (start 11:35)	
20/03/2008	11:59:38	Hatoma knoll	N 24 51.4960 E 123 50.4804	1460.9 21.5	HD start, overview flight of the structure around M3	

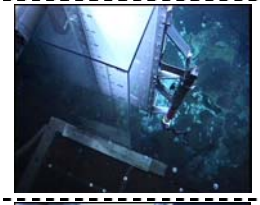
20/03/2008	12:02:01	Hatoma knoll	N 24 51.4958 E 123 50.4796	1472.9 3.5	shimmering water	
20/03/2008	12:02:20	Hatoma knoll	N 24 51.4956 E 123 50.4796	1472.6 6.8	bubbles	
20/03/2008	12:04:06	Hatoma knoll	N 24 51.4942 E 123 50.4776	1471.9 6.7	two chimeys emanating greyish shimmering fluid, high velocity, maybe boiling	
20/03/2008	12:05:50	Hatoma knoll	N 24 51.4951 E 123 50.4776	1471.6 4.0	close up of greyish fluid	
20/03/2008	12:09:06	Hatoma knoll	N 24 51.4944 E 123 50.4786	1471.9 5.6	proceeding overview flight around this chimney at M3	
20/03/2008	12:12:44	Hatoma knoll	N 24 51.4943 E 123 50.4774	1471.7 7.2	yellow brownish smoker	
20/03/2008	12:13:31	Hatoma knoll	N 24 51.4939 E 123 50.4779	1471.9 7.6	laser pointer	
20/03/2008	12:14:26	Hatoma knoll	N 24 51.4948 E 123 50.4788	1471.3 4.4	zooming into hot fluid , maybe boiling, very turbulent, maybe free gas	

20/03/2008	12:17:06	Hatoma knoll	N 24 51.4937 E 123 50.4780	1471.7 9.1	end of overview flight, End of HD sequence (No 13) of hot vent Hatoma Knoll (start 11:59)	
20/03/2008	12:17:26	Hatoma knoll	N 24 51.4945 E 123 50.4789	1468.4 0.0	heading towards next waypoint	
20/03/2008	12:21:43	Hatoma knoll	N 24 51.5045 E 123 50.4755	1470.9 8.9	bubbles inside B-box	
20/03/2008	12:22:23	Hatoma knoll	N 24 51.5045 E 123 50.4772	1468.5 13.0	light off	
20/03/2008	12:24:38	Hatoma knoll	N 24 51.5046 E 123 50.4768	1465.4 14.9	Sonar record on, range 5m	
20/03/2008	12:25:24	Hatoma knoll	N 24 51.5034 E 123 50.4771	1466.6 15.3	maybe Co2 droplet!	
20/03/2008	12:25:51	Hatoma knoll	N 24 51.5038 E 123 50.4773	1466.1 15.4	HD start	
20/03/2008	12:27:09	Hatoma knoll	N 24 51.5011 E 123 50.4775	1466.0 15.3	change tape, new: A3, B3	

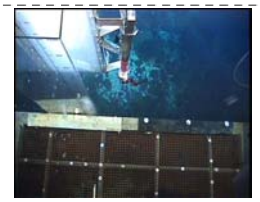
20/03/2008	12:28:42	Hatoma knoll	N 24 51.5019 E 123 50.4787	1461.0 18.9	bubbles inside B-box	
20/03/2008	12:31:58	Hatoma knoll	N 24 51.5020 E 123 50.4789	1459.5 20.2	HDTV No 4 stop (start 12:25), Sonar stop	
20/03/2008	12:34:03	Hatoma knoll	N 24 51.5023 E 123 50.4789	1465.3 13.8	heading towards CO2 droplet site	
20/03/2008	12:49:49	Hatoma knoll	N 24 51.5653 E 123 50.4531	1520.8 7.2	ROV approaching target	
20/03/2008	12:50:36	Hatoma knoll	N 24 51.5654 E 123 50.4535	1522.0 5.9	ROV on bottom	
20/03/2008	12:51:23	Hatoma knoll	N 24 51.5668 E 123 50.4543	1521.9 5.1	testing orion	
20/03/2008	12:52:56	Hatoma knoll	N 24 51.5736 E 123 50.4549	1524.4 2.6	ROV take off	
20/03/2008	12:59:08	Hatoma knoll	N 24 51.5854 E 123 50.4514	1520.2 6.0	searching for droplets	
20/03/2008	13:00:53	Hatoma knoll	N 24 51.5888 E 123 50.4493	1519.0 2.9	droplets found, HDG 270, 1517m depth	

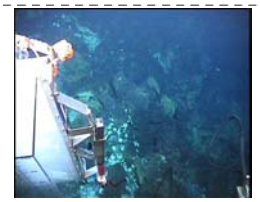
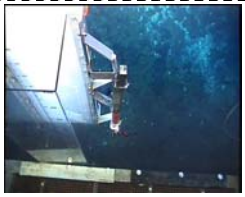
20/03/2008	13:02:08	Hatoma knoll	N 24 51.5887 E 123 50.4478	1517.8 4.4	HD start	
20/03/2008	13:02:30	Hatoma knoll	N 24 51.5888 E 123 50.4473	1517.3 3.4	droplets in B-box	
20/03/2008	13:04:19	Hatoma knoll	N 24 51.5895 E 123 50.4476	1519.1 1.9	light off	
20/03/2008	13:07:32	Hatoma knoll	N 24 51.5883 E 123 50.4472	1519.1 1.9	photos of droplets in B-box	
20/03/2008	13:16:00	Hatoma knoll	N 24 51.5889 E 123 50.4476	1518.3 0.0	Start bubble rise experiment 01, BB	No picture
20/03/2008	13:19:12	Hatoma knoll	N 24 51.5881 E 123 50.4471	1477.0 0.0	End bubble rise experiment 01 (start 13:16), 1475m BB	
20/03/2008	13:21:56	Hatoma knoll	N 24 51.5859 E 123 50.4412	1482.0 0.0	descending back to seafloor	
20/03/2008	13:23:37	Hatoma knoll	N 24 51.5873 E 123 50.4417	1511.0 11.6	HDTV No 5 stop (start 13:02)	
20/03/2008	13:25:48	Hatoma knoll	N 24 51.5854 E 123 50.4445	1514.5 7.3	change tape, new A4 B4	

20/03/2008	13:29:50	Hatoma knoll	N 24 51.5872 E 123 50.4404	1520.7 3.5	back at droplet site	
20/03/2008	13:30:47	Hatoma knoll	N 24 51.5878 E 123 50.4379	1519.9 4.3	HD start, Sonar start	
20/03/2008	13:36:42	Hatoma knoll	N 24 51.5845 E 123 50.4413	1520.5 4.4	HDTV No 6 stop (start 13:30)	
20/03/2008	13:41:30	Hatoma knoll	N 24 51.5841 E 123 50.4395	1520.0 5.1	some droplets found	
20/03/2008	13:46:14	Hatoma knoll	N 24 51.5900 E 123 50.4412	1522.1 1.1	HDTV start	
20/03/2008	13:46:32	Hatoma knoll	N 24 51.5888 E 123 50.4407	1523.3 0.8	droplets and shimmering water	
20/03/2008	13:48:01	Hatoma knoll	N 24 51.5882 E 123 50.4403	1521.6 1.5	droplets found	
20/03/2008	13:51:10	Hatoma knoll	N 24 51.5854 E 123 50.4421	1521.1 3.7	droplets inside B-box	
20/03/2008	13:52:32	Hatoma knoll	N 24 51.5847 E 123 50.4416	1521.5 3.6	Start bubble rise experiment 02, 1520m, BB	

20/03/2008	13:55:56	Hatoma knoll	N 24 51.5740 E 123 50.4462	1456.0 0.0	End bubble rise experiment 02 (start 13:52), 1456m, BB	
20/03/2008	13:57:41	Hatoma knoll	N 24 51.5681 E 123 50.4432	1453.3 0.0	HD tape change, new HD tape 3 at HDTV No 7 (start 13:46)	
20/03/2008	14:01:36	Hatoma knoll	N 24 51.5626 E 123 50.4489	1492.3 0.0	back to seafloor	
20/03/2008	14:06:46	Hatoma knoll	N 24 51.5741 E 123 50.4530	1517.5 9.4	bottom view	
20/03/2008	14:09:26	Hatoma knoll	N 24 51.5829 E 123 50.4551	1523.8 4.4	looking for previous droplet site	
20/03/2008	14:15:02	Hatoma knoll	N 24 51.5887 E 123 50.4481	1517.6 0.0	HD start	
20/03/2008	14:15:16	Hatoma knoll	N 24 51.5885 E 123 50.4481	1518.4 4.2	droplets found	
20/03/2008	14:23:39	Hatoma knoll	N 24 51.5891 E 123 50.4476	1516.8 3.6	Start Bubble rise experiment 03, BB	
20/03/2008	14:24:10	Hatoma knoll	N 24 51.5886 E 123 50.4490	1512.4 9.9	HD start	

20/03/2008	14:29:27	Hatoma knoll	N 24 51.5606 E 123 50.4643	1416.3 0.0	End bubble rise experiment 03 (start 14:23), BB	No picture
20/03/2008	14:29:27	Hatoma knoll	N 24 51.5606 E 123 50.4643	1416.3 0.0	HDTV No 8-9 off (start 14:15), Tape A5 B5	
20/03/2008	14:35:14	Hatoma knoll	N 24 51.5459 E 123 50.4596	1420.8 0.0	looking for bubble site	
20/03/2008	14:37:37	Hatoma knoll	N 24 51.5394 E 123 50.4542	1445.8 0.0	bottom view	
20/03/2008	14:39:00	Hatoma knoll	N 24 51.5524 E 123 50.4523	1451.2 0.0	fly to bubble site	
20/03/2008	14:43:20	Hatoma knoll	N 24 51.5792 E 123 50.4502	1484.6 0.0	droplets found, later lost again	
20/03/2008	14:51:19	Hatoma knoll	N 24 51.5824 E 123 50.4530	1507.0 18.1	droplets found, later lost again	
20/03/2008	14:54:39	Hatoma knoll	N 24 51.5847 E 123 50.4509	1509.7 13.8	bottom view	
20/03/2008	14:54:57	Hatoma knoll	N 24 51.5853 E 123 50.4500	1511.0 12.6	droplets found	

