



Yokosuka Cruise Report YK25-05C

In-situ deep-sea biodegradability tests of marine
biodegradable materials using microbial omics analysis
and in-situ culture experiment methods

Sagami Bay

20th April - 25th April, 2025

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

1. Cruise Information

- Cruise ID

YK25-05C

- Name of vessel

Yokosuka

- Title of project

In-situ deep-sea biodegradability tests of marine biodegradable materials using microbial omics analysis and in-situ culture experiment methods

- Title of cruise

In-situ deep-sea biodegradability tests of marine biodegradable materials using microbial omics analysis and in-situ culture experiment methods

- Chief Scientist [Affiliation]

Hiroyuki Kashima [JAMSTEC]

- Cruise period

20th April to 25th April, 2025

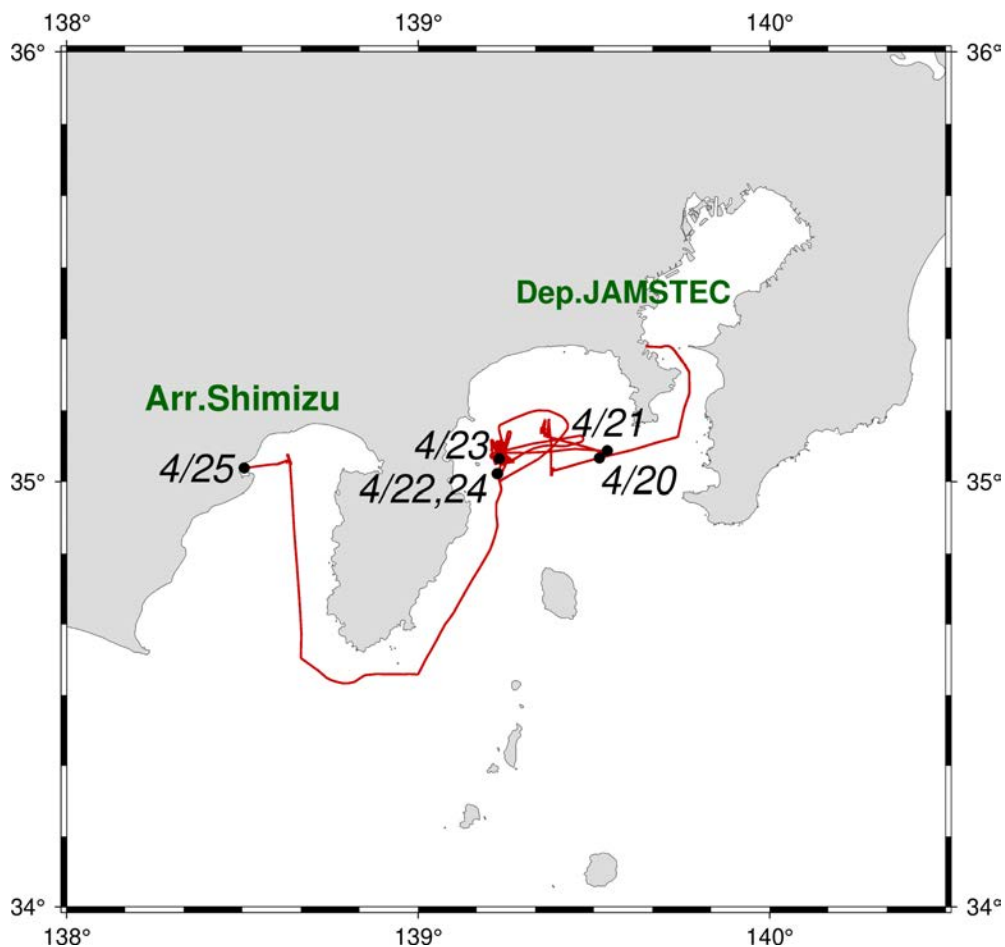
- Ports of departure / call / arrival

Yokosuka/Shimizu

- Research area

Sagami Bay

- Research map



2. Research Proposal and Science Party

- Title of proposal

In-situ deep-sea biodegradability tests of marine biodegradable materials using microbial omics analysis and in-situ culture experiment methods

- Representative of Science Party

Hiroyuki KASHIMA [Japan Agency for Marine-Earth Science and Technology]

- Science Party

Yuriko NAGANO	[JAMSTEC]
Ryota NAKAJIMA	[JAMSTEC]
Yuto KAKU	[JAMSTEC]
Lyn HOBDA	[JAMSTEC]
Michiko MANABE	[JAMSTEC]
Maki KAYAMORI	[JAMSTEC]
Wataru TOKUNAGA	[NME]
Kazuki TANIGUCHI	[NME]

