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R/V Kaiyo+ ROV Hyper-Dolphin 3000

“Cruise Report”

KY11-01 Leg 2 Cruise in Sagami Bay

Jan.22,2011-Jan.25,2011

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

Contents

Abstract

The cruise KY11-01 Leg2 took place from January 22nd to 25th, 2011, in Sagami Bay, onboard the R/V Kaiyo and with the ROV Hyper-Dolphin. A total of 4 dives were conducted at different study sites including a whale fall site, cold seeps, and a deep-sea observatory near Hatsushima Island. Different projects were carried out.
Biodiversity, dispersal and colonization mechanisms at whale falls were studied at an experimental site where 2 sperm whale carcasses were implanted since 2005 and 2008, respectively. Almost yearly surveys were performed at this site to observe carcass decay, the establishment of chemosynthesis-dependent animal communities and species succession.
During this cruise, we continued to document these processes and compared the two carcasses. Whale bones were collected as well as surrounding sediments, plankton, benthos and water. Preserved samples and live specimens were brought back to some laboratories including JAMSTEC where species diversity, nutrition and symbiosis will be investigated.
Studies at cold seeps sites were focused on *Calyptogena* clams and *Bathymodiolus* mussels. Distribution patterns of these species, shell size and life-history traits were investigated through sampling.

1. Cruise Information

Cruise ID: KY11-01 Leg2

Name of vessel: R/V Kaiyo and the ROV Hyper-Dolphin 3000

Title of the cruise: Studies on succession of two sperm whale-fall communities in Sagami Bay and characteristics of larval development in mussels inhabiting whale bones

Chief scientist: Kenji Okoshi [Toho University]

Representative of the Science Party: Kenji Okoshi [Toho University]

Cruise period and Ports of call: From 22nd (JAMSTEC) to 25th (JAMSTEC), January 2011

Research area: Sagami Bay, Japan

Water depths: 800-1000m

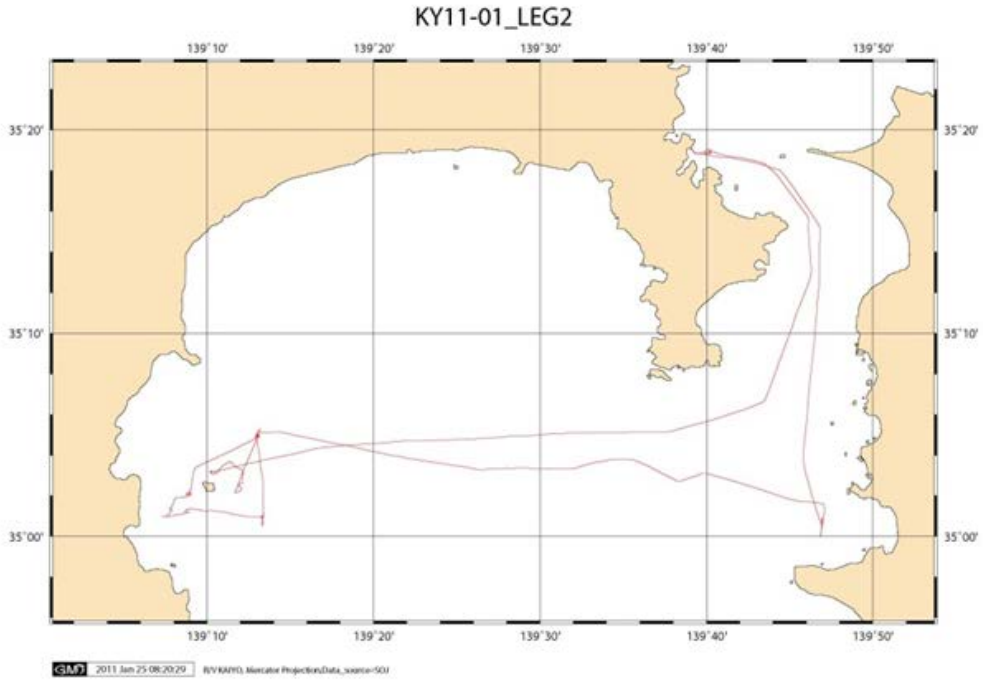

Fig.1 Map of cruise track of KY11-01 Leg 2.

