

CRUISE REPORT

R/V Shinsei-Maru Cruise KS-21-16

Volcanic evolution of the Daisan-Miyako Knoll related with the volcanic front in the central and southern Ryukyu Arc

August 2 to August 7, 2021
(Naha to Naha)



ACKNOWLEDGEMENTS

We are grateful to Captain Yoshiyuki Nakamura and the excellent crew of the R/V *Shinsei-Maru* for their outstanding efforts to make this scientific program successful. We also thank AORI and JAMSTEC for their support of this project.

1. Cruise information

Cruise ID and ship name: KS-21-16, R/V Shinsei-maru

Title of the cruise: Volcanic evolution of the Daisan-Miyako Knoll related with the volcanic front in the central and southern Ryukyu Arc

Chief-Scientist: Yumiko HARIGANE (Geological Survey of Japan, AIST)

Cruise period: August 2 to August 7, 2021

Ports: Naha, Japan to Naha, Japan

Research area: Central and southern Ryukyu Arc

2. Research proposal and scientific party

Title of the proposals: Volcanic evolution of the Daisan-Miyako Knoll related with the volcanic front in the central and southern Ryukyu Arc (proposed by YH) / Evaluation of taxonomic reexamination and diversity assessment of the genus *Ophiura* in the Nansei Islands (proposed by TM)

List of science party:

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Hiroki MINAMI (Japan Coast Guard Academy/Hydrographic and Oceanographic Department, Japan Coast Guard)

Gen SHIMODA (Geological Survey of Japan, AIST)

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Chiori TAMURA (Atmosphere and Ocean Research Institute, University of Tokyo)

Yukihiko NAKANO (Marine Work Japan Ltd.)

3. Research activities

The Ryukyu Arc is situated between the islands of Kyushu and Taiwan (~1200 km in the full length). This arc is by subduction of the Philippine Sea plate beneath the Eurasia Plate along the Ryukyu trench, and is composed of forearc islands, chains of arc volcanoes, and a back-arc rift called Okinawa Trough. Ryukyu Arc is commonly divided into three segments (northern, central and southern) that bounded by the Tokara Strait and the Kerama Gap, respectively (Fig. 1A; e.g., Konishi, 1965; Kato et al., 1982). The northern Ryukyu Arc (i.e., the Tokara Islands) has more numerous active frontal arc volcanoes,

whereas there are sparse active submarine volcanoes related to frontal arc volcanism from the southwest of Iotori-shima in the central Ryukyu Arc to the northern part of the southern Ryukyu Arc (Kimura et al., 1986; Shinjo et al., 1999). On the other hands, the volcanic activities related back-arc rifting such as Okinawa Trough well-develop around the central and southern Ryukyu Arc (Fig. 1B). The existence of volcanic activity associated with volcanic front developed in the central-southern Ryukyu Arc and their petrological characteristics, formation ages, magmatic features, and contribution of slab-derived materials are still unknown due to few geological surveys and studies.

Here, we focus on the submarine volcanoes such as Daisan-Miyako Knoll, Ikema Knoll and Daiichi-Miyako Knoll in the central-southern Ryukyu Arc (Fig. 1B) to investigate the frontal arc volcanism, where is extending in the southwest direction from the Kumejima Island. In KS-21-16 cruise, we aimed to following main objectives.

- 1) To define the nature of these volcanoes around the central-southern Ryukyu Arc.
- 2) To test volcanic rock samples for what kinds of magma generation occurs during the development of these volcanoes.
- 3) To establish the spatial distribution of igneous rocks on the submarine volcanoes.
- 4) To precisely determine the chronology of eruptive events (If possible).
- 5) To better understand the relationship between back-arc rifting and arc volcanism.

We conducted five dredges (Dredge site D01-D04 and D08) in the Daisan-Miyako Knoll, two dredges (Dredge site D05 and D06) in the Ikema Knoll and one dredge (Dredge site D07) in the Daiichi-Miyako Knoll to observe at the volcanic section and collect representative rock samples and animal samples. Sample recovery of the dredge hauls was good except for the dredge sites D04 and D05. The total weight of the recovered rocks was 355 kg in this cruise. Almost of all rock samples in the Daisan-Miyako Knoll are fresh rhyolitic lava. On the other hands, altered lava and pumice samples were collected in the Ikema Knoll and the Daiichi-Miyako Knoll. We also conducted surface geophysical surveys (multibeam swath bathymetry, magnetic, and gravity data) around these volcanoes and trans. Multibeam swath bathymetry data on the KS-21-16 cruise were obtained using SEABEAM3020. Magnetic data were also collected with two instruments (a shipboard three component magnetometer and a surface-towed proton magnetometer) in order to measure the vector and the intensity of the geomagnetic field, respectively. Gravity data were also collected with a shipboard gravimeter.

