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International Cooperative Program
Japan - U. S. A. - Korea

KR02-13
Kaiko/Kairei Cruise in the Challenger Deep

Japan
JAMSTEC ・ Nagasaki University
Miyazaki University ・ ORI, University of Tokyo
Chiba University

U. S. A.
MBARI

Korea
KORDI

October 15 - October 26, 2002

Onboard Report

Contents

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Kaiko **Operation team**

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Jun TAKENOUCHI (Pilot and Mechanics)

Kairei **Crew**

Hitoshi TANAKA (Captain)

Masayoshi ISHIWATA (Chief Officer)

Isao MAEDA (2nd Officer)

Kennji YANO (Junior 2nd Officer)

Tetsuya YOKOTA (3rd Officer)

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Harumitu SATO (Able Seaman)

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Kazuo ABE (Oiler)

Kazuaki NAKAI (Oiler)

Shuichi SONO (Oiler)

Koichiro TODA (Oiler)

Kaoru TAKASHIMA (Chief Steward)

Tomihisa MORITA (Cook)

Jihei NAKATSUKA (Cook)

Tadayuki TAKATSU (Cook)

Kiyotaka KOSUJI (Cook)

Cruise Operations

15 October, 2002

10:00	Embarked scientific party at Apla Port in Guam
15:00	Transited to the Challenger Deep from Apula Port

16 October, 2002

06:52	Arrived at the Challenger Deep, XBT measurement
08:12 – 09:09	Deployed three transponders
11:09 – 13:07	Calibration for the transponder network
13:13	Started proton magnetmeter measurement
15:07 – 15:43	Calibration of induced magneticzation of the ship
15:57	Started bathymetric measurement by multi-narrow beam echo-sounder

17 October, 2002

04:55	Finished bathymetric measurement by multi-narrow
06:18	Finished proton magnetmeter measurement
07:55	Launched Kaiko (start dive #272)
11:18 –11:28	Deploying benthic respirometer
11:55	Transcect-1 started (11°20.148'N, 142°11.794'E)
18:00	Transcect-1 finished (11°20.093'N, 142°12.850'E)
	Over-night dive

18 October, 2002

07:59	Transcect-2 started (11°20.091'N, 142°11.893'E)
09:25	Transcect-2 finished (11°20.176'N, 142°12.214'E)
10:38	Transcect-3 started (11°20.260'N, 142°13.226'E)
13:00	Transcect-3 finished (11°20.592'N, 142°12.973'E)
16:12	Recovered *Kaiko* (finish dive #272)
16:50	Started bathymetric and magnetic surveys
17:11 – 17:33	Calibration of induced magneticzation of the ship

19 October, 2002

all day	Bathymetric and magnetic surveys

20 October, 2002

06:16	Finished bathymetric and magnetic surveys
07:55	Launched *Kaiko* (started dive #273)
15:54	Recovered *Kaiko* (finished dive #273)
16:32	Started bathymetric and magnetic surveys

21 October, 2002

06:18	Finished bathymetric and magnetic surveys
09:26 –10:32	Recovered three transponders
10:39	Started bathymetric and magnetic surveys

22 October, 2002

06:18	Finished bathymetric and magnetic surveys
07:47	Launched *Kaiko* (start dive #274)
16:42	Recovered *Kaiko* (finish dive #274)
17:14	Started bathymetric and magnetic surveys

23 October, 2002

06:18	Finished bathymetric and magnetic surveys
07:53	Launched *Kaiko* (start dive #275)
13:02	Recovered benthic respirometer
17:09	Recovered *Kaiko* (finish dive #275)
17:45	Started bathymetric and magnetic surveys

24 October, 2002

06:21	Finished bathymetric and magnetic surveys
07:47	Launched *Kaiko* (start dive #276)
16:32	Recovered *Kaiko* (finish dive #276)
17:08	Started bathymetric and magnetic surveys

25 October, 2002

06:49	Finished bathymetric and magnetic surveys
07:41	Launched *Kaiko* (start dive #277)
15:36	Recovered *Kaiko* (finish dive #277)
15:56	Transit to Apla Port

26 October, 2002

09:00	Arrived at Apla Port in Guam
12:30	Scientific Party disembarked

Preface

The Challenger Deep was discovered in 1951 by the British naval surveying ship, *Challenger VIII*, and is the deepest point on the surface of the globe. The Deep is located in the southwestern part of the Mariana Trench (around 11°20'N, 142°10'E; Fig. 1). Several bathymetric surveys have been conducted over it and outlying areas (Fisher and Hess, 1963). At present, the maximum depth in the Challenger Deep is considered to be 10,924m ± 10m based on a discussion of ship navigation methods, sounding methods and velocity correction functions (Nishida *et al.*, 1985).

The first direct observation of the sea floor in the Challenger Deep was made by the bathyscaph Trieste in 1960. During this dive, the occurrence of a flat fish of approximately 30cm in total length was recorded but no photographic or video record remains of this observation. The only other megabenthos that has been reported from the Challenger Deep is the lysiannassid amphipods (*Hirondella gigas*), which had previously been captured in baited traps at 10,592m and in the Philippine Trench at 9,600 - 9,800m (Hessler *et al.*, 1978). Thus, to date, very little biological information on the hadal community is available.

In 1995, a test dive cruise of the Japanese ROV *Kaiko* (licensed to 11,000m depth) was conducted in the Challenger Deep. The *Kaiko* landed on the sea floor of the Challenger Deep and collected sediment samples (Takagawa *et al.*, 1997; Fujioka *et al.*, 1998). Deep-sea barophilic bacteria, planktonic archaea and some of the world's most widely-distributed bacteria (the genus *Pseudomonas*) were recognized in the sediment samples (Kato *et al.*, 1997). After the test dive cruise, two survey cruises of the hadal Challenger Deep by the *Kaiko* (KR98-05 and KR99-06) were organized by Japan Marine Science and Technology Center (JAMSTEC). The scientific team on these cruises included geophysicists and biologists who worked with the operation team to complete dives in the Challenger Deep. During these cruises, we were able to observe and capture benthopelagic holothurians, epibenthic polychaetes and largely lysiannassid amphipods (*Hirondella gigas*). However, the quality of video and photographic data from the dives was unsuitable for the identification of organisms and quantitative analyses of their distributions. Further, no exact survey track data were obtained.

Following these efforts in the Challenger Deep, a research cruise (KR02-13 *Kaiko/Kairei* Cruise) was planned as a Japan – U. S. A. –Korea cooperative research program. The purpose of the cruise is to obtain qualitative and quantitative information concerning the diversity and distribution of hadal organisms in the Challenger Deep, and to assess the role topographic isolation within trenches as a factor influencing speciation and diversification of hadal organisms. An additional research goal is to estimate the carbon demand of the sediment-dwelling community by measuring sediment community oxygen consumption (SCOC) using in situ benthic respiration system. Measurement of SCOC at these depths will be compared to the availability of organic carbon and the abundance of organisms comprising the sediment community.

The diving surveys by "*Kaiko*" were conducted at the western depression of the Challenger Deep (same target survey area of the KR98-05 and KR99-06 cruises) from 15th October to 26th October, 2002. During the cruise, 6 dives of the "*Kaiko*" were realized with fruitful results including continuous observation and video records over 3 km and sampling of hadal organisms.

The samples and data will be processed in land-based laboratories in many institutions. We are anticipating that many scientific reports and synthesis will be published in very near future.

We, the shipboard scientists of the KR02-13 *Kaiko/Kairei* Cruise in the Challenger Deep, express our sincere thanks to the operation manager, Mr. Kazuyoshi HIRATA, and operation team of the ROV "*Kaiko*", and the captain, Mr. Hitoshi TANAKA, and the crews of the R/V "*Kairei*" for their enthusiastic cooperation. We are especially thanks to the chief steward, Mr. Kaoru TAKASHIMA, and the cooks of the R/V "*Kairei*" for the wonderful meals provided during the cruise.

Jun Hashimoto
Nagasaki University

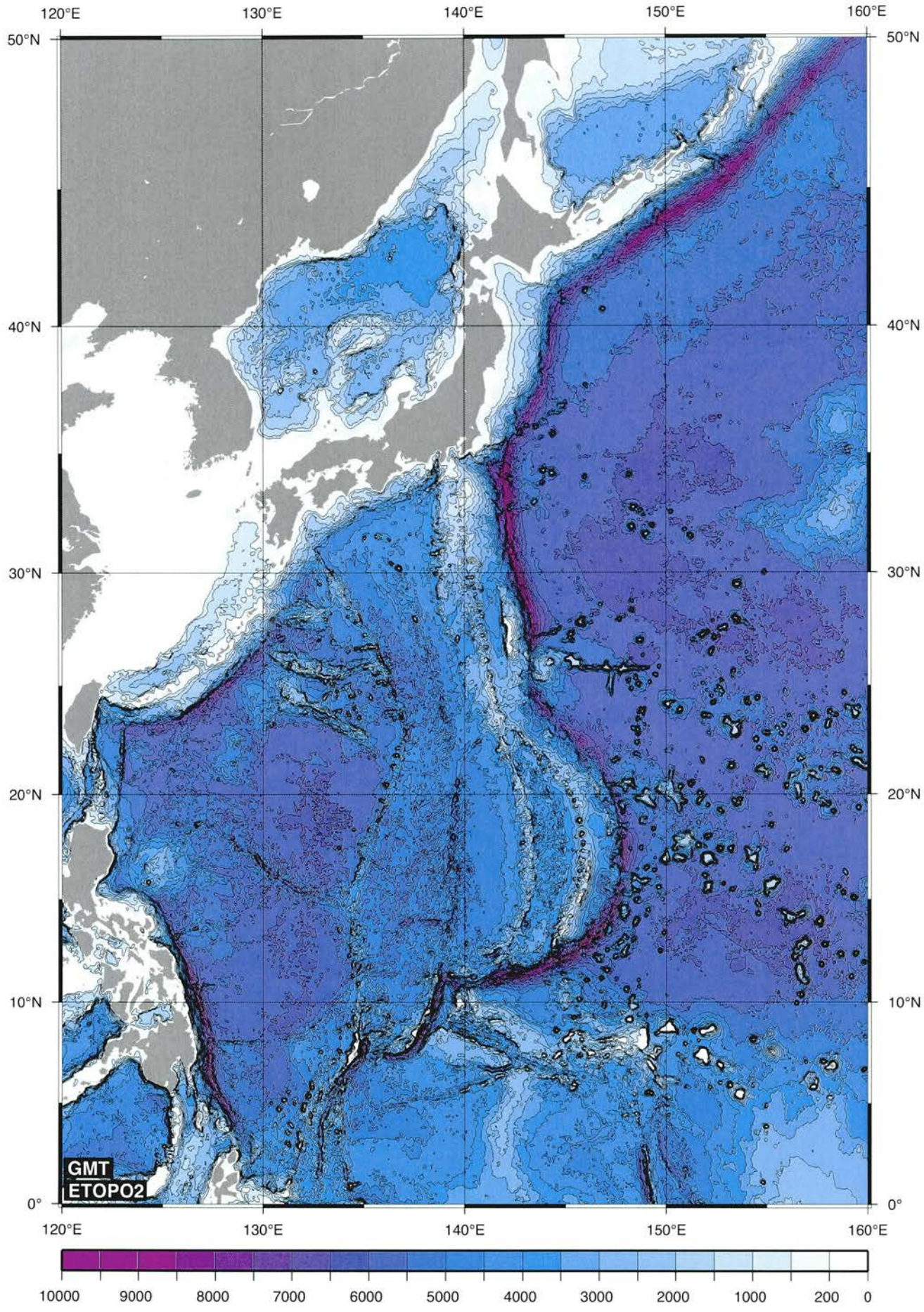


Fig.1: Survey Site with ETOPO2 bathymetric map. The map was made by GMT software.

