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Cruise Report

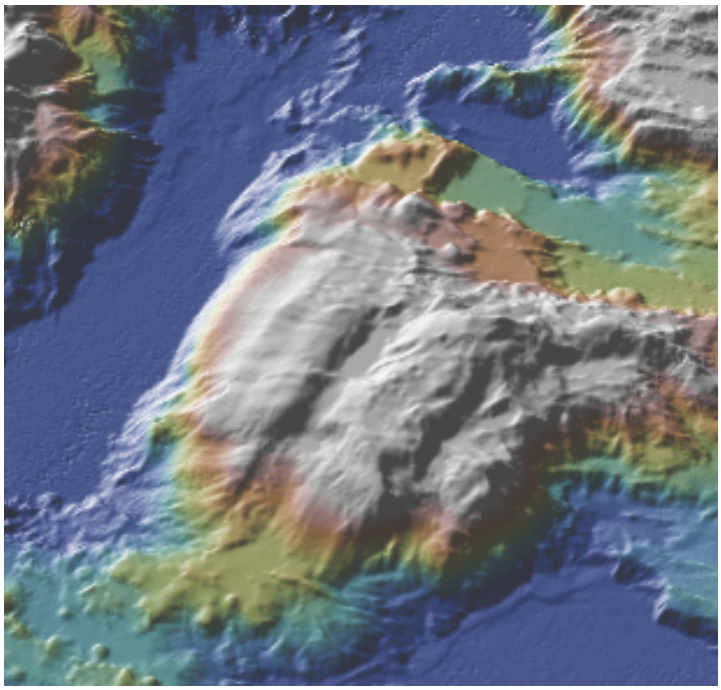
R/V Yokosuka YK19-04S Cruise

New window into backarc basin lithospheric study: a Shinkai dive study at a Shikoku Basin Oceanic Core Complex

Mado Megamullion, Shikoku Basin

April 8 to April 18, 2019

(Yokosuka, Japan to Futami, Japan)



Joint Usage/Research Center for Atmosphere and Ocean Science (JURCAOS)

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

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1. Cruise information

Cruise ID and ship name: YK19-04S, R/V Yokosuka

Title of the cruise: New window into backarc basin lithospheric study: a Shinkai dive study at a Shikoku Basin oceanic core complex

Chief-Scientist: Yasuhiko Ohara (Hydrographic and Oceanographic Department of Japan, and JAMSTEC)

Cruise period: April 8 to April 18, 2019

Ports: Yokosuka, Japan to Futami, Chichi-jima Island, Japan

Research area (Figs. 1 and 2): Mado Megamullion, Shikoku Basin

2. Research proposal and scientific party

Title of the proposal: New window into backarc basin lithospheric study: a Shinkai dive study at a Shikoku Basin oceanic core complex

Representative of science party: Yasuhiko Ohara (Hydrographic and Oceanographic Department of Japan, and JAMSTEC)

List of science party:
Yasuhiko Ohara (Hydrographic and Oceanographic Department of Japan, and JAMSTEC)
Jonathan E. Snow (University of Houston)
Osamu Ishizuka (JAMSTEC)
Katsuyoshi Michibayashi (Nagoya University)
Kota Ando (Nagoya University)
Yuki Tomioka (Nagoya University)
Norikatsu Akizawa (Atmosphere and Ocean Research Institute, University of Tokyo)
Hiroyuki Yamashita (Kanagawa Prefectural Museum of Natural History)
Masakazu Fujii (National Institute of Polar Research)
Alessio Sanfilippo (University of Pavia)
Camilla Sani (University of Pavia)
Kimiko Serizawa (Nippon Marine Enterprises, Ltd.)