20/03/2008	14:59:44	Hatoma knoll	N 24 51.5861 E 123 50.4597	1522.1 6.3	fly to north to bubble site	
20/03/2008	15:01:54	Hatoma knoll	N 24 51.5876 E 123 50.4492	1516.7 6.8	droplets found	
20/03/2008	15:02:42	Hatoma knoll	N 24 51.5878 E 123 50.4472	1514.9 7.3	HD on	
20/03/2008	15:05:33	Hatoma knoll	N 24 51.5769 E 123 50.4530	1508.1 18.2	HDTV No 10 off (start 15:02)	
20/03/2008	15:06:37	Hatoma knoll	N 24 51.5830 E 123 50.4500	1510.9 14.6	droplets found	
20/03/2008	15:10:46	Hatoma knoll	N 24 51.5886 E 123 50.4473	1516.5 5.2	HD on	
20/03/2008	15:11:26	Hatoma knoll	N 24 51.5873 E 123 50.4493	1505.4 18.0	Start bubble rise experiment 04, start 1512 m, BB	
20/03/2008	15:17:44	Hatoma knoll	N 24 51.5621 E 123 50.4588	1369.5 0.0	lost in 1368, Stop Bubble rise experiment 04 (start 15:11), BB	
20/03/2008	15:18:08	Hatoma knoll	N 24 51.5610 E 123 50.4583	1358.5 0.0	HDTV No 11 off (start 15:10)	

20/03/2008	15:25:37	Hatoma knoll	N 24 51.5794 E 123 50.4505	1474.0 0.0	change tape AB6	
20/03/2008	15:28:16	Hatoma knoll	N 24 51.5817 E 123 50.4532	1520.3 5.3	bottom view, look for bubble site	
20/03/2008	15:29:23	Hatoma knoll	N 24 51.5881 E 123 50.4479	1516.4 5.2	bubbles found	
20/03/2008	15:30:05	Hatoma knoll	N 24 51.5878 E 123 50.4477	1516.3 4.0	HD on	
20/03/2008	15:32:43	Hatoma knoll	N 24 51.5869 E 123 50.4487	1516.4 5.9	Start bubble rise experiment 05, start at 1517m, BB	
20/03/2008	15:38:54	Hatoma knoll	N 24 51.5639 E 123 50.4648	1385.6 0.0	End Bubble rise experiment 05 (start 15:32), BB	No picture
20/03/2008	15:38:54	Hatoma knoll	N 24 51.5639 E 123 50.4648	1385.6 0.0	lost in 1390m, HDTV No 12 off (start 15:30)	
20/03/2008	15:40:41	Hatoma knoll	N 24 51.5610 E 123 50.4637	1338.9 0.0	preparation for diving up (bubble box)	
20/03/2008	15:47:13	Hatoma knoll	N 24 51.5453 E 123 50.4647	1167.1 0.0	tape AB6 off, Stop Tlance logging, TL 00 (start 10:13)	

created Tue Mar 25 14:51:43 PHT 2008

Appendix

Dive 206

ALAMER : Operation list

Dive summaries Alamere

ALAMER : Operation list

Cruise : **SO196 - SUMSUN**
Dive : 206 SO196_086

Operation list :

Equipment	Num	Date	Hour	Latitude	Longitude	Depth	Altitude	Location	Biology	Water	Geochem.	Measure	Pict.	File	Comments
Benthic chamber 206	1	21/03/2008	05:50:19	N 24 50.4789	E 122 41.8599	1347	1	Yonaguni knoll					14		tchamber 1 is set down arget 20 12 cm penetration
Benthic chamber 206	1	21/03/2008	09:30:16	N 24 50.4801	E 122 41.8571	1349	0	Yonaguni knoll					152		chamber out
Benthic chamber 206	2	21/03/2008	11:23:09	N 24 50.7757	E 122 42.0383	1381	0	Yonaguni knoll					194		chamber positioned at target 22
Benthic chamber 206	2	21/03/2008	15:28:03	N 24 50.7741	E 122 42.0389	1379	0	Yonaguni knoll					292		lift chamber
HDTV camera	1	21/03/2008	07:51:17	N 24 50.6522	E 122 42.0701	1391	1	Yonaguni knoll					74	X	return to chamber HDTV 1 tape 1 off
HDTV camera	2	21/03/2008	09:03:01	N 24 50.4759	E 122 41.8572	1346	0	Yonaguni knoll					141	X	HDTV No 2 end tape #2
HDTV camera	3	21/03/2008	09:16:07	N 24 50.4778	E 122 41.8557	1348	0	Yonaguni knoll					146	X	HDTV No 3 end tape 2 off fat white seastar now on HD film
HDTV camera	4	21/03/2008	09:24:53	N 24 50.4831	E 122 41.8574	1350	0	Yonaguni knoll					151	X	HDTV No 4 tape 2 off
HDTV camera	5	21/03/2008	13:16:51	N 24 50.8179	E 122 42.0827	1366	1	Yonaguni knoll					245	X	HDTV No 5 tape 2 off
HDTV camera	6	21/03/2008	13:32:26	N 24 50.8494	E 122 42.1185	1349	1	Yonaguni knoll					255	X	HDTV No 6 tape 2 off
HDTV camera	7	21/03/2008	13:40:19	N 24 50.8697	E 122 42.1377	1329	2	Yonaguni knoll					262	X	HDTV 7 end tape 2 off
KIPS bottle	21	21/03/2008	06:08:50	N 24 50.4768	E 122 41.8586	1347	0	Yonaguni knoll		X			23		KIPS 21 start

KIPS bottle	22	21/03/2008	06:11:48	N 24 50.4779	E 122 41.8582	1347	0	Yonaguni knoll		X			24		KIPS 22 start
KIPS bottle	23	21/03/2008	06:20:38	N 24 50.4781	E 122 41.8570	1347	0	Yonaguni knoll		X			26		KIPS23 done
KIPS bottle	24	21/03/2008	06:25:44	N 24 50.4783	E 122 41.8568	1346	0	Yonaguni knoll		X			28		KIPS 24 stop
KIPS bottle	25	21/03/2008	11:46:54	N 24 50.7774	E 122 42.0387	1381	0	Yonaguni knoll		X			198		KIPS 25 done
KIPS bottle	26	21/03/2008	11:50:29	N 24 50.7778	E 122 42.0380	1381	0	Yonaguni knoll		X			2		stop KIPS 26
KIPS bottle	27	21/03/2008	11:53:07	N 24 50.7778	E 122 42.0385	1380	0	Yonaguni knoll		X			22		KIPS 27 off
KIPS bottle	28	21/03/2008	11:54:05	N 24 50.7778	E 122 42.0378	1381	0	Yonaguni knoll		X			23		KIPS 28
KIPS bottle	29	21/03/2008	11:58:21	N 24 50.7773	E 122 42.0377	1381	0	Yonaguni knoll	X				24		KIPS 29 taken at seafloor tape changed to #8
KIPS bottle	30	21/03/2008	12:07:03	N 24 50.7784	E 122 42.0376	1380	1	Yonaguni knoll	X				25		KIPS 30 taken 1 m asf
KIPS bottle	31	21/03/2008	12:15:35	N 24 50.7777	E 122 42.0375	1379	1	Yonaguni knoll	X				28		KIPS31 closed
KIPS bottle	32	21/03/2008	12:19:18	N 24 50.7779	E 122 42.0383	1380	1	Yonaguni knoll	X				21		KIPS 32 closed
KIPS bottle	33	21/03/2008	12:23:09	N 24 50.7789	E 122 42.0378	1379	1	Yonaguni knoll		X			212		KIPS 33 closed
KIPS bottle	34	21/03/2008	12:33:04	N 24 50.7789	E 122 42.0383	1379	2	Yonaguni knoll		X			214		KIPS 34 closed 2 m ab
KIPS bottle	35	21/03/2008	12:36:59	N 24 50.7774	E 122 42.0376	1379	2	Yonaguni knoll		X			216		KIPS 35 closed
KIPS bottle	36	21/03/2008	12:38:21	N 24 50.7775	E 122 42.0374	1378	2	Yonaguni knoll		X			217		kIPS 36
KIPS bottle	37	21/03/2008	12:46:07	N 24 50.7772	E 122 42.0383	1379	2	Yonaguni knoll		X			218		KIPS 37 closed
megafauna video transect	1	21/03/2008	07:27:56	N 24 50.6586	E 122 42.0578	1389	1	Yonaguni knoll					7	X	end video transect 1 transition zone with rocks and mats LBL 24 deg 50.658 122 deg 42.056
megafauna video transect	2	21/03/2008	08:40:38	N 24 50.4821	E 122 41.8634	1349	1	Yonaguni knoll					135	X	arrive at chamber end of video transect 2
megafauna video transect	3	21/03/2008	14:02:54	N 24 50.9386	E 122 42.1912	1274	1	Yonaguni knoll					282	X	target 23: stop video transect no 3 at 400 m away from chamber still signs of hydrothermal venting
sidescan sonar QUEST	1	21/03/2008	10:50:14	N 24 50.7955	E 122 42.0305	1374	4	Yonaguni knoll					185	X	sidescan sonar recording prof 1 off
sidescan sonar QUEST	2	21/03/2008	14:18:27	N 24 50.9383	E 122 42.1211	1260	0	Yonaguni knoll					285	X	side scan sonar prof 2 end signal disturbed

