



R/V *Yokosuka* Cruise Report YK12-17



**High-resolution mapping and geologic structure of
mud volcanos off Tanegashima Island (AUV *Urashima*)**

Oct. 05 - 15, 2012

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

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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.

1. Cruise Information

- Cruise ID YK12-17
- Name of vessel YOKOSUKA and URASHIMA
- Title of the cruise High-resolution mapping and geologic structure of mud volcanoes off Tanegashima Island (AUV *Urashima*)
- Title of proposal High-resolution mapping and geologic structure of mud volcanoes off Tanegashima Island, southwestern Japan: Toward the clarification of the potential of huge hydrocarbon resources
- Cruise period Oct. 05 - Oct. 15, 2012
- Ports of call Naha - Yokosuka
- Research area Off Tanegashima Island
- Research Map

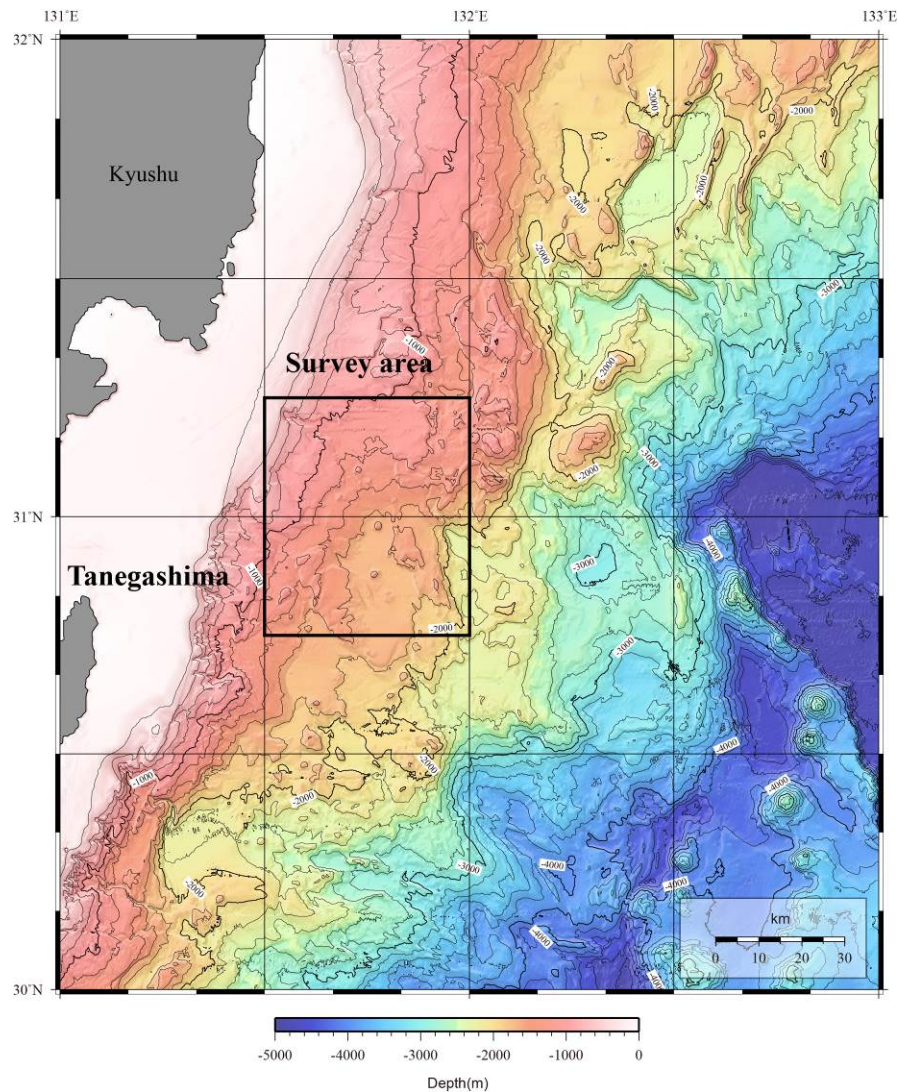


Figure 1: Index map of the survey area

2. Scientific Party

- Chief scientist [Affiliation]

