

Cruise Report

KS-22-1

ROV Hyper-Dolphin/RV SHINSEI MARU

**Elucidation of the latest volcanic activity of Nishinoshima,
approaching from the sky and sea**



22 January 2022 – 31 January 2022

1. Cruise information

Cruise ID: KS-22-1
Name of vessel: SHINSEI MARU
Title of the cruise: Elucidation of the latest volcanic activity of Nishinoshima,
approaching from the sky and sea
Title of proposal: Elucidation of the latest volcanic activity of Nishinoshima,
approaching from the sky and sea
Cruise period: 22 January 2022 – 31 January 2022
Ports of call: Yokosuka
Research area: Nishinoshima
Research map:

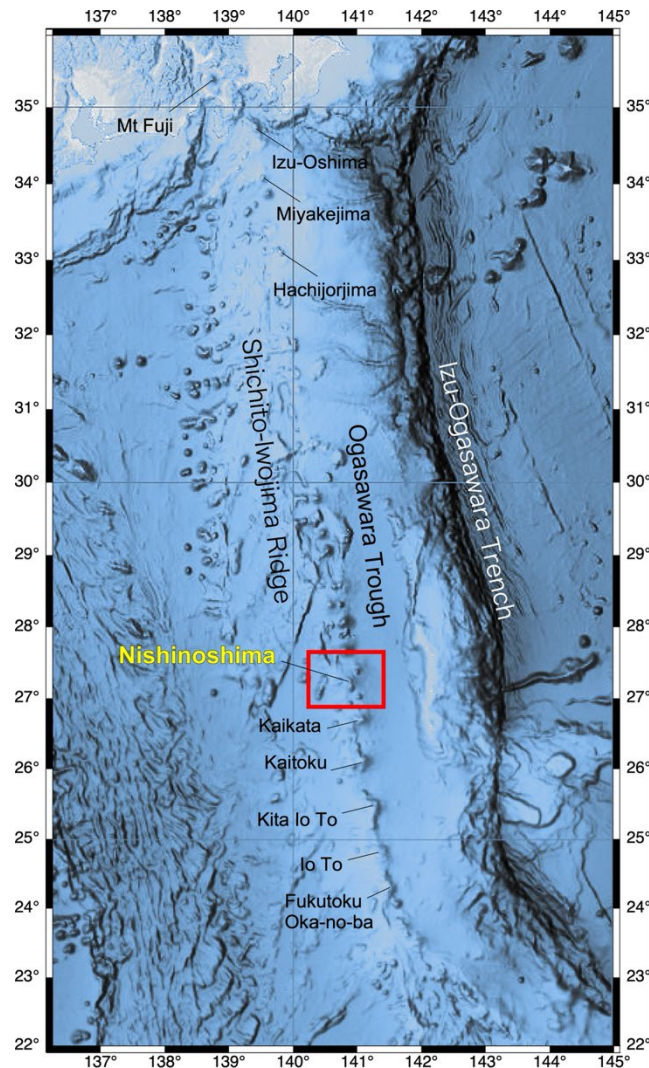


Fig. 1. Location map of Nishinoshima.