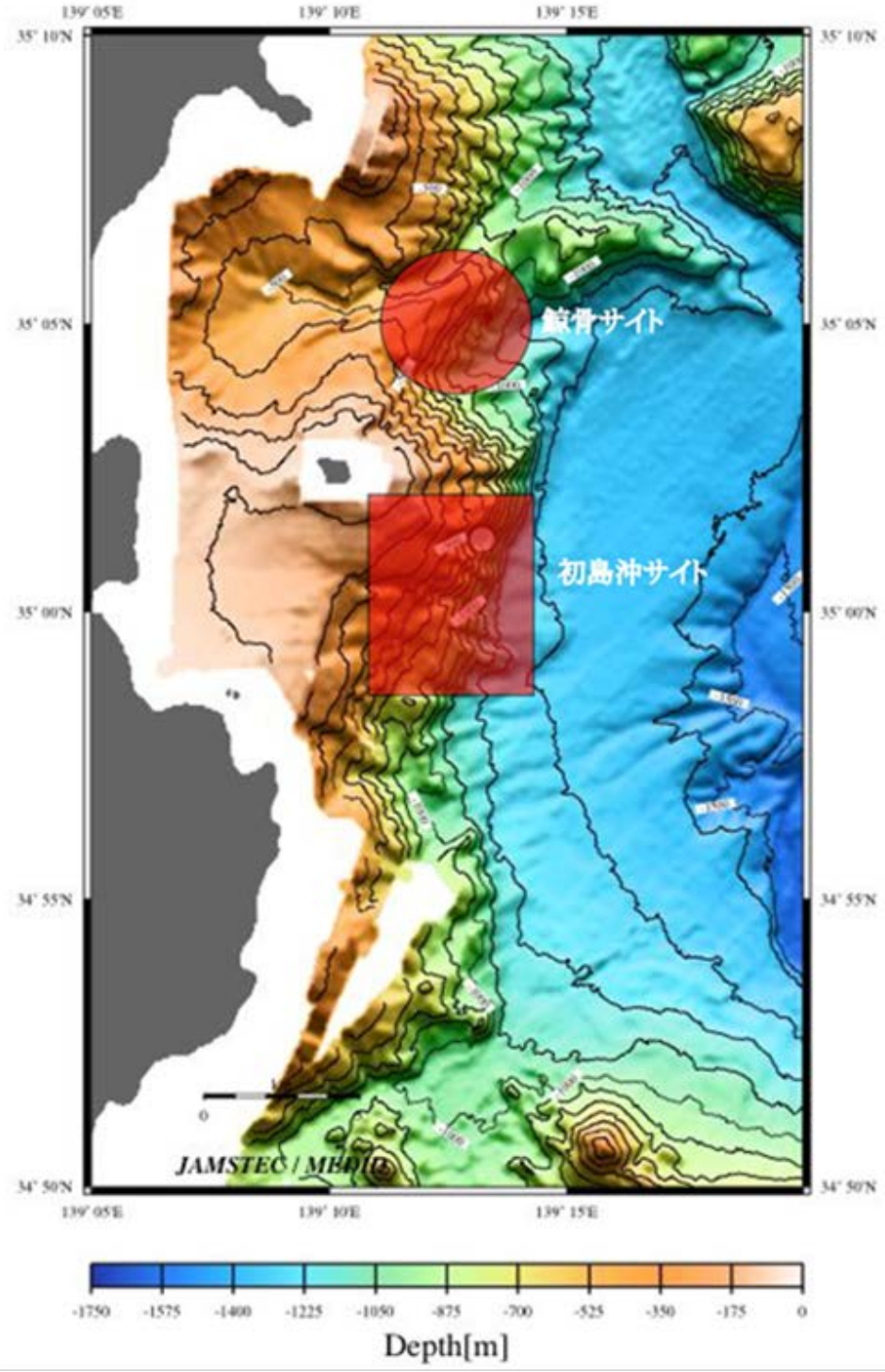

Fig.2 Map of study areas during KY11-01 Leg2 cruise.

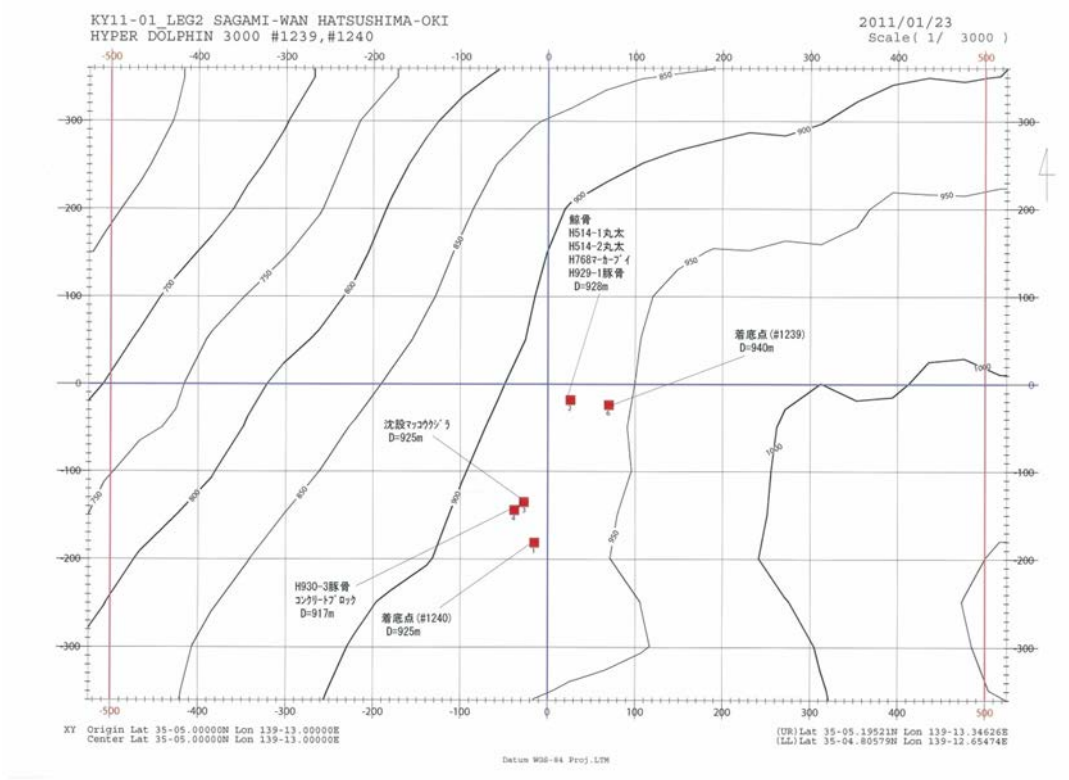

Fig.3 Map of whale fall sites in Sagami Bay

2. Onboard members

2.1. Science party

Chief scientist and Proponent of the proposal

Kenji Okoshi (Professor, Graduate School of Environmental Science, Toho University)