Preliminary results

(1) *Kaiko* dive #272

Date: 17-18 October 2002

Site: Western depression, Challenger Deep

Landing: 11°20.151'N, 142°11.767'E, 11:13 (17-October 2002), 10890m

Leaving: 11°20.592'N, 142°13.973'E, 13:01 (18-October 2002), 10889m

Purpose: 1) deploy *in situ* benthic respiration system, 2) deploy baited trap, 3) observe hadal benthos in the Challenger Deep, 4) perform quantitative video transects to document the presence and distribution of megafauna, and 5) collect sediment cores (2).

Payload equipment: an *in situ* benthic respiration system, a baited trap, two MBARI-type core sampler, CTD DO profiler (SeaBird SBE-19)

Video highlights:

(1) 11:18:00 ~ 11:28:00	17-October Deploying benthic respiration system
(2) 11:40:00	17-October Deploying baited fish trap
(3) 09:39:00 ~ 10:04:00	18-October Deploying sediment push cores

Cooperative Scientists:

Name	Affiliation	Specialty
Onboard scientists of KR02-13	JAMSTEC, Miyazaki University, Chiba University, Nagasaki University, ORI-University of Tokyo, MBARI, KORDI	Biology Molecular biology

Key words: ROV "*Kaiko*", Challenger Deep, *in situ* benthic respiration system, baited trap, deep-sea trench

I. Dive summary

I. Dive summary

Dive #272 was carried out at the Challenger Deep known as the deepest point in the world. It was the first time a multi-day dive was conducted using Kaiko.

(1) Deploy an *in situ* benthic respiration system

This system was developed by Monterey Bay Aquarium Research Institute (MBARI) (Figure 1). The benthic respirometer system (BRS) was deployed in the western basin of the Challenger Deep (11°20.148'N, 142°11.774'E (10893m)). The BRS consists of 3 respiration chambers (10 cm I.D. x ~35 cm Long), each containing an oxygen optrode and self-contained stirring motor. A fourth oxygen optrode is attached to the BRS frame to measure changes in ambient oxygen concentration. A titanium pressure housing rated to ~12,000 m depth holds a controller, data logger, and batteries.

Each optrode is a ruthenium-based oxygen sensor, using an intensity-based measurement system. The ruthenium-metal complex sensor is illuminated with light at 250 nm, and fluoresces at 610 nm. This fluorescence is quenched proportionate to the partial pressure of oxygen, and with higher temperature. A two-point oxygen calibration is required to calibrate each sensor, based on the initial ambient oxygen concentration and water samples drawn from each chamber at the end of the deployment.

Each chamber was inserted into the sediment approximately 25 cm, leaving a chamber volume of ~785 ml. Stir bars will operate continuously at 7 rpm during the deployment. Oxygen concentrations in each chamber will be measured every 30 minutes during the deployment.

Figure 1. Benthic respirometer deployed on the seafloor at 10, 893 m.

(2) Observation of hadal organisms

During the dive we observed holothurians (the dominant megafaunal organism), white polychaetes, amphipods, tubes (sabellid or other polychaete, hydroid, or crinoid?), echiurans (?), and aggregations of material that probably contain radioloarian tests. Some xenophyophores may also be present. Occasional paired linear bio-traces were observed.

Still photographs of the seafloor were taken (Number 1 – 375 on 17-October 2002 and 376 - 705 were taken on 17-October 2002) as multiple long transects were conducted.

(3) Deployment of baited trap (11°20.148'N, 142°11.774'E, 10,893 m)

(4) Water sample for Winkler titration (11°20.151'N, 142°11.767'E, 10890 m)

(5) Sediment cores (7 cm diameter)

Two MBARI-type push cores were used to collect sediment (Figure 2).

A) 11°20.193'N, 142°13.228'E (10,888 m)

B) 11°20.225'N, 142°13.174'E (10, 888 m) (failed to retrieve sediment)

Figure 2. Sediment push cores

II. Video Log

Time	Depth (m)	Vehicle Altitude(m)	Description
			17-October 2002
7:55	0		On the surface
8:10	150		Begin descent
10:58	10763	114	Stopped descending
11:02	10765	112	Vehicle was released from the launcher
11:07	11857	32	
11:11	10890	1.5	Observed the bottom and water sampling (11°20.151'N, 142°11.767'E)
11:13	10892	0	Landed at the bottom
11:14	10893		ROV homer deployed
11:18	10893	0	Benthic Respiration system deployed (11°20.148'N, 142°11.774'E)
11:23	10893	0	No. 3 Benthic Respiration core deployed

Time	Depth (m)	Vehicle Altitude(m)	Description
11:28	10893	0	No. 1 Benthic Respiration core deployed
11:32	10893	0	Vehicle was moved a little bit on the same point
11:40	10892	0	Setting of the baited trap on the bottom sediment
11:54	10893	0.4	Started to move and marine snow observed
11:55	10893	0.5	Transect started (11°20.148'N, 142°11.794'E)
12:00	10893	0.5	11°20.151'N, 142°11.840'E
12:01	10894	0.4	Stopped moving
12:02			Amphipod observed
12:05	10894	0.6	11°20.187'N, 142°11.833'E
12:10	10894	0.5	11°20.185'N, 142°11.839'E
12:12	10894	1.1	Course changed
12:15	10895	0.3	Animal trace?
12:18	10894	0.7	Holothurian
12:20	10895	1.2	11°20.151'N, 142°11.836'E, holothurians scattered
12:25	10895	0.1	Many holothurians (11°20.135'N, 142°11.834'E,)
12:27	10895	0.1	Amphipod
12:30	10895	0.1	11°20.149'N, 142°11.854'E
12:33	10896	0.1	Holothurian
12:35	10895	0.1	11°20.164'N, 142°11.860'E, holothurians
12:36	10895	0.4	Animal trace
12:38	10895	0.5	Many holothurians, head 87°
12:40	10894	1.9	11°20.174'N, 142°11.877'E, head 88°
12:44	10896	0.7	11°20.178'N, 142°11.883'E, head 86, many holothurians
12:47	10896	0.0	Landed again at the bottom, waiting for launcher coming 11°20.177'N, 142°11.887'E,
12:53	10896	0.0	Amphipod swimming
12:56	10897	0.0	Two lines like a train rail marked on the sediment
13:15	10897	0.0	Polychaete (polynoidae??)
13:32	10897	0.0	11°20.175N, 142°11.877'E, head 89°, Vehicle start again (transact starting, The wire length was 140m from vehicle to launcher)
13:35	10897	0.5	11°20.174'N, 142°11.898'E, head 89°
13:40	10897	0.5	11°20.175'N, 142°11.971'E, head 88°
13:43	10898	0.5	Holothuroid appeared
13:45	10898	0.4	Amphipod swimming well, 11°20.178'N, 142°11.932'E, head 88°
13:46	10898	0.5	Amphipod
13:47	10898	0.5	Two individuals of polychaetes
13:50	10899	0.5	11°20.175'N, 142°11.948'E, head 89°
13:51	10899	0.5	One individual of amphipod & one polychaete

Time	Depth (m)	Vehicle Altitude(m)	Description
13:55	10899	0.5	11°20.172'N, 142°11.966'E, head 88. Large sized holothurians
13:57	10899	0.5	Polychaete
13:58	10899	0.5	A few number of polychaetes & few number of amphipod
14:00	10899	0.5	11°20.170'N, 142°11.981'E
14:05	10899	0.5	11°20.167'N, 142°12.000'E, head 89°
14:10	10900	0.5	11°20.164'N, 142°12.013'E, head 88°
14:15	10900	0.5	11°20.164'N, 142°12.030'E, head 89°
14:20	10900	0.5	11°20.165'N, 142°12.048'E, head 89°
14:25	10900	0.6	11°20.159'N, 142°12.067'E, head 89°
14:26	10900	0.5	Amphipod swimming
14:29	10900	0.5	Amphipod swimming
14:30	10900	0.5	11°20.159'N, 142°12.086'E, head 90°
14:32	10900	0.5	Holothurian jumping
14:33	10900	0.5	Three holothurians
14:35	10900	0.6	11°20.158'N, 142°12.102'E, head 89°
14:40	10900	0.6	11°20.154'N, 142°12.119'E, head 89°, holothurians
14:45	10900	0.5	11°20.150'N, 142°12.136'E, head 88°
14:50	10900	0.5	11°20.144'N, 142°12.149'E, head 89°, white worm ?
14:55	10901	0.5	11°20.148'N, 142°12.165'E, head 89°
15:00	10901	0.5	11°20.148'N, 142°12.179'E, head 89°
15:03	10901	0.5	Holothurian crawling
15:05	10901	0.5	11°20.147N, 142°12.191'E, head 91°
15:09	10900	0.5	A few number of small black hole? and a small stone??
15:10	10901	0.5	11°20.137N, 142°12.210'E, head 88°
15:15	10900	0.5	11°20.144N, 142°12.226'E, head 89°
15:20	10900	0.5	11°20.136'N, 142°12.235E, head 89°
15:21	10900	0.5	Three holoturians moving on the surface of bottom
15:25	10900	0.5	11°20.137'N, 142°12.250E, head 89°
15:25	10900	0.5	Echiuroidea??
15:29	10900	0.5	Amphipod swimming
15:30	10900	0.5	11°20.137'N, 142°12.260E, head 89°
15:33	10900	0.5	Sea lily liked structure
15:35	10900	0.5	11°20.132'N, 142°12.277E, head 89°
15:37	10900	0.5	Sea lily liked structure
15:40	10900	0.5	11°20.130'N, 142°12.292E, head 89°, sea lily liked structure
15:42	10900	0.5	Amphipod swimming
15:45	10900	0.5	11°20.127'N, 142°12.303E, head 88°, some altered layer found on the sediment