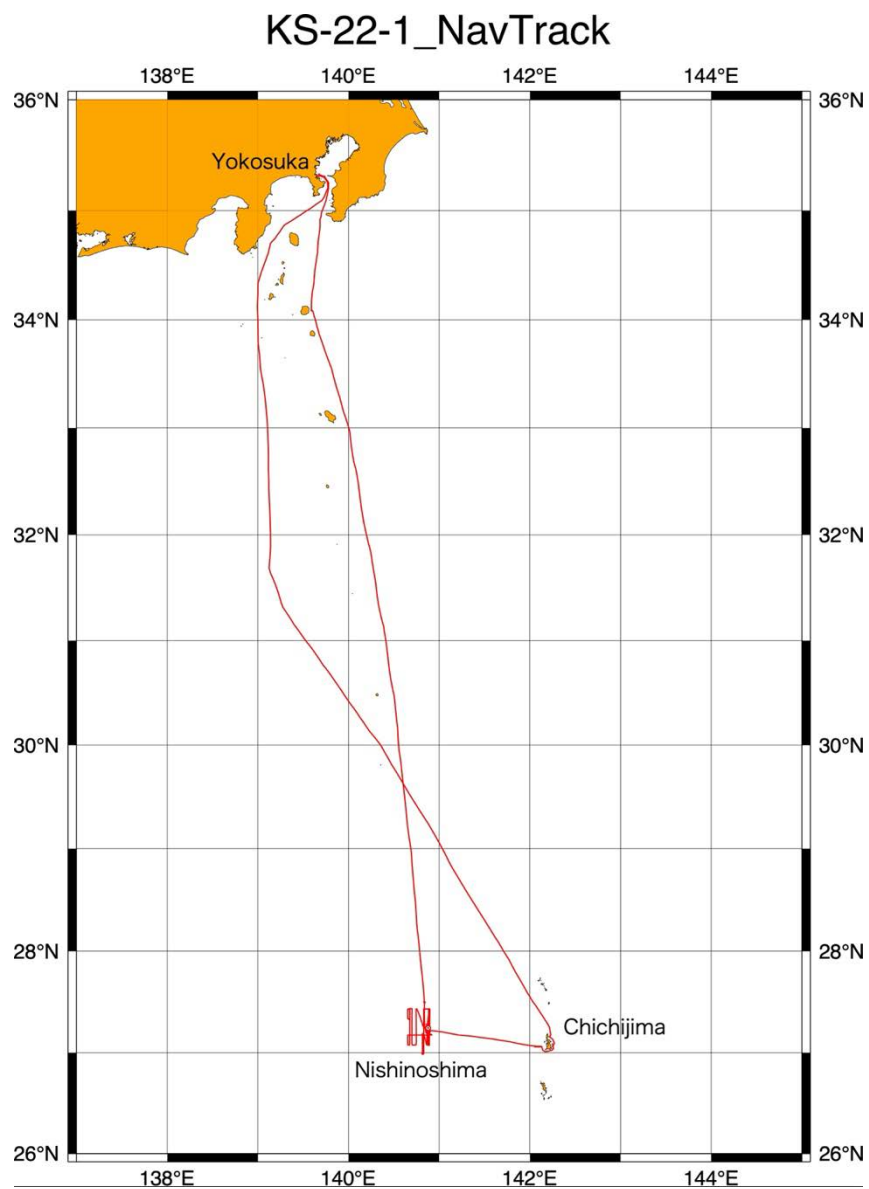


Fig. 2. Cruise track between Yokosuka, JAMSTEC, and Nishinoshima.