4. References

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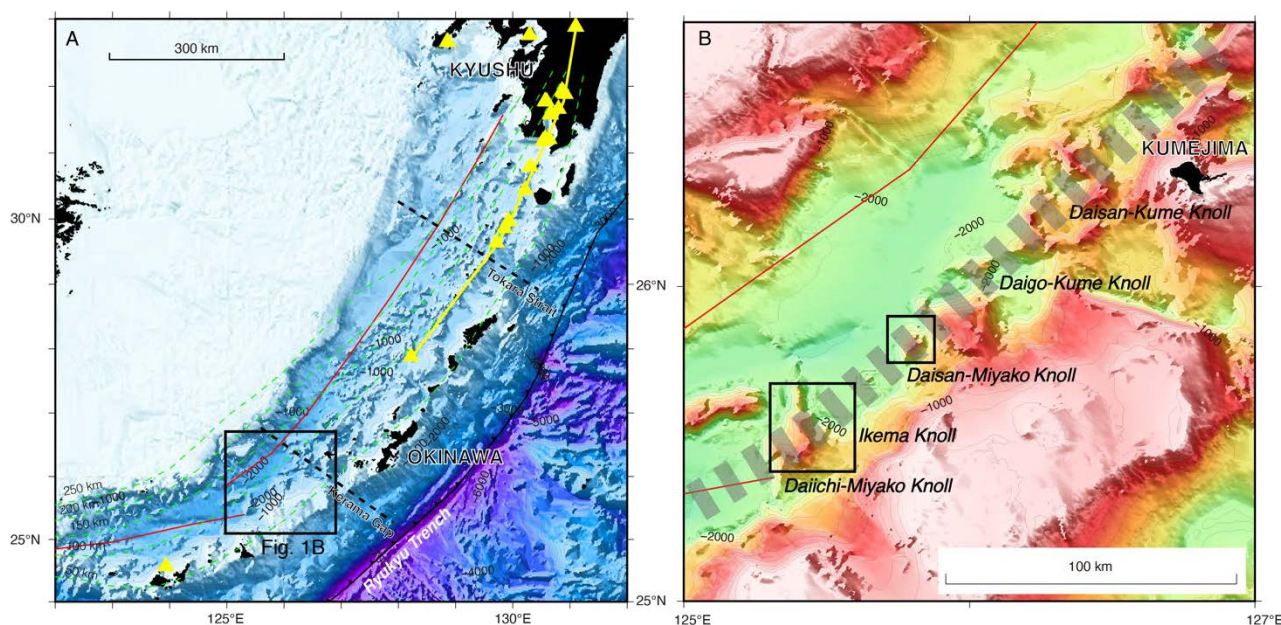
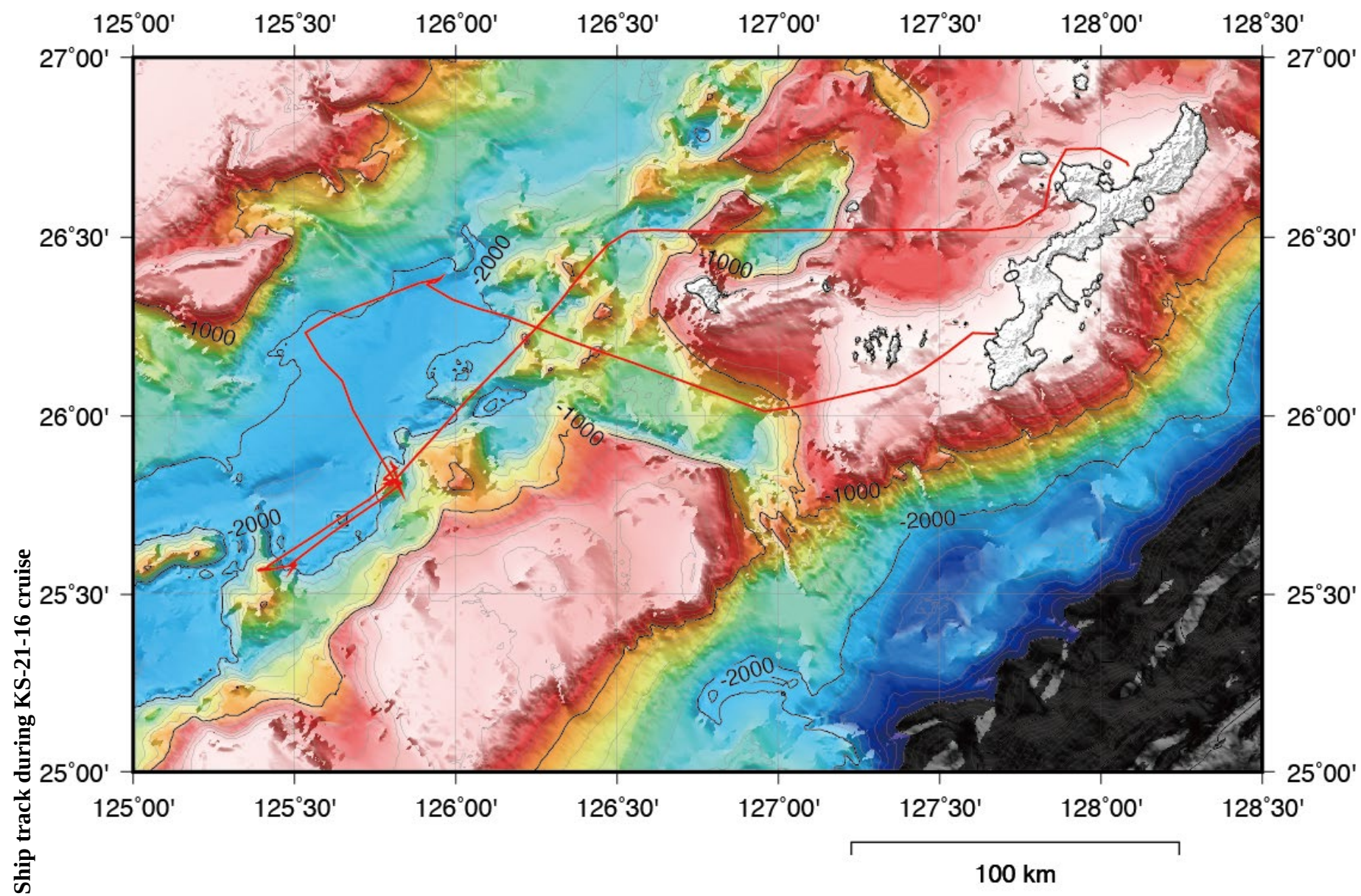