Time	Depth (m)	Vehicle Altitude(m)	Description
15:52	10900	0.5	Amphipod swimming
15:54	10900	0.5	Large sized blackish stone
15:55	10900	0.5	Like phiuroidea traced, 11°20.120'N, 142°12.329'E, head 88°
15:58	10899	0.4	Polychaetae ? (black)
16:00	10899	0.5	11°20.120'N, 142°12.341'E, head 88°
16:03	10899	0.5	Polynoidea? (white)
16:05	10899	0.6	11°20.116'N, 142°12.355'E, head 90°
16:06	10899	0.5	Cnidarian? (lope like)
16:08	10899	0.6	Lots of holothurians
16:19	10899	0.6	11°20.112'N, 142°12.368'E, head 88°
16:11	10899	0.6	Polychaetae? (Black)
16:13	10899	0.5	Amphipod swimming
16:15	10899	0.5	11°20.111'N, 142°12.392'E, head 88°
16:16	10899	0.6	Holothurian and amphipod swimming
16:20	10899	0.6	11°20.110'N, 142°12.408'E, head 90°
16:25	10899	0.5	11°20.110'N, 142°12.435'E, head 89°, swimming amphipod
16:30	10898	0.5	11°20.107'N, 142°12.453'E, head 89°, large shadow like a fish??
16:32	10899	0.5	Sea lily?
16:35	10898	0.5	11°20.107'N, 142°12.481'E, head 88°
16:37	10899	0.4	Unidentified organism running fast
16:39	10898	0.5	Three holothurians and amphipod swimming
16:40	10898	0.5	11°20.110'N, 142°12.508'E, head 88°
16:45	10898	0.4	11°20.106'N, 142°12.524'E, head 88°
16:50	10897	0.5	11°20.106'N, 142°12.552'E, head 88°
16:55	10897	0.5	11°20.102'N, 142°12.575'E, head 88°, polychaete swimming and settle down on the bottom, unidentified black stick shape
17:00	10897	0.4	11°20.103'N, 142°12.589'E, head 89°
17:05	10897	0.5	11°20.102'N, 142°12.600'E, head 89°
17:10	10896	0.5	11°20.101'N, 142°12.617'E, head 89°, cnidarian? (lope like)
17:13	10896	0.4	Amphipod swimming
17:15	10895	0.5	Cnidarian? (lope like), 11°20.098'N, 142°12.641'E, head 89°
17:18	10895	0.4	Polynoidae? (white)
17:20	10894	0.5	11°20.100'N, 142°12.660'E, head 88°, amphipod swimming
17:21	10894	0.4	Polychaeta? (black and sword like)

Time	Depth (m)	Vehicle Altitude(m)	Description
17:24	10893	0.5	Cnidarian? (lope like)
17:25	10893	0.5	11°20.097'N, 142°12.672'E, head 89°
17:26	10892	0.9	Polynoidae? swimming
17:27	10892	0.6	Cnidarian? (lope like) and amphipod swimming
17:30	10892	0.6	11°20.098'N, 142°12.691'E, head 89°
17:35	10891	0.7	11°20.098'N, 142°12.729'E, head 89°
17:41	10891	0.4	11°20.097'N, 142°12.766'E, head 88°
17:44	10891	0.5	Dead shell from the shallow zone?
17:45	10891	0.4	11°20.101'N, 142°12.801'E, head 88°
17:47	10892	0.4	Cnidarian (like lope)
17:49	10892	0.4	Polychaete swimming
17:50	10892	0.4	11°20.096'N, 142°12.809'E, head 88°
17:55	10892	0.4	11°20.098'N, 142°12.840'E, head 89°
17:58	10892	0.5	Round black stone?
17:59	10892	0.4	Almost similar scenery as before
18:00	10892	0.3	11°20.093'N, 142°12.850'E, head 89°, transect finished.

Time	Depth (m)	Vehicle Altitude(m)	Description
			18-October 2002
7:55	10765	0.5	Bottom in sight (11°20.091'N, 142°11.897'E)
7:59	10890	0.5	Starting transect (11°20.095'N, 142°11.893'E)
8:05	10890	0.5	Polychaete, radiolarians, holothrians (11°20.106'N, 142°11.917'E)
8:10	10890	0.5	Polychaete tubes (11°20.115'N, 142°11.935'E)
8:15	10890	0.8(0.5)	(11°20.116'N, 142°11.945'E)
8:20	10890	0.6(0.5)	(11°20.123'N, 142°11.965'E)
8:25	10890	0.7(0.5)	Holothurians (11°20.125'N, 142°11.987'E); direction 81°
8:30	10890	0.6(0.5)	(11°20.129'N, 142°12.'004E); direction 80°
8:35	10889	0.8(0.5)	(11°20.130'N, 142°12.025'E) ; direction 80°
8:40	10888	0.5	Holothurians (11°20.133'N, 142°12.'042E) ; direction 80°
8:45	10889	0.5	Holothurians, swimming amphipods, swimming polychaetes (11°20.133'N, 142°12.060'E) ; direction 78°
8:50	10889	0.4	Position ? (11°20.123'N, 142°12.101'E); direction 78°
8:55	10890	0.5	(11°20.166'N, 142°12.109'E) ; direction 78°
9:00	10890	0.5	(11°20.166'N, 142°12.125'E) ; direction 81°
9:05	10890	0.5	Swimming holothurian's shadow (11°20.171'N, 142°12.144'E) ; direction 79°
9:10	10890	0.5	(11°20.175'N, 142°11.161'E) ; direction 80°
9:15	10890	0.5	Wood (11°20.174'N, 142°11.177'E) ; direction79 °
9:20	10889	0.4	(11°20.179'N, 142°11.195'E) ; direction 81°
9:25	10889	0.5	Stopping transect (11°20.176'N, 142°11.214'E) ; direction 80°
9:32	10888	0.5	Turning to NW (direction320 °)
9:35	10888	0.5	Landing on the bottom (11°20.191'N, 142°13.230'E) ; direction 336°
9:39	10888	0.0	Red-top 7 cm diameter core collected (11°20.193'N, 142°13.228'E); direction 335°
9:47	10888	0.0	Red-top core placed in quiver
10:03	10888	0.0	Yellow-top 7 cm diameter core collected (11°20.225'N, 142°13.174'E); direction 335° (taken over possible polychaete tube)
10:04	10888	0.0	Yellow-top core placed in quiver
10:04	10888	0.0	Waiting for ship to catch up with launcher
10:38	10888	0.5	Resume transect (11°20.260'N, 142°13.226'E); direction 320°
10:45	10889	0.5	(11°20.277'N, 142°13.224'E) ; direction 320°
10:50	10890	0.5	(11°20.290'N, 142°13.216'E) ; direction 320°
10:55	10890	0.5	(11°20.306'N, 142°13.211'E) ; direction 300°
11:00	10890	0.5	(11°20.309'N, 142°13.210'E) ; direction 300°

Time	Depth (m)	Vehicle Altitude(m)	Description
11:10	10891	0.5	(11°20.325'N, 142°13.183'E) ; direction 300°
11:15	10891	0.4	(11°20.340'N, 142°13.182'E) ; direction 301°
11:20	10892	0.5	Position? (11°20.330'N, 142°13.206'E) ; direction 300°; photo No.600
11:25	10893	0.5	(11°20.357'N, 142°13.165'E) ; direction 299°
11:30	10893	0.5	(11°20.390'N, 142°13.154'E) ; direction 300°
11:35	10893	0.5	(11°20.383'N, 142°13.150'E) ; direction 299°
11:40	10893	0.5	(11°20.394'N, 142°13.142'E) ; direction 299°
11:45	10894	0.5	(11°20.402'N, 142°13.134'E) ; direction 300°
11:50	10894	0.5	(11°20.417'N, 142°13.125'E) ; direction 300°
11:55	10894	0.5	(11°20.430'N, 142°13.121'E) ; direction 301°
12:00	10893	0.5	(11°20.444'N, 142°13.106'E) ; direction 300°
12:05	10895	0.5	(11°20.455'N, 142°13.089'E) ; direction 300°
12:10	10896	0.5	(11°20.468'N, 142°13.083'E) ; direction 300°
12:15	10896	0.5	(11°20.478'N, 142°13.074'E) ; direction 300°
12:20	10896	0.5	(11°20.494'N, 142°13.063'E) ; direction 299°
12:25	10897	0.4	(11°20.509'N, 142°13.049'E) ; direction 301°
12:30	10896	0.5	(11°20.519'N, 142°13.042'E) ; direction 300°
12:35	10896	0.5	(11°20.536'N, 142°13.030'E) ; direction 300°
12:40	10895	0.5	(11°20.549'N, 142°13.019'E) ; direction 299°
12:45	10895	0.5	Mound or unusual mud swelling (11°20.558'N, 142°13.012'E) ; direction 300°
12:48	10895	0.5	White paper?
12:50	10894	0.5	(11°20.567'N, 142°13.001'E) ; direction 299°; Kim said "young young ill"
12:55	10893	0.5	(11°20.586'N, 142°12.990'E) ; direction 299°
13:00	10890	0.5	(11°20.592'N, 142°12.973'E) ; direction 300°
13:01	10889	0.5	Left the bottom (11°20.592'N, 142°13.973'E)

III. Still Image Log (17-October 2002)

Time	Frame	Comments
13:03	151	Transecting, Holothurian, polychaete
13:09	152	Polychaete on bottom
13:13	153	Transecting, Holothurian, polychaete
13:18	154	Radiolarian clump field
13:26	155	Radiolarian clump field
13:33	156	ZOOM transect started
13:34	157	Transecting
13:35	158	