KS-22-1

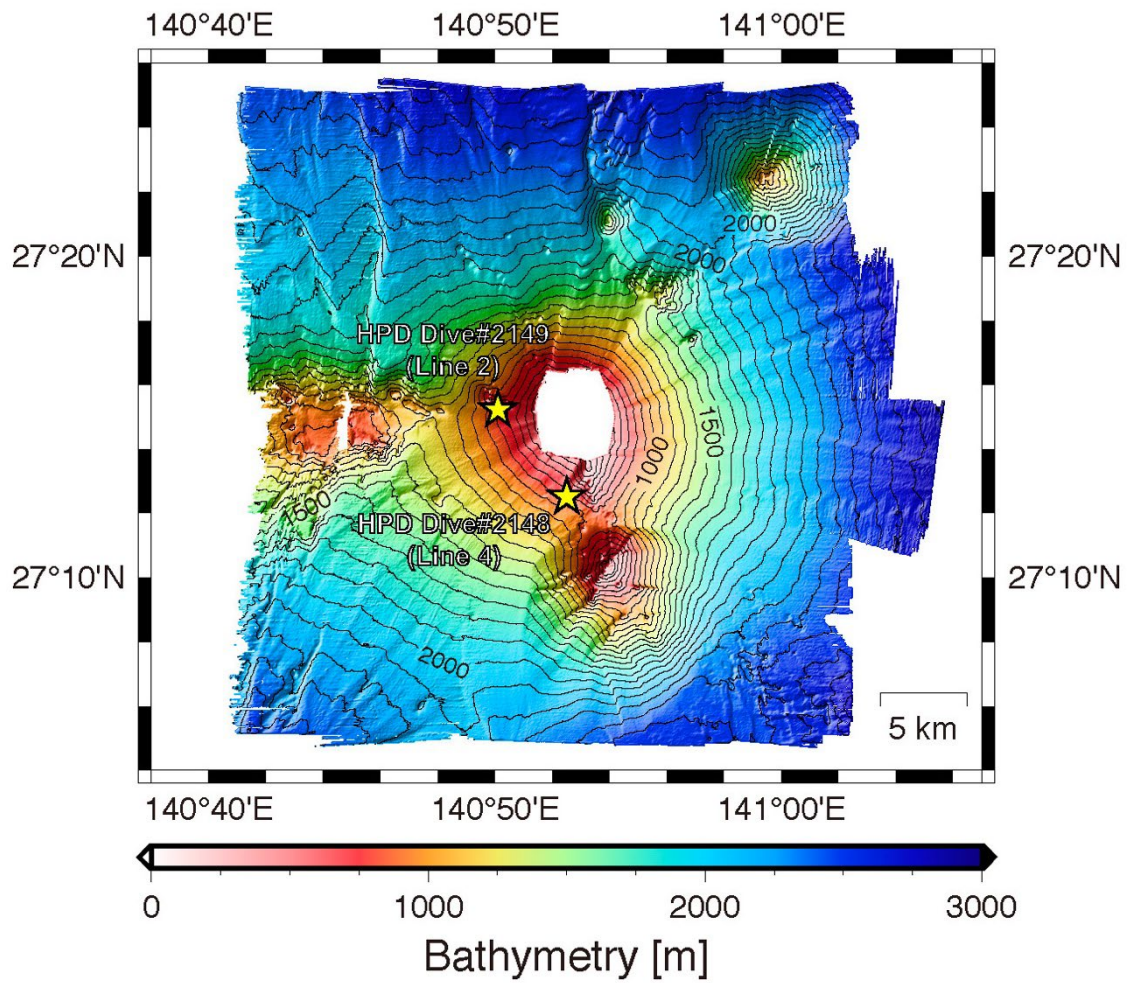


Fig. 3. Bathymetry and Dive locations around Nishinoshima.

2. Participants aboard

2-1. Research group

Chief Scientists	FUKASHI MAENO (ERI)
Scientist	NORIKO TADA (JAMSTEC)
Scientist	KAZUYA KITADA (JAMSTEC)
Scientist	KENTA YOSHIDA (JAMSTEC)
Scientist	ERIKA TANAKA (JAMSTEC)
Scientist	YUYA IKENAGA (ERI)
Scientist	KATSUYA NOGUCHI (Hexamedia)
Scientist	TOSHIMITSU NEGORO (Hexamedia)

2-2. Operation team of the ROV Hyper-Dolphin

ROV Operation Manager	KIDO TEPPEI
1 st ROV Operator	WAKAMATU HOMARE
2 nd ROV Operator	SAKAKIBARA YUDAI
2 nd ROV Operator	TAYAMA YUDAI
2 nd ROV Operator	YAMGUCHI TAIKEN
3 rd ROV Operator	ASANO WATARU

2-3. Captain and crew of the R/V Shinseimaru

Captain	NAKAMURA YOSHIYUKI
Chief Officer	SHISHIKURA TAKAAKI
2nd Officer	ITO YUKI
3rd Officer	KUSUMI KEISUKE
Chief Engineer	HASHIDE SHUICHI
1st Engineer	IKUTA SHINICHI
2nd Engineer	IKEGUCHI KENTA
3rd Engineer	TOMIYAMA YUSUKE
Chief Electronics Op.	INOUE YOICHI
2nd Electronics Op.	MATSUI RYOSUKE
3rd Electronics Op.	IKEDA KOHEI
Boat Swain	OHATA MASANORI
Quarter Master	FUJII TATSUO
Quarter Master	KAWAMURA KOSEI
Quarter Master	UENO SHINYA
Sailor	MIURA TAKUMI
Sailor	KIMURA MANATO
Sailor	ITO SHIN
No.1 Oiler	MORI JUNJI
Oiler	MIYAZAKI KATSUYUKI
Oiler	TAKAMIYA AOI
Assistant Oiler	ISHIDA MASAKAZU
Assistant Oiler	WAKUGAWA YUTA
Chief Steward	MURAKAMI TORU
Steward	TAKAKU NORIO
Steward	NOJIRI TAKEHIRO
Marine Tec.	SUZUKI KEITA

3. Objectives

Nishinoshima is an extremely rare place where the process of formation and evolution of an oceanic island can be traced. A series of volcanic activities of Nishinoshima since 2013, which was the largest eruption in the 21st century in Japan, provided new insights into the birth and growth of a new volcanic island, the origin of magma, and remote monitoring of volcanic activity. Also, advanced and applied research on remote surveys and observation methods, including hazard evaluation, have been promoted. The recent activities of Nishinoshima seemed to have ended after the 2018 eruption; however, resumed in December 2019 and continued until August 2020. In June 2020, the magma discharge rate reached the highest, and the activity pattern changed significantly from lava flows to pyroclastic eruptions. It is therefore thought that the volcanic activity has entered a new stage. Chemical analysis of the eruptive products has revealed that the magma composition has dramatically changed from andesite to basaltic andesite, but the cause of the change in its activity pattern and what kind of magma system drives this activity is not yet clear. The possibility of a large caldera-forming eruption is also considered, as bimodal features have been found in the seafloor eruptive deposits. The purpose of this study is to clarify what is happening on Nishinoshima by geological and geophysical approaches from the sky and the sea and to advance our knowledge of the process of formation and evolution of oceanic islands.

4. Observation and activities

By investigating the following three themes and integrating the results, we clarified the characteristics of volcanic activity in Nishinoshima.