Hideaki Machiyama [Japan Agency for Marine-Earth Science and Technology]

- Representative of the science party [Affiliation]

Fumio Inagaki [Japan Agency for Marine-Earth Science and Technology]

- Onboard science party [Affiliation]

Hideaki Machiyama [Japan Agency for Marine-Earth Science and Technology]

Fujio Yamamoto [Japan Agency for Marine-Earth Science and Technology]

Goichiro Uramoto [Japan Agency for Marine-Earth Science and Technology]

Further details are in Appendix A-1.

3. Cruise outline

We carried out only two diving surveys with AUV *Urashima*, because of bad sea state. We collected the high-resolution data of bathymetry and acoustic image at one mud volcano. In addition, onboard bathymetric mapping and single-channel seismic (SCS) survey were carried out to understand the geologic structure around mud volcanoes off Tanegashima Island. The details of the shipboard log is shown in Appendix A-2.

3.1. Objectives

There are more than 50 mud volcanoes off Tanegashima Island, southwestern Japan. Mud volcanoes, common geological features in fore-arc basin of the plate convergent margin, are “windows of deep subsurface” in which we find deep subsurface materials, such as gas, liquid, and solid particles from up to several kilometers. Also, it has been known that fore-arc mud volcanoes sometimes include methane hydrates. Therefore, the fore-arc mud volcanos are expected to have large potential of hydrocarbon resources as a natural pipeline of methane from deep subsurface. To reveal the fluid regime in the fore-arc basin and accretionary prism and the potential for methane resources, we conducted high-resolution mapping and geologic structure of mud volcanos off Tanegashima Island.

4. Operation

4.1. Methods and equipment

In this cruise, we conducted high-resolution mapping using AUV *Urashima*, onboard bathymetric survey, and SCS survey.

The specification of AUV *Urashima* is shown in appendix A-3. For the AUV survey, we prepared a fluxgate magnetometer as a payload in addition to the standard acoustic instruments on AUV *Urashima* (i.e. Seabat 7125 MBES, Edgetch 2000M Side-scan Sonar/Sub

Bottom Profiler).

4.2. Magnetometer

Three of three-component flux gate magnetometers were attached as a payload for AUV *Urashima*. They are still under development as a fundamental tool for seafloor resource study (under a project funded by MEXT). One of three was attached to the head part of AUV in the syntactic from buoyancy medium, and other two were to the port and starboard side of the payload space. Appendix A-5 shows the description of the magnetometer.

