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R/V Kaimei "Cruise Report"
KM22-01

A general study of Kikai submarine caldera

South to Southeast Offshore of Kyushu

Jan. 06, 2022-Jan.19, 2022

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

Contents

1. Cruise Information

Cruise ID : KM22-01
Name of vessel : *KAIMEI*
Title of cruise : A general study of Kikai submarine caldera
Chief Scientist [Affiliation] : Satoru Tanaka [JAMSTEC]
Cruise period : January 06, 2022 to January 19, 2022
Ports of departure / call / arrival: Yokosuka to Yokosuka
Research area:

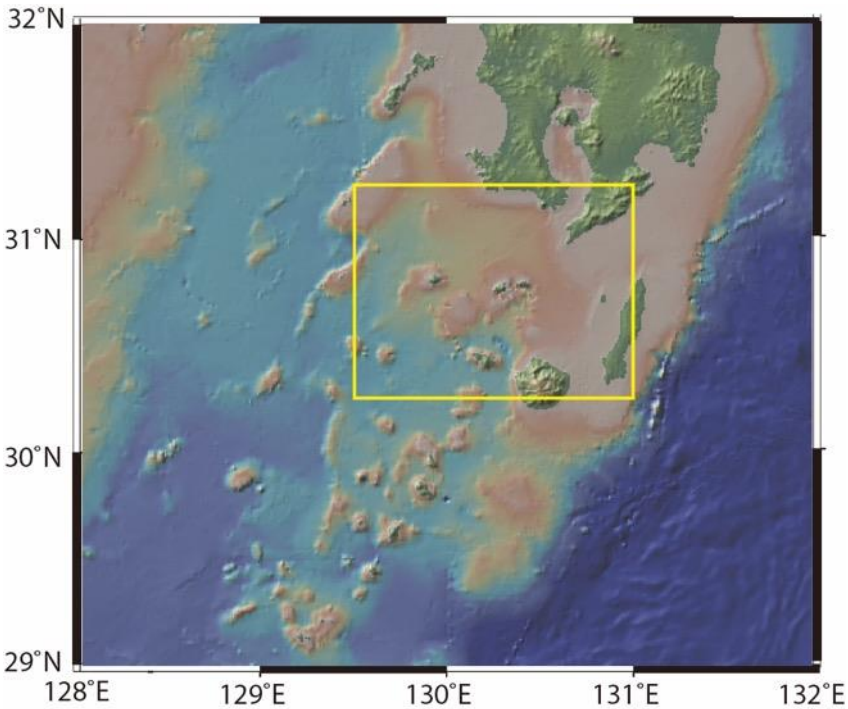

Figure 1. Research area. Yellow: Planned geophysical survey area.

Research map (Cruise track):

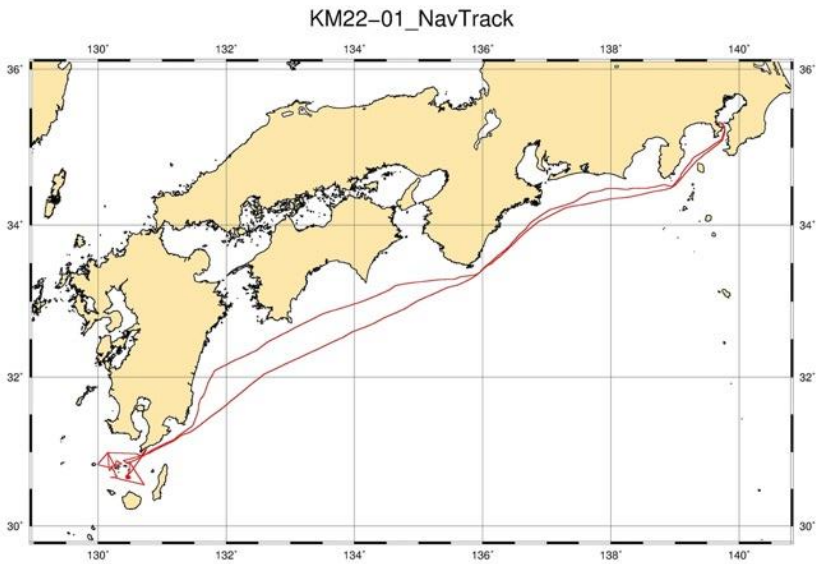

Figure 2. Cruise Track.

2. Research Proposal and Science Party

Title of proposal

A general study of Kikai submarine caldera

Representative of Science Party

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Volcanoes and Earth's Interior Research Center, Research Institute for Marine Geodynamics, Japan Agency for Marine-Earth Science and Technology

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Kuniaki Nishiki	[Secretariat of Nuclear Regulation Authority]
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Onboard Science party [Affiliation]

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Yasushi Hashimoto	[MWJ]
Naohito Mori	[MWJ]
Toru Koizumi	[MWJ]
Yuta Suzuki	[MWJ]

