



R/V Mirai Cruise Report

MR17-03C

SIP Project for Development of New-Generation Research Protocol
for Submarine Resources: survey for baseline condition of hydrothermal
vent area and in situ examination of observation tools.

Sea area around Nansei Islands

May 29-Jun 13,2017

Japan Agency for Marine-Earth Science and Technology
(JAMSTEC)

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1. Cruise Information

- Cruise ID MR17-03C

- Name of vessel R/V Mirai

- Title of the cruise

SIP Project for Development of New-Generation Research Protocol for Submarine Resources: survey for baseline condition of hydrothermal vent area and in situ examination of observation tools.

- Title of proposal _Survey and monitoring the hydrothermal ecosystem

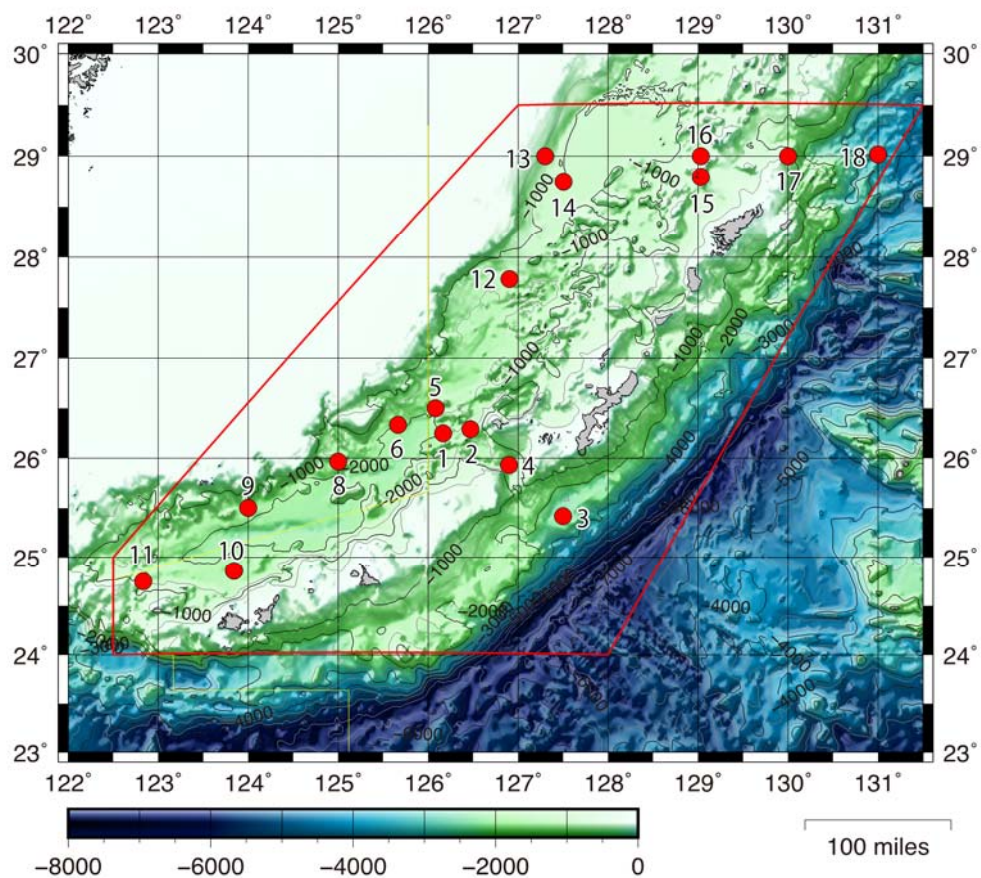
- Cruise period May 29 to June 13, 2017

- Ports of departure / call / arrival Nakagusuku, Okinawa/ Sekine-Hama, Aomori

- Research area Sea area around Nansei Islands

- Research Map

MR17-03C stations (ver170418)



2. Researchers

- | | |
|---------------------------------------|-----------------------------|
| ● Chief scientist | Hiroyuki YAMAMOTO [JAMSTEC] |
| ● Representative of the science party | Hiroyuki YAMAMOTO [JAMSTEC] |
| ● Science party (List) | |

Dhugal Lindsay	JAMSTEC
Taichi Yokokawa	JAMSTEC
Shunsuke Kondo	JAMSTEC
Yuya Tada	JAMSTEC
Kentaro Inomata	JAMSTEC
Eiji Tasumi	JAMSTEC
Hiromi Watanabe	JAMSTEC
Takuro Nunoura	JAMSTEC
Tatsuhiko Fukuba	JAMSTEC
Tomo Kitahashi	JAMSTEC
Jin-Kyu Choi	JAMSTEC
Akihi Tsutsumi	Kyushu University
Takuya Yahagi	University of Tokyo
Mehul Naresh Sangekar	University of Tokyo
Otis Brunner	OIST
Margaret Mars Brisbin	OIST
Hayato Kanzaki	Kyoto University
Andrew Gerard Carroll	Geoscience Australia
Meguru Miki	JAMSA
Nozomi Shimizu	JAMSA
Tatsunori Hayakawa	JAMSA
Atsuo Ohno	JAMSA

3. Observation

- Overview

This expedition has been planned in a series of research cruise to collect baseline data from surface to sub-seafloor of environments on Okinawa Trough, and to advance the development of observation tools and operation techniques. The baseline data on oceanographic structure, seafloor condition, biodiversity and distribution, were collected at 14 observation sites within Okinawa Trough and 3 reference sites on Pacific Ocean side adjacent to Ryukyu Islands.