Time	Frame	Comments
13:37	160	
13:38	161	
13:39	162	
13:40	163	
13:41	164	
13:42	165	
13:43	170	
13:44	171	
13:45	172	
13:46	173	
13:47	174	
13:48	175	
13:49	176	
13:50	177	
13:51	178	
13:52	179	
13:53	180	
13:54	181	Lots of polychaetes, radiolarian clumps, tubes
13:55	182	
13:56	183	
13:57	184	
13:58	185	
13:59	186	
14:00	187	
14:01	188	
14:01	189	
14:02	190	Line traces
14:03	191	
14:04	192	
14:05	193	
14:06	194	
14:07	195	
14:08	196	
14:09	197	
14:10	198	
14:11	199	Line traces
14:12	200	
14:13	201	
14:14	202	
14:15	203	
14:16	204	
14:17	205	
14:18	206	
14:19	207	
14:20	208	
14:21	209	

Time	Frame	Comments
14:23	211	
14:24	212	
14:25	213	
14:26	214	
14:27	215	
14:28	216	
14:29	217	
14:30	218	
14:31	219	
14:32	220	
14:33	221	
14:34	222	
14:35	223	
14:36	224	Line traces
14:37	225	
14:38	226	
14:39	227	
14:40	228	
14:41	229	
14:42	230	Holo crawling
14:43	231	Echiuran?
14:45	232	
14:46	233	Sea pen?
14:47	234	
14:48	235	
14:49	236	
14:50	237	Polychaete
14:51	238	
14:52	239	
14:53	240	
14:54	241	
14:55	242	
14:56	243	
14:57	244	Echiurans?
14:57	245	
14:58	246	
14:59	247	
15:00	248	
15:01	249	
15:02	250	
15:03	251	
15:04	252	
15:05	253	
15:06	254	
15:07	255	
15:08	256	

Time	Frame	Comments
15:10	258	
15:11	259	
15:12	260	tube
15:12	261	
15:13	262	
15:14	263	
15:15	264	
15:16	265	
15:17	266	
15:18	267	
15:19	268	
15:20	269	
15:21	270	
15:22	271	
15:23	272	
15:24	273	
15:25	274	
15:27	275	Hydroid?
15:28	276	
15:29	277	
15:30	278	
15:31	279	
15:32	280	
15:33	281	
15:34	282	
15:35	283	Board? On seafloor (not visible in zoom)
15:36	284	
15:38	285	
15:40	286	
15:41	287	
15:42	288	
15:44	289	
15:46	290	
15:46	291	Echiuran, big black?
15:48	292	
15:50	293	
15:52	294	Trace
15:53	295	Big black object
15:55	296	
15:56	297	
15:58	298	
16:00	299	
16:02	300	
16:02	301	Sea lily? Or hydroid? Lower left
16:04	302	Sea pen / poly tube
16:06	303	

Time	Frame	Comments
16:10	305	
16:12	306	
16:14	307	
16:16	308	
16:18	309	
16:20	310	
16:22	311	
16:24	312	
16:25		Amphipod
16:26	313	
16:28	314	
16:30	315	
16:32	316	
16:34	317	
16:36	318	
16:38	319	
16:40	320	
16:42	321	
16:44	322	
16:46	323	
16:48	324	
16:50	325	
16:52	326	
16:54	327	
16:56	328	
16:58	329	
17:00	330	
17:02	331	
17:04	332	
17:06	333	
17:08	334	
17:10	335	
17:12	336	
17:14	337	
17:16	338	
17:18	339	
17:20	340	
17:22	341	
17:24	342	
17:26	343	
17:28	344	
17:30	345	
17:32	346	
17:34	347	
17:36	348	
17:38	349	

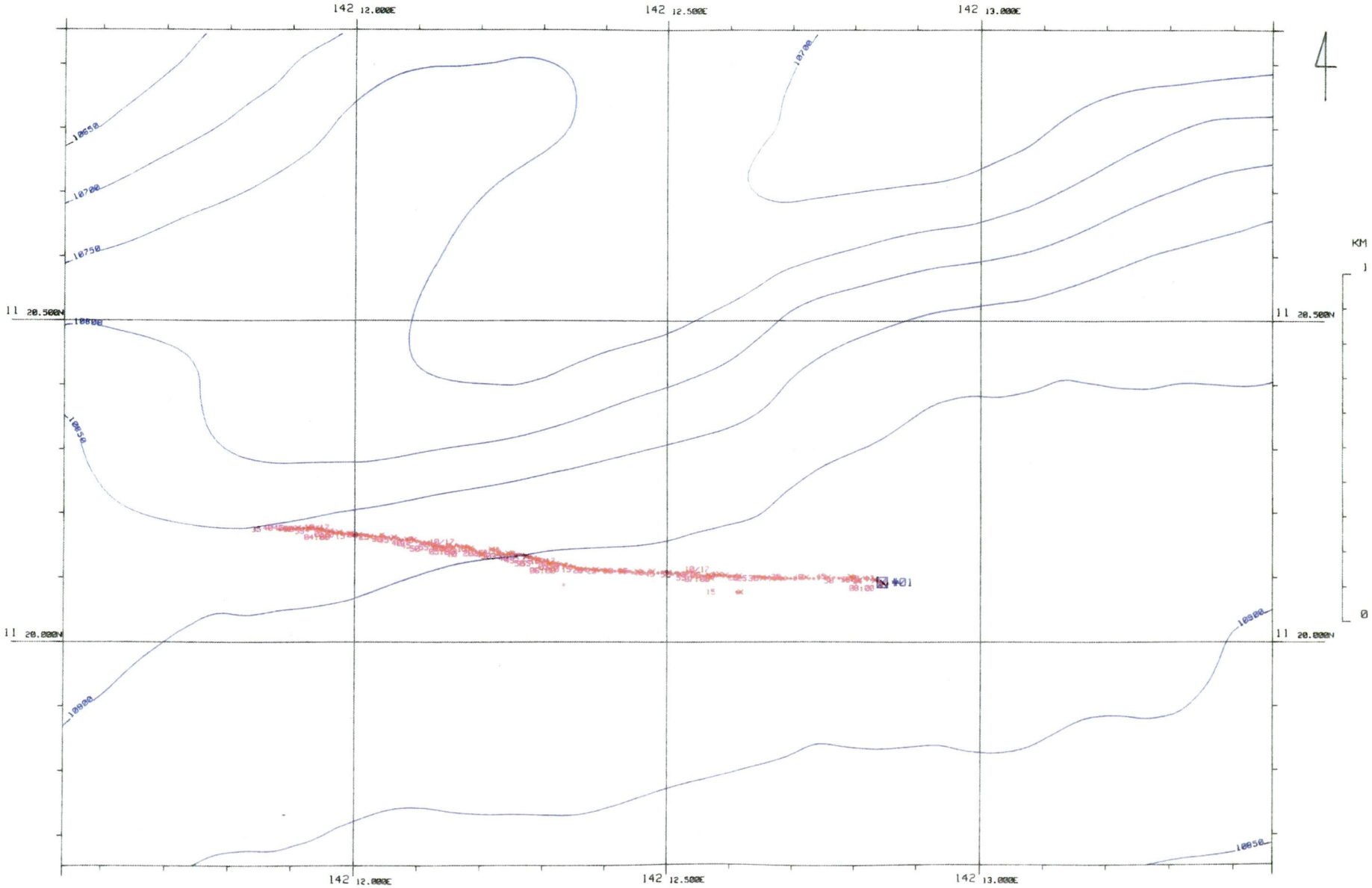
Time	Frame	Comments
17:42	351	
17:44	352	
17:46	353	
17:48	354	
17:50	355	
17:52	356	
17:54	357	
17:56	358	
17:58	359	
18:00	360	End of transect

KR02-13 Mariana Trench

Dive 272

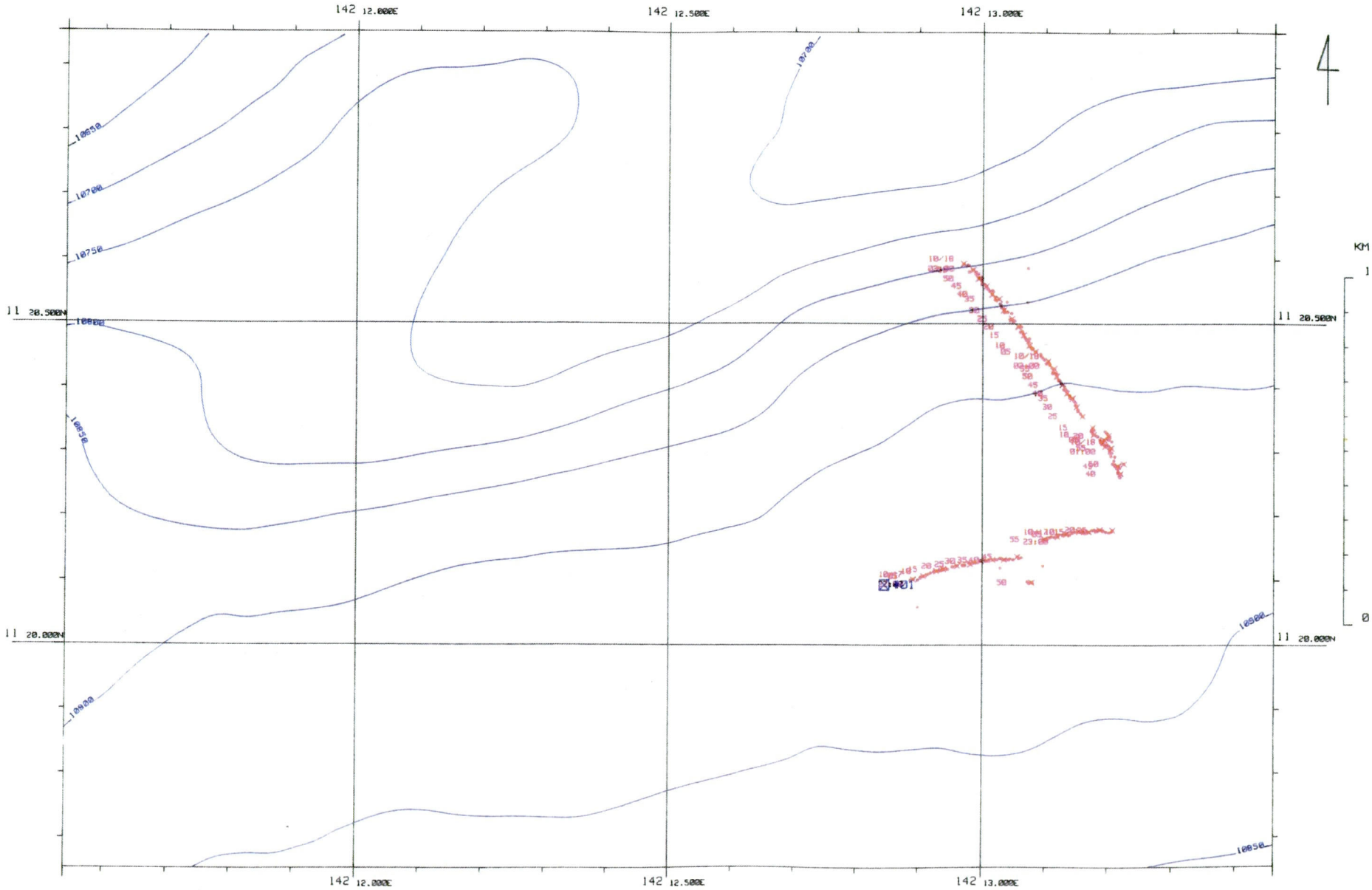
Date 2002/10/18

Scale (1/ 10000)