(1) Elucidation of eruption process and magma supply system based on eruptive products

For underwater, geology and geomorphology were observed at two locations (west and south) by ROV, lava and pyroclastic materials were sampled, and pyroclastic deposits consisting of the seafloor were collected by push core. On land, the topographical features and distribution of deposits were surveyed on the entire island with a drone. Based on topographical and deposit information and sample analysis, we discuss the volcanic activity and magma generation, storage, and ascent processes.

(2) Elucidation of magma activity based on magnetic field mapping

Since the rise and cooling of magma change the magnetization structures of the volcanic edifice, repeated observation of magnetization distribution is useful for understanding the temporal change of magmatic activity. In this survey, a three-component magnetometer and a proton magnetometer installed on a ship were used to clarify the distribution of magnetic field in the surrounding sea area and measured gravity.

(3) Understanding of volcanic activity based on onboard and aerial observations

We observed the temperature of the island with a thermal infrared camera. In addition, to elucidate the degassing process of magma, the amount of volcanic gas released was measured by drone with a device for volcanic gas observation. The latter was carried out even during non-eruptions and used to understand the activity of Nishinoshima.

Ship log

Date / Time	Descriptions	Weather, Wind and Sea condition
2022/1/22 Sat.	Noon Position:35-00.5N, 139-33.5E(North of Oshima)	bc/NE-4/3
8:30	Onboarded	
9:30	Let go all shore lines and left JAMSTEC for reserch area	
10:30-11:30	Carried out education and training for scientists	
18:00-19:00	Scientists meeting	
2022/1/23 Sun.	Noon Position:30-54.0N, 139-37.9E(North of Torishima)	bc/South-4/3
	- Bound for research area Nishinoshima	
8:30-9:30	Scientists meeting	
18:00-19:00	Scientists meeting	
2022/1/24 Mon.	Noon Position:27-09.3N,142-13.2E(Off Chichijima)	r/SSW-5/3
8:30-9:30	Scientists meeting	
9:00	Arrived at Chichijima to evacuate due to bad weather	
18:00-19:00	Scientists meeting	
2022/1/25 Tue.	Noon Position:27-02.0N,142-08.0E(Off Chichijima)	o/NE-5/3
	- Evacuating due to bad weather	
8:30-9:30	Scientists meeting	
18:00-19:00	Scientists meeting	
2022/1/26 Wed.	Noon Position:27-12.6N,140-52.5E(Off Nishinoshima)	o/SSW-5/4
3:00	Commenced proceeding to research area Nishinoshima	
9:30	Arrived at research area Nishinoshima	
9:46	Released XBT (27-06.44320N ,140-52.74450E)	
11:50	Released XBT (27-05.74280N ,140-51.39980E)	
13:11	Hoisted up "Hyper-Dolphin"	
13:17	Launched "Hyper-Dolphin"	
13:29	"Hyper-Dolphin" dove & com'ced her operation #Dive NO. 2148	
14:04	"Hyper-Dolphin" landed on the sea bottom (D: 797m)	
15:58	"Hyper-Dolphin" left the sea bottom (D: 727m)	
16:25	Hoisted up "Hyper-Dolphin"	
16:41	Recovered "Hyper-Dolphin" & finished her operation	
16:54	Deployed proton precession magnetometer	
17:22-5:35	Carried out MBES and SBP mapping survey	
18:00-19:00	Scientists meeting	
22:59-23:21	Carried out eight figure running	
2022/1/27 Thu.	Noon Position:27-15.0N,140-50.0E(Off Nishinoshima)	bc/NNW-4/3
6:25	Recovered proton precession magnetometer	
8:15-11:10	Carried out drone survey	
13:08	Hoisted up "Hyper-Dolphin"	
13:14	Launched "Hyper-Dolphin"	
13:26	"Hyper-Dolphin" dove & com'ced her operation #Dive NO. 2148	
14:05	"Hyper-Dolphin" landed on the sea bottom (D: 797m)	
15:51	"Hyper-Dolphin" left the sea bottom (D: 727m)	
16:17	Hoisted up "Hyper-Dolphin"	
16:33	Recovered "Hyper-Dolphin" & finished her operation	
16:44	Deployed proton precession magnetometer	
18:00-18:30	Scientists meeting	
18:09-7:19	Carried out MBES and SBP mapping survey	