- YOKOSUKA crew

Captain	Yoshiyuki NAKAMURA
Chief Officer	Masato CHIBA
2nd Officer	Riku MATSUDA
Jr.2nd Officer	Tatsuya NOZAWA
3rd Officer	Yuki KOYAISHI
Jr.3rd Officer	Masashi KANEMITSU
Chief Engineer	Daisuke GIBU
1st Engineer	Kenichi SHIRAKATA
2nd Engineer	Koki SHIMIZU
3rd Engineer	Yuji FURUYAMA
Jr.3rd Engineer	Takamasa OCHIAI
Chief Electronic Op.	Yosuke KOMAKI
2nd Electronic Op.	Takayuki MABARA
BoatSwain	Naoki IWASAKI
Quarter Master	Nao ISHIZUKA
Quarter Master	Shinya UENO
Quarter Master	Taisei TANAKA
Sailor	Taisei MATSUDA
Sailor	Shinnosuke INOUE
Sailor	Mizuki NAKANO
No.1 Oiler	Masanori UEDA
Oiler	Tamaki FUJISHIMA
Oiler	Daiki SATO
Assistant Oiler	Aoi DANTSUKA
Assistant Oiler	Kenzo OCHIAI
Chief Steward	Takahiro ABE
Steward	Tatsuya SHIRAISHI
Steward	Jun SATO
Steward	Tsugumi TANAKA
Steward	Keito SATO

- Shinkai 6500 operating team

Submersible Operation Manager	Kazuhiro CHIBA
Deputy Submersible Operation Manager	Tomoe KONDO
1st Submersible Staff	Mitsuhiro UEKI
1st Submersible Staff	Akihisa ISHIKAWA
1st Submersible Staff	Takuma ONISHI
2nd Submersible Staff	Keigo SUZUKI

2nd Submersible Staff	Ryo SAIGO
2nd Submersible Staff	Satsuki IIJIMA
2nd Submersible Staff	Motohiro MATSUSAKA
2nd Submersible Staff	Kaisei SATO
3rd Submersible Staff	Haruka SASAKI
3rd Submersible Staff	Tomoka EDA
Marine technician	Michiyasu KATAGIRI

3. Research/Development Activities

3. *In situ* biodegradability tests of different types of novel plastics on the deep-sea floor

3.1. Objectives

Marine plastic pollution being spreading throughout the oceans of our planet is recognized as a global issue that must be urgently addressed. Mismanagement of plastic wastes provoke leakage into the ocean and subsequent serious damages on marine ecosystems. Moreover, extreme weather events such as heavy rainfall and stormy wind remarkably intensifies the chances and amounts of plastic leakage into the ocean. Therefore, even under the proper management of plastic wastes, accidental releases by natural disasters such as extreme weather events and tsunamis are inevitable. Once released into the ocean, plastic debris is assumed to remain in the marine environment for more than several hundred years.

A potential solution for this issue is to replace plastic products that being inevitably released into the ocean with marine biodegradable materials. For now, there are very few plastic materials demonstrated marine biodegradability, and most of their biodegradation performances has been tested in shallow waters that are likely favorable for biodegradation with its high water temperature and a high microbial activity. However, deep-sea environments such as abyssal plain floor that consists much of the ocean floor is hypothesized to be a major destination for marine plastic wastes. Studies estimating the fate of marine plastic wastes using ocean simulation models suggested that large amount of plastic wastes being released into the oceans eventually sink onto the abyssal plain floor directly under ocean surface gyres that collect/accumulate plastic wastes drifting near the ocean surface. Recent researches by JAMSTEC and other organizations further demonstrated that both large plastic waste and microplastics have actually accumulated on the deep-sea floor.

With these recent findings, it is essential to develop materials that are biodegradable even under deep-sea environments with lower temperatures and lower microbial activity relative to shallow waters, and to confirm their biodegradability under the deep-sea environments. In this context, we launched a collaborative study with Japan BioPlastics Association (hereafter JBPA) to test and analyze the biodegradability of novel biodegradable materials developed by JAMSTEC and other private companies. This research cruise aimed to conduct in-situ deep-sea biodegradability test of marine biodegradable plastic materials.

3.2. Methods

We collected more than 40 types of novel biodegradable plastic material samples typically sizes of 40 mm in length into the sample chambers and deployed on the Off-Misaki deep-sea floor site of Sagami Bay in May 2024 with YK24-07C cruise. In this cruise, we retrieved that plastic material samples experienced for ~1 year as in-situ deep-sea biodegradability test at a deep-sea floor site. We also deployed new biodegradable plastic material samples in order to conduct another in-situ biodegradability test. In addition, we conducted physical/chemical environmental measurements and samplings for molecular/microbiological analyses of the seawater and the sediment to understand the decomposition conditions of biodegradable plastic materials under the deep-sea environment. We also retrieved plastic material sample sets being tested in-situ biodegradability for multiple

years at Off-Hatsushima deep-sea floor site in Sagami Bay, conducted environmental measurements and molecular/microbiological samplings.