Dive summary

ROV Quest - Dive: 206-10

SUMSUN (Sonne)

Date: **21/03/2008**
Observers: **BOETIUS Antje**
Station: **Yonaguni knoll**
Position: **N 24 50.7077 E 122 42.0005**

Dive duration:

Start: **21/03/2008 03:35:00**
At bottom: **21/03/2008 05:04:00**
Leave bottom: **21/03/2008 15:29:00**
End: **21/03/2008 16:25:00**

Explored sites:

Dive objectives:

Objectives:
1. chamber measurements at reference and seep site
2. KIPS, still fotos at chamber positions
3. Video observation transition between reference and seep area
4. Videomosaicking and Sidescan sonar

Dive schedule (11 hours bottom time)
Dive start 13:00
ROV on deck 02:00

ROV Shifts (2 hours):
14:00 to 16:00 DeBeer, Boetius
16:00 to 18:00 Haeckel, Boetius
18:00 to 20:00 Rehder, Boetius
20:00 to 22:00 Schneider, Rehder
22:00 to 24:00 Schneider, Nakamura
00:00 to 02:00 Nakamura, Boetius

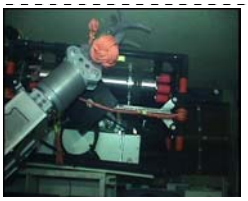
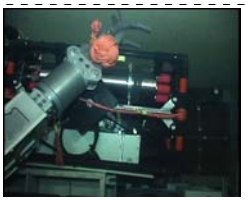
Operations synthesis:

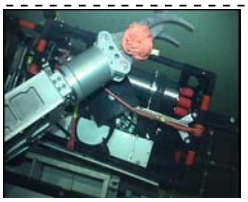
Sampling operations
Biology :
KIPS bottle : 4 samples,
Water :
KIPS bottle : 13 samples,
Measures
12 continue measures were realised,
Moorings
2 moorings were placed.
2 moorings were recovered.

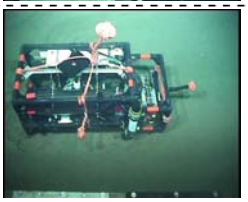
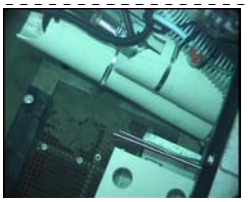
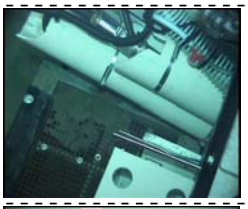
291 pictures captured,

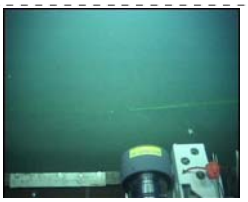
Dive summary:

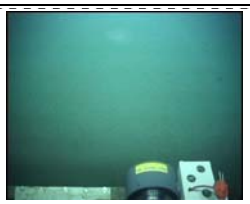
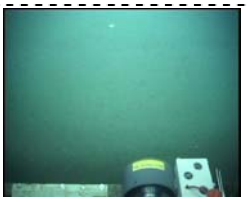
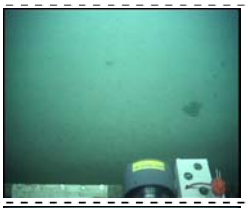
Dive report:

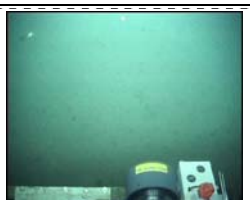
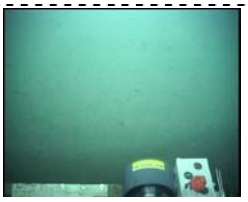
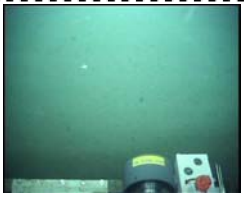
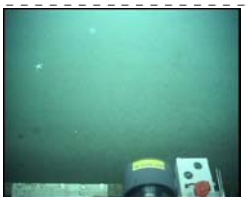
Date	Hour	Location	Latitude Longitude	Immersion Altitude	Comments	Picture
21/03/2008	05:03:44	Yonaguni knoll	N 24 50.4012 E 122 41.7735	1321.1 0.5	start	
21/03/2008	05:04:13	Yonaguni knoll	N 24 50.4010 E 122 41.7734	1320.8 0.5	arrive at seafloor in target area	
21/03/2008	05:04:35	Yonaguni knoll	N 24 50.4005 E 122 41.7731	1321.2 0.5	shift start Dirk, Antje	
21/03/2008	05:07:02	Yonaguni knoll	N 24 50.4023 E 122 41.7715	1320.9 0.5	many seacucumbers and seastars	
21/03/2008	05:14:27	Yonaguni knoll	N 24 50.4390 E 122 41.8160	1331.1 0.6	moved 100 m NE wards, still many holoturians and sea stars	
21/03/2008	05:19:24	Yonaguni knoll	N 24 50.4550 E 122 41.8339	1336.5 0.5	wait for ship	
21/03/2008	05:24:49	Yonaguni knoll	N 24 50.4604 E 122 41.8392	1338.7 0.9	further on NE wards	

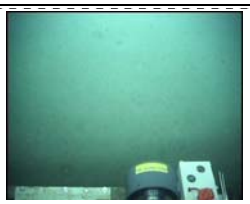
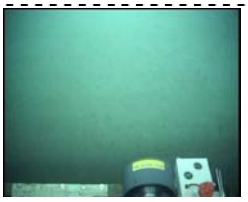
21/03/2008	05:25:14	Yonaguni knoll	N 24 50.4627 E 122 41.8402	1339.2 0.9	a blue and a white species of holothurians, and white seastars	
21/03/2008	05:30:20	Yonaguni knoll	N 24 50.4758 E 122 41.8510	1345.9 0.8	holothurians get less, starfish still there	
21/03/2008	05:30:30	Yonaguni knoll	N 24 50.4748 E 122 41.8519	1346.1 0.3	sit down to deploy chamber	
21/03/2008	05:31:23	Yonaguni knoll	N 24 50.4751 E 122 41.8501	1346.2 0.3	fish	
21/03/2008	05:34:32	Yonaguni knoll	N 24 50.4762 E 122 41.8494	1346.3 0.2	start deploying chamber	
21/03/2008	05:41:56	Yonaguni knoll	N 24 50.4755 E 122 41.8512	1346.5 0.0	the ROV is not sitting down properly, try again twice	
21/03/2008	05:50:19	Yonaguni knoll	N 24 50.4789 E 122 41.8599	1347.9 1.2	tchamber 1 is set down, arget 20, 12 cm penetration	
21/03/2008	05:55:57	Yonaguni knoll	N 24 50.4775 E 122 41.8587	1344.6 2.8	try to sit down in front of chamber for KIPS and Photo	
21/03/2008	05:56:17	Yonaguni knoll	N 24 50.4774 E 122 41.8588	1344.4 2.8	again pic	

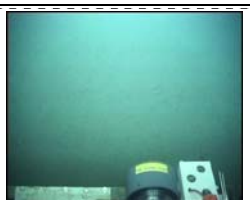
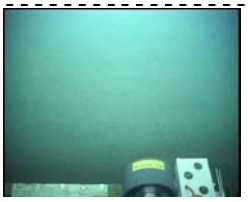
21/03/2008	05:57:17	Yonaguni knoll	N 24 50.4777 E 122 41.8588	1344.1 3.1	again pic	
21/03/2008	05:57:46	Yonaguni knoll	N 24 50.4781 E 122 41.8597	1345.4 2.2	again pic, problem with frame grab, reboot	
21/03/2008	05:59:02	Yonaguni knoll	N 24 50.4767 E 122 41.8559	1345.3 2.3	pic	
21/03/2008	06:05:43	Yonaguni knoll	N 24 50.4754 E 122 41.8597	1347.1 0.0	chamber penetrated to 12 cm, stills taken	
21/03/2008	06:06:00	Yonaguni knoll	N 24 50.4755 E 122 41.8597	1347.1 0.0	Tape 2	No picture
21/03/2008	06:08:50	Yonaguni knoll	N 24 50.4768 E 122 41.8586	1347.3 0.0	KIPS 21 start	
21/03/2008	06:11:48	Yonaguni knoll	N 24 50.4779 E 122 41.8582	1347.3 0.0	KIPS 22 start	
21/03/2008	06:16:10	Yonaguni knoll	N 24 50.4784 E 122 41.8565	1347.8 0.0	KIPS23 start	
21/03/2008	06:20:38	Yonaguni knoll	N 24 50.4781 E 122 41.8570	1347.0 0.0	KIPS23 done	