R/V KAIMEI crew

Naoto Kimura	Captain
Ryo Yamaguchi	Chief Officer
Masaki Okada	2nd Officer
Shun Ito	3rd Officer
Takumi Ojima	Jr 3rd Officer
Wataru Kurose	Chief Engineer
Kenichi Shirakata	First Engineer
Shohei Miyazaki	2nd Engineer
Genta Takeya	3rd Engineer
Shunsuke Fukagawa	Chief Electronic Operator
Ryuji Onikubo	2nd Electronic Operator
Keisuke Ohi	3rd Electronic Operator
Kaname Hirosaki	Boat Swain
Yuki Yoshino	Able Seaman
Kenji Nakae	Able Seaman
Takuya Miyashita	Able Seaman
Toru Nakanishi	Able Seaman
Kenta Nasu	Able Seaman
Kazuya Sumomozawa	Sailor
Keito Seguchi	Sailor
Masanori Ueda	No.1 Oiler
Kazuya Ando	Oiler
Toru Hidaka	Oiler
Marina Shimizu	Assistant Oiler
Tatsunari Onoue	Chief Steward
Yoshio Okada	Steward
Yoshie Hidaka	Steward
Yuma Fujimoto	Steward

BMS & KM ROV Team

Atsumori Miura	Operation Manager
Tetsuta Ishizuka	1st ROV Operator
Mitsuhiro Ueki	1st ROV Operator

Homare Wakamatsu	1st ROV Operator
Yosuke Senda	2nd ROV Operator
Shigeru Kiykua	2nd ROV Operator
Takuma Goto	2nd ROV Operator
Shinnosuke Kumagai	2nd ROV Operator
Shuya Sugiura	2nd ROV Operator
Keigo Suzuki	2nd ROV Operator
Atsushi Takenouchi	2nd ROV Operator
Yuto Okudaira	3rd ROV Operator
Daiki Ichinose	3rd ROV Operator
Yosuke Kawamura	[NMK]
Hiroaki Maeda	[JOSCO]
Harutaka Okayama	[JOSCO]
Hiroo Takahashi	[OCC]

3. Research/Development Activities

3.1 Responsible personnel

BMS:	Takeshi Hanyu
ROV:	Takashi Miyazaki
Underway geophysical survey:	Tetsuo Matsuno
OBS response check:	Satoru Tanaka

3.2 Background and Objective

Kikai Caldera, located in the south of Kyushu, is known as a large submarine caldera volcano that made a catastrophic eruption at approximately 7300 years ago. This volcano made several pulses of caldera-forming events within approximately 130,000 years. The latest caldera-forming eruption was followed by post-caldera volcanic activities that had intermittently occurred in and around the caldera. Because most part of the caldera volcano exists underwater, volcanic subsurface structure and activities during and after the caldera-forming events are poorly understood. Recent surveys revealed several characteristic topographic features in and around the caldera, including a central dome, small satellite cones, double caldera walls, and intrusive bodies. We have sampled volcanic and sedimentary rocks on the seafloor in these areas by dredge and piston coring during the KS-19-17, KR19-11 and KR20-11 cruises. After description of the samples on the ship, chemical compositions were determined in the laboratory to understand magmatic processes and eruption styles.

This cruise aims to conduct sampling of volcanic and sedimentary rocks by drilling with the boring machine system (BMS) and remotely operated vehicle (KM-ROV). We conducted drilling on the caldera wall to sample inferred intrusive bodies along the wall. Drilling inside and outside the caldera enable us to sample volcanic materials that occurred during older catastrophic eruptions and small eruptions in between them. KM-ROV is used for pre-survey at the drilling sites but also for observation and rock sampling from the seafloor in and around the caldera. Additionally, we conduct geophysical measurements of geomagnetic force, gravity, bathymetry, and sub-bottom profiling, etc. The operation of call and response for the unrecovered OBSs is done.

This research is conducted under the collaborative study of JAMSTEC and Kobe University "General investigations on caldera volcanoes that repeat large scale volcanic eruptions" (FY2019- FY2021), and that of JAMSTEC and Secretariat of Nuclear Regulation Authority "The study on the time evolution process of large-scale volcanic eruption phenomena".

3.3 List of equipment and instruments

The boring machine system (BMS)
The remotely operated vehicle (KM-ROV)
The expendable Bathy Thermograph (XBT)
Multibeam echo sounder EM122
Sub bottom profiler TOPAS PS18
Three component magnetometer SFG-2015
Gravity meter MGS-6

3.4 Results

(1) BMS

In order to understand the structure of the caldera wall and to investigate repeated catastrophic volcanism, the BMS apparatus was used to drill at two stations. The specification of the BMS is in the Appendix A. The first station (planned A1 site; BMS14) is on top of the caldera wall, below which the presence of intrusive bodies was inferred from the results of the previous seismic surveys. The second station (planned C1 site; BMS15 and BMS16) is approximately 40 km to the east of the caldera, where pyroclastic materials not only from 7.3 ka eruption but also from 95 ka (and possibly 130 ka) eruptions of the submarine caldera volcano might have been deposited. The drilling was performed using the H3 size (ϕ = 63 mm) coring tools. Each core section is 1.5 m long. The first drilling (BMS14) was conducted for approximately one day to reach the ~30 mbsf target. The second drilling (BMS15) was planned to reach the target depth of ~60 mbsf at the C1 site within approximately two days but there was a mechanical problem during this drilling, which recovered only 7.8 m. The operation of BMS16 was performed at the same site (approximately 5 m to the north of the BMS15 site) but failed to reach the 60 mbsf target because of a mechanical problem again. The recovered cores were left in the laboratory overnight to bring them to room temperature. The physical properties (natural gamma ray intensity, P-wave velocity, density, porosity, electric resistivity, magnetic susceptibility) were measured on whole cores before splitting into working half and archive half. A photo of each core was taken with the imaging scanner onboard before the archive half was visually described. Samples to be used for further chemical and physical properties analyses were collected from the working half.