3. Research activities

The largest oceanic core complex (OCC) on the Earth, Godzilla Megamullion, is one of the well-studied OCCs in the world. Although the extensive multi-beam bathymetric mapping by Japan's continental shelf survey has revealed the presence of potential OCCs in the multiple portions of the Philippine Sea Plate, such as in the Shikoku Basin, Kita-Daito Basin and West Philippine Basin [Ohara et al., 2015] (**Fig. 1**), these OCCs are remained largely unsampled except only a few locations that were sampled as reconnaissance study sites. These reconnaissance study sites yielded serpentinized peridotites, confirming that these OCCs are in fact the detachment fault surfaces that exhumed the oceanic lower crust and upper mantle. Two cruises in the 2018 summer (YK18-07 and KH-18-2) collected peridotites and gabbros from the main Shikoku Basin OCC, here we named "Mado Megamullion", significantly

increasing the information on these OCCs [Ohara et al., 2018]. In order to advance our understanding of the lithospheric composition of the Philippine Sea Plate, we decided to utilize Mado Megamullion and the associated OCCs as tectonic windows to sample the lower crust and upper mantle materials. The objective of this cruise was to increase the sampling point within Mado Megamullion and make detailed bathymetric survey of the parts of Mado Megamullion to reveal the morphological characteristics of the Mado detachment fault.

During the YK19-04S cruise, we carried out six Shinkai 6500 dives at Mado Megamullion and also conducted geophysical mapping of its vicinity. Among the six Shinkai dives, we made detailed bathymetric survey of the parts of Mado Megamullion with a multi-beam sonar Seabat 7125 installed on the Shinaki in three dives.

All of the planned six Shinkai dives were successfully conducted during the cruise [Ohara et al., 2019]. Among these, three dives (6K-1537, 6K-1539, and 6K-1541) were designed for detailed bathymetric survey of the parts of Mado Megamullion with a multi-beam sonar Seabat 7125 installed on the Shinaki, being conducted as one-man pilot dive or two-observers dive. The rest of dives (6K-1536, 6K-1538, and 6K-1540) were designed for sampling of the parts of the Mado Megamullion, being conducted as conventional two pilots dive. The location of the dives conducted in this cruise are (**Fig. 2**):

6K-1536 (One observer: K. Michibayashi): Head wall in the distal Mado Megamullion
6K-1537 (Two observers: Y. Ohara + M. Fujii):
Gentle slope adjacent to the head wall in the distal Mado Megamullion
6K-1538 (One observer: A. Sanfilippo): Small scarp in the proximal Mado Megamullion
6K-1539 (Two observers: O. Ishizuka + N. Akizawa):
Head wall in the distal Mado Megamullion
6K-1540 (One observer: J.E. Snow): Steep slope in the proximal Mado Megamullion
6K-1541 (Two observers: Y. Ohara + H. Yamashita): Termination area of Mado Megamullion

Extensive geophysical mapping (bathymetry, total magnetics, and vector magnetics; however, no gravity) was also successfully conducted in this cruise (**Figs. 1 and 2**), resulting in almost complete mapping of the Mado Megamullion and its vicinity [Ohara et al., 2019].

References

Ohara, Y., Y. Kato, T. Yoshida, and A. Nishimura, Geoscientific Characteristics of the Seafloor of the Southern Ocean of Japan Revealed by Japan's Continental Shelf Survey, J. Geography, 124(5), 687-709, 2015.

Ohara, Y., K. Okino, N. Akizawa, M. Fujii, Y. Harigane, N. Hirano, K. Hirauchi, O. Ishizuka, S. Machida, K. Michibayashi, A. Sanfilippo, J.E. Snow, and H. Yamashita, Introducing an oceanic core complex in the Shikoku Basin: Mado Megamullion, JpGU 2019, SMP30-07, 2019.

Ohara, Y., K. Okino, N. Akizawa, M. Fujii, Y. Harigane, N. Hirano, K. Hirauchi, S. Machida, K. Michibayashi, A. Sanfilippo, J.E., Snow, and H. Yamashita, A new tectonic window into the backarc basin lower oceanic crust and upper mantle: Mado Megamullion in the Shikoku Basin, 2018 AGU Fall Meeting, T32C-05B, Washington, DC, USA, 2018.