Figure 1. (A) Regional map of the study area on the Ryukyu Arc. Black rectangle is our study area. The yellow triangles show the active subaerial volcanoes (Japan Meteorological Agency, 2013). The yellow solid line indicates the Quaternary volcanic front. The green dotted lines indicate the slab depths from 50 km to 250 km in Nakamura and Kaneshiro (2000). (B) Location map around the Daisan-Miyako Knoll area. Black rectangles are our study area during the KS-21-16 cruise. The red broken line indicates the back-arc rifting such as Okinawa Trough, which this rifting data is referred by the plate boundaries data in Coffin et al. (1998). The gray thick dashed line indicates the inferred volcanic front around the central-southern Ryukyu Arc.



2020/8/2	2020/8/3	2020/8/4	2020/8/5	2020/8/6	2020/8/7
0:00	0:00 XCTD、プロトン投入、8の字	0:00 ドレッシング作業開始	0:00	0:00	0:00
1:00	1:00	1:00 D05 IK03 水深1676m	1:00	1:00	1:00
2:00	2:00 航走観測A-A' (地形、プロトン、SBP、3成分磁力計)	2:00 ドレッシング	2:00	2:00	2:00
3:00	3:00	3:00 移動 (0.7mile)	3:00 回航	3:00	3:00
4:00	4:00	4:00 D06 IK02 水深1173m	4:00	4:00	4:00
5:00	5:00	5:00 ドレッシング	5:00	5:00	5:00
6:00	6:00	6:00 移動 (5.6mile)	6:00	6:00	6:00
7:00	7:00	7:00 D07 1M03 水深1253m	7:00	7:00	7:00
8:00	8:00 航走観測A-A' (地形、プロトン、SBP、3成分磁力計) 移動 (2.4mile) ドレッシング作業開始	8:00 ドレッシング	8:00	8:00	8:00 下船
9:00	9:00 D01 3M02 水深1850m	9:00 ドレッシング	9:00	9:00	9:00
10:00	10:00 ドレッシング	10:00	10:00	10:00	10:00
11:00	11:00 移動 (2.4mile)	11:00 海域移動 (第一宮古海丘周辺 → 第三宮古海丘周辺)	11:00	11:00	11:00
12:00	12:00 D02 3M08 水深1190m	12:00 移動 (26mile)	12:00	12:00	12:00
13:00	13:00 ドレッシング	13:00 航走観測 (地形、SBP、3成分磁力計)	13:00	13:00	13:00
14:00	14:00 出港	14:00 ドレッシング作業開始	14:00	14:00	14:00
15:00	15:00 移動 (0.5mile)	15:00 D08 D04_re 水深1039m	15:00	15:00	15:00
16:00	16:00 D03 3M19-2 水深995m	16:00 ドレッシング	16:00	16:00	16:00
17:00	17:00 移動 (0.8mile)	17:00	17:00	17:00	17:00
18:00	18:00 D04 3M18-3 水深1105m	18:00	18:00	18:00	18:00
19:00	19:00 ドレッシング	19:00	19:00	19:00	19:00
20:00	20:00 回航	20:00 航走観測 (地形、SBP、3成分磁力計)	20:00	20:00	20:00
21:00	21:00	21:00 回航	21:00	21:00	21:00
22:00	22:00 海域移動 (第三宮古海丘周辺 → 第一宮古海丘周辺)	22:00	22:00	22:00	22:00
23:00	23:00 移動 (20.4mile) 航走観測 (地形、SBP、3成分磁力計)	23:00	23:00	23:00	23:00

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.

Users of information on this report are requested to submit Publication Report to Cooperative Research Cruise office.

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新青丸研究航海報告

- * 航海番号 KS-21-16 次研究航海
- * 航海名称 中部-南部琉球弧の火山フロントに関連する第3宮古海丘の火山構造発史
Volcanic evolution of the Daisan-Miyako Knoll related with the volcanic front In the central and southern Ryukyu Arc
- * 観測海域 南西諸島
Nansei Islands
- * 航海期間 令和 3年8月2日(月)～令和 3年8月7日(土)
(実質的な航海作業日程は令和 3年8月2日(月)～令和 3年8月5日(木))
- * 出港日時・場所 8月2日14時 那覇港
- * 入港日時・場所 8月 日 時 鹿児島港 * 乗船研究者は8月7日に通船にて下船
- * 寄港期間・場所 なし
- * 研究課題 中部-南部琉球弧の火山フロントに関連する第3宮古海丘の火山構造発達史
(針金申請課題: S21-13) / 南西諸島におけるクモヒトデ属の分類学的
再検討と多様性の評価 (松尾申請課題: SGC-21-02)
- * 主席研究員(氏名・所属・職名)
針金 由美子 産業技術総合研究所地質情報研究部門・主任研究員
- * 研究内容, 主調査者, 観測項目
観測項目 1. ドレッジによる岩石・泥・生物などの試料採取及び露頭撮影: 針金由美子・谷
健一郎・松尾拓己

観測項目 2. マルチビーム音響測深機、サブボトムプロファイラー、船上三成分磁力計、曳
航式プロトン磁力計、船上重力計による地球物理観測: 針金由美子・南宏樹
- * 乗船研究者氏名・所属・職名
針金 由美子・産業技術総合研究所 地質情報研究部門・主任研究員
下田 玄・産業技術総合研究所 地質情報研究部門・研究グループ長
Conway Christopher・産業技術総合研究所 活断層・火山研究部門・研究員
南 宏樹・海上保安大学校 海事工学講座・准教授
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Arran Murch・国立科学博物館 地学研究部・JSPS 外国人特別研究員
小川 晟人・国立科学博物館 動物研究部・特別研究生
松尾 拓己・東京大学大学院 理学系研究科・大学院生
山本 真生・東京大学大学院 理学系研究科・大学院生

田村 千織・東京大学大気海洋研究所・技術専門職員

中野 幸彦・マリン・ワーク・ジャパン 海洋地球科学部・観測技術員

* 航跡・測点図