<u>BMS14</u>

Date: January 9 - 10, 2022
Location: On the caldera wall to the east of Takeshima
Position: 30°45.991'N, 130°29.276'E, 180 m
Bottom of the Hole: 24.590 mbsf
Assembly: H-type bit, 63mm liner
Description:

The objective of this drilling is to recover rocks that comprise the intrusion-like structure near the caldera wall as inferred from the seismic section obtained during previous surveys. The drilling station was chosen based on previously collected seismic data and the subbottom profiling data acquired prior to drilling at the site during this cruise. It is expected to encounter hard rocks after penetrating the sedimentary units with less than ten meters thickness.

The BMS apparatus was placed on the muddy seafloor. The drilling started penetrating indurated rock just below the seafloor, which turned out to be a limestone containing some pumice and seashells, as recovered in Core-1. Core-2 included banded pumice. The recovery of Core-3 was very low, in which a few pieces of small pumice were collected. The recovery rate became better after Core-4. Core-4 was filled with pyroclastic materials including glass shards, minerals, a variety of pumice clasts (white, dark, banded) together with seashells, suggesting secondary or reworked deposit origin. Harder rocks were recovered from Core-5 to Core-17, consisting of gray to dark gray massive volcanic rocks, fractured blocks, and finely brecciated rocks (interpreted as hyaloclastite) that grade into more massive flows from Core 7 down. Volcanic rocks were generally plagioclase-phyric (maximum of 6 mm in size, up to 20% phenocryst mode). From Core 5 to Core 6, the recovered sections consist of highly brecciated volcanic fragments supported by fine light-gray matrix. Glass rim was occasionally observed along some clast margins within this brecciated upper part. In the deeper

part (Core-7 to Core 17), the light-gray matrix supporting monolithologic brecciated fragments diminished to fracture spaces between fragments (i.e., autobrecciated), and the population of brecciated rocks became smaller downhole. There were some alteration veins in the lower part of the drilled cores (Core-14 and below). Several light-gray enclaves were included in Cores-15 to -17. No lava flow unit boundaries were visibly identified in the hard rock section.

Core No.	Drill length (m)	Recovery length (m)	Recovery rate (%)
1	1.500	0.265	17.7
2	0.601	0.285	47.4
3	1.499	0.075	5.0
4	1.500	1.410	94.0
5	1.501	1.015	67.6
6	1.499	1.080	72.0
7	1.500	1.280	85.3
8	1.500	1.120	74.7
9	1.503	1.550	103.1
10	1.498	1.465	97.8
11	1.500	1.430	95.3
12	1.489	0.985	66.2
13	1.500	1.000	66.7
14	1.500	0.735	49.0
15	1.501	1.545	102.9
16	1.500	1.470	98.0
17	1.499	1.465	97.7
total	24.590	18.175	73.9

BMS15

Date: January 14, 2022
Location: To the southeast of the Kikai Caldera
Position: 30°33.361'N, 130°43.299'E, 145 m
Bottom of the Hole: 7.851 mbsf
Assembly: H-type bit, 63mm liner
Description:

The objective of this drilling is to recover pyroclastic units of the previous gigantic eruptions of the Kikai Caldera. The drilling station was chosen based on previously collected seismic data and subbottom profiling data.

The BMS apparatus was placed on the sandy seafloor. Samples were not recovered from Core-1 and Core-2. From Core-3 to Core-6, the samples contained glass shards, several kinds of minerals (orthopyroxene, clinopyroxene, plagioclase, biotite, magnetite), pumice fragments (up to 2.5 cm), and seashells. Considering the presence of biotite, these samples are interpreted to be a mixture of volcanic materials with terrigenous-derived materials. Sandy silt occurred at the bottom of Core-6. This drilling was abandoned after taking Core-6 because of some mechanical problems.

Core No.	Drill length (m)	Recovery length (m)	Recovery rate (%)
1	1.500	0.000	0.0
2	0.350	0.000	0.0
3	1.500	0.347	23.1
4	1.500	0.684	45.6
5	1.500	0.395	26.3
6	1.501	0.295	19.7
total	7.851	1.721	21.9

BMS16

Date: January 15, 2022
Location: To the southeast of the Kikai Caldera
Position: 30°33.362'N, 130°43.297'E, 145 m
Bottom of the Hole: 12.17 mbsf
Assembly: H-type bit, 63mm liner
Description:

The objective of this drilling is to recover pyroclastic units of the previous gigantic eruptions of the Kikai Caldera. The drilling station was the same as that of BMS15.

The BMS apparatus was placed on the sandy seafloor. Samples were not recovered from Core-1 or Core-7. Core-2 contained a few tens of pumice. Core-3 to Core-9 consisted of fine sands, including clear glass shards, black fine fragments, several kinds of minerals (orthopyroxene, clinopyroxene, plagioclase, biotite), pumice fragments, and foraminifera. Pumice (up to 1.5 cm) and seashells were also contained. Sands were well sorted in each core. This drilling was abandoned after taking Core-9 because of mechanical problems on the BMS.