The sample collections were carried out by CTD Carousel water sampling system, multiple core sampler, vertical multi plankton-net system (VMPS), in situ filtration pump system. The in situ physicochemical sensors are used for photosynthesis by fast repetition rate of fluorescence from chlorophyll, microbial productivity by ATP amount and CO₂ concentration. These data were used to determine biochemical profiles of water column. The high performance imaging observation system consisted of 4K stereo video camera, holographic camera, video plankton recorder, and GoPro camera was installed in Deep Tow to determine plankton distribution from surface to 1000m depth layer. The seafloor observation was performed by the standalone observation platform Edokko Mrk 1 of which deployed on seafloor due to complete long-term observation for 6 months. The physical measurements by shipboard instruments, acoustic doppler current profiler (ADCP), sub-bottom profiler (SBP), Multi-beam echo sounder (MBES), geophysical measurements, were continuously carried out through the cruise.

These baseline data combined environmental conditions with profiles of biological and microbial communities have potential to study the primary mechanism of robustness and resilience of ecosystem. Major biological drivers of such mechanism are productivity, diversity and connectivity. Physical driver conducted by water circulation may be a strong factor for migration and dispersion process. This cruise collected these data and samples related to the mechanism.

○ Research Schedule

MR17-03C_cruise schedule for observation

day	date		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23				
1	29-May	operation								Departure Nakagusuku,																CTD				
		site	Stn 1 (KG4)																											
2	30-May	operation					VMPS-IN				CTD-IN		Ebbike deployment		Pump down															
		site	Stn 2 (ANA)																											
3	31-May	operation				MC		CTD		DT-OUT										CTD		MC								
		site	Stn 3 (KG1)										Stn 4 (KG3)																	
4	1-Jun	operation				CTD				MC		CTD								CTD							CTD			
		site	Stn 5 (KG5-SC4)						Stn 6 (SC3)				Stn 8 (SC2)						Stn 9 (SC1)											
5	2-Jun	operation					DT-IN				CTD-OUT		VMPS-IN								VMPS-OUT		CTD-OUT		MC-OUT					
		site	Stn 10 (HTM)										Stn 11 (pYNG) Stn 11 (pYNG)																	
6	3-Jun	operation									CTD-IN		FRRF		VMPS-OUT															
		site	Stn 10 (HTM)																											
7	4-Jun	operation													CTD		Pump_test													
		site	Stn 12 (SC6)																											
8	5-Jun	operation									CTD		MC						MC		CTD		FRRF							
		site	Stn 13 (SC7-TKR1)										Stn 14 (ToKi)																	
9	6-Jun	operation									CTD-OUT		MC-OUT						CTD-IN		DT-IN									
		site	Stn 16 (TKR2)										Stn 15 (YKA)																	
10	7-Jun	operation									Pump down				VMPS-IN															
		site	Stn 15 (YKA)																											
11	8-Jun	operation									MC			CTD			FRRF													
		site	Stn 18 (TKR4)																											
12	9-Jun	operation									DT-OUT			CTD		VMPS-OUT		MC												
		site	Stn 17 (TKR 3)																											

○ Sampling frequency

CTD/Carousel water sampling system:	17sites
Multiple core-sampler:	9sites
Vertical multi-plankton net system (VMPS):	5sites
In-situ filtration pump system:	3sites
Fast repetition rate fluorometer (FRRF):	3sites
Deep-Tow camera systems:	4sites

○ Research Information

- CTD/ water sampling

Yuya Tada, Taichi Yokokawa, Takuro Nunoura, Kentaro Inomata, Eiji Tasumi, Akihi Tsutsumi, Hayato Kanzaki, Meguru Miki, Nozomi Shimizu, Tatsunori Hayakawa, Atsuo Ohno Sonoka Tanihara, Kenichi Katayama, Hiroki Ushiromura, Rio Kobayashi, Katsunori Sagishima, Erii Irie, Yoshiko ISHIKAWA

CTD/Carousel Water Sampling System, which is 36-position Carousel water sampler (CWS) with Sea-Bird Electronics, Inc. CTD (SBE9plus), was used during this cruise. 12-litter Niskin Bottles were used for sampling seawater. The sensors attached on the CTD were temperature (Primary and Secondary), conductivity (Primary and Secondary), pressure, dissolved oxygen (SBE43: Primary and Secondary), transmission, fluorescence, turbidity, colored dissolved organic matter sensor and altimeter. The Practical Salinity was calculated by measured values of pressure, conductivity and temperature. The CTD/CWS was deployed from starboard on working deck.