Onboard scientist

Yoshihiro Fujiwara (BioGeos, JAMSTEC)

Masaru Kawato (BioGeos, JAMSTEC)

Masayuki Miyazaki (BioGeos, JAMSTEC)

Takayoshi Sekiguchi (BioGeos, JAMSTEC/JSPS)

Yuichi Umezu (BioGeos, JAMSTEC)

Asuka Nishimura (BioGeos, JAMSTEC)

Julien Lorion (BioGeos, JAMSTEC)

Kaoru Kubokawa (University of Tokyo)

Tomoko Yamamoto (Kagoshima University)

Satoshi Mitarai (Okinawa Institute of Science and Technology)

Masako Nakamura (Okinawa Institute of Science and Technology)

Masahiro Ichimura (Toho University)

Masahiro Suzuki (Ishinomaki Senshu University)

Ryohei Yamaguchi (Ishinomaki Senshu University)

Chikayo Noda (Aburatsubo Marine Park)

Satoshi Tada (Tokyo Sea Life Park)

Haruyoshi Kawai (Kawai Shoji Company)

Hisanori Iwamoto (Nippon Marine Enterprises)

2.2. KAIYO Crew members

Hyperdolphin Operation Team

Kazuya MITSUFUJI, Operation Manager

Kazuki IIJIMA, ROV Operator

Katsushi CHIBA, ROV Operator

Tetsuya ISHITSUKA, ROV Operator

Yudai SAKAKIBARA, ROV Operator

Shigeru KIKUYA, ROV Operator

Atsushi TAKENOUCHI, ROV Operator

Kaiyo Crews

Eiko UKEKURA, Captain

Takafumi AOKI, Chief Officer

Shintaro HASHIMOTO, 2nd Officer

Hidehiko KONNO, 3rd Officer

Hiroyoshi KIKKAWA, Chief Engineer

Kazuhiko KANEDA, 1st Engineer

Kenzo KATO, 2nd Engineer

Fukutaroh YAMAGISGI, 3rd Engineer

Satoshi WATASE, Chief Radio Operator

Hidehiro ITO, 2nd Radio Operator

Yuka MORIWAKI, 3rd Radio Operator

Yasuyoshi KYUKI, Boat Swain

Yoshiaki KAWAMURA, Able Seaman

Shuji TAKUNO, Able Seaman

Hideo ISOBE, Able Seaman

Saikan HIRAI, Able Seaman

Jiro HANAZAWA, Sailor

Shun ABE, Sailor

Kozo MIURA, No.1 Oiler

Toshikazu IKEDA, Oiler

Takeshi WATANABE, Assistant Oiler

Ryo MATSUUCHI, Assistant Oiler

Sueto SASAKI, Chief Steward

Shigeto ARIYAMA, Steward

Koji KIRITA, Steward

Shiho SHIMIZU, Steward

Yoshie HIDAKA, Steward

3. Scientific Reports

3.1. Purpose, Objectives, Background

The first discovery of a whale-fall in situ occurred in 1987 in the Santa Catalina Basin, California at a depth of 1240 m (Smith et al. 1989). A large chemosynthetic assemblage was reported around the whale carcasses (Smith et al. 1989), with similarities to hydrothermal vent and cold-seep communities. Since this discovery, many whale-fall communities have been reported, including modern and fossil assemblages (Smith & Baco 2003)

Whale falls have been thought to be 'stepping stones' not only for dispersal of deep-sea chemosymbiotic species but also for the introduction over evolutionary time of chemoautotrophy-dependent invertebrates to vent and seep environments (Smith et al. 1989; Distel et al. 2000).

A mass stranding of 14 sperm whales (*Physeter macrocephalus* Linnaeus, 1758) occurred on the southwestern coast of Kyushu Island, southern Japan, on January 22, 2002. The bodies of 12 whales were sunk by local government authorities in the waters off Cape Nomamisaki, southwestern tip of Kyushu Island, at depths of 200–300 m on February 1, 2002 (Fujiwara et al., 2007)

Most ecological studies of whale falls have been conducted on baleen whale carcasses off California, at depths of 1000–2000 m (Smith & Baco 2003). No sperm whale falls and related biological assemblages have been discovered before this mass sinking, although this whale species should be sufficiently large to sustain whale-fall-specific biological assemblages. In addition, sperm whales have an oil-rich structure known as the spermaceti organ that takes up 25–33% of the animal's body (Whitehead 2003).

This unusual organ might serve as a unique habitat for whale-fall specialists. The sperm whale falls off Cape Nomamisaki were located in waters shallower than most previously studied whale falls. The only whale-fall community reported shallower was at 125 m in the North Sea (Glover et al. 2005).
The whale bone-eating siboglinid worm *Osedax mucofloris* was the most abundant species on the North Sea skeleton (Glover et al. 2005). It was not clear whether mass aggregation of chemosymbiont-bearing invertebrates occurs at shallow-water whale falls, as on deep-water falls.
While many whale-fall communities have been reported from the northeast Pacific, limited whale-fall information is available from the northwest Pacific. The only whalefall community reported from this region was on the Torishima

Seamount at a depth of 4037 m (Fujioka et al.1993; Wada 1993). The skeleton had already been eroded heavily by the time of discovery. Unidentified mytilids,tubicolous polychaetes and galatheid crabs were abundant (Naganuma et al. 1996).