Core No.	Drill length (m)	Recovery length (m)	Recovery rate (%)
1	1.501	0.000	0.0
2	0.351	0.073	20.8
3	1.498	0.167	11.1
4	1.500	0.156	10.4
5	1.500	0.752	50.1
6	1.502	0.628	41.8
7	1.498	0.000	0.0
cuttings		0.300	
8	1.500	0.510	34.0
9	1.320	0.359	27.2
total	12.170	2.645	21.7

(2) KM-ROV

KM-ROV was used for pre-survey of the BMS stations and for seafloor observation and rock/sediment sampling in and around the caldera. The specification of KM-ROV is in the Appendix B.

KM-ROV Dive# 169

Date: 10 January 2022

Site: Around Kikai Caldera L1
Landing: 30-39.3941N, 130-27.5130E, 322.8 mbsl
Leaving: 30-39.3768N, 130-27.7129E, 303.2 mbsl
Chief observer: Takeshi Hanyu
Payload: Push corer (3), Sample box with a lid (1)

The objective of this dive is to conduct a pre-drilling survey for the BMS station (B1 30-39.52N, 130-27.79E, 300 mbsl). KM-ROV was used for seafloor observation and rock/sediment sampling around this station.

KM-ROV landed on the seafloor at 30-39.3941N, 130-27.513E, 322.8 mbsl. This point was about 500 m ESE away from the BMS station (B1). To check the seafloor condition, we touched the seafloor using the KM-ROV manipulator. We confirmed that the seafloor is covered with soft sediments consisting of sands with pebble- to cobble-sized clasts (maximum 4 cm). The KM-ROV headed ENE toward the BMS station (B1) and climbed up the gentle slope. On the way to the BMS station (B1), we observed that the sandy seafloor was dotted with several pumice boulders. The size of these pumices was measured by comparing with the size of the KM-ROV manipulator and was estimated to be more than 1m. At 30-39.4079N, 130-27.549E, 322.7 mbsl, a piece (about 20cm) was broken off from the giant pumice (R01) successfully. We resumed observation heading 60. At 30-39.4179N, 130-27.5846E, 316.4 mbsl, coarse clasts were visible on the sandy sea floor. We lowered the ROV and scooped the sediment two times using a push corer and stored the collected materials into the sample box with a lid (S01). Then, we continued moving toward BMS station (B1). While moving, the bands of coarse clasts were observed on the seafloor covered mainly of fine sand. The pumice boulders were also observed sporadically. At 30- 39.4248N, 130- 27.6151E, 314.7 mbsl, a small piece of boulder was collected, presumed to be broken off from pumice boulders nearby (R02). We continued to climb the gentle slope heading 59 and then 52. At 30- 39.4927N, 130- 27.7678E, 303 mbsl, pumice boulders with cooling joints were observed. We sampled a piece of this pumice (R03) and obtained a sediment core from the seafloor (Push core #1). Then, we resumed moving toward BMS station (B1), and several pumice boulders were observed on the way. At 30- 39.5221N, 130- 27.7915E, 303.1 mbsl, we arrived at the position close to the BMS station (B1 30-39.52N, 130-27.79E, 300 mbsl) and obtained a sediment core from the seafloor (Push core #2). The seafloor around the BMS station (B1) is covered with sand and coarse clasts. We continued the survey around the BMS station (B1) and changed the heading to 200 then 210. At 30- 39.4944N, 130- 27.7805E, 303 mbsl, pumice boulders were observed. We collected two samples from the broken fragments of a boulder from this point (R04, R05). We continued the survey heading to 200. At 30- 39.4858N, 130- 27.7769E, 301.4 mbsl, a rock pile consisting of many blocks was observed. We tried sampling many times but failed because the rocks are very fragile. We continued the seafloor observation, heading 206. Bands of coarse clasts and large boulders (pumice?) were observed on sandy seafloor. At 30- 39.4302N, 130- 27.7426E, 300.8 mbsl, we collected a black-colored rock (R06). We continued moving and changed the heading to 140. At 30-39.4205N, 130-27.7541E, 299.8 mbsl, we collected two pieces of sample from a blocky mound (R07A, R07B). We changed the heading to 180 and went down slope. At 30-39.3903N, 130-27.7729E, 302.6 mbsl, the seafloor cover changed to coarser clasts. We pinched the clasts to check the hardness and verified them as pumice judging from the ease by which the manipulator arm crushed them. We changed the heading to 240. The band of coarse clasts, blocky mound, and blocky rock fragments were observed on sandy seafloor. At 30-39.3772N, 130-27.7117E, 302.9 mbsl we obtained the last sediment core from the seafloor (Push core #3). We left the bottom at 30- 39.3768N, 130- 27.7129E, 303.2 mbsl.

Rocks collected from the seafloor around BMS station B1 are mainly weakly vesiculated (~5 to 10 %) volcanic rocks (R01-R05). Most of them are subangular because they were broken off from large boulders with a manipulator. They are relatively fresh with pale grey to grey color. They are aphyric to sparsely phyric with <8 vol% plagioclase and pyroxene phenocrysts. The R06 sample is an altered, dark-colored, very weakly vesiculated (~2 %) volcanic rock. It is a phyric rock with ~15 vol% plagioclase and pyroxene phenocrysts. The R07A sample is weakly vesiculated (~10 %) with greenish alteration by chlorite. R07B samples is a weakly vesiculated (~15 %), fresh, black-colored volcanic rock.