2022/1/28 Fri.	Noon Position:27-38.5N,140-49.5E(North of Nishinoshima)	bc/WSW-5/4
8:06	Recovered proton precession magnetometer	
8:25-9:10	Carried out drone survey	
9:20	Left research area Nishinoshima for JAMSTEC	
10:50-11:10	Carried out eight figure running	
18:00-18:30	Scientists meeting	
2022/1/29 Sat.	Noon Position:32-02.0N,140-12.0E(South East of Aogashima)	c/NNW-4/3
-	Return to JAMSTEC	
18:00-18:30	Scientists meeting	
2022/1/30 Sun.	Noon Position:34-45.5N,139-40.3E(East of Oshima)	bc/NE-3/2
-	Return to JAMSTEC	
18:00-18:30	Scientists meeting	
2022/1/31 Mon.	-	-
10:00	Sent out 1st shore line, arrived at JAMSTEC, then completed voy. No. KS-22-1	
	Disembarked, then completed voyage No. KS-22-1	

5. Dive reports

5-1. HPD# 2148

Date: 26 January 2022

Location: Line 4, Southern flank of Nishinoshima

This dive aimed to obtain geological data from the southern flank of the volcano and collect rock samples. The sea bottom of the landing site (797 m b.s.l.) was sandy and characterized by ripple marks. Lava blocks are scattered on the sandy seafloor in the initial ~100 m of the dive root, but with distance and with an increase in slope angle, the fraction of lava blocks increased, and the seafloor became rough due to the blocky lava surface. During this dive, we collected 5 rock samples (R01-R05). All samples were lava blocks of aphyric olivine-bearing plagioclase basalt.

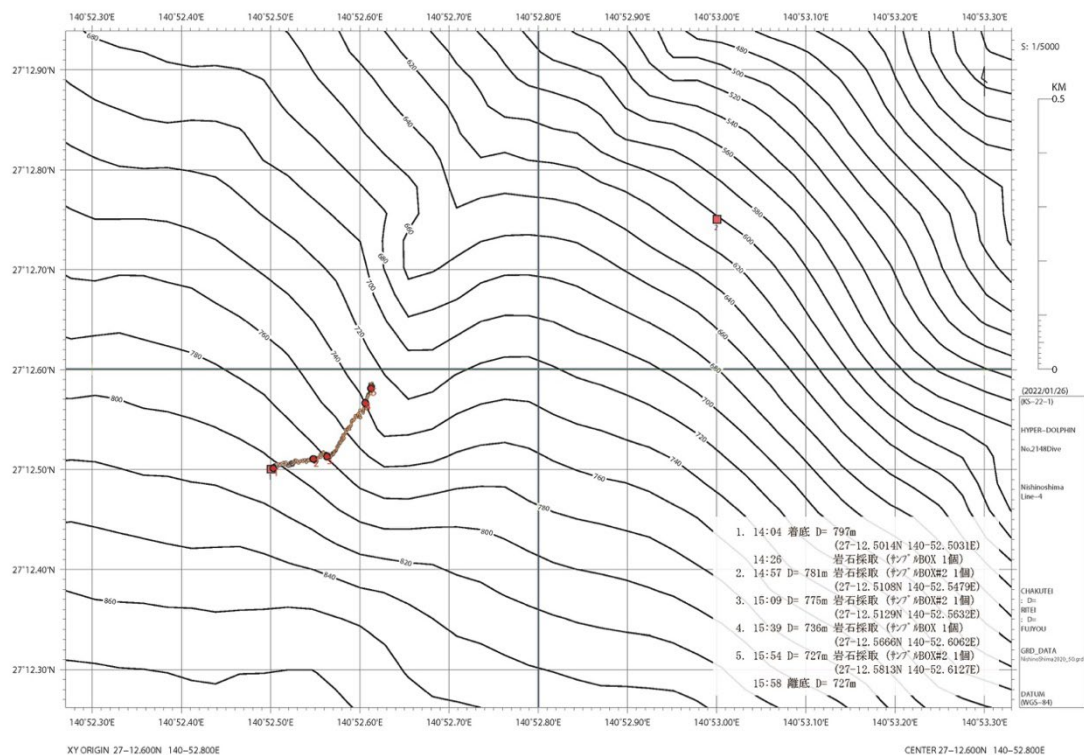
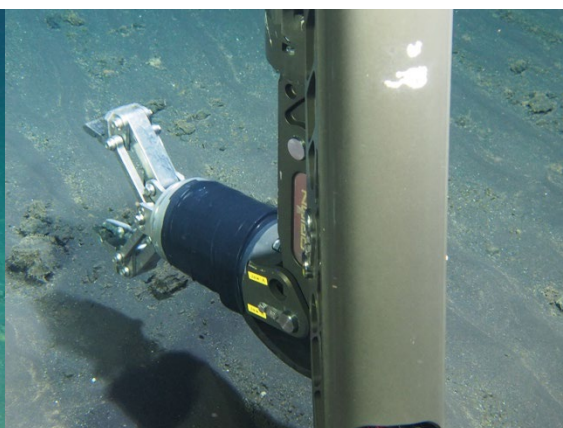


Fig. 4. Track of Dive#2148, the southern flank of Nishinoshima.