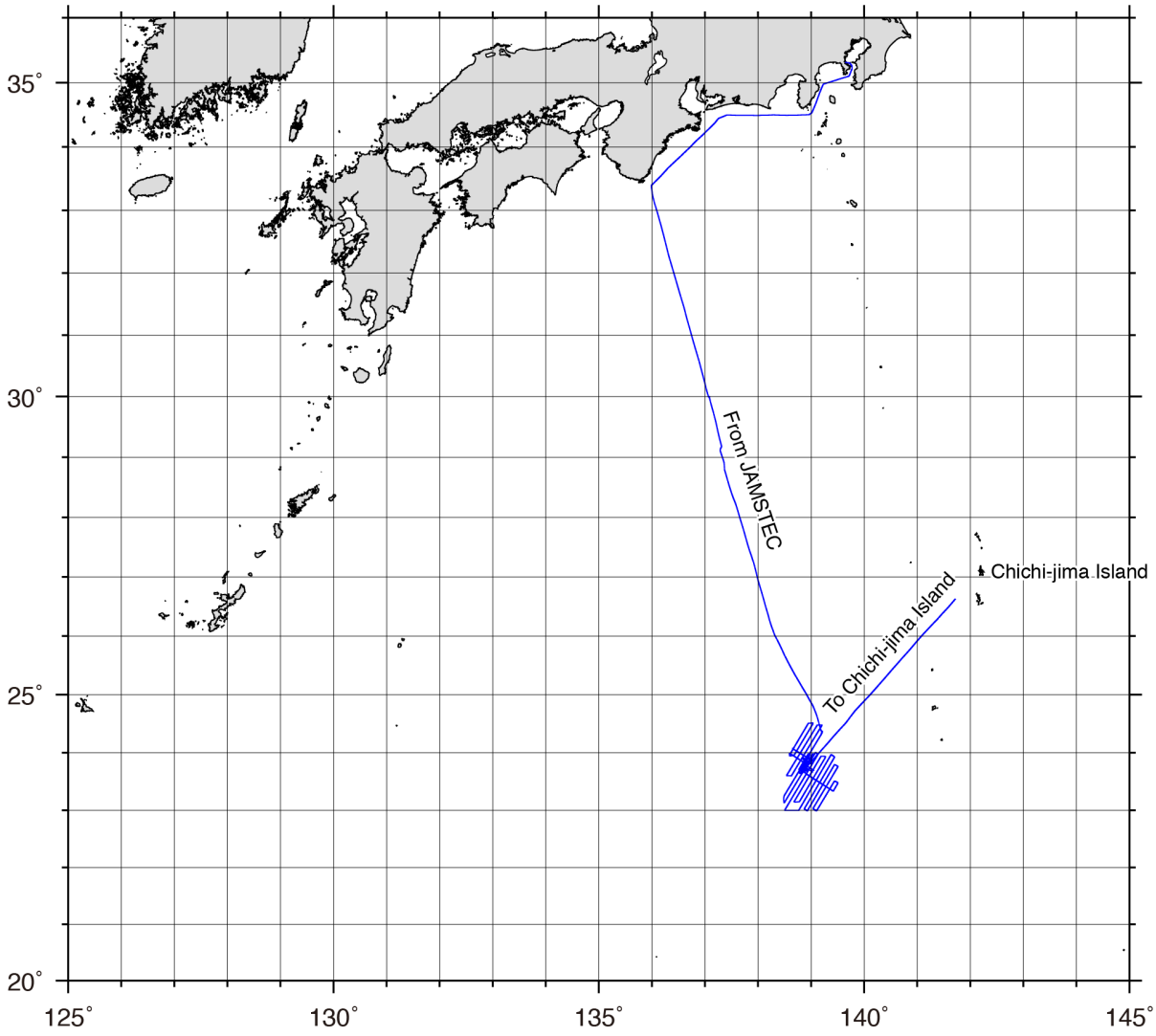

Fig. 1. Index map showing the location of studied area during YK19-04S cruise. Cruise track lines are also shown.