There have been no previous observations of multiple large whale carcasses implanted simultaneously in a specific limited area. Sperm whale-fall communities off Nomamisaki were investigated for 8 years

using an ROV. Five sperm whale carcasses sustained chemosynthesis-based communities at depths of 219–254 m, which were similar to the deeper whale-fall communities in general but with certain unique features. The rate of epifaunal succession was notably more rapid than that of deeper communities on large whale falls. The sulphophilic stage appears to be much shorter, although the whale carcass sizes should have been sufficiently large for long-term support of sulphophilic species. No vent/ seep specialists were present at this whale-fall site and many new, poorly described and/or rarely encountered species appeared. Further information on whale carcasses from a wide range of areas and depths will clarify the spatiotemporal dynamics of deep-sea life in such isolated, ephemeral habitats.

In 2005, the first sperm whale carcasses named “Sagami” implanted at 925 m depth in Sagami Bay, after which it was observed and sampled 6 times. Succession of species was observed and we identified *Osedax* spp. No mussel belonging to the genus *Adipicola* and/or *Idasola* which were the dominant species of the whale-fall community off Nomamisaki at a depth of 220m, was observed in the early stage of succession in Sagami Bay. In 2008, a 2nd whale “Satomi” was immersed about 120m away from the “Sagami”. This was a good opportunity to compare species diversity and succession on two carcasses in close proximity and at different degradation stages.

The aims of this study are to (1) clarify whether sperm whale carcasses sustain chemosynthetic communities, (2) characterize the macrofaunal assemblages on whale falls in relatively deep water in the northwest Pacific, (3) investigate the ecological differences between sperm whale-fall communities around Japan, and (4) document patterns of ecological succession in relatively deep-water whale-fall communities near seep.

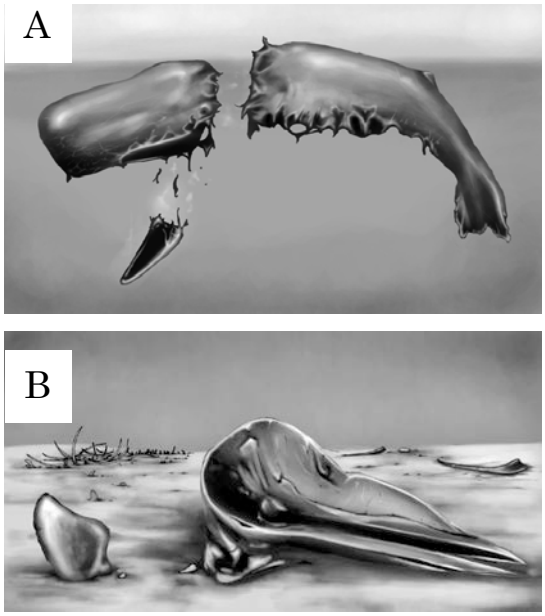

Fig.4 Schematic diagram of floating carcass of sperm whale (A) and whale bones settled on the seabed (from Okoshi, 2008)

3.2. Proposal, Onboard results, Future study

3.2.1. Development, growth and survival in the whale bone attached mussels

(1) larval studies of mussels, (2) shell morphology and microstructure

Kenji Okoshi, Masahiro Ichimura (Toho University), Masahiro Suzuki and Ryohei Yamaguchi (Ishinomaki Senshu University)

Proposal

The object of this study is to find swimming larva, juvenile and adult mussels which attached to whale bone and in order to obtain effective information on development, growth, behavior and hard tissue formation. Microstructures of the shells are also observed by SEM. These can be used to understand recruitment and growth performance in some species of bivalves from whale fall.

Cruise results

Plankton samples including swimming larva of mollusks were collected using a suction sampler with a 0.05mm-mesh net installed on the ROV. Whale bones and teeth were also collected this time.using manipulators and stored in a sample box. Most epifaunal species including juveniles of bivalves attached on bones and woods were also collected using a suction sampler. Biological sorting was conducted using three sieves with different mesh sizes (0.5 mm, 1 mm and 2 mm). Taxonomic identifications were made using collected specimens under stereomicroscope.
Several species of infaunal bivalves were collected. *Osedax* spp. were observed on the whale bones collected, no larva of mytilid was observed and collected from the surface of recovered whale bones

Future study

To find larvae and juveniles of mussels attached on whale bones, formalin fixed sample will be observed. If live specimens will be found, behavior of larva and juvenile will be also observed.

3.2.2.Sex determination system of *Osedax* sp.

Asuka Nishimura and Tomoko Yamamoto (Kagoshima University)

Sunken whale carcasses supply a large amount of unusual organic matter to deep-sea ecosystems, and they support a widespread and characteristic fauna called as “whale-fall community” including chemosymbiotic invertebrates (see Smith and Baco 2003). Whale falls are ephemeral and insular

environments. Therefore, endemic species to the environments may have some unique reproductive strategy including dispersal.
Genus of *Osedax* is thought to be specific to this unique habitat, because in nature, they have not been sampled except for whale-fall. *Osedax* has the dwarf male, as well as some endemic species of this kind of unique habitat. However, little is known about their reproduction including the system of their sex determination. To know whether their sex is determined genetically or posteriori, we would like to analysis their karyotype. If we can find different karyotype between female and dwarf male, their sex must be determined genetically.