The CTD raw data were acquired on real time using the Seasave-Win32 (ver.7.23.2) provided by Sea-Bird Electronics, Inc. and stored on the hard disk of the personal computer. Seawater was sampled during the up cast by sending fire commands from the personal computer. We stop at each layer for 30 seconds to stabilize then fire. 18 casts of CTD measurements were conducted. The dissolved oxygen in seawater was determined by Winkler titration. The salinity analysis was carried out using the salinometer (Model 8400B “AUTOSAL” ; Guildline Instruments Ltd.: S/N 62827) with an additional peristaltic-type intake pump (Ocean Scientific International, Ltd.).

other components, DO, salinity, nutrients of seawater were analyzed at onboard laboratory.

Cast table of CTD/Carrousel water sampling system

Stnnbr	Castno	Date(UTC) (mmddyy)	Time(UTC)		BottomPosition		Depth	Wire Out	HT Above Bottom	Max Depth	Max Pressure	CTD Filename	Remark
			Start	End	Latitude	Longitude							
C01	1	052917	06:04	07:44	26-15.27N	126-10.08E	1972.0	1961.2	10.0	1956.0	1978.2	C01M001	
C02	1	053017	00:03	01:25	26-17.49N	126-28.16E	1079.0	1066.3	9.9	1066.0	1075.8	C02M001	
C03	1	053017	20:08	21:57	25-24.94N	127-30.11E	2405.0	2386.4	9.8	2385.0	2414.3	C03M001	
C04	1	053117	04:10	05:48	25-56.02N	126-53.96E	1847.0	1849.1	9.5	1834.0	1854.2	C04M001	
C05	1	053117	18:05	19:36	26-30.12N	126-05.20E	1917.0	1901.7	8.9	1900.0	1921.3	C05M001	
C06	1	053117	23:50	01:32	26-20.02N	125-40.04E	1942.0	1937.0	7.3	1926.0	1947.7	C06M001	
C08	1	060117	05:12	06:34	25-56.01N	124-59.04E	1689.0	1675.7	9.2	1671.0	1688.7	C08M001	
C09	1	060117	10:58	12:32	25-30.28N	123-59.98E	1900.0	1893.1	8.8	1890.0	1911.0	C09M001	
C10	1	060217	00:29	01:59	24-51.64N	123-50.81E	1449.0	1377.6	31.5	1371.0	1384.4	C10M001	
C11	1	060217	11:54	13:00	24-45.71N	122-50.62E	1235.0	1218.9	10.7	1217.0	1228.5	C11M001	
C10	2	060217	23:07	00:47	24-51.43N	123-50.32E	1531.0	1516.7	12.5	1515.0	1530.4	C10M002	
C12	1	060417	04:09	05:07	27-47.32N	126-54.36E	1055.0	1032.0	9.1	1024.0	1033.4	C12M001	
C13	1	060417	23:33	00:24	29-00.37N	127-20.46E	853.0	838.8	9.9	834.0	841.4	C13M001	
C14	1	060517	04:08	05:24	28-45.05N	127-30.39E	1026.0	1021.7	8.9	1013.0	1022.4	C14M001	
C16	1	060517	23:08	23:57	29-00.02N	129-01.81E	835.0	825.6	9.8	826.0	833.3	C16M001	
C15	1	060617	03:56	04:05	-	-	-	-	-	-	-	C15M001	pump error
C15	1	060617	04:32	05:41	28-47.53N	129-01.80E	783.0	773.2	6.8	776.0	782.7	C15M001	retry
C18	1	060817	03:38	06:09	28-58.96N	130-54.37E	2969.0	2959.9	6.8	776.0	782.7	C18M001	
C17	1	060917	02:49	03:35	28-57.54N	129-34.11E	778.0	776.6	6.5	772.0	778.7	C17M001	

- Abundance of metabolically active microbial population

Yuya Tada

To measure microbial respiration, we used the CTC (cyanoditolyl tetrazolium chloride) method (Yoshida et al., 2006 M&E). After collecting the seawater sample from niskin bottles, seawater (500 μ L each) were incubated with CTC at *in situ* temperature $\pm 3^{\circ}\text{C}$ for 24 h. Then, these seawater were stored at -80°C until further analysis on land. We will count the CTC positive cells using flow cytometry.

- Community structure of actively growing prokaryotes

Yuya Tada

To analyze the active prokaryotic community, the seawater samples collected from 3 to 4 sampling depths at each site, were incubated with 1 μM bromodeoxyuridine (BrdU, nucleoside tracer) at *in situ* temperature $\pm 3^{\circ}\text{C}$ for 24 h, and filtered with 0.22- μm cartridge filters. Then, these filtered were stored at -80°C until further analysis on land. We will analyze actively growing fraction using next generation sequencer after BrdU immunocapture.

- Vertical Profiles of Microbial Abundance and Diversity

Taichi Yokokawa , Takuro Nunoura

Microbial abundance

Samples for microbial abundances (prokaryotes, eukaryotes and viruses) were collected in every routine cast and depth. Samples were fixed with glutaraldehyde (final concentration 0.5%) and frozen at -80°C . The abundance of microbes and viruses will be measured by a flow cytometry in JAMSTEC after nucleic acid staining with SYBR-Green I.