KR02-13 Mariana Trench
Dive 272

Date 2002/10/18
Scale (1/ 10000)



4

(2) *Kaiko* dive #273

Date: 20 October 2002
Site: Western depression, Challenger Deep
Landing (Lat., Long., Time, Depth): 11°20.184'N, 142°11.756'E, 11:24, 10894m
Leaving (Lat., Long., Time, Depth): 11°20.184'N, 142°11.756'E, 12:45, 10894m
(same as the landing point)

Purpose: Recovering and deploying baited traps, biological sampling using suction sampler, collection of bottom sediment and water samples, observation of hadal benthos in the Challenger Deep

Payload equipment: a baited trap, a suction sampler, three MBARI-type core samplers, water sampler (Niskin-type)

Video highlights:

(1) 11:22:35 ~ 11:25:25	Close-up of a baited trap deployed during dive #272
(2) 11:33:35 ~ 11:37:05	Sampling a polychaete (?) tube by a suction sampler
(3) 11:53:30 ~ 11:57:15	Sampling a polychaete (?) tube with a MBARI-type core sampler
(4) 12:08:20 ~ 12:09:15	Sampling fine aggregates by suction sampler
(5) 12:29:50 ~ 12:30:50	Sampling polychaetes by suction sampler

Cooperative Scientists:

Name	Affiliation	Specialty
Onboard scientists of KR02-13	JAMSTEC, Miyazaki University, Chiba University, Nagasaki University, ORI-University of Tokyo, MBARI, KORDI	Biology

Key words: ROV '*Kaiko*', Challenger Deep, suction sampler, baited trap,

I. Dive summary

Dive#273 was carried out at the Challenger Deep known as the deepest point in the world to collect and observe benthic organisms.

(1) The baited trap deployed during the dive 272 was recovered. Although many amphipods and other small crustaceans (copepods ?) were observed in the baited trap before recovery, most of them were lost during recovery of Kaiko. Besides planktonic copepods, nine lycianasiid amphipods were collected.
(2) Single water sample and two sediment core samples were obtained.
(3) Four polynoiid polycaetes, one polychaete's (?) tube and some copepods were sampled by suction sampler.
(4) Unfortunately, this dive was finished earlier than planned due to cable trouble of the Kaiko system. Two hundred and fifty-six photographs were taken.

II. Video Log

Time	Depth (m)	Vehicle Altitude (m)	Description
7:55	0		Surfaced
8:07	150		Started descending
10:54	10763	132	Stopped descending
10:57	10761	135	Vehicle was released from the launcher
11:05	10887	5	Bottom in sight, 108m from homer (left side)
11:09	10887	4.5	Water sampling (11°20.236'N, 142°11.811'E)
11:09	10887	4.5	Toward the homer
11:12	10890	2.4	Respirometer system in sight
11:15	10892	1.4	The baited trap deployed during the last dive was observed, many amphipods and small crustaceans (copepods?) were seen in the trap
11:17	10894	0.0	Landed on fine mud bottom (11°20.184'N, 142°11.756'E)
11:22	10894	0.0	Close-up of the baited trap
11:24	10894	0.0	Checked two cores of respirometer system
11:28	10894	0.0	Vehicle moved slightly and check the remaining core
11:30	10894	0.0	Set a new baited trap (11°20.187'N, 142°11.761'E)
11:36	10894	0.0	Sampled a polychaete (?) tube by suction sampler (cannister #1)
11:41	10894	0.0	Sampled amphipods by suction sampler (cannister #1)
11:43	10894	0.0	Off bottom and slightly moved

Time	Depth (m)	Vehicle Altitude (m)	Description
11:47	10894	0.0	Landing
11:57	10894	0.0	Sampling a polychaete (?) tube by a MBARI core (green)
12:02	10894	0.0	Tryed to release yellow core tube
12:05	10894	0.0	Gave up on yellow core tube
12:06	10894	0.0	Suction sampling of radiolarians, cannister #2
12:10	10894	0.0	Suction sampling of polychaete, cannister #3
12:11	10894	0.0	Suction sampling of a tube of polychaete (?)
12:13	10894	0.0	Suction sampling of another tube polychaete
12:16	10893	0.5	Off bottom and moved west
12:17	10894	0.0	Landing
12:19	10894	0.0	Sampling a holothurian by suction sampler (cannister #4) (11°20.215'N, 142°11.770'E)
12:21	10894	0.0	Sampling fine aggregates by suction sampler (cannister #5)
12:26	10893	0.2	Off bottom and moved west
12:28	10893	0.0	Landing on bottom
12:30	10893	0.0	Sampling 7 polychaetes and 2 holothurians by suction sampler (cannister #5) (11°20.213'N, 142°11.772'E)
12:37	10893	0.0	Finished sampling
12:38	10894	1.0	Off bottom, return to baited trap site
12:40	10894	0.0	Landing in front of the baited trap deployed during the last dive
12:41	10894	0.0	The baited trap was recovered
12:45	10894	0.0	Left bottom
12:46	10886	4.8	The baited trap released from the vehicle accidentally
12:48	10893	0.0	The baited trap was recovered again

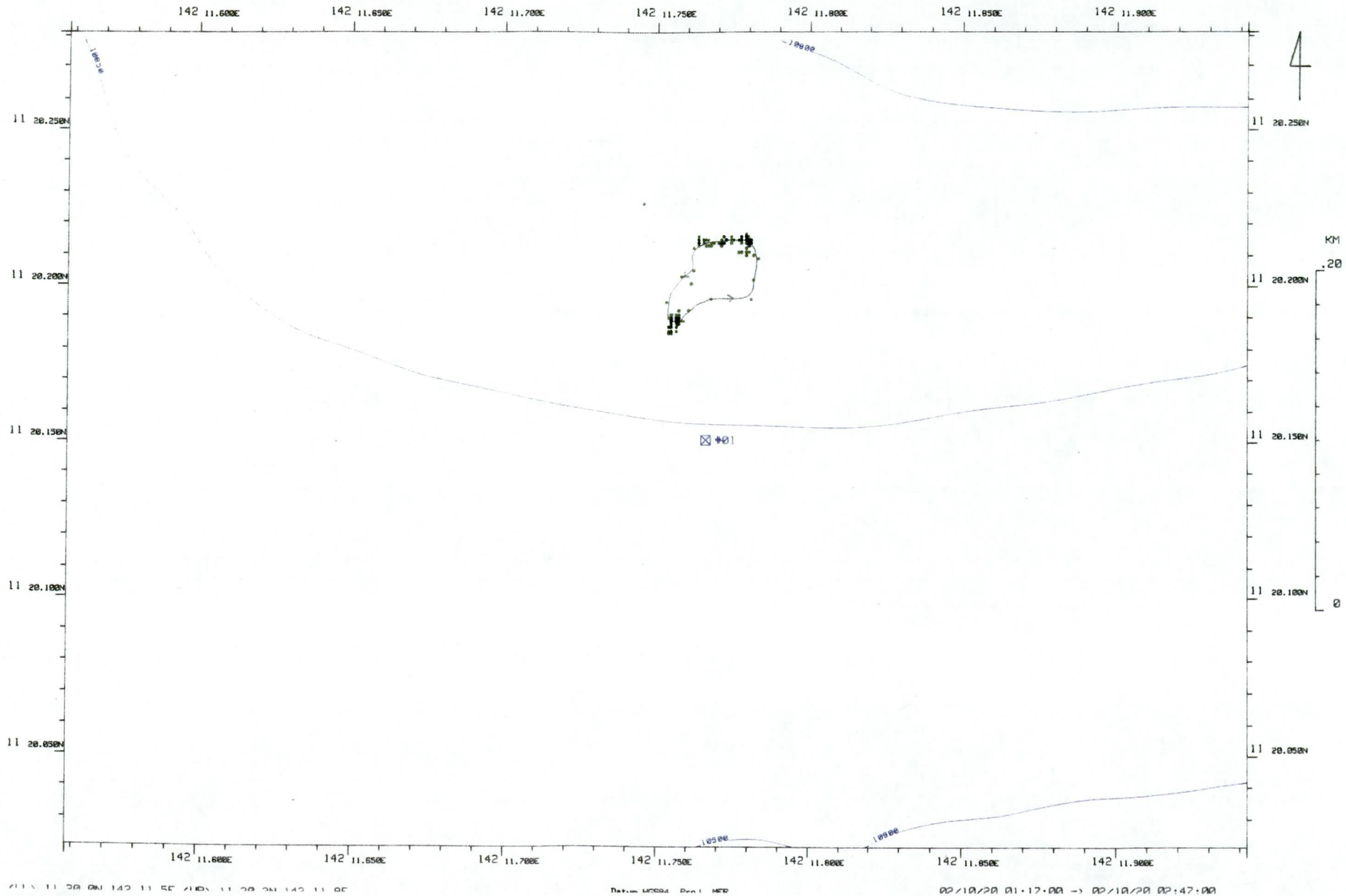
Shigeaki Kojima (ORI, University of Tokyo) & Kurt Buck (MBARI)

KR02-13 Mariana Trench

Dive 273

Date 2002/10/20

Scale (1/ 2000)