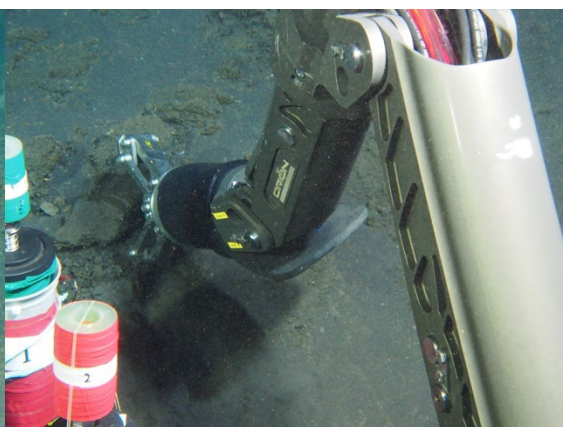
Near landing point in Dive HPD#2148 at 14:31:48



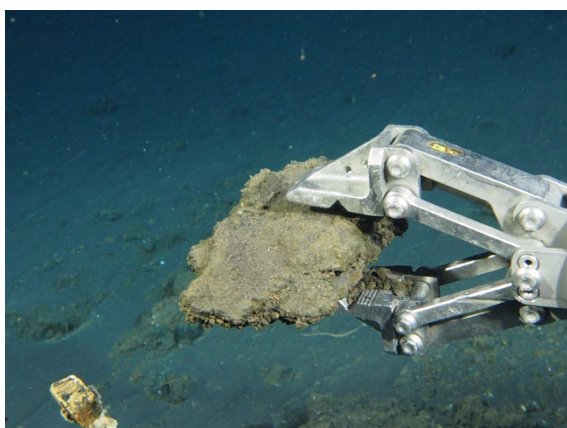
Sampling R02 at 14:55:43



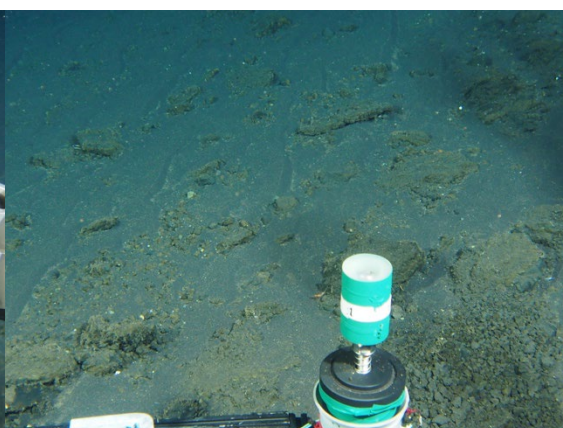
Gentle slope in the former half at 15:28:50



Sampling R05 at 15:52:47



Sampling R05 at 15:54:01



Endpoint in Dive HPD#2148 at 15:54:56

Fig. 5. Photos taken during Dive#2148.

5-2. HPD# 2149

Date: 27 January 2022

Location: Line 2, the western flank of Nishinoshima

This dive aimed to obtain geological data of lava flows consisting of the western flank of the volcano and to collect rock and seafloor sediment samples. The sea bottom of the landing site was sandy and characterized by a dune structure. Lava blocks are scattered on the sandy seafloor in the initial ~50 m of the dive root, but with the distance, the fraction of lava blocks increased. At the endpoint, we observed an accumulation of lava blocks. During this dive, we collected 6 rock samples (R01-R06) and 2 sediment samples (S01-S02). All blocks are plagioclase andesite lava.