Microbial diversity

Microbial cells in water samples were filtrated on cellulose acetate filter (0.2 μm) and stored at -80°C . Environmental DNA or RNA will be extracted from the filtrated cells and used for 16S/18S rRNA gene tag sequencing using MiSeq, quantitative PCR for genes for 16S rRNA, and/or metatranscriptomics. Samples for microbial diversity were taken at specific depths of all the stations.

- Onboard ATP quantification

Tatsuhiro Fukuba, Choi Jinkyu

Concentration of ATP (adenosine triphosphate) as a proxy of microbial biomass was measured onboard. Water samples collected using a CTD Carousel water sampling system were transferred to clean plastic tubes aseptically and processed after each cast. Sample was immediately processed with a Luciferin-Luciferase assay kit (CheckLight HS, Kikkoman Biochemifa) and bioluminescence intensity was measured using a desktop photodetector (ATTO) for total ATP quantification. Portion of each sample was filtrated using a satirized membrane filter unit (0.2 μm pore size) and the filtrate was processed to

measure extracellular (dissolved) ATP concentration.

- In situ pH/pCO₂ measurement

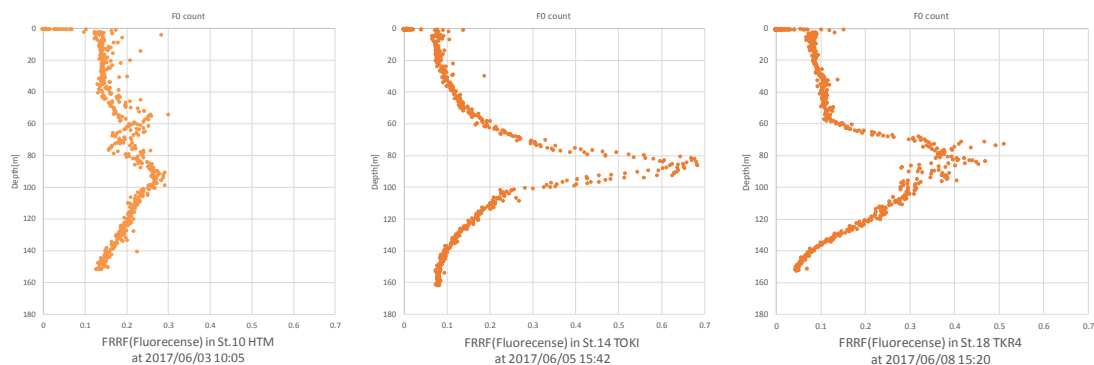
Tatsuhiko Fukuba, Choi Jinkyu

Hybrid pH/pCO₂ sensor (HCS-10, JAMSTEC/Kimoto Electric) was mounted on a CTD carousel water sampling system for *in situ* measurement of seawater pH and pCO₂. pH is measured by using a glass electrode on HCS-10. pCO₂ is measured by monitoring the changes of pH of internal solution flowing through a tube made by a gas-permeable material. The pH changes of the internal solution containing a pH-indicator dye are measured with colorimetric method. The sensor was operated with a rechargeable battery unit and measured data was stored on a sensor.

- The Fast Repetition Rate Fluorometer (FRRF)

Shunsuke Kondo

The Fast Repetition Rate Fluorometer (FRRF) is an in-situ sensor for determination of potential activity of photosynthesis. In this cruise, FRRF was operated by using the cable winch, and the measuring area was from surface to 150m-depth layer at St.10(HTM), St.14(TOKI), and St.18(TKR4). The figure below shows the F₀ count of chlorophyll fluorescence.



- Vertical Multiple-opening Plankton Sampler and in-situ filtration pump system

Takuya Yahagi, Hiromi Watanabe, Dhugal Lindsay

Dispersal plays a significant role in the population dynamics, geographic distributions and evolutionary processes of marine organisms with a planktonic life stage. Knowledge on dispersal, spatial distributions and population connectivity is important to understand their natural history, but also to evaluate the robustness and resilience of marine ecosystems associated with the exploitation of hydrothermal deposits. In this cruise, the biodiversity and spatial distribution of planktonic organisms were investigated from seafloor to surface waters in the Okinawa region by using two quantitative sampling methods, the Vertical Multiple-opening Plankton Sampler (VMPS6000D, Tsurumi Seiki: Fig. 1) and in-situ filtration pump system (WTS-LV-30, McLANE: Fig. 2).

Planktonic organisms were collected from near the seafloor (< 1500 m depth) to surface waters at five sites (St. 2, 10, 11, 15 and 17) using the VMPS, and at depths of 700, 750 or 1500 m for < one hour at three sites (St. 10, 12 and 15) using the in-situ filtration pump system. At the same time, turbidity, temperature and depth were measured by a logging sensor (RBR XR-420 + Seapoint NWT-D2N) equipped on the VMPS and the in-situ filtration pump system. The collected organisms were preserved on board in 99% ethanol for imaging, taxonomic and molecular analyses.