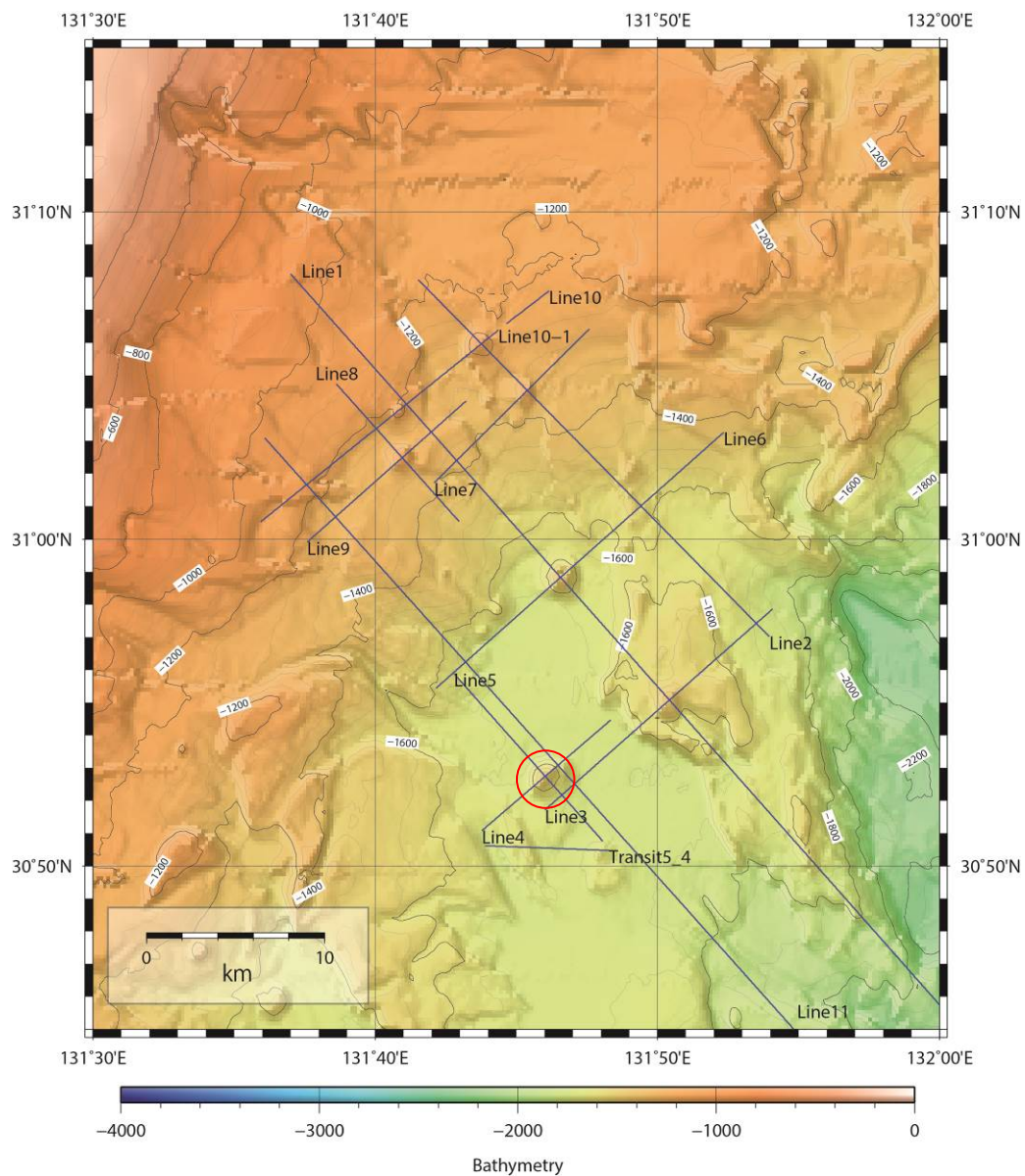


Figure 2: Map showing AUV diving survey point (red circle) and SCS survey tracks (solid lines).

5. Future Plan and Data QC, etc

QC of magnetometer will be carried on land by shore-based scientific team led by T. Kasaya. The result will also be submitted by T. Kasaya. After the standard post processing of AUV *Urashima* MBES and SSS/SBP, these acoustic data will be investigated by M. Asada and her collaborators.

6. Acknowledgements

Here we express our sincere appreciation for the excellent support and assistance by Captain Eiko Ukekura and his crew, and the Operation Manager of Urashima, Keita Matsumoto, and his AUV team throughout the cruise.

Appendix A-1: List of participants

1. Research group

Hideaki Machiyama	Japan Agency for Marine-Earth Science and Technology
Fujio Yamamoto	Japan Agency for Marine-Earth Science and Technology
Goichiro Uramoto	Japan Agency for Marine-Earth Science and Technology
Fumio Inagaki	Japan Agency for Marine-Earth Science and Technology
Koichi Iijima	Japan Agency for Marine-Earth Science and Technology
Hitoshi Tomaru	Japan Agency for Marine-Earth Science and Technology
Akira Ijiri	Japan Agency for Marine-Earth Science and Technology
Yasuyuki Nakamura	Japan Agency for Marine-Earth Science and Technology
Takehiro Hirose	Japan Agency for Marine-Earth Science and Technology
Yoshiro Nishio	Japan Agency for Marine-Earth Science and Technology
Wataru Tanikawa	Japan Agency for Marine-Earth Science and Technology
Satoshi Okada	Nippon Marine Enterprise
Mitsuteru Kuno	Nippon Marine Enterprise
Satomi Minamizawa	Nippon Marine Enterprise
Waka Komatsu	Nippon Marine Enterprise
Toshimasa Nasu	Nippon Marine Enterprise