3.3. Results & findings in this cruise

We retrieved all of plastic material samples after ~1 year of in-situ deep-sea biodegradability test at a deep-sea floor site of Off-Misaki of Sagami Bay in safe and also successfully deployed a new set of plastic material samples for another in-situ biodegradability test at the site. We also retrieved other sets of plastic material sample sets experienced few years at the deep-sea floor site of Off-Hatsushima of Sagami Bay. Furthermore, we collected “natural” plastic debris, sediment, and seawater for environmental monitoring and background meta-omics analyses.

3.4. Future plans

The retrieved plastic samples will be examined the degradation states by visual observations, weight-loss, SEM observations, and microbiological analyses, based on the collaborative study requirements. Sediment, seawater samples will be analyzed with microbiological/meta omics analyses in order to understand microbial activities associated with plastic polymer degradation on the deep-sea floor. The newly deployed sample set is planned to be retrieved next year.

○ 4. Cruise Log

日付 Date	時間 Local Time	内容 Note	特記事項 Description	本船位置／気象／海象 Position/Weather/Wind/Sea condition
20-Apr-25	08:00	Scientists onboarded.		12:00 (UTC+9h)
	09:00	Let go all share line and left JAMSTEC quay No.1 for research area.		35-03.6N, 139-32.3E
	09:15-10:00	6K team and scientists meeting.		Off west of Jyogashima
	10:45-11:15	Carried out education and training for scientists.		Weather:o
	12:45	Arrived at research area		Wind:SW-6
	13:00-14:00	6K briefing.		Wave scale:3
	13:11	Released XBT.		Swell scale:1
	19:00-19:10	Scientists meeting.		Visibly: 7'
21-Apr-25	07:00	Hoisted up "SHINKAI6500".		12:00 (UTC+9h)
	08:10	Launched "SHINKAI6500".		35-04.3N,139-32.3E
	08:55	"SHINKAI6500" dove, and started her operation dive No.1847.		Central of Sagami-wan bay
	09:31	"SHINKAI6500" landed the sea bottom.	D=760m	Weather:bc
	13:48	"SHINKAI6500" left the sea bottom.	D=734m	Wind:ENE-0
	14:04	Refloated "SHINKAI6500"		Wave scale:2
	14:28	Recovered "SHINKAI6500",and finished above operation.		Swell scale:1
	19:00-19:15	Scientists meeting.		Visibly: 8'

22-Apr-25	08:00	Hoisted up "SHINKAI6500".		12:00 (UTC+9h)
	09:10	Launched "SHINKAI6500".		35-01.1N, 139-13.5E
	09:57	"SHINKAI6500" dove, and started her operation dive No.1848.		Off Hatsushima
	10:38	"SHINKAI6500" landed the sea bottom.	D=1,050m	Weather:c
	16:25	"SHINKAI6500" left the sea bottom.	D=865m	Wind:South-5
	16:45	Refloated "SHINKAI6500"		Wave scale:3
	17:10	Recovered "SHINKAI6500",and finished above operation.		Swell scale:1
	19:30-19:45	Scientists meeting.		Visibly: 8'
23-Apr-25	09:00-10:45	Tour the "SHINKAI6500"		12:00 (UTC+9h)
	19:00-19:15	Scientists meeting.		35-03.0N, 139-14.1E
				Central of Sagami-wan bay
				Weather:r
				Wind:South-3
				Wave scale:3
				Swell scale:2
				Visibly: 2'
24-Apr-25	06:50	Hoisted up "SHINKAI6500".		12:00 (UTC+9h)
	08:10	Launched "SHINKAI6500".		35-01.1N, 139-13.5E
	08:59	"SHINKAI6500" dove, and started her operation dive No.1849.		Central of Sagami-wan bay
	09:40	"SHINKAI6500" landed the sea bottom.	D=1,208m	Weather:o
	15:32	"SHINKAI6500" left the sea bottom.	D=732m	Wind:South-3
	15:49	Refloated "SHINKAI6500"		Wave scale:1
	16:13	Recovered "SHINKAI6500",and finished above operation.		Swell scale:2
	19:00-19:15	Scientists meeting.		Visibly: 6'
25-Apr-25	10:00	Arrived at Simizu port. Finished YK25-05C cruise.		

● 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.

<https://www.godac.jamstec.go.jp/darwin/en/note.html#report>
E-mail: submit-rv-cruise@jamstec.go.jp