Fig. 1. Left: Vertical multiple-opening plankton sampler that collects planktonic organisms from up to eight multiple depth layers from near the seafloor (< 6000 m) to surface waters. Top right: Cod end nets (100 µm mesh) of VMPS. Bottom right: An example of planktonic organisms collected by VMPS, including copepods, ostracods, gastropods, pteropods and foraminiferans.

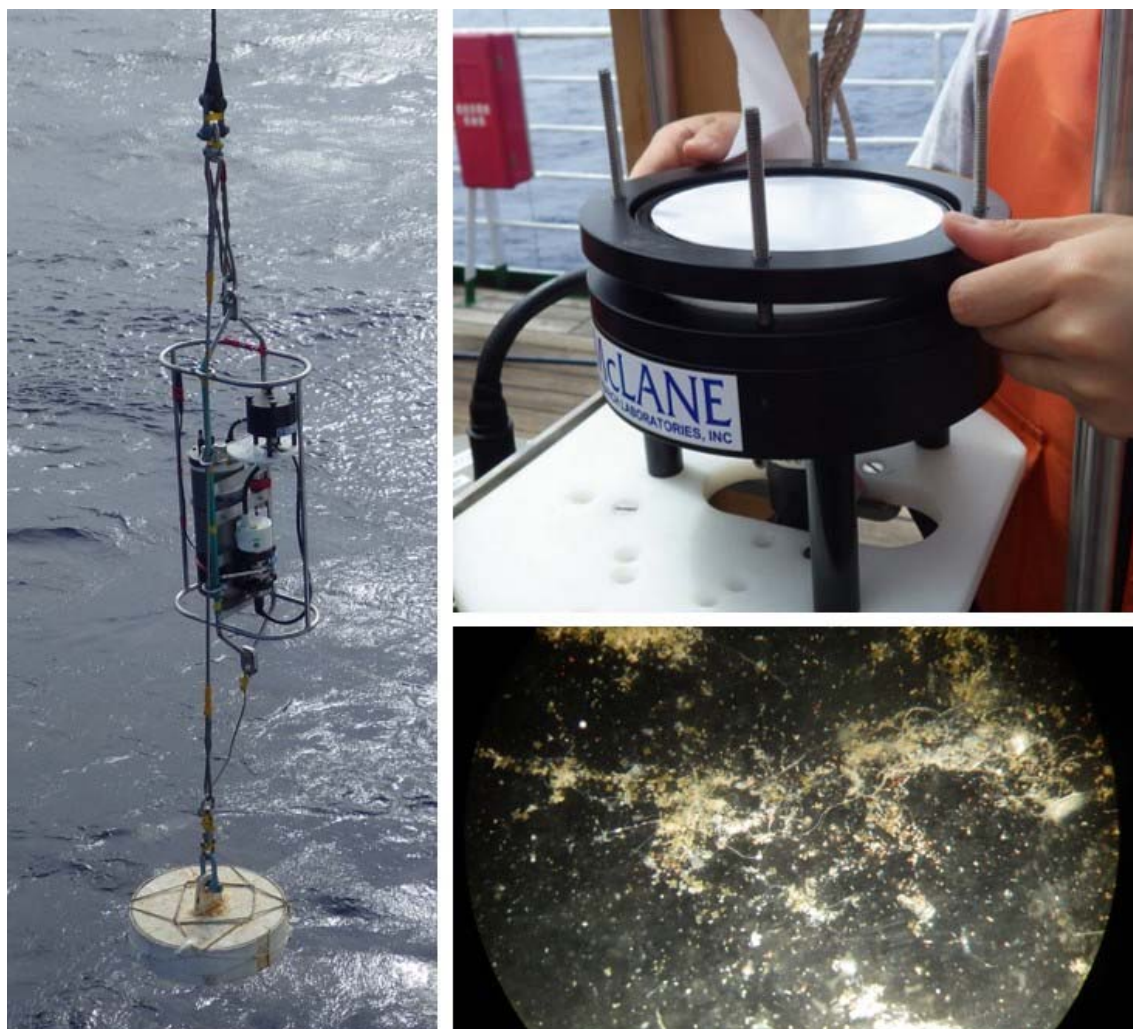


Fig. 2. Left: In-situ filtration pump system that collects planktonic organisms at a given depth. Top right: Collection mesh of the pump system. Bottom right: An example of samples collected by this pump system, including copepods and diatoms.

- Water-column sampling of pico-, nano-, and microeukaryotes to determine diversity and metabolic activity eukaryotic plankton

Margaret Brisbin, Otis Brunner

Two replicates of 5 gallons of seawater were collected at the surface by bucket, and at the subsurface chlorophyll maximum, mid-water column, and near bottom (10m above bottom) by Niskin bottle at each station (except st. 6). Each replicate of 5 gallons was filtered sequentially through 10.0 μm and 0.2 μm PTFE filters to separately concentrate pico- & nanoeukaryotes and microeukaryotes. Each filter was placed in a 2 ml cryo-vial and immediately immersed in liquid nitrogen to preserve both RNA and DNA. The samples will be kept frozen at -80°C until they are processed, at which point, RNA and DNA will be simultaneously extracted from each filter using the Qiagen AllPrep kit. An aliquot of RNA will be reverse