2. Operation team of the AUV URASHIMA

Operation Manager	Keita Matsumoto
1 st Submersible staff	Shinobu Omika
1 st Submersible staff	Masanobu Yanagitani
2 nd Submersible staff	Akihisa Ishikawa
2 nd Submersible staff	Yudai Sakakibara
3 rd Submersible staff	Hitomi Ikeda

3. Captain and crew of the R/V YOKOSUKA

Captain	Eiko Ukekura
Chief Officer	Tatsuo Adachi
2 nd Officer	Shozo Fujii
3 rd Officer	Motoi Katsumata
Chief Engineer	Eiji Sakaguchi
1 st Engineer	Kimio Matsukawa
2 nd Engineer	Takahiro Mori
3 rd Engineer	Katsuto Yamaguchi

Chief Radio officer	Takehito Hattori
2 nd Electronic Operator	Yosuke Komaki
3 rd Electronic Operator	Ryousuke Komatsu
Boat Swain	Masanori Ohata
Able Seaman	Kazumi Ogasawara
Able Seaman	Kaito Murata
Able Seaman	Hiroaki Murase
Able Seaman	Takuya Miyashita
Sailor	Shinsuke Uzuki
Sailor	Toru Nakanishi
No.1 Oiler	Hiroyuki Oishi
Oiler	Katsuyuki Miyazaki
Oiler	Yoshinori Kawai
Assistant Oiler	Makoto Kozaki
Assistant Oiler	Eiji Aratake
Assistant Oiler	Naoto Mitsuo
Chief Steward	Sueto Sasaki
Steward	Shigeto Ariyama
Steward	Yoshinobu Hasatani
Steward	Tatsunari Onoue
Steward	Seiji Ho