02/10/20 01:12:00 -> 02/10/20 02:47:00

(3) *Kaiko* dive #274

Date: 22 October 2002

Site: Western depression, Challenger Deep

Landing: 11°20.114'N, 142°11.785'E, 11:00, 10890m

Leaving: 11°20.100'N, 142°13.780'E, 13:01, 10892m

Purpose: 1) to collect water sample by a Niskin bottle 2) to deploy a baited trap 3) to observe hadal organisms 4) to collect hadal organisms by a suction sampler 5) to collect sediment samples by MBARI type core samplers 6) to recover a baited trap

Payload equipment: a suction sampler with large canister, a baited trap, three MBARI type core samplesr, a Niskin water sampler, CTD DO profiler (SeaBird SBE-19, on the launcher)

Video highlights:

(1) 11:07:00 ~ 11:20:00	Observing a colony of polychaetes on a corrugated cardboard and sampling by core samplers and suction sampler
(2) 11:30:30 ~ 11:35:00	Observing baited trap deployed during the *Kaiko* dive #272 (17th October)
(3) 13:09:00 ~ 13:13:00	Observing benthic respirometer system

Cooperative Scientists:

Name	Affiliation	Specialty
Onboard scientists of KR02-13	JAMSTEC, Miyazaki University, Chiba University, Nagasaki University, ORI-University of Tokyo, MBARI KORDI	Biology Molecular biology Geophysics

Key words: ROV "*Kaiko*", Challenger Deep, baited trap, holothurians, amphipods, polynoid polychaetes, MBARI type core sampler, suction sampler

I. Dive summary

The "*Kaiko*" dive #274 was conducted at the western depression of the Challenger Deep (11°20.11'N, 142°11.78'E, 10893m). The objectives were as follows;

(1) Collect Niskin Water sample for oxygen measurements by Winkler titration. The Niskin bottle was activated 3.2 m above the bottom The niskin bottle was activated 3.2 m above the bottom as the *Kaiko* vehicle first arrived near the seafloor.

(2) Collect CTD measurements using Seabird CTD mounted on Kaiko launcher. A Seabird CTD was mounted on the Kaiko launcher and collected data throughout dive #274.

(3) Collect sediment cores (3) for meiofaunal, macrofaunal, and other analyses. Two MBARI-type push cores were used to collect sediment. One core was used for meiofaunal studies. Core 2 was inserted into the sediment over a suspected polychaete worm, to be examined for taxonomic purposes.

(4) Collect macrofaunal organisms using a suction sampler with a 5-chamber carousel. These animals will be used for taxonomic studies. Several animals, including polychaetes, holothurians, foraminifera, and suspected xenophaeophores, were collected during the dive. A summary of these collections is presented below.

(5) Inspect the operation of the benthic respiration system (BRS), deployed during the *Kaiko* Dive #272. The BRS was observed when the *Kaiko* arrived at the seafloor. One chamber was observed and its stirring bar was operating properly.

(6) Collect a baited trap deployed during the *Kaiko* Dive # 273. Poor visibility due to suspended sediment near the baited trap prevented recovery of this trap during dive #274. It will be recovered during dive #275.

(7) Deploy a baited trap for collection of scavenger species, principally the lysianassid amphipod (?). This trap was deployed adjacent to the BRS at the end of the dive.

(8) Observation of hadal organisms

During the dive we observed holothurians (the dominant megafaunal organism), white polychaetes, amphipods, tubes (sabellid or other polychaete), and aggregations of material that probably contain radioloarian tests. Some xenophyophores may also be present. Occasional paired linear bio-traces were observed. Still photographs of the seafloor were taken (Number 1 – 401).

II. Video Log

Time	Depth (m)	Vehicle Altitude (m)	Description
07:47			Launched ROV
10:50	10763		Released vehicle from launcher, (11° 20.114' N, 142° 11.785' E)
10:59	10890		Near bottom
11:00	10890	3.2	Water sampler tripped, (11° 20.114' N, 142° 11.785' E)
11:03	10889		Flying to Respirometer (~44 m away)
11:05	10892	0	Unknown object on seafloor - debris fall? It looks like a cover of hairy tubes (xenophaeophores?) Tried to core over it, but it looks like there is a cloth or paper underneath - no core. We'll try to suction some of it., (11° 20.157' N, 142° 11.751' E)
11:14	10892	0	Using core (green top) to core about 1 m from patch, (11° 20.157' N, 142° 11.751' E)
11:19	10892	0	Suctioning material from mat - also sucking some organic debris (rag?) Chamber 1, (11° 20.157' N, 142° 11.751' E)
11:25		0	getting ready to continue toward respiration system
11:29		0	BRS in sight
11:33	10894	0	Arrive at BRS site, (11° 20.135' N, 142° 11.771' E)
11:34	10894	0	Observing baited trap. About 50 amphipods swimming inside. There doesn't appear to be as many in or around the trap as were observed for baited trap #1, (11° 20.133' N, 142° 11.774' E)
11:39	10894	0	Searching for animals to collect - stopping near holothurians and worm tubes
	10894	0	Rotated to chamber 2
11:43			Searching for animals to collect - we have a core (red top) and the suction sampler ready., (11° 20.136' N, 142° 11.789' E)

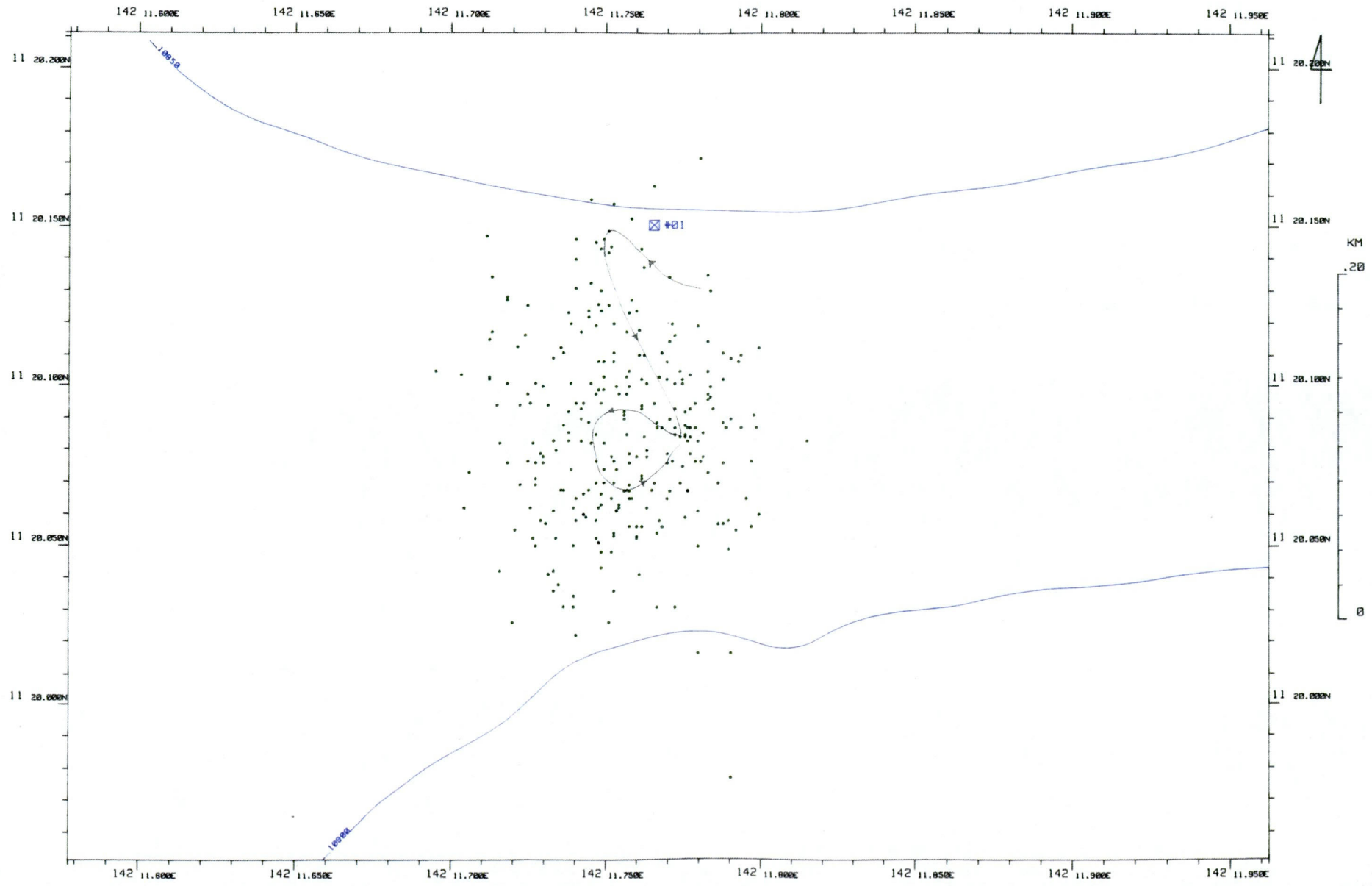
Time	Depth (m)	Vehicle Altitude (m)	Description
11:52	10894	0	Worm tube observed - looks like it has something on the end. We're trying to core over it with the red topped core. - We got it - looks great. Anoxic layer at bottom of core visible, (11° 20.102' N, 142° 11.738' E)
11:55	10894	0	Positioning robotic arm to use suction sampler for collections
11:57	10894	0	Traces visible on seafloor - are they manmade - probably not.
12:00	10894	0	Continuing to search for animals to collect. Waiting for dust to clear
12:08	10894	0	White objects (foraminiferans) seen in front of basket - trying to suction into Chamber 2, (11° 20.116' N, 142° 11.741' E)
12:12			Too cloudy - we are moving to clear area for more searching
12:18	10893	0	Landed near Holothurian - suctioning, also polychaete into chamber 2
12:23			Cloudy - moving a bit to new location.
12:26	10893	0	Suctioning polychaete, xenophaeophore (or whatever it is)
12:28			Moving out of cloud - cloud may come from suction sampler exhaust pipe.
12:30	10893	0	Waiting for dust cloud to clear
12:33			Moved to new location out of cloud
12:34	10893	0	Suctioning tubeworm and some xenophaeophore? material into Chamber 3, (11° 20.59' N, 142° 11.732' E)
12:38	10893	0	Now trying to collect another 2 polychaetes into chamber 4
12:42	10893	0	Observed tubeworm nearby - there is a shallow circular depression around the tube, which is bent over nearly touching the ground. The tubeworm is probably feeding on the bottom. We collected this tubeworm into chamber 4
12:44	10893	0	Collected holothurian into chamber 4
12:46	10893	0	Collecting holothurian into chamber 5 - one more (2 total?)
12:50	10893	0	Traces visible on seafloor – parallel
12:52			Returning to BRS site to collect baited trap and deploy another
12:57	10892	0	Landing at BRS location - we flew over it, and have now landed at the site - it is very cloudy and we can't see the system or trap yet - waiting for dust to clear
13:02	10892	0	Still cloudy - we are moving a bit - toward BRS?
13:05	10892	0	Sitting on bottom - very cloudy - no visibility
13:08	10892	0	Visibility improving somewhat.