The sediment samples in Push cores (C01, C02 and C03) consist of sand-sized grains with gray color overall. They are mainly composed of shell fragments, foraminifera, plagioclase, orthopyroxene, clinopyroxene, bubble wall volcanic glass, and volcanic rock clasts with rare biotite, quartz, and sedimentary rock clast. They have no depositional structure because they were mixed up during

sampling. The sediment sample (S01) was scooped up with a push core. This sample is almost identical in component to the other push core samples, except for the presence of lapilli sized pumice fragments.

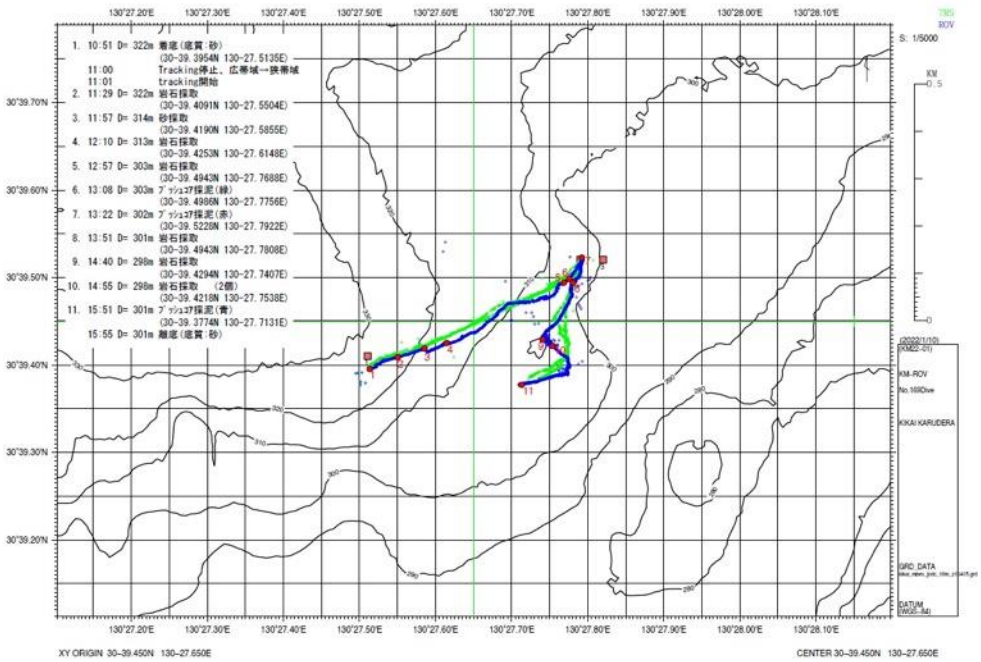

Figure 3. Dive Map of KM-ROV Dive# 169

Figure 4. Photos of Collected Samples of KM-ROV Dive# 169

KM-ROV Dive# 170

Date: 16 January 2022
Site: Around Kikai Caldera L4
Landing: 30-39.6066N, 130-13.0167E, 399.0 mbsl
Leaving: 30- 39.6852N, 130- 13.2576E, 329.6 mbsl
Chief observer: Takeshi Hanyu
Payload: Push corer (3)

The objective of this dive is to conduct a survey for the broad, gently sloping (plateau-like) southwestern outer wall of the Kikai Caldera. KM-ROV was used for seafloor observation and rock/sediment sampling around this area.

KM-ROV landed on the seafloor at 30-39.6066N, 130-13.0167E, 399.0 mbsl. This point was near the base of the steep edge of the broad plateau forming the outer caldera wall. To check the seafloor condition, we examined the seafloor sediment using the KM-ROV manipulator and confirmed that the material was sand with several gravels. At 30-39.6057N, 130-13.0171E, 401.2 mbsl, we obtained a sediment core from the seafloor (Push core #1). The KM-ROV headed ESE toward the base of the steep slope. On the way to the base of the slope (30-39.6273N, 130-13.0744E, 394.5 mbsl), boulders (consolidated mud?) were visible on the sandy sea floor. At 30- 39.6312N, 130-13.0863E, 391.0 mbsl, two small pieces from a boulder (R01 A and B) and one other boulder (R02) were collected. We started to climb along a valley and observed rock talus on sandy seafloor. At 30-39.6333N, 130- 13.0935E, 386.2 mbsl, a piece of boulder was collected (R03). Along the slope just before we reached the top (30-39.637N, 130-13.106E, 368.2 mbsl), three pieces of boulder were collected (R04, R05, R06). Around the top of the broad plateau (30-39.6449N, 130-13.1181E, 350.1 mbsl), many rock blocks were observed and a piece of one boulder was collected (R07). On the plateau, we continued the survey heading toward 61 and observed large blocks (30-39.6540N, 130-13.1326E, 342.1 mbsl) forming what was inferred as front lobe of a lava flow. We finished the observation around the first slope and moved to a second slope to the south of the first one. We reached the second slope and landed at 30-39.5642N, 130-13.083E, 414.1 mbsl. At the bottom of the valley (30- 39.566N, 130- 13.0884E, 409.1 mbsl), two pieces of boulders were collected (R08 and R09). We continued the survey heading 30 and observed some blocky rocks on the seafloor. At 30-39.6049N, 130- 13.1242E, 396.7 mbsl, a piece of boulder was collected (R10). We resumed observation heading North. At 30- 39.6102N, 130- 13.125E, 389.7 mbsl, we encountered a large domal feature and collected two pieces of boulders around its base (R11 and R12). We resumed observation heading 20. We examined the steep wall toward the top of the slope and collected a piece of boulder at 30- 39.61523N, 130- 13.123E, 368.7 mbsl (R13). We started to climb to the top of the slope. Around the top of the slope (30- 39.6268N, 130- 13.1555E, 350.5 mbsl), we observed blocky fragmental rocks along the slope and collected two pieces of boulders (R14 and R15). On the plateau (30- 39.6293N, 130- 13.1551E, 348.5 mbsl), we observed a volcaniclastic breccia and collected both matrix and several clasts (R16). We resumed observation heading 13. At 30- 39.6573N, 130-13.2071E, 337 mbsl, we collected a piece of boulder (R17). At 30-39.6675N, 130-13.2264E, 333.7 mbsl, we obtained a sediment core from the seafloor (Push core #2). At 30-39.6853N, 130-13.2576E, 329.6 mbsl, we obtained another sediment core from the seafloor (Push core #3). We left the bottom at 30- 39.6852N, 130- 13.2576E, 329.6 mbsl.