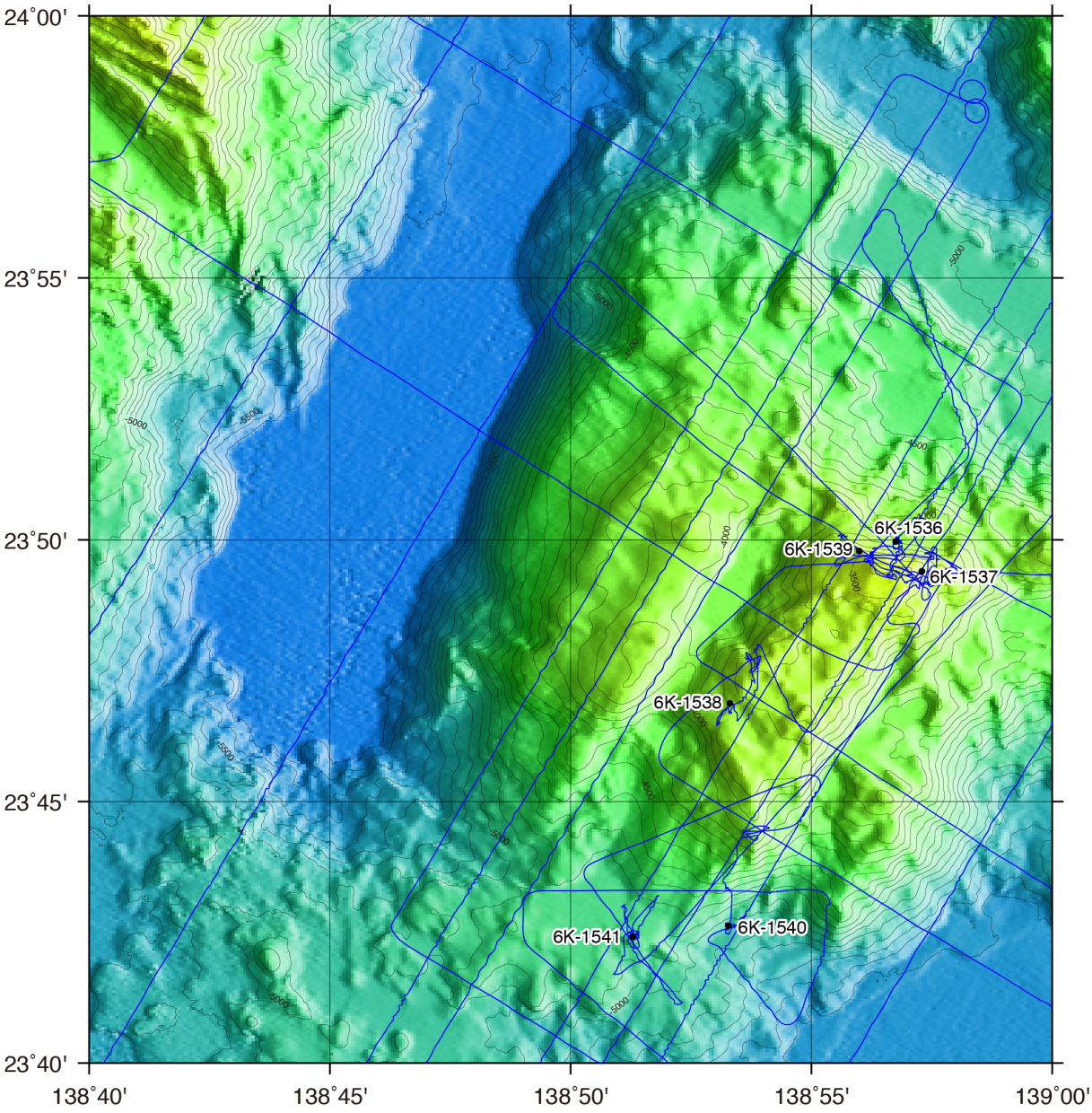

Fig. 2. Location of the dives during YK19-04S cruise. Cruise track lines are also shown.