Cruise results
Whale bones and teeth were collected.using manipulators and stored in a sample box. Osedax spp. were observed on the whale bones and teeth, and this is the first record that Osedax sp. was collected from the sperm whale teeth.

3.2.3. Isolation of plastic-degrading bacteria from deep-sea sediments collected from sunken whale-bones areas.

Takayoshi Sekiguchi (JAMSTEC & Tokyo University of Marine Science and Technology)

Proposal
Plastic wastes are one of the factors in causing environment pollutions, because of their semi-permanence stability in natural environments. The ocean is a common environment influenced by plastic pollution. Specifically, the deep-sea floor has the potential of being the final site for plastic wastes. Actually, abundant plastic wastes have often been found during deep-sea investigations using the research submersibles (Fujikura et al., 2008). Partial replacement of non-degradable plastics with biodegradable polymers is one strategy for reducing the negative environmental impact caused by plastic materials since the biodegradable polymers can be degraded by microorganisms. The biodegradable plastics have ester bonds for these chemical bonds. This chemical structure is common a lipid materials.
In sunken whale-bone environments, numerous specific animals such as *Osedax* were observed. These animals life were sustained by lipid of whale-bone. Therefore, it is considered that many lipid materials degrading bacteria also exist in the whale-bone areas. And these bacteria might be had a plastic-degrading ability. However, there is no information related to the degrading ability of plastics in the sunken whale-bones areas. In this research cruise, I try to isolate of biodegradable-plastic-degrading bacteria from these areas. Our results suggested a possibility that the whale-bone areas were one of the best spot, in order to isolate of useful bacteria.

Cruise results

Inoculated these sediment samples on the agar-medium and liquid medium.

Medium List

No. 1 : HK + PLA agar medium

Composition : 2% highnewt? HK (hydrolysis of soybeans), 1%Yeast Extract, 3%NaCl, 2%agar, PLA film(one of the biodegradable plastics)

No. 2 : Glycerol + PLA agar medium

Composition : 3%Glycerol, 0.2%NaNO3, 0.1%K2HPO4, 0.05%KCl, 0.05%MgSO4・7H2O, 0.01%CaCl2・2H2O, 0.15%MgCl2・6H2O, 2%agar, PLA film

No. 3 : MB + PCL agar medium

Composition : 3.37%Marine Broth, 2%agar, 1%PCL powder (one of the biodegradable plastics)

No. 4 : Glycerol + PLA agar medium

Composition : 3%Glycerol, 0.2%NaNO3, 0.1%K2HPO4, 0.05%KCl, 0.05%MgSO4・7H2O, 0.01%CaCl2・2H2O, 0.15%MgCl2・6H2O, 2%agar, PLA film

No. 5 : PLA　liquid medium : PLA film, 0.2%NaNO3, 0.1%K2HPO4, 0.05%KCl, 0.05%MgSO4・7H2O, 0.01%CaCl2・2H2O, 0.15%MgCl2・6H2O, 0.01%Trace Element Solution

No. 6 : PLA + Yeast liquid medium : PLA film, 0.2%NaNO3, 0.1%K2HPO4, 0.05%KCl, 0.05%MgSO4・7H2O, 0.01%CaCl2・2H2O, 0.15%MgCl2・6H2O, 0.01%Trace Element Solution, 1%Yeast Extract

Used samples

HPD1239

MBARI Red (0-5cm)

MBARI Blue (0-5cm)

MBARI Green (0-5cm)

HPD1240

MBARI Red (0-5cm)

MBARI Green (0-5cm)

MBARI Blue (0-5cm)

HPD1241

MBARI Red (0-5cm)

HPD1242

MBARI Red (0-5cm)
MBARI Green (0-5cm)
MBARI Blue (whale wax)

Other samples and remained samples were stored at 4 °C.
Whale wax sample was stored at 4 and -80 °C

Future study
I try to isolate the microbes had the ability of producing esterase and/or lipase for degrading the bioplastics. And I try to isolate the bioplastics producing microbes from stored samples.

3.3. Other related projects

Succession patterns and colonization mechanisms of chemosynthetic organisms associated to whale falls in Sagami Bay
Yoshihiro Fujiwara, Masaru Kawato, Yuichi Umezu, Julien Lorion, Masayuki Miyazaki (JAMSTEC)

Keeping deep-sea fish and mollusca using an aquarium system
Satoshi Tada (Tokyo Sea Life Park) and Chikayo Noda (Aburatsubo Marine Park)

Succession of microbial diversity and taxonomic studies in whale-fall community
Masayuki Miyazaki (JAMSTEC)