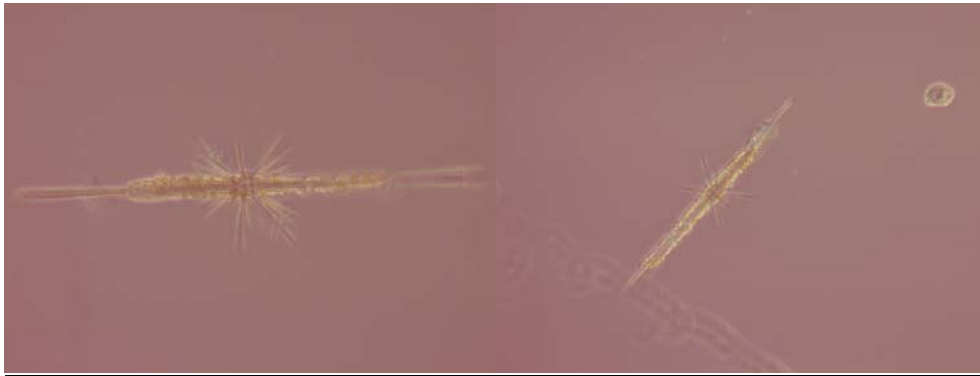
transcribed to cDNA and the 18S rRNA V4 gene region will be amplified from the cDNA and DNA samples with eukaryote specific primers. Amplicons will be sequenced with Illumina MiSeq and the diversity in RNA and DNA samples will be compared. The remaining RNA from each sample will be ribo-depleted and the resulting mRNA will be used to build metatranscriptome libraries that will be sequenced with Illumina HiSeq to study the physiology of microbial eukaryotes at varying locations and depths in the water column.

- Near-surface Acantharian collection for single-cell transcriptomics

Margaret Brisbin

Acantharians (class: Radiolaria), host the haptophyte *Phaeocystis* as an intracellular photosynthetic symbiont. As endosymbiotic mixotrophs, acantharians can contribute significantly to photosynthesis in oligotrophic waters. *Phaeocystis* spp., when free-living, can form harmful algal blooms (HABs) in elevated nutrient conditions. This relationship is therefore interesting both for its contribution to photosynthesis in low-nutrient surface waters and because it represents an additional life-history strategy in a globally-distributed bloom-forming haptophyte.

In order to further investigate physiological changes in symbiotic *Phaeocystis* and to perhaps identify mechanisms of host control, 42 elongate acantharians were isolated on this cruise. Plankton samples were collected by passing seawater pumped from the surface waters through a 100 µm mesh plankton net. Samples were observed with a dissecting microscope and acantharians were picked with a glass micropipette. Each cell was rinsed once with 0.2 µm filtered seawater, photographed with an inverted microscope, and then transferred to a 0.5 µl lo-bind PCR tube. Each tube was observed under 10x magnification to confirm that the cell was successfully transferred before the addition of 30 µl of Qiagen RLT+ buffer. After buffer addition, PCR tubes were immersed in liquid nitrogen and then stored at -80°C. Samples will be processed by extracting RNA with Agencourt RNA AMPure beads followed by cDNA synthesis and amplification with the SMART-seq v4 Ultra Low-Input kit. cDNA libraries will be sequenced with Illumina HiSeq, and for analysis, symbiotic *Phaeocystis* transcriptomes will be compared with transcriptomes from several species of *Phaeocystis* in laboratory culture under varying nutritional regimes.



Sample A36; station 17; June 9, 2017

Sample A42; station 17; June 9, 2017

- Spatial pattern in prokaryote and eukaryote diversity in the sediment at the Okinawa Trough

Tomo Kitahashi, Takuro Nunoura, Masashi Tsuchiya

Sediment samples were collected at 8 sites (Table #) using a multiple corer (Barnett et al., 1984), which simultaneously collects up to eight sediment cores (internal diameter: 74 mm). Each core was used for different purposes and processed as follows in each site;

> Meiofauna: three cores were sliced into 6 layers; 0-0.5, 0.5-1, 1-2, 2-3, 3-4 and 4-5 cm below the sea floor. The samples were fixed and preserved individually in 5% buffered seawater formalin.

> Metagenomic analysis: one or two cores were sliced into 9 layers; 0-1, 1-2, 2-3, 3-4, 4-5, 5-7.5, 7.5-10, 10-15 and 15-20 cm below the sea floor. The samples were immediately deep frozen (-80°C).

> TOC (total organic matter): one core was sliced into 9 layers; 0-1, 1-2, 2-3, 3-4, 4-5, 5-7.5, 7.5-10, 10-15 and 15-20 cm below the sea floor. The samples were immediately deep frozen (-80°C).

> Nutrient analysis: core was sliced into 9 layers; 0-1, 1-2, 2-3, 3-4, 4-5, 5-7.5, 7.5-10, 10-15 and 15-20 cm below the sea floor for nutrient analysis. The samples were centrifuged and the extracted pore water was gently filtered through a 0.22 µm membrane filter attached to a 20-ml syringe and then deep frozen (-80°C).