Rocks collected from the seafloor around the surveyed area are weakly to strongly vesiculated (5 to 40 %) volcanic rocks. Most of them are somewhat altered, with pale grey to dark grey color. Most of them are aphyric to sparsely phyric dacitic rocks with <8 vol% plagioclase and pyroxene phenocrysts (R01A, R01B, R02, R06, R07, R08, R09, R10, R11, R12, R13, R14, R15, R17). The R03 sample is a rhyolitic to dacitic rock with 10% phenocrysts having shapes similar to hornblende, and 10% of plagioclase. The R04 and R05 samples are porphyritic andesitic rocks with plagioclase (5-8 vol%) and pyroxene (8-10 vol%) phenocrysts. The R16 sample consists of sand-sized sediment with small number of crystals (plagioclase, pyroxene), volcanic glasses, and foraminifers. Bigger clasts that were not crushed during sampling also exist in the R16 sample.

The sediment samples in Push cores (C01, C02 and C03) consist of sand-sized grains with gray color overall. The upper part (0 -10 cm) of C01 is fine sand (bubble wall glass, volcanic glass, plagioclase, orthopyroxene, clinopyroxene, and lithic) to silt (fine volcanic glass and crystals plagioclase, pyroxene) with shell fragment and foraminifera. The lower part (10-20 cm) of C01 is

coarse sand (pumice, lithic, bubble wall glass, volcanic glass, plagioclase, orthopyroxene, clinopyroxene, quartz) and silt (fine volcanic glass and crystals plagioclase, pyroxene). The upper part (0 -10 cm) of C02 is sand (lithic, plagioclase, volcanic glass, orthopyroxene, and clinopyroxene) to silt (fine volcanic glass and crystals plagioclase, pyroxene, hornblende?) with abundant shell fragment and foraminifera. The lower part (10-20 cm) of C02 is very fine sand (several grains of plagioclase, bubble wall glass, clinopyroxene, orthopyroxene, and lithic) to silt (fine volcanic glass and crystals). The upper part (0 -3 cm) of C03 is fine sand (bubble wall glass, volcanic glass, pumice grain, small amounts of crystals of plagioclase, pyroxene) to silt (fine volcanic glass and crystals) with shell fragment and foraminifera. The middle part (3-6 cm) is very coarse sand (plagioclase, orthopyroxene, clinopyroxene, quartz and magnetite) to fine sand and silt (volcanic glass, fine crystals). The lower part (6-11.5 cm) of C03 is very coarse sand, with the same mineral components as the middle part, with shell fragments and foraminifera.

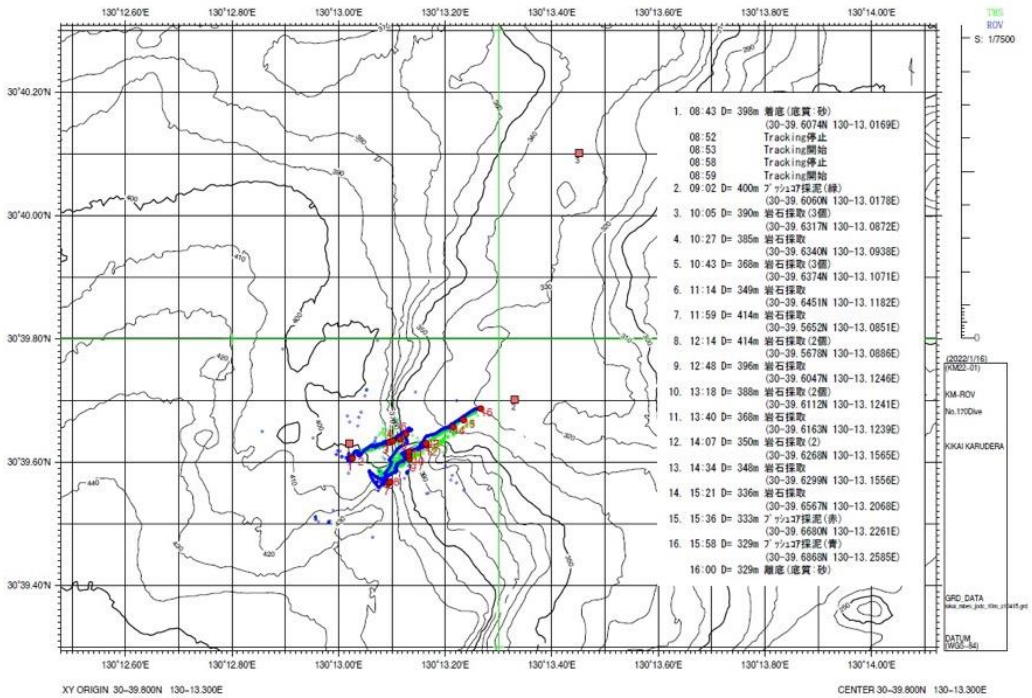

Figure 5. Dive Map of KM-ROV Dive# 170

Figure 6. Photos of Collected Samples of KM-ROV Dive# 170

(3) Underway geophysical survey

Underway geophysical survey includes acoustic reflection (sub-bottom profiling), multibeam mapping, and three-components magnetometer measurements.