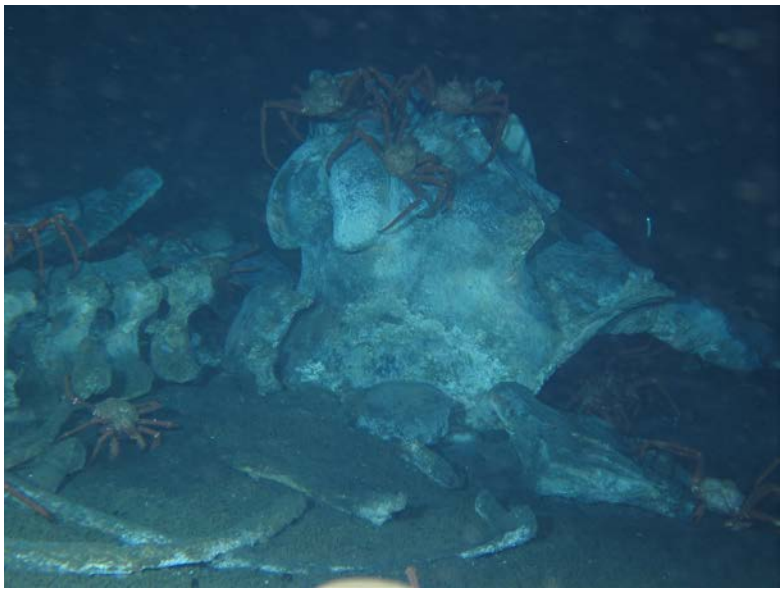

Fig.5 “Satomi” whale in Sagami Bay.

Fig.6 Satomi whale (illustrated by Haruyoshi Kawai)

3.4. Dive Results

Preliminary Results of the ROV Hyper Dolphin Dive #1240

Date: Jan. 23, 2011

Site: Sagami Bay

Landing: Time: 13:53, Lat: 35˚04.8806'N, Long: 139˚13.0022'E, Depth: 915 m

Leaving: Time: 15:57, Lat: 35˚04.9297'N, Long: 139˚12.9789'E, Depth: 924m

Chief observer: Tomoko Yamamoto (Kagoshima University)

Purpose:

1) Observe the changes in carcass degradation, faunal diversity on the carcass and impact on surrounding sediments.

2) Diversity and life history of *Osedax* polychaetes and whale bone attached mussels

Payload equipments:

Long sample box 1

Suction sampler 1

Multicanister (1,5:plankton, 2-4:large animals)

Single canister 1

Scoop sampler 1

MBARI cores 3

Niskin bottles 2

Dive summary

Satomi whale sunk in 2008 was searched and discovered at the depth of 921 m. Since skeleton was preserved very well, we could recognize their structure. Some types of *Osedax* were observed covering the rib bone and jaw bone densely. Then two rib bones and a small bone of unknown part were sampled. Plankton sampling was conducted on the bone by suction sampler. Sediment was sampled by using MBARI cores, and water was also sampled. Whale teeth and fishes were sampled by using suction sampler.

Dive report

Water sampling

Two Niskin bottles were used to collect seawater: one in the water column just after seeing the bottom (at about 913 m depth), one at the side of Satomi whale.

Sediment sampling

Sediments were collected with MBARI cores beside of whale (Red), just beside sampled bone (green)

and under the deployment (Deployed in HPD1079) (Blue).

Observation and sampling of whale bone

After settlement at beside the head of whale, we observed and photographed the skeleton. The cranial bone and vertebrates lined orderly. We found many individuals of Paralomis gathering on the bones especially on the cranial bone. Some types of Osedax were found on the jawbone, cranial bone and rib bone.

Sampling & marker points

(1) Sampling NO.1 NISKIN 35°04.8806'N, 139°13.0022'E, Depth: 915m

(2) Sampling of NO.2 NISKIN and plankton (Canister #1, #5), sediment sampling by using MBARI cores (blue, black and yellow), sampling of whale teeth and fishes

35°04.9297'N, 139°12.9789'E, Depth: 921m

Video highlights

Time	Descriptions
14:10:18 -14:10:28	Paralomis gathering on the cranial bone
14:29:18 -14:29:28	Osedax on the bone
14:29:45 -14:29:55	Osedax on the bone
14:37:50 -14:38:05	Landscape of skelton
14:42:30 -14:43:30	Sampling of a rib bone
14:50:20 -14:51:00	Osedax on the head bone
14:53:10 -14:53:40	Plankton sampling on the bone
15:00:00 – 15:00:20	Careproctus on the body of Paralomis

Preliminary Results of the ROV Hyper Dolphin Dive #1241

Date: January 24, 2011

Site: 800m site of seep community, off Hatsushima

Landing Time: 8:44 (D=854m, 35-00.9541N 139-13,3421E)

Leaving Time: 11:21 (D=800m, 35-00.9397N 139-13.2225E)

Chief observer: Kenji Okoshi（Toho University）

Purpose: Succession patterns and colonization mechanisms at whale falls

1)Observe the changes in carcass degradation, faunal diversity on the carcass and impact on surrounding sediments.

2) Diversity of epi- and infauna around seep community. Payload equipments: Sample box (large),

Sample box(small), Suction sampler system with multi-bottles and single canister for large animal, Niskin bottle (x2), MBARI-type core sampler (x3),
Scoop sampler

Dive summary　Just before landing near the seep community, water was sampled by one bottle of Niskin. The ROV landed on muddy bottom at about 5m from the edge of the seep community. Firstly, we sampled sediment using the scoop sampler (large box) and took an MBARI core (red). The ROV moved to the colony of the *Bathymodiolus* spp. attached on rocks at a depth of 832m. We found two black-colored shells partly embedded in the mussel colony and tried to collect by the suction sampler with multi-bottles. We sampled one empty shell of the mussel *Bathymodiolus* sp. (canister No.2). There were not living organisms in the bottle. After sampling of water by Niskin bottle (826m), the ROV landed on the seep community at a depth of 823m. *Bathymodiolus* and *Calyptogena* clams were collected by scoop sampler (box). On our way to other clam colony, we observed a starfish, which we collect alive using the suction sampler. After putting the starfish into the box, we collected a zoarcid fish belonging to the Zoarcoidei using the suction sampler (canister No.3). Finally we collected benthic animals (mainly *Bathymodiolus* mussels and *Calyptogena* clams) using the suction sampler with the single canister.