Appendix A-2

YK12-17 Shipboard Log

日付 Date	時間 Local Time	内容 Note	特記事項 Description	本船位置／気象／海象 Position/Weather/Wind/Sea condition
05-Oct-12		Sail out, proceeding to research area		10/05 12:00(UTC+9h)
	9:00	Let go all shore line, left NAHA for research area.	for OFF TANEGASHIMA	26-46.7N,127-54.2E
	10:00-10:30	Carried out onboard education & training for scientists.		NORTH OFF OKINAWA
	11:15-11:40	"AUV URASHIMA" team & scientist meeting.		Fine but cloudy
				NNE-5 (Fresh breeze)
				4 (Sea moderat eh)
				2 (Low swell long)
				Visibly: 7'
06-Oct-12		Arrived at research area.		10/06 12:00(UTC+9h)
	13:30	Arrived at research area.	for OFF TANEGASHIMA	30-29.6N,131-39.4E
	13:42	Released XBT.	30-45.0320N,131-54.6063E	EAST OFF TANEGASHIMA
	13:52-14:05	Carried out figure eight turn measurement.		Fine but cloudy
	14:46	Com'ced MBES site survey.		NORTH 4 (Moderate breeze)
	18:00-18:20	Scientist meeting.		3 (Sea slight)
				3 (Moderate short)
				Visibly: 7'
07-Oct-12		Dive URASHIMA(#151) & SCS Survey (Line6,Line5)		10/07 12:00(UTC+9h)
	5:30	Finished MBES site survey.		30-51.7N,131-47.1E
	7:21	Hoisted up "AUV-URASHIMA"		OFF TANEGASHIMA
	7:30	Launched above "AUV-URASHIMA"		Fine but cloudy
	7:31	"AUV-URASHIMA" dove & started her operation(#151).		NNE-6 (Strong breeze)
	11:51	Refloated "AUV-URASHIMA"		4 (Sea moderate)
	12:18	Recovered "AUV-URASHIMA" & finished her operation(#151).		3 (Moderate short)
	13:40-16:30	Carried out MBES site survey.		Visibly: 7'
	17:36-17:41	Lounched Cluster gun.		
	17:44-17:53	Lounched streamer cable.		
	17:54	Com'ced SCS survey on line 6.		
	20:43	Cleaed out line 6.		
	21:07	Com'ced SCS survey on line 5.		
	22:43	Cleaed out line 5.		
	22:48	Com'ced SCS survey on Transit line 5 - line 4.		
08-Oct-12		SCS Survey (Transit line5-line4, Line4, Line3)		10/08 12:00(UTC+9h)
	0:01	Cleaed out Transit line5-line4.		30-54.1N,131-48.9E
	0:09	Com'ced SCS survey on line 4.		OFF TANEGASHIMA
	1:19	Cleaed out line 4.		Fine but cloudy
	3:05	Com'ced SCS survey on line 3.		NE-6 (Strong breeze)
	5:17	Cleaed out line 3 & finished SCS survey.		5 (Sea rough)
	6:00-6:02	Recovered Cluster gun.		4 (Moderate average)
	6:08-6:15	Recovered streamer cable.		Visibly: 7'
	9:27-16:30	Carried out MBES site survey.		
	17:34-17:37	Lounched Cluster gun.		
	17:40-17:49	Lounched streamer cable.		
	18:02	Com'ced SCS survey on line 1.		
09-Oct-12		SCS Survey (Line1) & drifting at SHIBUSHI WAN		10/09 12:00(UTC+9h)
	1:10	Cleaed out line 1 & finished SCS survey.		31-23.9N,131-9.7E
	5:38-5:43	Recovered Cluster gun.		SHIBUSHI WAN
	5:45-5:51	Recovered streamer cable.		Fine but cloudy
	6:00	Left research area for SHIBUSHI WAN.		NNE-4 (Moderate breeze)
	9:00	Arrived at SHIBUSHI WAN.		3 (Sea slight)
	9:30	Com'sed drifting her.		1 (Low swell)
				Visibly: 7'
10-Oct-12		Proceeding to research area.		10/10 12:00(UTC+9h)
	9:00-9:10	Scientist meeting.		31-23.7N,131-9.9E
	20:00	Com'ced proceeding to research area.	for OFF TANEGASHIMA	SHIBUSHI WAN
	22:45	Arrived at research area.		Fine but cloudy
	22:51	Com'ced MBES mapping survey.		WSW-2 (Light breeze)
				1 (Calm)
				1 (Low swell)
				Visibly: 7'