The survey, especially sub-bottom profiling, was conducted for subseafloor profiling of the target area and site survey for BMS drilling. The track of sub-bottom profiler survey is shown in Figure 7. Multibeam mapping and three components geomagnetic field data will be processed to combine with the existing data.

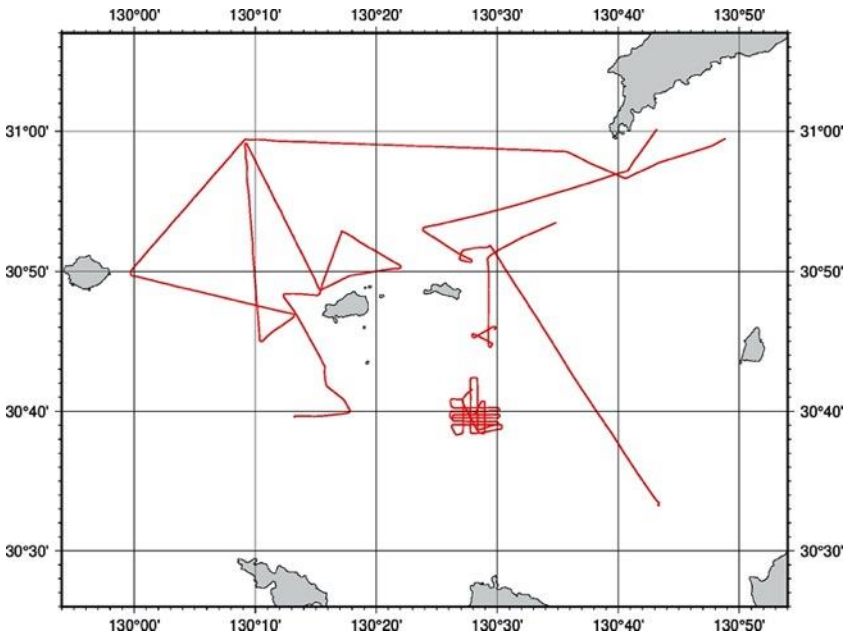

Figure 7. A map for the track of sub-bottom profiler survey (red line).

(4) OBS response check

SP06
Date & Time: January 14, 2022 08:13
The response from the OBS was confirmed.

SP07
Date & Time: January 14, 2022 09:09
The response was confirmed.

OBS23
Date & Time: January 16, 2022 18:06
The response was not confirmed probably because the distance from the ship is too far.

SP10
Date & Time: January 16, 2022 18:50
The response was not confirmed even when the signal was sent just above the OBS.

SP05
Date & Time: January 16, 2022 19:50

The response was not confirmed even when the signal was sent just above the OBS.

SP11
Date & Time: January 16, 2022 20:35
The response was not confirmed probably because the distance from the ship is too far.

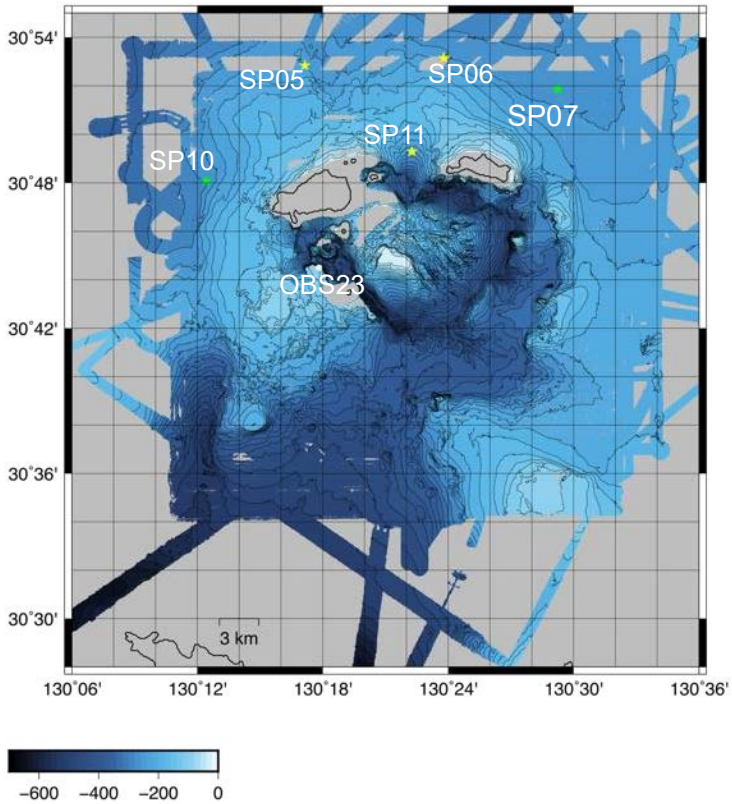

Figure 8. Distribution of unrecovered OBSs.