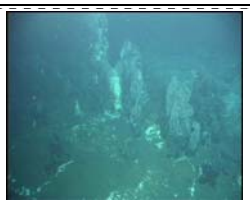
21/03/2008	06:23:22	Yonaguni knoll	N 24 50.4786 E 122 41.8573	1347.2 0.0	KIPS 24 start	
21/03/2008	06:25:44	Yonaguni knoll	N 24 50.4783 E 122 41.8568	1346.9 0.0	KIPS 24 stop	
21/03/2008	06:26:26	Yonaguni knoll	N 24 50.4790 E 122 41.8572	1347.9 0.0	KIPS 25 start	
21/03/2008	06:30:51	Yonaguni knoll	N 24 50.4784 E 122 41.8587	1347.0 0.0	KIPS 25 no sample, forgot to close it	
21/03/2008	06:31:02	Yonaguni knoll	N 24 50.4788 E 122 41.8592	1347.5 0.0	measurements for videomosiacking, porch ca 1.50 m, height ca 2 m when sitting down	
21/03/2008	06:32:35	Yonaguni knoll	N 24 50.4785 E 122 41.8591	1347.1 0.0	leave chamber, start videomosaicking	
21/03/2008	06:39:18	Yonaguni knoll	N 24 50.5016 E 122 41.9162	1374.4 0.7	0.1m /s, 1m above ground, laser	
21/03/2008	06:40:35	Yonaguni knoll	N 24 50.5055 E 122 41.9186	1376.2 0.7	laser on	
21/03/2008	06:40:51	Yonaguni knoll	N 24 50.5064 E 122 41.9195	1376.6 0.7	start video transect 1	

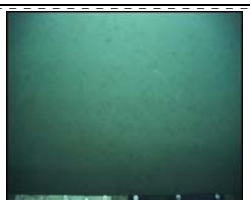
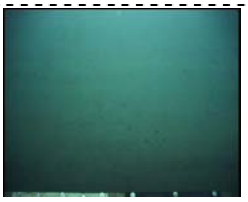
21/03/2008	06:41:29	Yonaguni knoll	N 24 50.5083 E 122 41.9212	1377.9 0.7	white holothurian	
21/03/2008	06:41:39	Yonaguni knoll	N 24 50.5094 E 122 41.9225	1378.2 0.7	starfish	
21/03/2008	06:42:52	Yonaguni knoll	N 24 50.5140 E 122 41.9247	1379.0 0.7	starfish	
21/03/2008	06:44:39	Yonaguni knoll	N 24 50.5216 E 122 41.9292	1380.1 0.7	fish	
21/03/2008	06:47:17	Yonaguni knoll	N 24 50.5321 E 122 41.9361	1380.1 0.7	starfish	
21/03/2008	06:48:21	Yonaguni knoll	N 24 50.5348 E 122 41.9376	1380.5 0.7	starfish	
21/03/2008	06:50:14	Yonaguni knoll	N 24 50.5416 E 122 41.9394	1380.8 0.7	fish	
21/03/2008	06:50:25	Yonaguni knoll	N 24 50.5420 E 122 41.9402	1380.5 0.7	2 starfish	
21/03/2008	06:52:10	Yonaguni knoll	N 24 50.5494 E 122 41.9415	1381.2 0.7	starfish	

21/03/2008	06:54:39	Yonaguni knoll	N 24 50.5590 E 122 41.9430	1380.8 0.7	2 starfish	
21/03/2008	06:55:25	Yonaguni knoll	N 24 50.5599 E 122 41.9467	1381.2 0.7	1 starfish	
21/03/2008	06:55:41	Yonaguni knoll	N 24 50.5611 E 122 41.9483	1381.2 0.7	starfish	
21/03/2008	06:57:58	Yonaguni knoll	N 24 50.5705 E 122 41.9576	1382.2 0.7	starfish	
21/03/2008	06:59:43	Yonaguni knoll	N 24 50.5754 E 122 41.9647	1381.4 0.7	starfish	
21/03/2008	07:00:31	Yonaguni knoll	N 24 50.5765 E 122 41.9675	1381.6 0.7	tape 3, Kristina in	
21/03/2008	07:01:05	Yonaguni knoll	N 24 50.5778 E 122 41.9707	1382.0 0.7	2 starfish	
21/03/2008	07:03:37	Yonaguni knoll	N 24 50.5839 E 122 41.9830	1382.4 0.7	large pelagic slug	
21/03/2008	07:04:00	Yonaguni knoll	N 24 50.5846 E 122 41.9862	1382.6 0.7	starfish	

21/03/2008	07:04:56	Yonaguni knoll	N 24 50.5889 E 122 41.9916	1382.2 0.7	white seacucumber	
21/03/2008	07:05:09	Yonaguni knoll	N 24 50.5900 E 122 41.9917	1382.4 0.7	starfish	
21/03/2008	07:06:01	Yonaguni knoll	N 24 50.5949 E 122 41.9952	1382.2 0.7	starfish	
21/03/2008	07:06:21	Yonaguni knoll	N 24 50.5964 E 122 41.9965	1382.1 0.7	starfish	
21/03/2008	07:06:58	Yonaguni knoll	N 24 50.6002 E 122 41.9989	1382.1 0.7	many holes in the seafloor	
21/03/2008	07:08:30	Yonaguni knoll	N 24 50.6097 E 122 42.0041	1382.0 0.7	small blue seacucumber	
21/03/2008	07:10:49	Yonaguni knoll	N 24 50.6152 E 122 42.0075	1382.1 0.7	fish	
21/03/2008	07:12:13	Yonaguni knoll	N 24 50.6191 E 122 42.0109	1382.9 0.7	starfish	
21/03/2008	07:17:59	Yonaguni knoll	N 24 50.6303 E 122 42.0296	1386.8 0.7	large shrimp	

21/03/2008	07:19:32	Yonaguni knoll	N 24 50.6351 E 122 42.0349	1387.6 0.7	sea anemone	
21/03/2008	07:22:49	Yonaguni knoll	N 24 50.6436 E 122 42.0459	1388.3 0.7	fish	
21/03/2008	07:24:20	Yonaguni knoll	N 24 50.6499 E 122 42.0518	1390.4 0.7	seafloor has less biostructures, less traces, some spots	
21/03/2008	07:24:49	Yonaguni knoll	N 24 50.6511 E 122 42.0534	1390.2 0.7	pavement	
21/03/2008	07:25:09	Yonaguni knoll	N 24 50.6520 E 122 42.0554	1391.2 0.7	fish	
21/03/2008	07:25:31	Yonaguni knoll	N 24 50.6536 E 122 42.0554	1389.8 1.3	Sea spider,white mats	
21/03/2008	07:26:10	Yonaguni knoll	N 24 50.6565 E 122 42.0561	1388.7 1.6	white mats,rocks, sedimented	
21/03/2008	07:27:56	Yonaguni knoll	N 24 50.6586 E 122 42.0578	1389.0 1.5	end video transect 1, transition zone with rocks, and mats, LBL 24 deg 50.658, 122 deg 42.056	
21/03/2008	07:31:28	Yonaguni knoll	N 24 50.6588 E 122 42.0553	1388.7 1.5	HDTV 1 on, tape 1	

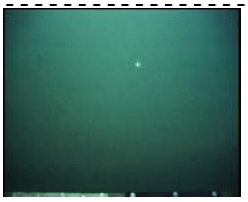
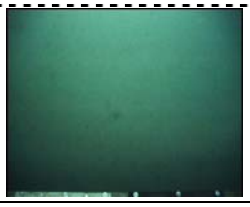
21/03/2008	07:40:07	Yonaguni knoll	N 24 50.6617 E 122 42.0548	1389.9 0.0	many fish	
21/03/2008	07:45:22	Yonaguni knoll	N 24 50.6633 E 122 42.0555	1388.8 1.5	shimmering fluid	
21/03/2008	07:51:17	Yonaguni knoll	N 24 50.6522 E 122 42.0701	1391.3 1.3	return to chamber, HDTV 1 tape 1 off	
21/03/2008	07:53:36	Yonaguni knoll	N 24 50.6350 E 122 42.0697	1391.0 1.1	video transect 2 starts, 6 seaspiders	
21/03/2008	07:53:54	Yonaguni knoll	N 24 50.6331 E 122 42.0700	1391.1 1.2	white pavement	
21/03/2008	07:56:28	Yonaguni knoll	N 24 50.6279 E 122 42.0720	1391.2 1.3	2 seaspiders	
21/03/2008	07:57:41	Yonaguni knoll	N 24 50.6233 E 122 42.0677	1390.7 1.5	end of mat	
21/03/2008	07:58:41	Yonaguni knoll	N 24 50.6201 E 122 42.0622	1389.7 1.0	normal seafloor	
21/03/2008	08:00:35	Yonaguni knoll	N 24 50.6161 E 122 42.0517	1388.0 1.7	starfish, tape 4	

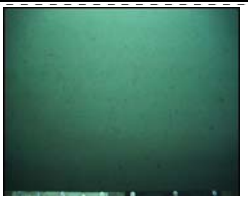
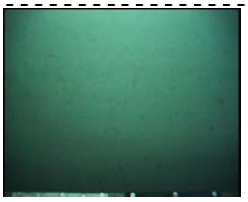
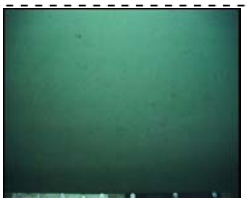
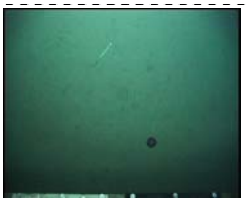
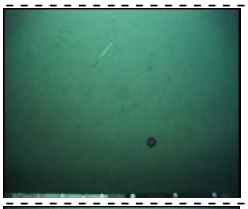
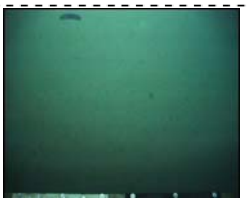
21/03/2008	08:03:58	Yonaguni knoll	N 24 50.6077 E 122 42.0302	1384.4 1.3	octopus	
21/03/2008	08:05:46	Yonaguni knoll	N 24 50.6039 E 122 42.0211	1382.9 1.2	starfish	
21/03/2008	08:07:04	Yonaguni knoll	N 24 50.5921 E 122 42.0175	1382.9 1.1	starfish	
21/03/2008	08:09:03	Yonaguni knoll	N 24 50.5783 E 122 42.0140	1384.1 0.9	red shrimp	
21/03/2008	08:09:59	Yonaguni knoll	N 24 50.5726 E 122 42.0104	1383.9 0.9	starfish, shrimp	
21/03/2008	08:10:43	Yonaguni knoll	N 24 50.5689 E 122 42.0094	1384.0 1.1	fish	
21/03/2008	08:11:32	Yonaguni knoll	N 24 50.5637 E 122 42.0112	1384.3 1.2	2 starfish	
21/03/2008	08:11:53	Yonaguni knoll	N 24 50.5620 E 122 42.0123	1384.2 1.5	4 blue holoturians	
21/03/2008	08:12:12	Yonaguni knoll	N 24 50.5599 E 122 42.0120	1385.0 0.9	5 blue holothurians	