Event site list	Event	Time	Depth	Locality
(1)	Water sampling by Niskin bottle	08:57	856m	35-00.9563N, 139-13.3235E
(2)	MBARI core sampling (Red)	09:05	856m	35-04.9600N, 139-13.3215E
(3)	Sediment sampling (Large box)	09:24	856m	35-04.9600N, 139-13.3215E
(4)	Water sampling by Niskin bottle	10:06	826m	35-00.9353N, 139-13.2508E
(5)	Sampling benthic animals (box)	10:30	826m	35-00.9353N, 139-13.2508E
(6)	Sampling a zoarcid fish (canister No.3)	10:52	823m	35-00.9402N, 139-13.2497E
(7)	Sampling benthic animals (single canister)	11:18	800m	35-00.9397N, 139-13.2225E

Preliminary Results of the ROV Hyper Dolphin Dive #1242

Date: January 24, 2011
Site: Satomi and Sagami whales off Hatsushima
Landing Time: 13:53 (D=910m, 35-04.8938N 139-12,9765E)
Leaving Time: 16:48 (D=926m, 35-04.9899N 139-13.0127E)
Chief observer: Kaoru Kubokawa（University of Tokyo）
Purpose: Succession patterns and colonization mechanisms at whale falls
1)Observe the changes in carcass degradation, faunal diversity on the carcass and impact on surrounding

sediments.

2) Diversity of epi- and infauna around seep community. Payload equipments: Sample box (large), Sample box(small), Suction sampler system with multi-bottles and single canister for large animal collection, Niskin bottle (x2), MBARI-type core sampler (x3), Scoop sampler

Dive summary Background observation was carried out on our way to the whale carcass named Satomi. Just before landing near the head region of the whale carcass, water was sampled by one bottle of Niskin. The ROV landed. Firstly, we sampled sediment under the spermaceti using the scoop sampler (large box) and took an MBARI core (red). We observed the jaws in detail and found the *Osedax* colony. After that we tried to collect the spermaceti using MBARI core (blue). We also tried to collect a part of jaw and got a small piece of jaw. Then, we found almost all teeth of lower jaw have come out and picked up two teeth with suction sampler (blank). After putting the tooth into the blank part of the canister, we collected a zoarcid fish using the suction sampler (blank). The ROV moved to another whale carcass named Sagami about 100m from Satomi whale carcass. Just before landing near the head region of the whale carcass, water was sampled by another bottle of Niskin. MBARI(green) core was sampled from the sediment(spermaceti, wax) near the jaws. Sediment sampling was also carried out using the scoop sampler. We sampled a zoarcid fish, small crab and red colored shrimp using suction sampler with the single canister. We also collected a piece of plastic bag by the ribs and vertebra. Finally, we cut off a floating rope using the special device named Mantis cutter.

Event site list	Event	Time	Depth	Locality
(1)	Water sampling by Niskin bottle	13:59	923m	35-04.9277N, 139-12.9820E
(2)	MBARI core sampling (ged)	14:01	923m	35-04.9295N, 139-12.9794E
(3)	Sediment sampling (large box)	14:26	923m	35-04.9295N, 139-12.9794E
(4)	Sampling spermaceti	14:42	923m	35-04.9295N, 139-12.9794E
(5)	Sampling jaw and tooth	15:01	924m	35-04.9295N, 139-12.9794E
(6)	Water sampling by Niskin bottle	15:24	925m	35-04.9867N, 139-13.0118E
(7)	MBARI core sampling (green)	15:38	927m	35-04.9899N, 139-13.0127E
(8)	Sediment sampling(small box)	16:04	927m	35-04.9899N, 139-13.0127E
(9)	Sampling fish and benthos (canister)	16:20	927m	35-04.9899N, 139-13.0127E

3.5. Beginners' impressions

3.5.1. Beginners' impression by Satoshi Mitarai

I would like to thank Prof. Kenji Okoshi and the project team members for allowing me to join such a stimulating cruise. The challenge that the team is pursuing (understanding colonization

patterns and mechanisms around whale carcass) is undoubtedly a great one, which I believe will serve as an example of how to do things in the scientific realm of deep ocean ecology. I have learned a lot from this cruise.

I joined this cruise as a "guest observer." While I have some experience in single-day field observations, I had no experience in a research cruise with this magnitude, including 20 researchers and multiple remotely operated vehicle (ROV) operations, because I mainly do modeling. Dr. Yoshihiro Fujiwara, one the chief observers of this cruise, suggested that I should see his observations for our future collaboration. Dr. Fujiwara, I and several other collaborators were recently awarded a grant from Canon Foundation for the study of larval dispersal of hydrothermal vent species. Because it overlaps with this field survey to great extent in methodology (and also scientifically), the experience that I gained from this cruise will certainly help propel the project, for which a similar cruise is in the plan.