4. Cruise Log

Date		
January 6, 2022		Stay at Yokosuka due to poor visibility caused by snow
January 7	09:00	Departed from Yokosuka, transit to the survey area
January 8		Transit
January 9	06:00	Arrived at A1. Sub Bottom Profiling around A1.
	08:00	Start of the BMS #14 preparation and winch maintenance
	13:45	Start of the BMS #14 deployment
	14:08	BMS entered water
	14:20	Attach the transponder to the cable at 50 m from the BMS
	14:32	BMS landed at the sea floor
	15:11	The start of the drilling preparation
	15:37	Start drilling
January 10, 2022	06:38	The end of the drilling
	06:45	Recovering the pipes
	08:09	BMS left the sea floor
	08:30	BMS on deck
		Move to B1
	10:00	ROV dive #169 along L1 across the BMS site B1

	16:00	The ROV survey was finished
	17:00	The Sub Bottom Profiling around the BMS site B1 started
	22:30	Transit to offshore east coast of Ohsumi Peninsula
January 11, 2022		Stay offshore east coast of Ohsumi Peninsula
		Maintenance of the BMS
		Core description and core packing
January 12, 2022		Stay offshore east coast of Ohsumi Peninsula
		The maintenance of the BMS was continued.
January 13, 2022		Stay offshore east coast of Ohsumi Peninsula
January 14, 2022	06:00	Departure from offshore east coast of Ohsumi Peninsula
		Sub Bottom Profiling
	08:13	Confirmation of the OBS response at SP06
	09:09	Same at SP07
		Transit to C1
	11:00	Arrival at C1 and start of the BMS #15 preparation
	13:08	Start of the BMS deployment
	13:25	Entrance of the BMS in water
	13:38	Attach the transponder to the cable at 50 m from the BMS
	14:14	The BMS landed on the sea floor
	14:34	The start of the drilling preparation
	14:43	Start drilling
	19:20	BMS left the sea floor
	20:00	BMS on deck
		Maintenance of the BMS
January 15, 2022	09:00	The start of the BMS #16 deployment
	09:40	Attach the transponder to the cable at 50 m from the BMS
	10:22	The BMS landed on the sea floor
	10:55	Start drilling
	22:15	The start of the emergency recovery
	23:00	BMS on deck
January 16, 2022	08:00	Start of ROV dive #170
	08:20	ROV entered water
	08:43	The ROV arrived at the sea floor
	16:00	End of the ROV survey
	17:00	ROV on deck
	17:40	Start of Sub Bottom Profiling
	18:06	Check of the response at OBS23
	18:50	SP10
	19:50	SP05
	20:35	SP11
January 17, 2022	06:00	Leave the study area
January 18, 2022		Transit
January 19, 2022	09:00	Arrival at Yokosuka

5. Notice on Report Usage

This cruise report is a preliminary documentation as of the end of the cruise.
This report is not necessarily corrected even if there is any inaccurate description (i.e. taxonomic classifications). This report is subject to be revised without notice. Some data in this report may be raw or unprocessed. If you are going to use or cite the data in this report, it is recommended to ask the Chief Scientist for the latest status.
Users of information in this report are requested to submit Publication Report to JAMSTEC.

http://www.godac.jamstec.go.jp/darwin/explain/1/e#report
E-mail: submit-rv-cruise@jamstec.go.jp

6. Acknowledgements

We thank Captain Naoto Kimura and the crew of *R/V Kaimei*, Submersible Operation Manager Atsumori Miura and the Submersible Technician Team, and the scientific support staffs of MWJ (the leader Yohei Katayama). Support from shore-based researchers and MarE3 is highly appreciated.

Appendix A: specification and description of JAMSTEC BMS

General Description of BMS
Length : 3.1m
Width : 3.1m
Height : 5.7m
Weight : 7.0t (including drilling tool)
Weight : 12.0t (including drilling tool & MUD)
Maximum operation depth :3000m

Drilling tool
H-size(φ:60mm) : maximum penetration : 66m
※core length :1.5m /1core
T146(φ:146mm) : maximum penetration : 7.5m
※core length :1.5m /1core
φ450mm Drilling tool(φ:450mm):
maximum penetration : 0.4m
※ core sample is unavailable

Manufactured by CELLULA ROBOTICS Ltd.

Appendix B: specification and description of KM-ROV

General Description about KM-ROV

UBC

- cable length ：3500m(Φ28.5mm)
- cable weight：8855kg（in air, 2530kg/km）
  6580kg（in water, 1880kg/km）

TMS

- length：2.2m
- width ：1.9m
- weight：2600kg（in air）
  1580kg（in water）
- cable：425m(Φ28mm)
- cable weight：675kg（in air）
  45kg（in water）

ROV

- length：2.6m
- width ：1.7m
- height：2.0m + 0.5m (height of skid)
- weight：3900kg(air),
- No. of thruster : 4(horizontal), 3(vertical)
- Manipulator ：

ORION（7P Dual Manipulator System）

- No. of camera：NTSC:3 , HDTV:1
- No. of Light ：10(LED)

General Description about KM-ROV

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- cable weight：8855kg（in air, 2530kg/km）
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- No. of thruster : 4(horizontal), 3(vertical)
- Manipulator ：
  ORION（7P Dual Manipulator System）
- No. of camera：NTSC:3 , HDTV:1
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