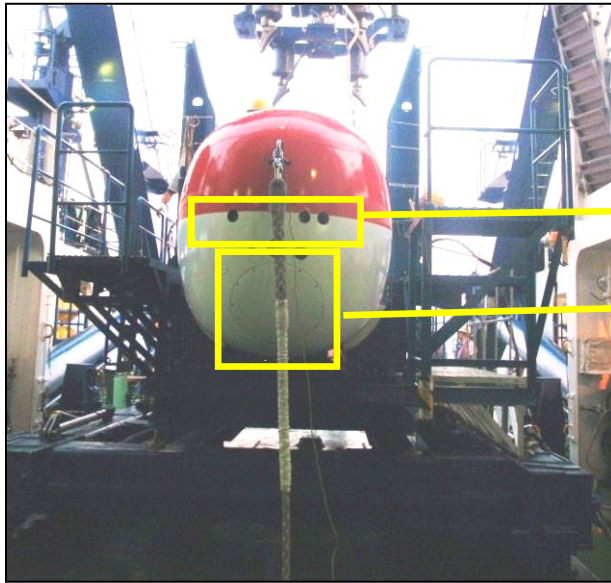
11-Oct-12		Dive URASHIMA(#152) & SCS Survey (Line2)	10/11 12:00(UTC+9h)
	4:57	Finished MBES site survey.	30-52.2N,131-46.1E
	7:15	Hoisted up "AUV-URASHIMA".	OFF TANEGASHIMA
	7:23	Launched above "AUV-URASHIMA".	Cloudy
	7:24	"AUV-URASHIMA" dove & started her operation(#152).	NE-4 (Moderate breeze)
	16:31	Refloated "AUV-URASHIMA".	3 (Sea slight)
	16:57	Recovered "AUV-URASHIMA" & finished her operation(#152).	1 (Low swell)
	18:35-18:38	Lunched Cluster gun.	Visibly: 7
	18:43-18:49	Lunched streamer cable.	
	19:46	Com'ced SCS survey on line 2.	
	23:20	Cleaed out line 2.	
12-Oct-12		SCS Survey (Line10,Line9,Line11)	10/12 12:00(UTC+9h)
	0:22	Com'ced SCS survey on line 10.	30-01.1N,131-46.4E
	3:04	Cleaed out line 10.	OFF TANEGASHIMA
	3:32	Com'ced SCS survey on line 9.	Fine but cloudy
	5:05	Cleaed out line 9& finished SCS survey.	NNE-6 (Strong breeze)
	5:59-6:05	Recovered Cluster gun.	5 (Sea rough)
	6:07-6:12	Recovered streamer cable.	3 (Moderate short)
	7:05-16:35	Carried out MBES site survey.	Visibly: 7
	17:59-18:02	Lunched Cluster gun.	
	18:04-18:16	Lunched streamer cable.	
	18:28	Com'ced SCS survey on line 11.	
13-Oct-12		SCS Survey (Line8,Line7) & Left research area for YOKOSUKA	10/13 12:00(UTC+9h)
	0:13	Cleaed out line 11.	31-10.4N,131-55.4E
	5:52	Com'ced SCS survey on line 8.	SOUTH EAST OFF TOIMISAKI
	2:12	Cleaed out line 8.	Cloudy
	2:41	Com'ced SCS survey on line 7.	EAST-5 (Fresh breeze)
	4:15	Cleaed out line 7& finished SCS survey.	4 (Sea moderate)
	5:58-6:04	Lunched Cluster gun.	3 (Moderate short)
	6:07-6:14	Lunched streamer cable.	Visibly: 7
	6:30-10:00	Carried out MBES site survey. & Left research area for YOKOSUKA	
	17:30-18:00	Scientist meeting.	
14-Oct-12		Proceeding to YOKOSUKA	10/14 12:00(UTC+9h)
	9:00-9:30	scientist seminar.	33-38.0N,138-58.7E
			SOUTH WEST OFF MIKURAJIMA
			Cloudy
			NE-5 (Fresh breeze)
			4 (Sea moderate)
			3 (Moderate short)
			Visibly: 7
15-Oct-12		Arrived at YOKOSUKA	10/15 12:00(UTC+9h)
	9:00	Sent out 1st shore line, arrived at Yokosuka	JAMSTEC
		Concluded YK12-17 cruise.	

Appendix A-3: General description of AUV *Urashima*

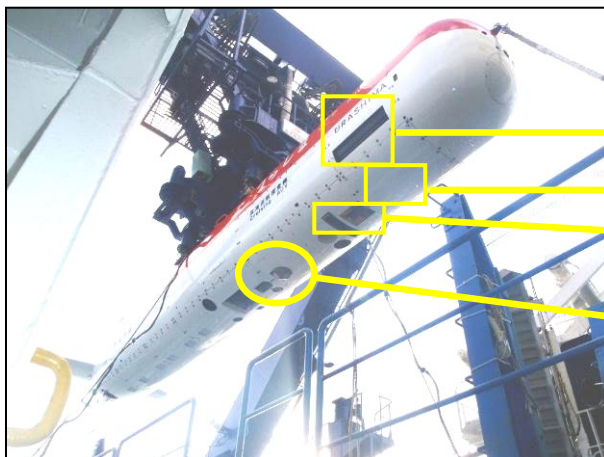
Autonomous Underwater Vehicle (AUV) *Urashima* is cruised by itself for built in control system. It is not connected by the cable between the mother vessel, therefore it can survey the sea floor widely and clearly. There are acoustic sonar equipments and sensors, Side Scan Sonar, Sub Bottom Profiler, Multi Narrow Beam Echo Sounder, and CTDO sensor.