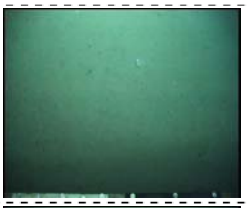
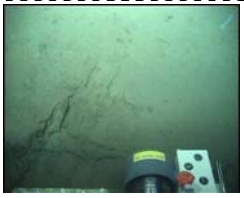
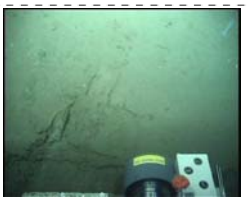
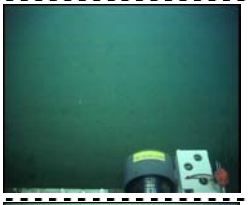
21/03/2008	08:12:45	Yonaguni knoll	N 24 50.5569 E 122 42.0111	1381.9 4.2	13 blue holothurians	
21/03/2008	08:13:04	Yonaguni knoll	N 24 50.5547 E 122 42.0095	1380.8 4.6	left seafloor	
21/03/2008	08:13:19	Yonaguni knoll	N 24 50.5542 E 122 42.0091	1384.5 0.7	1 blue holothurian	
21/03/2008	08:14:25	Yonaguni knoll	N 24 50.5520 E 122 42.0041	1383.5 1.9	back at seafloor	
21/03/2008	08:14:57	Yonaguni knoll	N 24 50.5508 E 122 42.0006	1382.2 2.7	1 starfish	
21/03/2008	08:16:14	Yonaguni knoll	N 24 50.5450 E 122 41.9922	1383.3 1.5	1 blue holothurian	
21/03/2008	08:17:09	Yonaguni knoll	N 24 50.5407 E 122 41.9875	1383.2 1.3	starfish	
21/03/2008	08:17:43	Yonaguni knoll	N 24 50.5382 E 122 41.9848	1383.2 1.3	2 starfish	
21/03/2008	08:18:33	Yonaguni knoll	N 24 50.5356 E 122 41.9822	1382.7 1.3	2 starfish, white Holothurian	

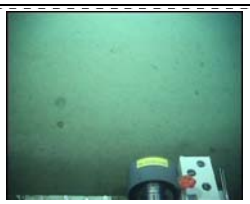
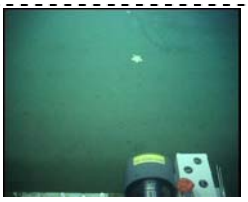
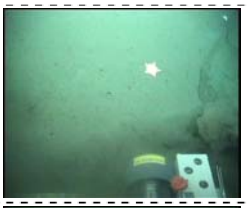
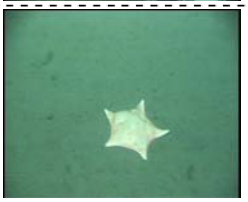
21/03/2008	08:19:07	Yonaguni knoll	N 24 50.5341 E 122 41.9793	1382.5 1.3	starfish	
21/03/2008	08:19:53	Yonaguni knoll	N 24 50.5324 E 122 41.9752	1382.7 1.3	starfish	
21/03/2008	08:20:14	Yonaguni knoll	N 24 50.5321 E 122 41.9744	1381.8 1.4	sea anemone	
21/03/2008	08:20:50	Yonaguni knoll	N 24 50.5315 E 122 41.9716	1381.9 1.3	white holothurian, starfish	
21/03/2008	08:22:09	Yonaguni knoll	N 24 50.5292 E 122 41.9674	1381.7 1.3	fish	
21/03/2008	08:22:38	Yonaguni knoll	N 24 50.5283 E 122 41.9650	1381.2 1.3	sea anemone	
21/03/2008	08:23:08	Yonaguni knoll	N 24 50.5282 E 122 41.9625	1381.4 1.4	blue holothurian	
21/03/2008	08:23:40	Yonaguni knoll	N 24 50.5274 E 122 41.9598	1380.8 1.5	starfish, blue holothurian	
21/03/2008	08:25:01	Yonaguni knoll	N 24 50.5251 E 122 41.9536	1380.8 1.3	white holothurian	

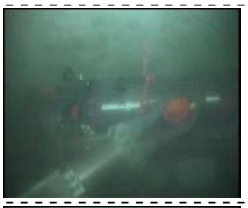
21/03/2008	08:25:14	Yonaguni knoll	N 24 50.5256 E 122 41.9524	1380.1 1.5	fish	
21/03/2008	08:25:50	Yonaguni knoll	N 24 50.5250 E 122 41.9488	1380.2 1.4	blue holothurian	
21/03/2008	08:26:52	Yonaguni knoll	N 24 50.5246 E 122 41.9425	1380.3 1.4	blue holothurian	
21/03/2008	08:27:14	Yonaguni knoll	N 24 50.5244 E 122 41.9403	1379.8 1.4	3 blue holo	
21/03/2008	08:28:10	Yonaguni knoll	N 24 50.5238 E 122 41.9364	1379.8 1.4	blue holo	
21/03/2008	08:28:55	Yonaguni knoll	N 24 50.5211 E 122 41.9336	1379.1 1.8	fish	
21/03/2008	08:29:12	Yonaguni knoll	N 24 50.5202 E 122 41.9329	1378.7 1.6	starfish	
21/03/2008	08:30:02	Yonaguni knoll	N 24 50.5180 E 122 41.9268	1378.8 1.4	starfish	
21/03/2008	08:30:56	Yonaguni knoll	N 24 50.5162 E 122 41.9193	1378.8 1.5	starfish	

21/03/2008	08:31:15	Yonaguni knoll	N 24 50.5170 E 122 41.9170	1378.3 1.5	starfish	
21/03/2008	08:32:43	Yonaguni knoll	N 24 50.5152 E 122 41.9101	1376.7 1.5	2 starfish	
21/03/2008	08:33:28	Yonaguni knoll	N 24 50.5139 E 122 41.9058	1374.3 1.6	blue holo	
21/03/2008	08:33:37	Yonaguni knoll	N 24 50.5126 E 122 41.9050	1373.9 1.5	starfish	
21/03/2008	08:34:42	Yonaguni knoll	N 24 50.5099 E 122 41.8963	1370.3 1.5	white and blue Holo	
21/03/2008	08:35:06	Yonaguni knoll	N 24 50.5084 E 122 41.8941	1369.1 1.5	3 holo	
21/03/2008	08:35:16	Yonaguni knoll	N 24 50.5080 E 122 41.8925	1368.4 1.5	1 holo	
21/03/2008	08:35:29	Yonaguni knoll	N 24 50.5068 E 122 41.8912	1367.8 1.5	1 holo	
21/03/2008	08:35:38	Yonaguni knoll	N 24 50.5069 E 122 41.8896	1367.6 1.5	2 starfish	

21/03/2008	08:37:04	Yonaguni knoll	N 24 50.5004 E 122 41.8818	1362.1 1.4	sea anemone	
21/03/2008	08:37:16	Yonaguni knoll	N 24 50.4983 E 122 41.8803	1361.3 1.4	starfish	
21/03/2008	08:37:38	Yonaguni knoll	N 24 50.4961 E 122 41.8785	1359.3 1.5	blue holo, starfish	No picture
21/03/2008	08:37:59	Yonaguni knoll	N 24 50.4940 E 122 41.8756	1357.2 1.5	blue holo, starfish	
21/03/2008	08:38:17	Yonaguni knoll	N 24 50.4924 E 122 41.8742	1355.8 1.6	2 holo, 1 w holo	
21/03/2008	08:38:42	Yonaguni knoll	N 24 50.4901 E 122 41.8736	1354.0 1.5	fish, seaurchin	
21/03/2008	08:38:56	Yonaguni knoll	N 24 50.4887 E 122 41.8732	1353.1 1.6	fish, 2 blue holo	
21/03/2008	08:39:13	Yonaguni knoll	N 24 50.4879 E 122 41.8714	1352.3 1.5	blue holo	
21/03/2008	08:39:32	Yonaguni knoll	N 24 50.4858 E 122 41.8683	1350.6 1.6	2 blue holo	

21/03/2008	08:40:26	Yonaguni knoll	N 24 50.4837 E 122 41.8643	1349.3 1.5	starfish, blue holo	
21/03/2008	08:40:38	Yonaguni knoll	N 24 50.4821 E 122 41.8634	1349.2 1.5	arrive at chamber, end of video transect 2	
21/03/2008	08:42:20	Yonaguni knoll	N 24 50.4824 E 122 41.8598	1349.7 0.3	hdtv 2 tape 1 on, film white holo in action	
21/03/2008	08:44:12	Yonaguni knoll	N 24 50.4813 E 122 41.8608	1349.5 0.0	stll	
21/03/2008	08:51:34	Yonaguni knoll	N 24 50.4819 E 122 41.8599	1349.7 0.0	chitine tube from worm	
21/03/2008	08:53:27	Yonaguni knoll	N 24 50.4814 E 122 41.8617	1349.9 0.0	baby seacucumber eaten by spider like thing in sand	
21/03/2008	08:57:24	Yonaguni knoll	N 24 50.4808 E 122 41.8607	1349.6 0.2	tape changed to #5	
21/03/2008	09:03:01	Yonaguni knoll	N 24 50.4759 E 122 41.8572	1346.4 0.9	HDTV No 2 end, tape #2	
21/03/2008	09:04:14	Yonaguni knoll	N 24 50.4756 E 122 41.8577	1346.5 0.0	weird anemone,like flower on sand.	