Time	Depth (m)	Vehicle Altitude (m)	Description
13:11	10892	0	BRS is visible directly to the right of the vehicle on the bottom. Still too cloudy to see chambers clearly. Kurt saw that at least one chamber was stirring, though slowly, when we first arrived on the bottom today
13:15	10892	0	Still waiting for cloud to clear
13:21	10892	0	Very frustrating - still too cloudy to operate. Chambers are only 1 m away, but we cannot see them clearly.
13:26	10892	0	Still too cloudy – waiting
13:27	10892	0	Deploying baited trap - will then leave the bottom for the surface
13:28	10892	0	Trap deployed
13:29	10892	0	Leaving the bottom for the surface, (11° 20.100' N, 142° 11.780' E)
13:29			Film counter is 401
13:37	10763		Vehicle arrives at launcher for ascent

II. Suction Sampler Collection Summary

Suction Sampler	Chambers (and number collected)				
Organism	1	2	3	4	5
Foraminifera? (white)		2			
Polychaete? Tube			1	1	
Polychaete (Hessionidae)				2	
Holothurian (Peniogone?)				1	2
Xenophaeophore-like Material	some		some		

Jun Hashimoto (Nagasaki University) & James Barry (MBARI)


KR02-13 Mariana Trench
Dive 274
Date 2002/10/22
Scale (1/ 2000)
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142 11.650E
142 11.700E
142 11.750E
142 11.800E
142 11.850E
142 11.900E
142 11.950E
11 20.200N
11 20.150N
11 20.100N
11 20.050N
11 20.000N
-1000
-1000
#01
KM
.20
0

(4) *Kaiko* dive #275

Date: 23 October 2002

Site: Western depression, Challenger Deep

Landing: 11°20.098'N, 142°11.840'E, 11:13 , 10897m

Leaving: 11°20.100'N, 142°13.780'E, 13:22, 10894m

Purpose: 1) recovery the *in situ* benthic respiration system, 2) deploy a baited trap with ROV homing pinger, 3) collect sediment cores, 4) collect sterile sediment cores, 5) sample bottom water, 6) observe hadal benthos in the Challenger Deep

Payload equipment: a baited trap, a ROV homing pinger, six MBARI-type core samplers, two sterile core samplers, Niskin water sampler

Video highlights:

(1) 11:08:00	Water sampling (Niskin bottle)
(2) 11:13:00	Coconut collecting and placing in basket
(3) 11:14:00 ~ 11:18:00	Placing navigation beacon and deploying baited trap
(4) 11:21:00 ~ 11:23:00	Sediment sampling used by microbiological corer
(5) 11:26:00 ~ 12:02:00	Sediment and beenthic macro organism sampling used by MBARI push corer
(6) 12:22:00 ~ 12:35:00	Recovering of baited trap
(7) 12:35:00 ~ 13:14:00	Recovering of BRS system

Cooperative Scientists:

Name	Affiliation	Specialty
Onboard scientists of KR02-13	JAMSTEC, Miyazaki University, Chiba University, Nagasaki University, ORI-University of Tokyo, MBARI, KORDI	Biology Molecular biology

Key words: ROV "*Kaiko*", Challenger Deep, *in situ* benthic respiration system, baited trap, deep-sea trench

I. Dive summary

Dive #275 was a continuation of the dive series by *Kaiko / Kairei* KR02-13 in the western basin of the Challenger Deep (11°20.148'N, 142°11.774'E, 10893m).

Objectives

(1) Collect Niskin Water sample for oxygen measurements by Winkler titration

The Niskin bottle was activated 1.0 m above the bottom as the Kaiko vehicle first arrived near the seafloor.

(2) Collect sediment cores for meiofaunal, macrofaunal, and other analyses.

Six MBARI-type push cores were used to collect sediment. Three cores were used for meiofaunal studies (Kim). One core was collected for foraminiferal studies (Hashimoto). One core was collected over a holothurian for taxonomic studies (Hashimoto). One core was collected over a suspected tube-worm, to be used for taxonomy (Barry).

(3) Two sterile microbiological samples were taken for studies of barophilic microbes. The first functioned very well. The collection tube from the second microbiological sampler dislodged and was lost during coring. Nevertheless, a mud sample was collected with this corer..

(4) The benthic respiration system (BRS), deployed during *Kaiko* Dive #272, was recovered during dive #275. Three respiration chambers were removed from the seafloor and inserted into quivers on the BRS frame, secured, and the entire system was attached to a recovery line for ascent to the surface beneath Kaiko.

(5) Collect two baited traps deployed during *Kaiko* Dive # 273 and #274. These traps were located near the BRS, attached to the Kaiko, containing many hadal amphipods, and returned to the surface.

(6) Deploy a baited trap for collection of scavenger species. A baited trap was deployed, along with a homer pro navigation beacon for relocating the system during Kaiko dive #276.

(7) Observation of hadal organisms

During the dive we observed holothurians (the dominant megafaunal organism), white polychaetes, amphipods, tubes (sabellid or other polychaete), and aggregations of material that probably contain radioloarian tests. Some xenophyophores may also be present. Occasional paired linear bio-traces were observed. Still photographs of the seafloor were taken (Number 1 – 602).

II. Video Log

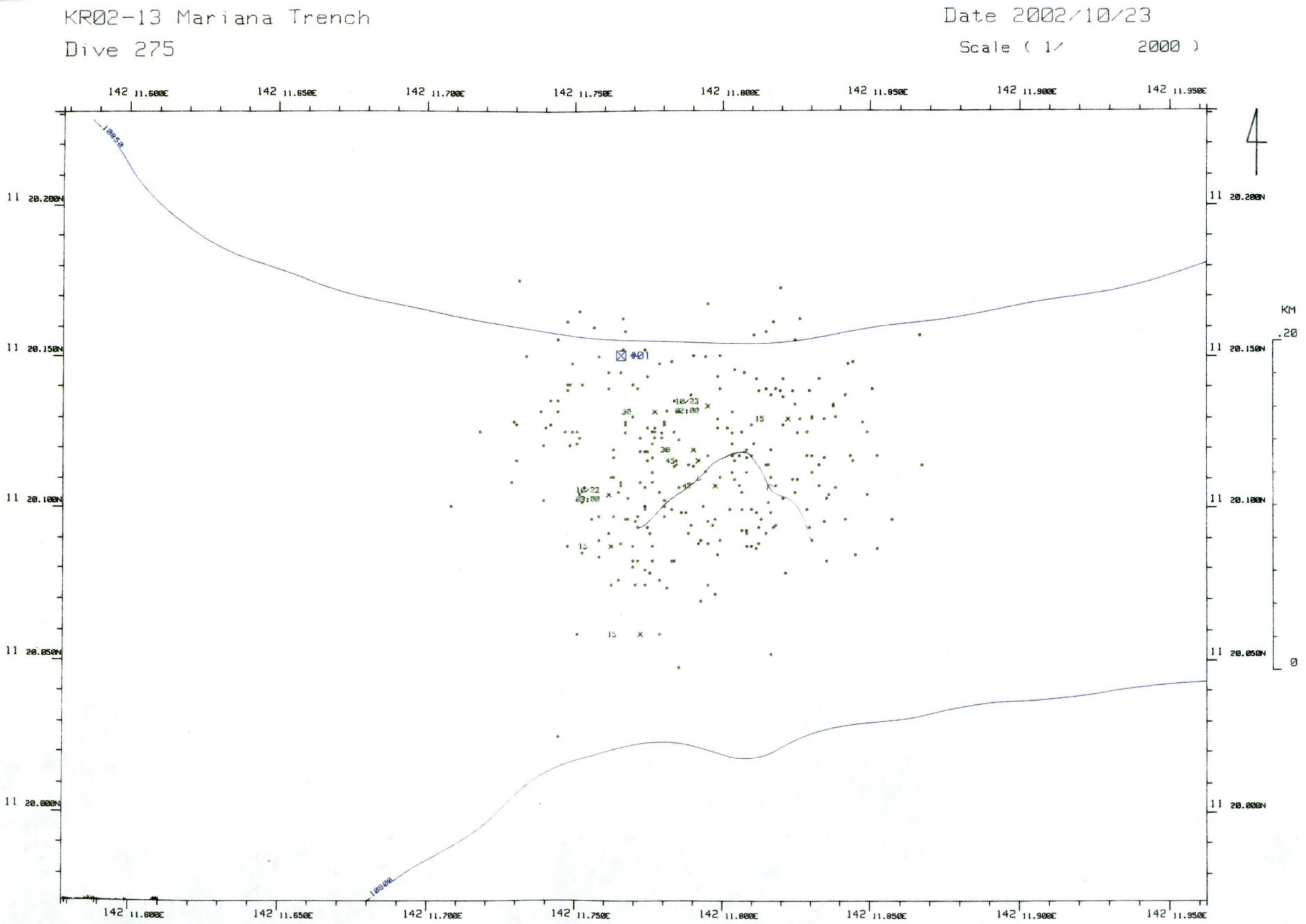
Time	Depth (m)	Vehicle Altitude (m)	Description
7:53			On surface
8:05	150		Beginning descent
10:54	10771		Stopped descent for release of vehicle
11:02	10765		Vehicle released from launcher
11:02	10888	5.6	Descending
11:06	10895	1.7	Approaching bottom
11:08	10896	1.1	Water sampler (Niskin bottle) tripped
11:10	10897	0	Coconut observed on seafloor , (11 20.098 N, 142 11.840 E)
11:13			Coconut collected and placed in basket (120 m from BRS), (11 20.098 N, 142 11.840 E)
11:14			Placing Navigation beacon (#12) on seafloor (same location as coconut), (11 20.098 N, 142 11.840 E)
11:18			Deployed Baited trap next to navigation beacon, (11 20.098 N, 142 11.840 E)
11:20	10896	0	Moving toward BRS., (11 20.098 N, 142 11.840 E)
11:21	10896		Microbiological core collected (yellow top) (Kato - JAMSTEC), (11 20.098 N, 142 11.840 E)
11:23			Collecting second microbiological sample (green top) - although core sample holder fell off device, some mud was collected., (11 20.098 N, 142 11.840 E)
11:26	10897	0	Sediment core collected with Green top MBARI-type core for foraminifera (Hashimoto), (11 20.098 N, 142 11.840 E)
11:29	10895	1	Moving toward BRS.
11:30	10896	0	Landing ~10 m from last site, for meiofaunal core collections, (11 20.093 N, 142 11.803 E)