It's easy to say, but very hard to do. I found that each cruise involved a numerous number of discussions, scheduling and instruments, much more than I had imagined. I found that even a single ROV dive could take hours, facing many unexpected problems, even with very careful preparations. (Fortunately, nothing serious happened at this time.) Most importantly, I learned that good communication with the research vessel crew was the crucial part of a successful survey. They are the ones who realize scientists' ideas with their masterful skills.

Finally, I hope to develop collaborative studies with the scientists with whom I got acquainted. They all kindly shared their research goals/methods with me. I would definitely try my best to keep in touch with them, and this hopefully leads to fruitful joint research.

Again, thank you very much for having me in this wonderful cruise.

Satoshi Mitarai

Satoshi Mitarai
Independent New Investigator ("Young PI")

Marine Biophysics Unit
Okinawa Institute of Science and Technology

3.5.2. Beginners' impression by Masako Nakamura

This cruise was the first time for me to join the deep-sea observation. Everything was new to me, who have only been to the research cruises for coral reefs; life in a research vessel, research works in a large vessel, deep-sea world and lives in the deep-sea etc.

This cruise was impressive. There were large differences from my previous studies done in coral reefs, especially for (1) the number of people, (2) Remotely operated vehicle (ROV), (3) methodology.

(1) The number of people

I was impressed by the number of people involved in a project; a large number of people gathered for achieving a great scientific project, understanding community structuring and succession around whale carcass. There were almost 20 researchers, a team for the ROV operations and teams for the vessel.

(2) ROV

It was first time for me to see ROV and its operations. It was incredible! I could not imagine that we could realize such multiple operations with ROV. I was also impressed by the techniques of ROV operation team. The team manipulated ROV as parts of their own bodies.

(2) Methodology

Because I have mainly worked on dispersal of coral larvae in the field, there were many differences for the methodology, including sampling and observations by ROV. I learned a lot from the researchers about the way to work on the vessel and also about deep-sea animals.

As I will start to extend my larval dispersal study to hydrothermal vent species, this experience will help me to plan my studies on larval dispersal in the deep-sea community. This was the only first step for me to discover the deep-sea world and to learn how to conduct surveys in the deep-sea. I would like to learn and discover more about the deep-sea community. If I could have a chance, I hope to build up some collaborative works with such a great group.

Finally, I would like to express my sincere thanks to Prof. Kenji Okoshi and the project team members for

allowing me to join the deep-sea observation cruise, which opened my eyes to a spectacular research field! It was a really great opportunity for me to participate such a great project.

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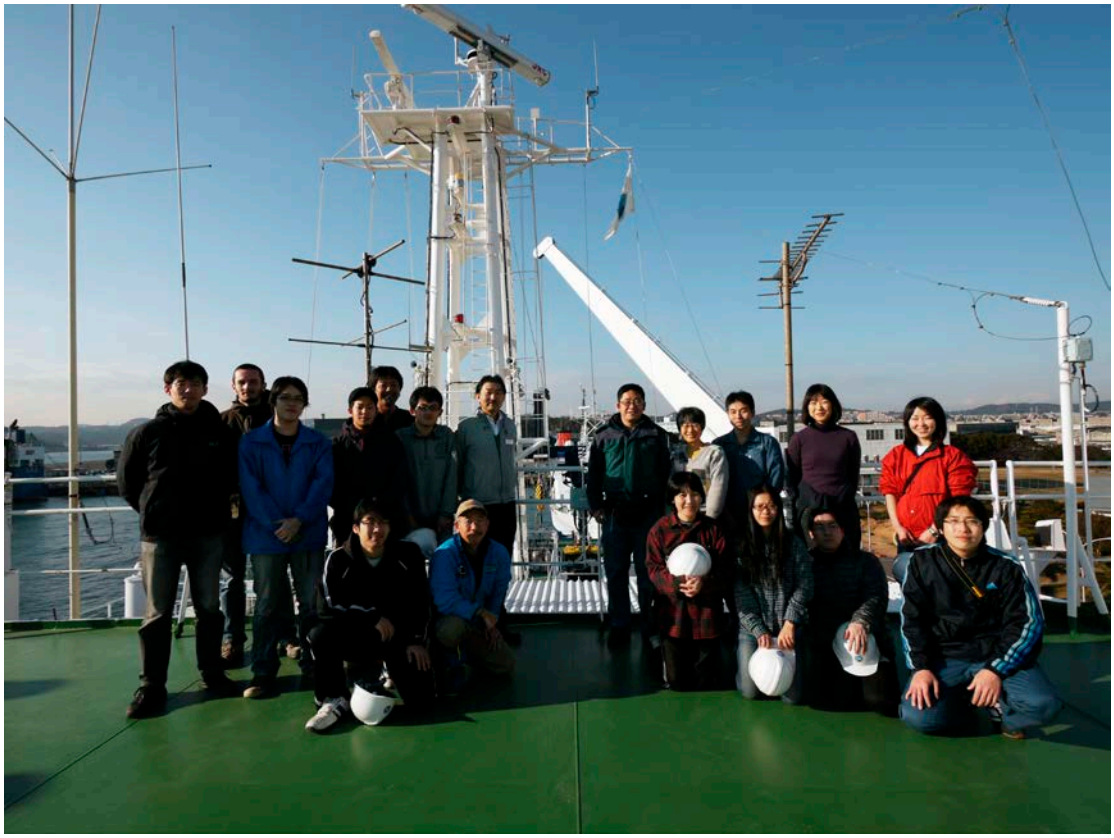

4. Notice on Using

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