Table #. Location of the sampling stations during Mirai MR17-03C.

Station		Date	Latitude		Longitude		Water depth (m)
3	KG1	31-May-17	25:24.9469	N	127:30.0008	E	2407
4	KG3	31-May-17	25:55.9931	N	126:54.0486	E	1848
6	SC3	1-May-17	26:19.7440	N	125:39.9824	E	1942
11	pYNG	2-May-17	24:45.0770	N	122:50.0781	E	1189
14	Toki	5-May-17	28:44.9946	N	127:30.2371	E	1024
16	TKR2	6-May-17	29:00.0060	N	129:01.7587	E	834
18	TKR4	8-May-17	29:01.0265	N	130:59.9383	E	3382
17	TKR3	9-May-17	28:57.5486	N	129:34.1045	E	778

- Dissolved gas analysis

Eiji Tasumi, Yohei Matsui

Seawater samples were horizontally collected by using CTD at Stn.1 (CTD#001), Stn.2 (CTD#002), Stn.10 (CTD#009 and #011), Stn.14 (CTD#014), Stn.15 (CTD#016), Stn.16 (CTD#015). Concentrations of H₂ and CO in subsampled seawater samples were measured in a few hours after sampling by using gas chromatograph (GC) equipped with a trace reduction gas detector (TRD-1, R science). The measurement conditions were as follows: carrier gas, nitrogen; flow rate, 30 mL/min; column, Molecular Sieve 5A 60/80 mesh (SUS 3 m x 1/8 inch); column temperature, 50°C; detector temperature, 270°C. In order to remove H₂O from sample gases, a pre-cut column (Silicagel, SUS 3 m x 1/8 inch) was connected in front of the separation column. Concentrations and isotopic characteristics of CH₄ and N₂O will be determined after the cruise.

- DeepTow6KC Video and Storage Details

Dhugal Lindsay, Mehul Naresh Sangekar ,Andrew Gerard Carroll

The primary cameras with real-time video feeds were a downward-facing colour 3-CCD camera (KY-F560, Victor Company of Japan, Ltd.; S4x5.5BMD lens [61°37' horizontal field angle]) and a forward-facing colour CCD camera (XC-505, Sony Electronics, Inc.; LM5NF NF-mount lens, Kowa Optics) capable of capturing SD video at 29.97 fps NTSC. The width imaged by the 3-CCD camera was approximately equal to the altitude of the DeepTow6KC (ie. 3.06m at 3.0m altitude, 5.1m at 5.0m altitude). Linear TimeCode (LTC) was supplied to all video recording equipment via LTC In by a timecode generator (HD-488E/GPS/NTP, ESE) that extracted time from the GPS satellite feed via a GPS antenna (GPA-019, Furuno) and converted it to Japan Standard Time (JST). A microphone (Ultravoice XM8500, Behringer) was set up on a stand in the control container with phantom power supplied via the XLR connector from a Portable Active Signal Splitter (Kickbox 4x4, Drawmer Electronics Ltd.), which split and provided audio via XLR to the video recording equipment.

The two primary video feeds were taken directly from the shipside optical transceiver module (Sumitomo Electric Industries, Ltd.; JAMSTEC000725) via BNC connectors and input via single pin video connectors into two analogue 1-input:4-output composite video distribution amplifiers (Shinybow, SB-3701) with the video feed output via single pin video connectors and resupplied back to the DeepTow6KC shipboard system via BNC connectors. One output (single pin video) for each camera was input into each of two Roland VC-1-SC scan converters (via single pin connectors), which upconverted and digitized the composite video to HD-SDI. The HD-SDI outputs (BNC) were input (BNC) into an AJA Ki Pro and an AJA Ki Pro Quad (Encode Type: ProRes 422HQ, Dropped Frames: Continue, Record Type: PsF, In Convert: None, Video Input: SDI 1 YCbCr, Audio Input: XLR, Analogue Audio: +24dBu, TC In: LTC, TC Type: DF, Loss of Video: CONT Rec). The original AJA Ki Pro is provided with an LTC Out port (BNC connector) and this LTC feed was input into the AJA Ki Pro Quad (nb. the Quad is lacking this functionality so LTC would need to be split using a BNC T-connector). Audio was input from the Kickbox 4x4 via XLR cables. The AJA Ki Pro Quad includes an embedded monitor but the the AJA Ki Pro video output needed to be converted (OutConvert: HD 1080) for visualization on an external camera view finder monitor (HDF-700V, ProTech MasterTron, Nippon Video System Co., Ltd.) via a BNC-BNC cable. The AJA Ki Pro Quad recorded onto AJA's PAK512 SSDs, which require a proprietary reader (AJA's PAK dock via Thunderbolt 2) to ingest, while the AJA Ki Pro HDD cassettes require a Firewire 800 connection. The AJA KiPro Quad has dual media ports, with recording automatically switching between media once full.