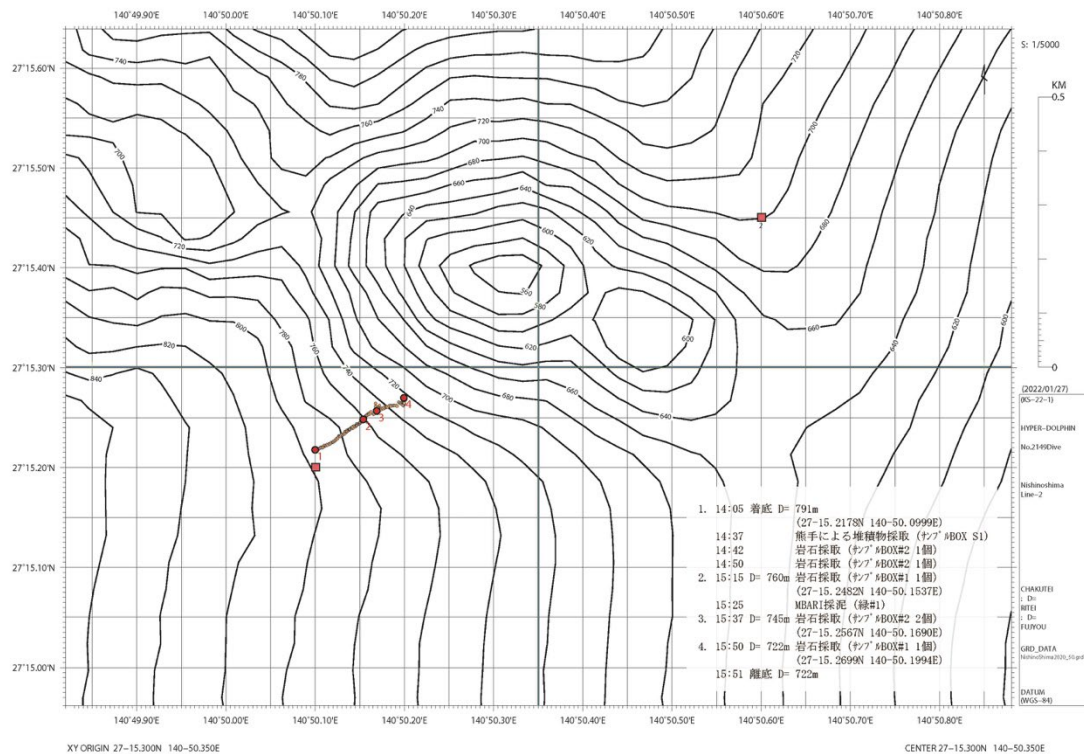
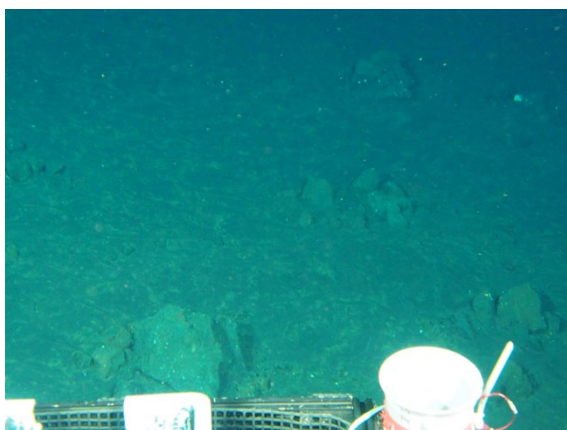


Fig. 6. Track of Dive#2149, western flank of Nishinoshima.



Initial gentle slope in Dive HPD2149 at 14:11:50



Middle of the dive at 14:56:03



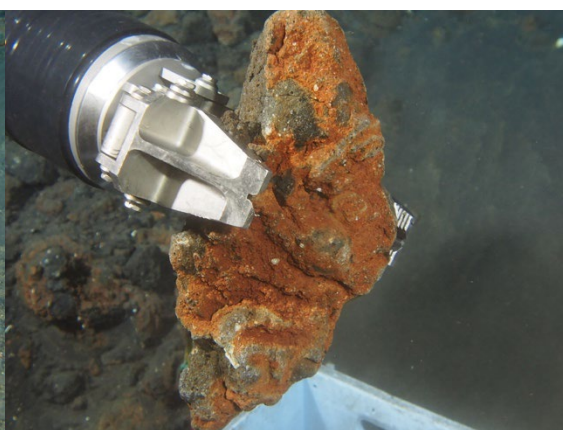
Sampling sediment using a push-core at 15:17:21



Near the location of R04 and R05 at 15:31:11



Location of R06 at 15:46:41



Sampling R06 at 15:49:50

Fig. 7. Photos taken during Dive#2149.

6. Drone flight

The geological survey was carried out with a drone.

The volcanic gas observation was also carried out. The observation device (Multi-GAS) was mounted on a medium-sized drone to navigate around and inside the central crater and measured volcanic gas species and concentrations.

Approximately 30 minutes per flight (takeoff and landing: 5 minutes, flight: 15 minutes, maintenance: 10 minutes) were carried out 9 times.