Table A. : The specifications of AUV *Urashima*

Dimensions	Length (m)	10
	Width (m)	1.3
	Height (m)	1.5
	Weight (t)	6.5
Max Depth	3500 m	
Cruising Speed	3 kt	
Positioning	Inertial Navigation System Doppler Sonar SSBL Sonar	
Operation Mode	Autonomous Remote (Acoustic, Optical)	
Payload	200 kg in air	
Equipments	Side Scan Sonar (2200-M / Edge Tech Sub Bottom Profiler (DT106 / Edge Tec) Multi Narrow Beam Echo Sounder (SeaBat 7125 / Reson) CTDO (SBE9plus / SeaBird ELC.)	



Forward looking sonar



Side scan sonar (SSS)

Sub bottom profiler (SBP)

Multi Narrow Beam Echo Sounder (MBES)

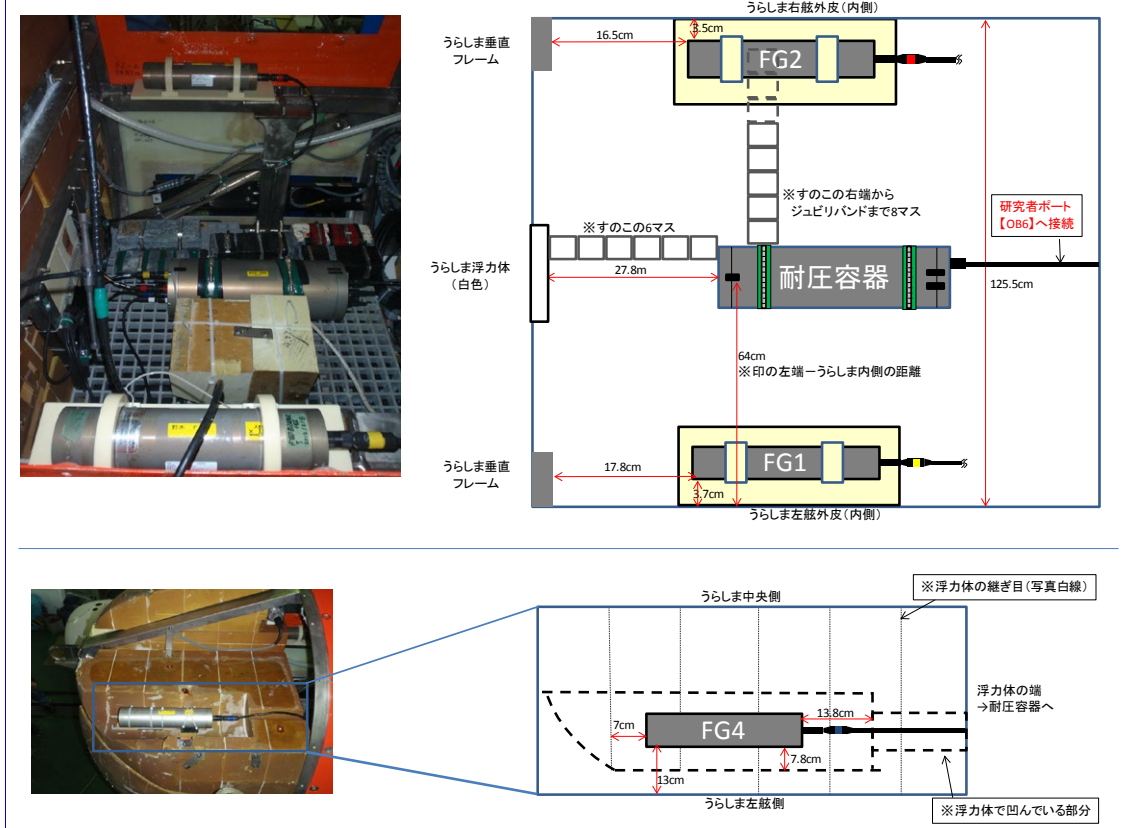
(DVL)



CTDO

Appendix A-4

FG三成分磁力計 取り付け位置



URASHIMA Dive151&152

FG3成分磁力計