4. Cruise log

Local time	Notes
8-Apr-19	**The Yokosuka YK19-04S cruise began. The Yokosuka was underway to Mado Megamullion.**
8:00	All scientists got aboard at the JAMSTEC pier in Yokosuka.
9:00	YK19-04S cruise began.
9-Apr-19	**The Yokosuka was underway to Mado Megamullion.**
10-Apr-19	**The Yokosuka was arrived at the Mado Megamullion area in the evening. The Yokosuka conducted geophysical mapping during the night.**

17:28	Geophysical mapping survey started.
11-Apr-19	**The 1st Shinaki dive (6K-1536) was conducted at the distal region of Mado Megamullion. Katsuyoshi Michibayashi as the observer. The Yokosuka conducted geophysical mapping during the night.**
10:04	The Shinkai opened vent, start of 6K-1536 dive. K. Michibayashi as the observer.
11:57	The Shinkai on bottom (3899 m).
15:47	The Shinkai off bottom (3390 m).
17:32	The Shinaki on deck.
12-Apr-19	**The 2nd Shinaki dive (6K-1537) was conducted at the distal region of Mado Megamullion. Yasuhiko Ohara and Masakazu Fujii as the two observers (an one-man pilot dive). The Yokosuka conducted geophysical mapping during the night.**
10:20	The Shinkai opened vent, start of 6K-1537 dive. Y. Ohara and M. Fujii as the two observers (a one-man pilot dive).
12:06	The Shinkai started Seabat 7125 mapping survey (3455 m).
15:48	The Shinkai off bottom (3511 m).
17:31	The Shinaki on deck.
13-Apr-19	**The 3rd Shinaki dive (6K-1538) was conducted at the proximal region of Mado Megamullion. Alessio Sanfilippo as the observer. The Yokosuka conducted geophysical mapping during the night.**
10:03	The Shinkai opened vent, start of 6K-1538 dive. A. Sanfilippo as the observer.
11:48	The Shinkai on bottom (3881 m).
15:35	The Shinkai off bottom (3918 m).
17:20	The Shinaki on deck.
14-Apr-19	**The 4th Shinaki dive (6K-1539) was conducted at the distal region of Mado Megamullion. Osamu Ishizuka and Norikatsu Akizawa as the two observers (a one-man pilot dive). The Yokosuka conducted geophysical mapping during the night.**
10:02	The Shinkai opened vent, start of 6K-1539 dive. O. Ishizuka and N. Akizawa as the two observers (an one-man pilot dive).
11:35	The Shinkai started Seabat 7125 mapping survey (3453 m).
15:40	The Shinkai off bottom (3686 m).
17:27	The Shinaki on deck.
15-Apr-19	**No Shinkai dive was conducted. The Yokosuka conducted geophysical mapping.**
16-Apr-19	**The 5th Shinaki dive (6K-1540) was conducted at the distal region of Mado Megamullion. Jonathan E. Snow as the observer. The Yokosuka conducted geophysical mapping during the night.**
9:08	The Shinkai opened vent, start of 6K-1540 dive. J.E. Snow as the observer.
11:19	The Shinkai on bottom (5050 m).
15:36	The Shinkai off bottom (4059 m).
17:26	The Shinaki on deck.

17-Apr-19	**The 6th Shinaki dive (6K-1541) was conducted at the termination area of Mado Megamullion. Yasuhiko Ohara and Hiroyuki Yamashita as the two observers (a one-man pilot dive). The Yokosuka was underway to Futami Harbor, Chichi-jima Island.**
9:02	The Shinkai opened vent, start of 6K-1541 dive. Y. Ohara and H. Yamashita as the two observers (a one-man pilot dive).
11:10	The Shinkai started Seabat 7125 mapping survey (4647 m).
14:13	The Shinkai off bottom (4777 m).
16:19	The Shinaki on deck.
17:00	The Yokosuka was underway to Futami Harbor, Chichi-jima Island.
18-Apr-19	**The Yokosuka arrived at Futami Harbor, Chichi-jima Island at noon. End of the cruise.**
12:00	The Yokosuka arrived at Futami Harbor, Chichi-jima Island at noon. End of the cruise.
15:00	YK19-04S scientists disembarked.