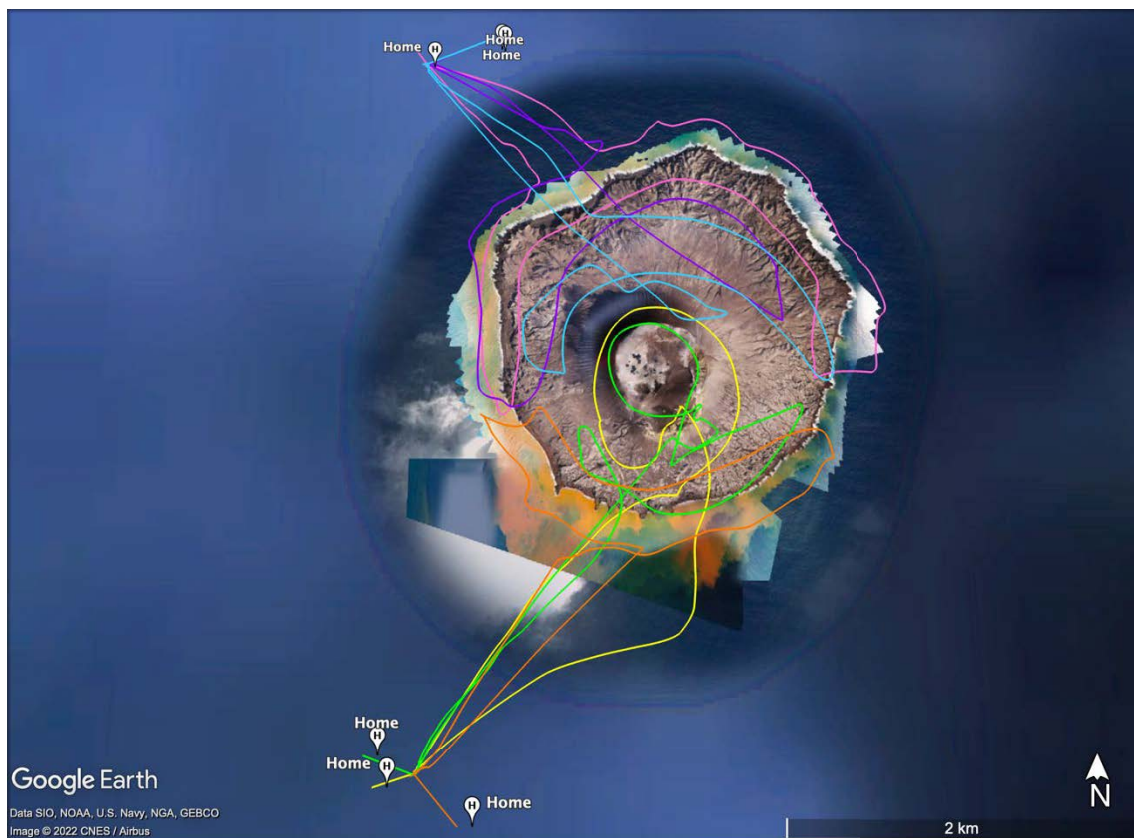


Fig. 8. Representative drone flight paths. The drone was operated from two locations in the northwest and southwest offshore Nishinoshima. Home: location of Shinseimaru.

7. Onboard observation

The surface condition of the volcanic edifice of Nishinoshima was investigated with a thermal infrared camera. In the northern and southern areas, high-temperature regions are spread even outside the central crater.



Fig. 9. Northern flank of the volcano. On the cone surface, high-temperature regions are recognized. Fumarolic activity was also visible.

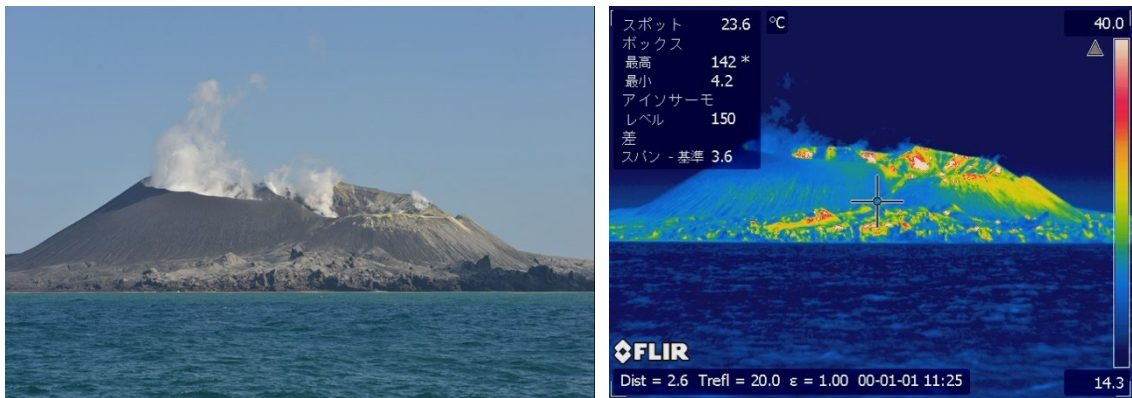


Fig. 10. The southern flank of the volcano. High-temperature regions are widely spread near the coast.

8. Notice on Using

This cruise report is a preliminary documentation as of the end of 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 on this report may be raw or unprocessed. If you are going to use or refer the data on this report, it is recommended to ask the Chief Scientist for latest status.

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