21/03/2008	09:05:21	Yonaguni knoll	N 24 50.4756 E 122 41.8560	1346.8 0.0	lots of holes ca 5 cm diameter, maybe from animals, guess from the anemone	
21/03/2008	09:09:10	Yonaguni knoll	N 24 50.4773 E 122 41.8543	1346.6 0.3	white fat seastar, HDTV 3 tape 2 on	
21/03/2008	09:11:05	Yonaguni knoll	N 24 50.4776 E 122 41.8554	1347.3 0.0	more anemones in background	
21/03/2008	09:16:07	Yonaguni knoll	N 24 50.4778 E 122 41.8557	1348.0 0.0	HDTV No 3 end tape 2 off, fat white seastar now on HD film	
21/03/2008	09:20:11	Yonaguni knoll	N 24 50.4814 E 122 41.8588	1349.7 1.0	bleu seacucumber	
21/03/2008	09:20:40	Yonaguni knoll	N 24 50.4828 E 122 41.8588	1350.0 0.4	hd 4 tape 2 on	
21/03/2008	09:22:02	Yonaguni knoll	N 24 50.4821 E 122 41.8583	1349.8 0.2	laser on, beast is 20 cm	
21/03/2008	09:22:34	Yonaguni knoll	N 24 50.4831 E 122 41.8591	1349.9 0.2	parasites on bleu cucumber	
21/03/2008	09:24:53	Yonaguni knoll	N 24 50.4831 E 122 41.8574	1350.3 0.2	HDTV No 4 tape 2 off	

21/03/2008	09:30:16	Yonaguni knoll	N 24 50.4801 E 122 41.8571	1349.0 0.0	chamber out	
21/03/2008	09:38:05	Yonaguni knoll	N 24 50.4795 E 122 41.8579	1348.6 0.0	chamber on porch	
21/03/2008	09:41:17	Yonaguni knoll	N 24 50.4808 E 122 41.8570	1349.4 0.0	side-scan sonar transect to wp21 delayed, no dataconnection	
21/03/2008	09:44:39	Yonaguni knoll	N 24 50.4809 E 122 41.8569	1349.1 0.2	pilot change	
21/03/2008	09:56:52	Yonaguni knoll	N 24 50.4805 E 122 41.8568	1349.1 0.0	side scan record on	
21/03/2008	09:57:25	Yonaguni knoll	N 24 50.4808 E 122 41.8562	1349.3 0.4	tape changed to #6	
21/03/2008	09:58:12	Yonaguni knoll	N 24 50.4801 E 122 41.8571	1347.8 1.8	ROV to 8 m	
21/03/2008	09:59:55	Yonaguni knoll	N 24 50.4822 E 122 41.8572	1339.2 10.8	start transect at 11.3 m asf	
21/03/2008	10:03:52	Yonaguni knoll	N 24 50.4972 E 122 41.8943	1355.6 11.6	time synchronization sidescan sonar, start transect 1	

21/03/2008	10:21:25	Yonaguni knoll	N 24 50.6214 E 122 42.0190	1374.2 11.4	ship movement	
21/03/2008	10:21:58	Yonaguni knoll	N 24 50.6259 E 122 42.0246	1372.0 14.3	high backscatter patch	
21/03/2008	10:22:52	Yonaguni knoll	N 24 50.6288 E 122 42.0298	1376.8 10.7	due to structures ROV went up 5 m	
21/03/2008	10:24:01	Yonaguni knoll	N 24 50.6363 E 122 42.0346	1378.1 10.2	structure on outer star board side	
21/03/2008	10:26:45	Yonaguni knoll	N 24 50.6538 E 122 42.0518	1378.1 12.6	end of structure starbord side	
21/03/2008	10:27:15	Yonaguni knoll	N 24 50.6593 E 122 42.0566	1373.4 17.4	arrived at wp21	
21/03/2008	10:27:45	Yonaguni knoll	N 24 50.6603 E 122 42.0608	1379.8 10.7	ship truning around, new heading NNW	
21/03/2008	10:31:11	Yonaguni knoll	N 24 50.6876 E 122 42.0426	1378.4 11.2	track parallel to fracture on starbord	
21/03/2008	10:32:28	Yonaguni knoll	N 24 50.7000 E 122 42.0451	1376.6 13.3	speed 30 cm/s 10.5 m asf	

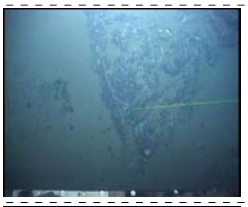
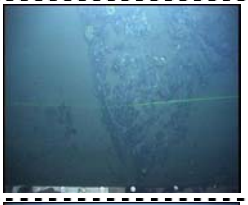
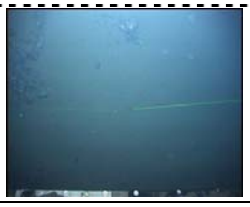
21/03/2008	10:36:01	Yonaguni knoll	N 24 50.7272 E 122 42.0544	1379.2 9.9	hammocky patch portside	
21/03/2008	10:36:46	Yonaguni knoll	N 24 50.7321 E 122 42.0537	1381.1 7.9	chimney portside	
21/03/2008	10:38:14	Yonaguni knoll	N 24 50.7451 E 122 42.0489	1378.9 10.0	high backscatter anomalie outer port side	
21/03/2008	10:38:51	Yonaguni knoll	N 24 50.7509 E 122 42.0470	1378.1 9.9	end chiney at portside	
21/03/2008	10:39:10	Yonaguni knoll	N 24 50.7538 E 122 42.0465	1378.1 10.1	gas in water column	
21/03/2008	10:39:29	Yonaguni knoll	N 24 50.7564 E 122 42.0450	1378.1 10.2	again gas bubbkles, also observed in scanning sonar ROV	
21/03/2008	10:39:51	Yonaguni knoll	N 24 50.7599 E 122 42.0451	1377.9 10.3	flare in water column	
21/03/2008	10:41:42	Yonaguni knoll	N 24 50.7770 E 122 42.0411	1371.7 9.4	gas in watercolumn	
21/03/2008	10:41:55	Yonaguni knoll	N 24 50.7791 E 122 42.0398	1370.5 9.7	passing ventfield	

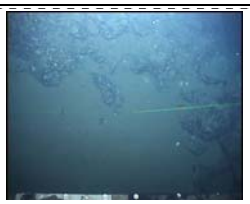
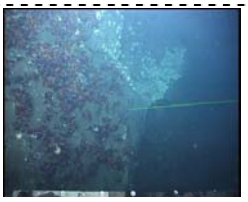
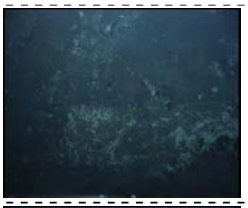
21/03/2008	10:42:13	Yonaguni knoll	N 24 50.7820 E 122 42.0398	1368.6 10.3	depressions on both sides	
21/03/2008	10:42:33	Yonaguni knoll	N 24 50.7837 E 122 42.0387	1367.6 10.4	passing abyss	
21/03/2008	10:45:34	Yonaguni knoll	N 24 50.8011 E 122 42.0323	1366.2 10.6	small hydrates visible	
21/03/2008	10:45:59	Yonaguni knoll	N 24 50.8066 E 122 42.0305	1363.1 15.3	white scatters in watercolumn	
21/03/2008	10:46:42	Yonaguni knoll	N 24 50.8088 E 122 42.0291	1365.9 13.6	chimney outer bordside	
21/03/2008	10:47:15	Yonaguni knoll	N 24 50.8091 E 122 42.0286	1366.4 13.3	end transect is 60 m NNW of target position	
21/03/2008	10:50:14	Yonaguni knoll	N 24 50.7955 E 122 42.0305	1374.5 4.4	sidescan sonar recording prof 1 off	
21/03/2008	10:52:20	Yonaguni knoll	N 24 50.7771 E 122 42.0391	1376.5 4.5	recording on again	
21/03/2008	10:53:11	Yonaguni knoll	N 24 50.7776 E 122 42.0387	1377.9 3.2	recording off	

21/03/2008	10:54:47	Yonaguni knoll	N 24 50.7768 E 122 42.0407	1381.1 0.0	ROV landed at chamber 2 site	
21/03/2008	10:55:27	Yonaguni knoll	N 24 50.7775 E 122 42.0402	1380.2 0.0	slope 9 degrees	
21/03/2008	10:57:17	Yonaguni knoll	N 24 50.7797 E 122 42.0404	1380.3 0.8	ROV turned 180 degrees	
21/03/2008	10:58:26	Yonaguni knoll	N 24 50.7795 E 122 42.0400	1380.3 0.5	tape change to #7	
21/03/2008	11:14:30	Yonaguni knoll	N 24 50.7769 E 122 42.0396	1378.5 3.5	reposition to exact target	
21/03/2008	11:17:51	Yonaguni knoll	N 24 50.7767 E 122 42.0383	1381.0 0.4	target sediment has 1 cm holes	
21/03/2008	11:23:09	Yonaguni knoll	N 24 50.7757 E 122 42.0383	1381.1 0.5	chamber positioned at target 22	
21/03/2008	11:28:54	Yonaguni knoll	N 24 50.7774 E 122 42.0372	1381.1 0.3	chamber 14 cm, still	
21/03/2008	11:37:07	Yonaguni knoll	N 24 50.7768 E 122 42.0380	1381.0 0.3	wait for mud cloud to pass by for KIPS	