All computer clocks from both the science party and the operations team were synced using the ship's Time Server (gts1.mirai.jamstec.go.jp). To ensure and check synchronization of all data feeds, composite video from the two video distribution amplifiers, from one video feed after navigation and CTD data were overlaid/superimposed, and from an SD security video camera (TK-S340, Victor) that was filming the realtime CTD profile output monitor, was input into 4 Video Network Stations (Sony Corporation, SNT-EX101E) that converted and live-streamed the video via Ethernet. These video-streaming units were plugged into a Power-over-Ethernet (PoE)-enabled hub (Panasonic ES Networks, Switch-S8GPWR+ PN24089) and accessed via the ethernet port of a desktop PC running Windows 7 (Veriton N4620G, Acer Inc.) and the security camera management software package RealShot Manager Advanced. This software package works with the Ipela streaming units but was unable to integrate feeds from other ethernet cameras that were tested (eg M1011-W, AXIS Communications). A custom layout was created using the 2x2 screen template and devices ("camera" video windows) were dragged to the respective panels for the desired layout. The combined 4-panel observation screen was switched to FullScreen mode and the external monitor output from the Acer PC (HDMI) was input into a Roland VC-1-SC scan converter (via HDMI) where analogue audio from the Kickbox 4x4 (XLR) was input via a single pin connector and

embedded. The HDMI output from the VC-1-SC was input into a BlackMagic Intensity Extreme unit via HDMI, output via Thunderbolt 2 to a MacBook Pro (13 inch, Mid 2012, OS 10.8.5) running the recording software supplied on CD with the BlackMagic Unit (Media Express), and recorded to an external SSD (Samsung 2TB EVO-Pro) in an Oyen Digital MiniPro housing via USB 3.0.

Media cassettes were carried from the DeepTow6KC control van post-dive to the main lab for ingestion via a MacBook Pro onto an 8TB external hard disk. Files were all renamed to include the date and video source type with the format of DT6KCYYYMMDD-VideoSource, where the VideoSource was "forward", "down" or "combined".

The DeepTow6KC operations team recorded the SD-NTSC camera video streams, with navigation and CTD data overlaid/superimposed, using DVD Recorders (DVR-710H, Panasonic).

Offline mini-cameras (1x Hero4+, 2x Hero5, GoPro) were deployed on the DeepTow6KC platform in custom-made (RecSea/SeaTool) single (Hero4+) or stereo (Hero 5) housings. Recording settings were progressively modified during the cruise with the final settings being at 30fps, ISO6400 and EV+2.0. Even then, lighting was sub-optimal unless the highly reflective seafloor was included in the imaged area/volume. Time values on each GoPro camera drifted but a wristwatch, synchronized to shiptime, was imaged and an audio cue (handclap) provided before each deployment to aid in synchronization. Correct timecode will need to be embedded using qtChange2.26 after the .mpg files are combined in Quicktime Player Pro 7.6.6 and saved as a single .mov file.

The eHolocam computer's internal clock was set manually using a remote desktop connection and the host PC's (ToughBook CF-31, Panasonic) clock, synced to the ship's time server. The DPI computer clock was also synced in the same way.

- Deployment of Edokko Mark I for 6-month observation

Shunsuke Kondo, Choi Jinkyu

Edokko Mark I was deployed at St.2 ANA of Okinawa Trough on 30 May 2017 for long-term seafloor observation, approximately 6 months. Edokko Mark I is a stand-alone type and has cameras and lights to take moving images of seafloor for a given length of time at every given time interval. The video recording time and time interval are programmed through a simple user interface before the launch. A free-fall method is used to deploy it on the seafloor and a weight is released by using acoustic communication for recovery. The position placed on the seafloor is 26°17.428'N, 126°28.205'E, and 1087m depth, which were measured by the transponder mounted on Edokko Mark I and the super short baseline (SSBL) system of R/V Mirai. Edokko Mark I deployed in this expedition will take a moving

image for 1 minute at every 8 hours through approximately 6 months and is planned to be recovered on November this year.



Figure: Just before the launch of Edokko Mark I for 6-month observation.

4. Notice on Using

Notice on using: Insert the following notice to users regarding the data and samples obtained.

This cruise report is a preliminary documentation as of the end of the cruise.

This report may not be corrected even if changes on contents (i.e. taxonomic classifications) may be found after its publication. This report may also be changed without notice. Data on this cruise report may be raw or unprocessed. If you are going to use or refer to the data written on this report, please ask the Chief Scientist for latest information.

Users of data or results on this cruise report are requested to submit their results to the Data Management Group of JAMSTEC.

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We are grateful thank to all crews of “R/V Mirai” for the safe navigation and the skillful operation for our sampling and observation.



Appendix I:

Marine Technician

Ryo Oyama	NME
Shinya Okumura	NME
Wataru Seta	NME
Kenichi Katayama	MWJ
Hiroki Ushiromura	MWJ
Sonoka Tanihara	MWJ
Rio Kobayashi	MWJ
Katsunori Sagishima	MWJ
Tomonori Watai	MWJ
Yoshiko Ishikawa	MWJ
Erii Irie	MWJ
Ei Hatakeyama	MWJ
Yuki Miyajima	MWJ
Takehiro Kanii	MWJ

Appendix II:

Cruise track

