



R/V Shinseimaru Cruise Report
KS-20-J07
Leg.2

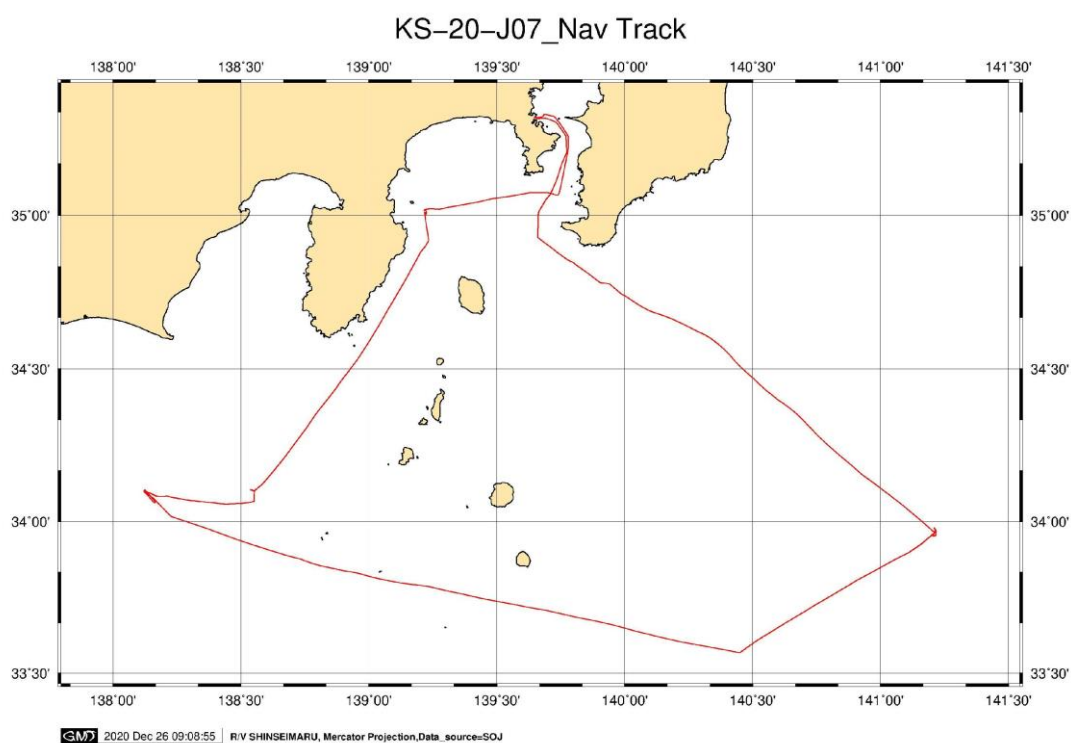
Trial of Deep-sea Freezer

Research area:
Sagami-Bay
Dec.25, 2020-Dec.26, 2020

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

1. Cruise Information

- Cruise ID: KS-20-J07
- Name of vessel: R/V *Shinseimaru*
- Title of cruise:
 - Trial of Deep-sea Freezer (*Leg.2*)
- Chief Scientist: Yoshinobu Nambu
- Cruise period:
 - December 20,2020 to December 24,2020 (*Leg.1*)
 - December 25,2020 to December 26,2020 (*Leg.2*)
- Ports of departure/arrival: JAMSTEC Headquarter, Yokosuka
- Research area:
 - Sagami-Bay, Off Hatsu-shima (*Leg.2*)
 - 2 - mile radius from [35°00.00'N, 139°13.00'E]
- Research map



2. Research Proposal and Science Party

- Title of proposal
 - Trial of Deep-sea Freezer (*Leg.2*)
- Representative of the science party [Affiliation]
NAMBU YOSHINOBU [JAMSTEC]
- Science party (*on shore)
 - *Leg.2*
NAMBU YOSHINOBU [JAMSTEC]
YAMAZAKI YASUYUKI [JAMSTEC]
KAWAGUCHI SHINSUKE [JAMSTEC]
MATSUI YOHEI [JAMSTEC]

- SHINSEIMARU Crew

Captain	AKIHISA TSUJI
Chief Officer	FURUKAWA YUKI
2nd Officer	YUKAWA TOMOHIRO
3rd Officer	KUSUMI KEISUKE
Chief Engineer	IKUTA SHINICHI
1st Engineer	TADOOKA NAOHITO
2nd Engineer	INOMOTO TAKAATSU
3rd Engineer	TOMIYAMA YUSUKE
Chief Electronics Op.	TAKAHASHI MASAMOTO
2nd Electronics Op.	SUGIMOTO YOHEI
Boat Swain	HIROSAKI KANAME
Able Seaman	NAKAE KENJI
Able Seaman	KAWAMURA KOSEI
Able Seaman	NAKANISHI TORU
Able Seaman	SAGA TOSHIYA
Sailor	ITO SHIN
Sailor	MATSUDA TASEI
No.1 Oiler	YOSHIDA KATSUYUKI
Oiler	HIGASHIGAWA YUJI
Oiler	MISAGO SOTA
Assistant Oiler	MANNA SHOTA
Chief Steward	HIRAYAMA KAZUHIRO
Steward	SHIRAISHI TATSUYA
Steward	TAKAMA TOSHIYUKI