21/03/2008	11:43:01	Yonaguni knoll	N 24 50.7777 E 122 42.0376	1380.9 0.3	KIPS25 start	
21/03/2008	11:46:54	Yonaguni knoll	N 24 50.7774 E 122 42.0387	1381.1 0.3	KIPS 25 done	
21/03/2008	11:47:06	Yonaguni knoll	N 24 50.7775 E 122 42.0383	1380.9 0.3	start KIPS 26	
21/03/2008	11:50:29	Yonaguni knoll	N 24 50.7778 E 122 42.0380	1381.5 0.3	stop KIPS 26	
21/03/2008	11:50:41	Yonaguni knoll	N 24 50.7774 E 122 42.0384	1381.0 0.3	KIPS 27	
21/03/2008	11:53:07	Yonaguni knoll	N 24 50.7778 E 122 42.0385	1380.1 0.3	KIPS 27 off	
21/03/2008	11:54:05	Yonaguni knoll	N 24 50.7778 E 122 42.0378	1381.4 0.3	KIPS 28	
21/03/2008	11:58:21	Yonaguni knoll	N 24 50.7773 E 122 42.0377	1381.1 0.3	KIPS 29 taken at seafloor, tape changed to #8	
21/03/2008	12:07:03	Yonaguni knoll	N 24 50.7784 E 122 42.0376	1380.5 1.1	KIPS 30 taken, 1 m asf	

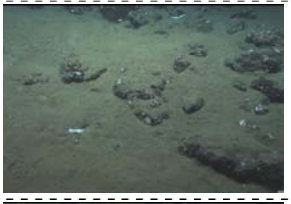
21/03/2008	12:10:18	Yonaguni knoll	N 24 50.7778 E 122 42.0378	1380.1 1.3	KIPS close function not controlled	
21/03/2008	12:12:21	Yonaguni knoll	N 24 50.7785 E 122 42.0380	1380.3 1.2	KIPS 31 open 1 m asf	
21/03/2008	12:15:35	Yonaguni knoll	N 24 50.7777 E 122 42.0375	1379.9 1.2	KIPS31 closed	
21/03/2008	12:16:20	Yonaguni knoll	N 24 50.7761 E 122 42.0387	1379.2 1.2	KIPS 32 open 1 m asf	
21/03/2008	12:19:18	Yonaguni knoll	N 24 50.7779 E 122 42.0383	1380.4 1.2	KIPS 32 closed	
21/03/2008	12:19:35	Yonaguni knoll	N 24 50.7772 E 122 42.0377	1379.8 1.2	KIPS 33 open	
21/03/2008	12:23:09	Yonaguni knoll	N 24 50.7789 E 122 42.0378	1379.1 1.2	KIPS 33 closed	
21/03/2008	12:30:17	Yonaguni knoll	N 24 50.7786 E 122 42.0383	1379.1 2.0	KIPS 34 start	
21/03/2008	12:33:04	Yonaguni knoll	N 24 50.7789 E 122 42.0383	1379.6 2.1	KIPS 34 closed, 2 m ab	

21/03/2008	12:33:18	Yonaguni knoll	N 24 50.7780 E 122 42.0380	1379.0 2.3	KIPS 35 open	
21/03/2008	12:36:59	Yonaguni knoll	N 24 50.7774 E 122 42.0376	1379.2 2.0	KIPS 35 closed	
21/03/2008	12:38:21	Yonaguni knoll	N 24 50.7775 E 122 42.0374	1378.8 2.0	kIPS 36	
21/03/2008	12:46:07	Yonaguni knoll	N 24 50.7772 E 122 42.0383	1379.5 2.0	KIPS 37 closed	
21/03/2008	12:47:07	Yonaguni knoll	N 24 50.7782 E 122 42.0381	1378.9 2.0	finish kips	
21/03/2008	12:53:44	Yonaguni knoll	N 24 50.7792 E 122 42.0373	1377.7 2.2	Start videomosaicking	
21/03/2008	12:56:12	Yonaguni knoll	N 24 50.7802 E 122 42.0417	1377.2 1.7	Einmessung mit Laser bei 1.5 m, fly with 2.5	
21/03/2008	12:56:56	Yonaguni knoll	N 24 50.7816 E 122 42.0420	1375.8 2.6	star fish	
21/03/2008	12:57:09	Yonaguni knoll	N 24 50.7822 E 122 42.0432	1374.5 2.6	rocks, sulfur	

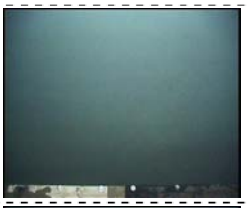
21/03/2008	12:57:34	Yonaguni knoll	N 24 50.7825 E 122 42.0444	1374.6 2.6	tape 9	
21/03/2008	12:59:11	Yonaguni knoll	N 24 50.7858 E 122 42.0460	1373.7 3.0	vent fauna, Bathymodiolus	
21/03/2008	13:00:46	Yonaguni knoll	N 24 50.7883 E 122 42.0442	1371.0 1.8	rocks	
21/03/2008	13:01:06	Yonaguni knoll	N 24 50.7890 E 122 42.0436	1371.1 1.5	rocks and sediments	
21/03/2008	13:01:42	Yonaguni knoll	N 24 50.7894 E 122 42.0428	1371.0 1.4	passed rocks, go down hill	
21/03/2008	13:02:50	Yonaguni knoll	N 24 50.7936 E 122 42.0425	1372.4 2.4	large rocks with snails, sponges,	
21/03/2008	13:04:00	Yonaguni knoll	N 24 50.7981 E 122 42.0469	1366.5 3.5	Sediment on rocks	
21/03/2008	13:04:27	Yonaguni knoll	N 24 50.7990 E 122 42.0482	1366.7 1.8	sponges on rocks	
21/03/2008	13:04:47	Yonaguni knoll	N 24 50.7976 E 122 42.0497	1364.7 3.3	downhill sediment	

21/03/2008	13:05:22	Yonaguni knoll	N 24 50.7964 E 122 42.0513	1366.8 1.3	sulfur on sediments	
21/03/2008	13:05:55	Yonaguni knoll	N 24 50.7975 E 122 42.0531	1365.8 2.2	rocks with sponges	
21/03/2008	13:07:03	Yonaguni knoll	N 24 50.8002 E 122 42.0573	1366.7 1.6	sediments	
21/03/2008	13:07:46	Yonaguni knoll	N 24 50.8017 E 122 42.0595	1367.2 1.1	crab	
21/03/2008	13:07:58	Yonaguni knoll	N 24 50.8028 E 122 42.0602	1367.4 1.1	1 m abg	
21/03/2008	13:08:46	Yonaguni knoll	N 24 50.8034 E 122 42.0621	1367.0 1.1	empty seafloor, no traces	
21/03/2008	13:09:31	Yonaguni knoll	N 24 50.8041 E 122 42.0643	1367.5 1.1	fish	
21/03/2008	13:12:44	Yonaguni knoll	N 24 50.8083 E 122 42.0745	1370.1 1.1	small holes in a circle, appears now and then	
21/03/2008	13:13:10	Yonaguni knoll	N 24 50.8087 E 122 42.0771	1370.3 1.1	octopus	

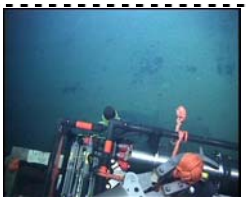
21/03/2008	13:13:36	Yonaguni knoll	N 24 50.8113 E 122 42.0790	1369.8 1.1	HD 5 tape 2 on	
21/03/2008	13:14:54	Yonaguni knoll	N 24 50.8135 E 122 42.0818	1368.6 1.1	many larger holes in the seafloor, ca 1-2 cm diameter	
21/03/2008	13:16:06	Yonaguni knoll	N 24 50.8161 E 122 42.0822	1367.2 1.1	even larger holes, ca 5-10 cm, and some tubes sticking out of the sediment	
21/03/2008	13:16:51	Yonaguni knoll	N 24 50.8179 E 122 42.0827	1366.8 1.1	HDTV No 5 tape 2 off	
21/03/2008	13:18:25	Yonaguni knoll	N 24 50.8212 E 122 42.0865	1365.9 1.1	fish	
21/03/2008	13:20:50	Yonaguni knoll	N 24 50.8277 E 122 42.0924	1364.3 1.0	large crab	
21/03/2008	13:23:13	Yonaguni knoll	N 24 50.8322 E 122 42.0980	1362.6 1.5	some white material	
21/03/2008	13:26:47	Yonaguni knoll	N 24 50.8417 E 122 42.1102	1356.5 1.2	rock with sponges	
21/03/2008	13:27:58	Yonaguni knoll	N 24 50.8440 E 122 42.1160	1354.1 1.2	rocks with crusty sponges	

21/03/2008	13:28:20	Yonaguni knoll	N 24 50.8447 E 122 42.1162	1353.3 1.2	HDTV No 6 tape 2 on, worms vent with fluid flow, stopped briefly	
21/03/2008	13:29:45	Yonaguni knoll	N 24 50.8457 E 122 42.1169	1352.7 1.3	still taken, vent diameter 50 cm	
21/03/2008	13:31:25	Yonaguni knoll	N 24 50.8444 E 122 42.1156	1353.0 1.3	continue with mosaicking	
21/03/2008	13:31:53	Yonaguni knoll	N 24 50.8444 E 122 42.1162	1352.1 1.2	CO2 bubbles	
21/03/2008	13:32:26	Yonaguni knoll	N 24 50.8494 E 122 42.1185	1349.8 1.5	HDTV No 6 tape 2 off	
21/03/2008	13:35:34	Yonaguni knoll	N 24 50.8559 E 122 42.1248	1343.2 1.3	rock	
21/03/2008	13:35:53	Yonaguni knoll	N 24 50.8576 E 122 42.1250	1342.7 1.3	rock with sponges	
21/03/2008	13:36:07	Yonaguni knoll	N 24 50.8583 E 122 42.1256	1341.4 1.5	lots of rocks	
21/03/2008	13:36:19	Yonaguni knoll	N 24 50.8584 E 122 42.1251	1340.7 1.7	seaspider	

21/03/2008	13:36:27	Yonaguni knoll	N 24 50.8583 E 122 42.1250	1340.7 1.7	HD 7 tape 2 on	
21/03/2008	13:36:41	Yonaguni knoll	N 24 50.8602 E 122 42.1260	1339.4 1.7	some red shrimps, go to 2 m hight because of rocks	
21/03/2008	13:40:19	Yonaguni knoll	N 24 50.8697 E 122 42.1377	1329.9 2.7	HDTV 7 end tape 2 off	
21/03/2008	13:42:56	Yonaguni knoll	N 24 50.8774 E 122 42.1388	1322.3 2.8	crabs	
21/03/2008	13:44:06	Yonaguni knoll	N 24 50.8830 E 122 42.1424	1318.6 3.0	rocks	
21/03/2008	13:45:07	Yonaguni knoll	N 24 50.8925 E 122 42.1467	1312.9 2.8	rocks with sponges	
21/03/2008	13:45:22	Yonaguni knoll	N 24 50.8953 E 122 42.1462	1313.0 2.7	sediment	
21/03/2008	13:45:42	Yonaguni knoll	N 24 50.8978 E 122 42.1465	1309.9 2.9	octopus	
21/03/2008	13:45:58	Yonaguni knoll	N 24 50.8993 E 122 42.1467	1309.2 1.9	rock with sponges	

21/03/2008	13:46:15	Yonaguni knoll	N 24 50.9023 E 122 42.1481	1307.3 2.0	fish	
21/03/2008	13:46:30	Yonaguni knoll	N 24 50.9043 E 122 42.1480	1307.2 2.7	rocks	
21/03/2008	13:47:11	Yonaguni knoll	N 24 50.9084 E 122 42.1481	1306.8 1.9	fish	
21/03/2008	13:47:53	Yonaguni knoll	N 24 50.9103 E 122 42.1506	1304.3 1.5	yellow spots, a few more traces on the seafloor	
21/03/2008	13:50:19	Yonaguni knoll	N 24 50.9109 E 122 42.1604	1297.7 1.5	rocks	
21/03/2008	13:50:58	Yonaguni knoll	N 24 50.9110 E 122 42.1632	1295.2 1.7	small starfish on rock	
21/03/2008	13:54:09	Yonaguni knoll	N 24 50.9169 E 122 42.1698	1287.5 2.0	seaspider on rock	
21/03/2008	13:54:41	Yonaguni knoll	N 24 50.9159 E 122 42.1731	1285.6 2.1	large slug	
21/03/2008	13:55:26	Yonaguni knoll	N 24 50.9183 E 122 42.1775	1283.8 2.1	seaspider on rock	

21/03/2008	13:56:20	Yonaguni knoll	N 24 50.9232 E 122 42.1801	1282.5 1.8	change to tape 10	
21/03/2008	13:58:04	Yonaguni knoll	N 24 50.9284 E 122 42.1883	1278.9 1.7	rocks	
21/03/2008	13:59:43	Yonaguni knoll	N 24 50.9319 E 122 42.1922	1276.1 1.1	no sign of echinoderms	
21/03/2008	14:01:11	Yonaguni knoll	N 24 50.9403 E 122 42.1954	1272.3 1.3	rock with lots of whitish stuff	
21/03/2008	14:02:54	Yonaguni knoll	N 24 50.9386 E 122 42.1912	1274.7 1.6	target 23: stop video transect no 3 at 400 m away from chamber, still signs of hydrothermal venting	
21/03/2008	14:06:27	Yonaguni knoll	N 24 50.9412 E 122 42.1913	1274.1 1.5	fly back to chamber position	
21/03/2008	14:15:14	Yonaguni knoll	N 24 50.9580 E 122 42.1595	1264.3 21.8	had to bring in a lot of cable	
21/03/2008	14:18:27	Yonaguni knoll	N 24 50.9383 E 122 42.1211	1260.3 0.0	side scan sonar prof 2 end, signal disturbed	

21/03/2008	14:20:54	Yonaguni knoll	N 24 50.9285 E 122 42.1100	1267.7 0.0	switch off	
21/03/2008	14:21:03	Yonaguni knoll	N 24 50.9295 E 122 42.1102	1271.8 0.0	switch on again	
21/03/2008	14:28:25	Yonaguni knoll	N 24 50.9681 E 122 42.1393	1285.6 9.4	ship maneuver, we have to wait with ROV	
21/03/2008	14:59:52	Yonaguni knoll	N 24 50.8872 E 122 42.0243	1240.1 0.0	Tape 11 is in	
21/03/2008	15:21:46	Yonaguni knoll	N 24 50.7775 E 122 42.0424	1377.4 0.7	arrive at chamber	
21/03/2008	15:23:53	Yonaguni knoll	N 24 50.7746 E 122 42.0405	1378.8 0.8	where ROV sat to place chamber sediments turned black	
21/03/2008	15:28:03	Yonaguni knoll	N 24 50.7741 E 122 42.0389	1379.3 0.6	lift chamber	
21/03/2008	15:29:29	Yonaguni knoll	N 24 50.7749 E 122 42.0404	1378.6 1.6	end of dive	

created Mon Mar 24 14:41:22 JST 2008

Appendix

Dive 207
ALAMER : Operation list
Dive summaries Alamere

Responsible for Dive: Dirk De Beer, Gregor Rehder
Site: Yonaguni Knoll
22.03.2008
Starting position ship: 24°50.053 N ; 122° 41.590 E

1) Arrival Point for profiler: New target:
    a. Reference site target 20: **24° 50.4756 N 122 *° 41.8605 E ;***
    b. Program Profiler starts at ***08 :14 UTC***
2) *Video Mosaiquing starting and ending at reference site,*
    a. Waypoint 1 – based on overlaying track
    b. Waypoint 2
    c. Waypoint 3
    d. Program Profiler ends at ***10 :01 UTC, be there in time for pick up***
3) *Transfer with Profiler to Position near Abyss vent*
    a. **Position: 24° 50.781N ; 122° 42.030 E**
    b. **Program starts at *13 :01 UTC* Deployment need to be done before**
4) Lift off for Tiger chimney ;
    a. **Pos. :24° 50.873N ; 122° 42.016 E**
    b. Investigate area, look for hot bubbling site and nearby heat source, try to allocate 2 sites for samplng
    c. Fill gas sampler 2 & 4; if needed, melt hydrate into sampler with heat, try to **sample at different locations**
    d. **When done, close both samplers with drawer**
    e. **Fill Phase Transition assembly at same site**
    f. Monitor phase transition during cooling
5) Transfer to Bubbly chimney
    a. **24°50.8227 N 122° 42.0111**
    b. Investigate area, look for prominent gas site and heat source
6) If time allows, heat gas in Phase Transition assembly until one gas phase, re-observe behavior
7) If time allows and mood is good, spend time on Video work
8) Return to Profiler station near Abyss
    a. **Pick up Profiler not earlier than *14 :48 UTC***
    b. Grab and secure Profiler
9) **Lift off, end of Dive**

List of instruments:

Drawer and Porch

Profiler
2 Gas samplers
Phase transition T-Probe/Corer
1 T-lance online
KIPS sampling (all bottles)
High resolution still camera

Objectives:

1. profiler measurements at reference and seep site
2. KIPS, still fotos at profiler positions
3. Video observation, Side Scan on transition between reference and seep area
4. Gas sampling, monitor phase transition
5. Visit of vents

Dive schedule (11 hours bottom time)

Dive start	14:14
ROV on deck	02:00

ROV Shifts (2 hours):

Assuming switch on at 13:00

Time:	PI	Alamer
15:00 to 17:00	DeBeer	Thomas
17:00 to 19:00	Thomas	Boetius
19:00 to 21:00	de Beer	Schneider
21:00 to 23:00	Schneider/Nakamura	Rehder
23:00 to 01:00	Rehder	Nakamura/Inagaki
towards end	Nakamura/Rehder	Inagaki (de Beer for PickUp)

Dive Tasks and Schedule

1. Go to reference site, place profiler (3 hr from deck)
2. take 4 kips at bottom, stills
3. Do transects in direction of abyss vent and back (2h for 2&3)
4. Take profiler ()
5. Go to seep site to place profiler(max 3h)
6. take 5 kips at bottom ()
7. investigate Bubbly Chimney and Tiger Chimney, fill 2 gas samplers and 1 Phase Transition device
8. Remelt and reobserve phase transition
9. Investigate area of large chimneys if time and mood allows
10. Pick up profiler, end of dive (0.5 hr)

IMPORTANT:

- Ask ROV pilots for still fotos of profiler, observe chamber penetration.
- Write down if you have observed gas bubbling at touch down
- Prepare for bottom photography (vertical camera), videomosaicking and side scan sonar
- Ask pilots to put targets to all chamber measurements and transition zones (presence / absence echinoderms)