- Hyper-Dolphin Operation Team

Operation Manager	TEPPEI KIDO
2nd ROV Operator	TAKENOUCHI ATSUSHI
2nd ROV Operator	SAKAKIBARA YUDAI
2nd ROV Operator	TAYAMA YUDAI
3nd ROV Operator	YAMAGUCHI TAIKEN
3nd ROV Operator	ASANO WATARU

3. Research/Development Activities

- Trial of Deep-sea Freezer (Leg.2)

The prototype DSF- α consists of a Peltier device (PD), two copper blocks attached to the ‘hot’ and ‘cool’ faces of the PD, an aluminium-made heat sink chamber, a thermocouple, an electric connector, a pressure housing, an electric unit housing, and a peristaltic pump. The DSF- α system, mounted on the acrylic chamber, was secured on the front side of payload basket on the ROV *Hyper-Dolphin*. Dive #2120 of ROV *Hyper-Dolphin* was conducted off Hatsushima Island (35°01.0’N 139°13.3’E), Sagami Bay on December 25th, 2020 during the R/V *Shinsei-Mar* cruise KS-20-07J. A video camera was set to continually monitor and record the DSF- α chamber. When the ROV was deployed at the sea surface (08:22 JST, same for all time stamps hereafter), air in the DSF- α housing was substituted by surface seawater which was at 20°C.

The peristaltic pump was started, and following that the power supply to the PD was started at 08:52, at the water depth of 300 m. At this point the ambient temperature was 11.1°C while the ‘cool’ face of the DSF- α was at 14°C. At 600 m (09:04) depth the DSF- α temperature measurement decreased to 0°C, where ambient seawater temperature was 5.4°C. The lack of shimmering waters at the exhaust vent of the

peristaltic pump suggests the seawater that has passed through the heat sink chamber was not significantly warmer than the ambient seawater. At 09:19, just after the ROV arrived at the seafloor (depth 854 m, ambient seawater temperature 3.7°C), the temperature of the DSF- α has decreased to -5°C. Production of the first deep-sea ice was first seen near the opening of the housing chamber at around 11:00 (Supplementary Video file), when the DSF- α temperature had reached -9°C. The lowest temperature of the 'cool' side of the DSF- α system recorded during the dive was -10°C which was maintained for 3.5 hours. The deep-sea ice steadily increased in size until 16:00, when the ROV left the sea bottom for recovery. The deep-sea ice had a cloudy, slurry appearance which suggests it is slush-like rather than a solid block. During the ROV's ascent, the temperature of the 'cool' face on the DSF- α increased with time (and therefore shallower depth and increasing ambient seawater temperature). While ascending, seawater around the deep-sea ice exhibited a shimmering appearance. This suggested that the ice was starting to melt, generating a water density difference between the surrounding seawater and water originating from the melting deep-sea ice. Melting was more rapid past the water depth 600 m, where the ambient seawater temperature was 5°C. The deep-sea ice continued to reduce in size and was visible until the depth of 100 m at 16:25. The shimmering effect disappeared at 16:28, when the ROV reached the sea surface. The deep-sea ice had completely melted when the DSF- α was observed after the ROV was recovered on-deck.

4. Cruise Log

Date	Local Time	Description
-Sun.20.Dec	08:00	Scientists party onboard a vessel
	08:40	Kick-off meeting
	09:00	Departed from JAMSTEC Headquarter, Yokosuka
		Transited to Izu-Ogasawara
	10:00	Onboard lecture
Mon.21.Dec	02:00	Arrived at o Izu-Ogasawara
	08:24	Started to pay out the cable of #6 winch for free fall #1
	12:00	Hold with a cable length of 4,500m for 20 min.
	12:20	Started to wind up the cable
	14:42	Recovered cable
	18:00	Scientist Meeting
Tue.22.Dec	08:13	Started to pay out the cable for free fall
	10:40	Hold with a cable length of 4,500m for 20 min.
	11:00	Started to roll up the cable
	13:00	Recovered cable.
	17:40	Transited to Northern Nankai Trough Scientist meeting
Wed.23.Dec	11:00	Arrived at Northern Nankai Trough
	11:04	Deployed XBT
	11:48	Conducted SBP
	12:11	Completed SBP
	14:06	Launched HPD, Dive #2118
	15:00	Conducted function test at WD 2000m without landing on sea bottom
	16:42	Recovered HPD
Thu.24.Dec	08:31	Launched HPD, Dive #2119
	10:36	Landed sea bottom WD 3,593m

		Working on the seafloor
	13:55	Left sea bottom, WD 3556m
	14:56	Recovered HPD
	14:52	Transited to Off Hatsusima
	16:49	Preparation work for Leg.2
	18:00	Scientist meeting
	21:30	Arrived at Off Hatsusima.
Fri.25.Dec	7:40	Deployed XBT.
	8:20	Launched HPD, Dive #2120
	9:14	Landed sea bottom WD 849m
		Conducted Trial of Deep-sea Freezer (Leg.2)
	16:00	Left sea bottom
	17:00	Recovered HPD
	18:00	Scientist Meeting
	18:30	Transited to JAMSTEC Headquarter, Yokosuka
Fri.26.Dec	09:20	Arrived at JAMSTEC Headquarter, Yokosuka

5. 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 JAMSTEC.

<http://www.godac.jamstec.go.jp/darwin/explain/1/c#report>

E-mail: submit-rv-cruise@jamstec.go.jp