Time	Depth (m)	Vehicle Altitude (m)	Description
11:31	10896	0	MBARI - white taped core collected for meiofauna - taken over radiolarian / xenophaeophore patch - good core (Kim-san), (11 20.093 N, 142 11.803 E)
11:35	10896	0	MBARI - red taped core collected for meiofauna - taken over relatively barren seafloor location - good core (Kim-san), (11 20.093 N, 142 11.803 E)
11:41	10896	0	MBARI - yellow taped core collected for meiofauna - taken over relatively barren seafloor location - good core (Kim-san), (11 20.093 N, 142 11.803 E)
11:42	10896	0	Completed coring at this location, moving to search for tubeworms and holothurians, (11 20.093 N, 142 11.803 E)
11:47	10896	0	Stopped ~10 m away from last location for tubeworm collection using a sediment core. It appears to have some sort of "head" structure., (11 20.093 N, 142 11.803 E)
11:52	10896	0	Collected it using white tapped core with yellow handle - good core, but may have cut worm in 1/2, (11 20.093 N, 142 11.803 E)
11:52			Moving on to search for holothurian, which will be collected by MBARI core.
11:53			Stopped, waiting for cloud to clear for core collection, (11 20.120 N, 142 11.811 E)
12:02	10896	0	Cored over holothurian using blue-handled core, which is stored in its quiver at angle, (11 20.120 N, 142 11.811 E)
12:05			Moving to the BRS site for recovery of BRS and baited trap.
12:19			Landed near BRS and inspecting baited trap - lots of amphipods, various sizes., (11 20.100 N, 142 11.780 E)
12:22	10894	0	Attempting to insert sponges into baited trap mouth., using 2 robotic arms Very difficult, but completed in about 5 min., (11 20.100 N, 142 11.780 E)
12:35			Carrying baited trap to the BRS, (11 20.100 N, 142 11.780 E)
12:39	10894		Preparing to replace cores in quiver at BRS, (11 20.100 N, 142 11.780 E)
			Waiting for dust to clear, (11 20.100 N, 142 11.780 E)
12:43			Placing respiration chamber 1 in quiver., (11 20.100 N, 142 11.780 E)

Time	Depth (m)	Vehicle Altitude (m)	Description
12:44			Placing respiration chamber 2 in quiver., (11 20.100 N, 142 11.780 E)
12:45			Moving slightly for recovery of last BRS core, (11 20.100 N, 142 11.780 E)
12:47			Waiting for dust to clear, (11 20.100 N, 142 11.780 E)
12:50			Placing respiration chamber 3 in quiver., (11 20.100 N, 142 11.780 E)
12:56			Waiting for dust to clear, (11 20.100 N, 142 11.780 E)
13:02			Securing BRS system for recovery, (11 20.100 N, 142 11.780 E)
13:14			Attached recovery line to BRS after attaching each core to BRS frame, (11 20.100 N, 142 11.780 E)
13:16			Paying out recovery line from basket, (11 20.100 N, 142 11.780 E)
13:19			Moving to pick up baited traps, (11 20.100 N, 142 11.780 E)
13:22			Attached baited traps to ROV basket., (11 20.100 N, 142 11.780 E)
13:22			Left bottom for recovery of vehicle to launcher
13:36			Tether from vehicle to launcher is tangled in BRS recovery line.
13:44			Vehicle nearly reattached to launcher
13:50			Descending with Launcher and vehicle to seafloor to release tension on BRS recovery line.
14:00			Attempting to untangle the lines near the seafloor
14:05			Recovering vehicle to launcher to check tether.
14:09			Vehicle still tangled, but reattached to launcher.
14:10			Beginning ascent to surface
17:00			Kaiko on deck of Kairei

Film count for still camera is at 602 frames

Shinji Tsuchida (JAMSTEC), James Barry (MBARI) & Dongsung Kim (KORDI)


KR02-13 Mariana Trench
Dive 275
Date 2002/10/23
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142 11.750E
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142 11.950E
11 20.200N
11 20.150N
11 20.100N
11 20.050N
11 20.000N
#01
10/23 02:00
10/23 03:00
KM
20
0

(5) Kaiko dive #276

Date: 24 October 2002
Site: Western depression, Challenger Deep
Landing: 11°20.072'N, 142°11.909'E, 11:00, 10898m
Leaving: 11°20.150'N, 142°11.702'E, 13:25, 10896m

Purpose: 1) deploying a baited trap close to ROV homing pinger, 2) collect sediment cores, 3) observing and collecting hadal benthos in the Challenger Deep

Payload equipment: a baited trap, four MBARI-type core samplers, suction sampler with large canister

Video highlights:

(1) 11:34:00~11:35:00 Observing holothurian in core tube
(2) 13:18:00~13:21:00 Baited trap with large amphipods

Cooperative Scientists:

Name	Affiliation	Specialty
Onboard scientists of KR02-13	JAMSTEC, Miyazaki University, Chiba University, Nagasaki University, ORI-University of Tokyo, MBARI, KORDI	Biology Molecular biology

Key words: ROV "*Kaiko*", Challenger Deep, *in situ* benthic respiration system, baited trap, deep-sea trench

I. Dive summary

During this dive, 167 specimens of amphipods, 4 specimens of holothurians and 26 specimens of polynoid polychaetes were collected between depths of 10,894m and 10,898m. Four sediment samples with a holothurian were also collected for meiofaunal, macrofaunal, and other analyses.

Recovery of a baited trap deployed on 23rd October was successfully made just before ascending.

Fig. 1. Hadal amphipods collected by a baited trap.

II. Video Log

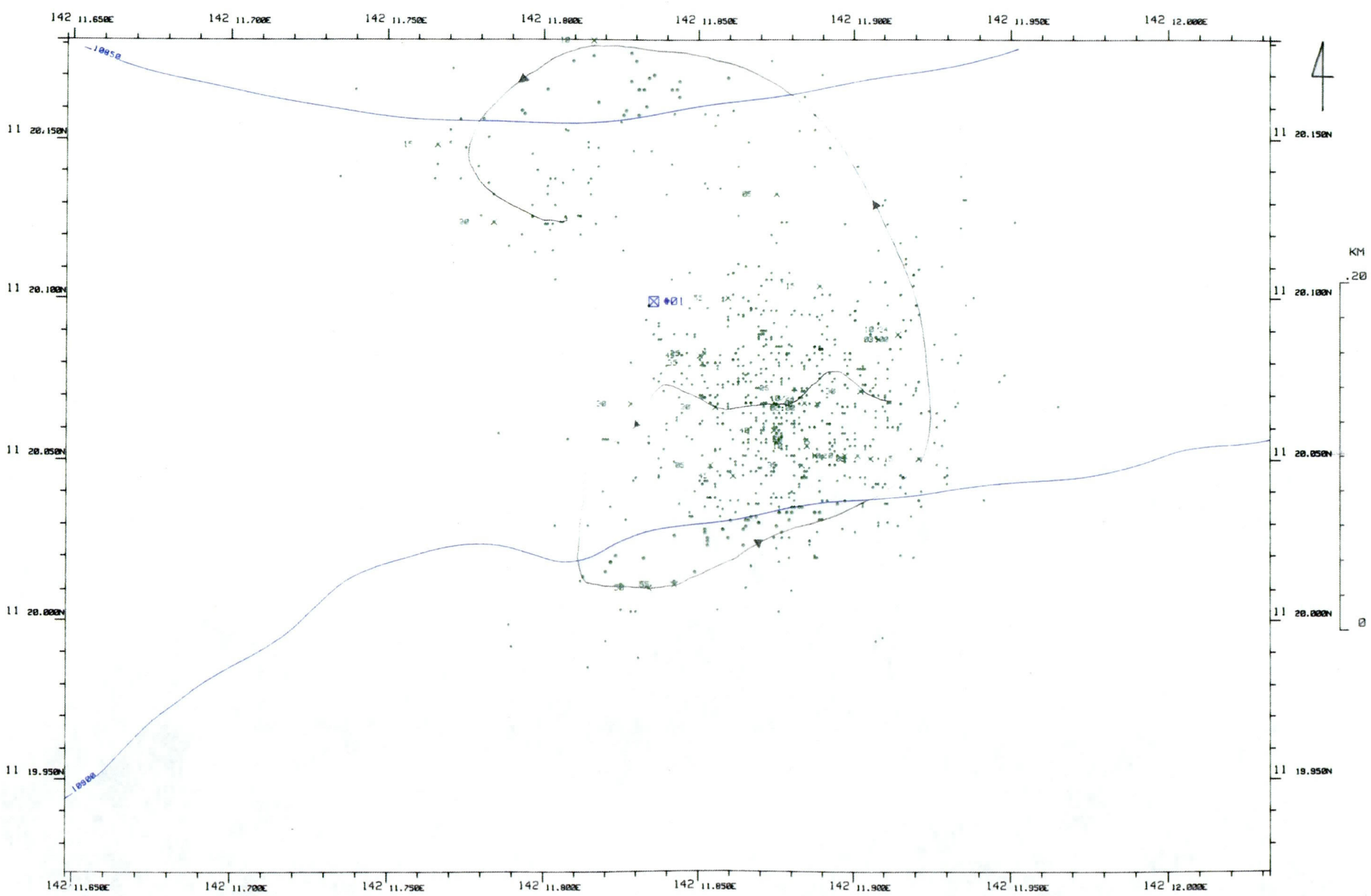
Time	Depth (m)	Vehicle Altitude(m)	Description
07:57	0		Launched the ROV *Kaiko*
11:00	10898	0	Landing on the bottom (11°20.072'N, 142°11.909'E)
11:00	10898	0	Yellow-top core deployed (11°20.072'N, 142°11.909'E)
11:05	10898	0	Observing the seafloor, radiolarians and holothurians

Time	Depth (m)	Vehicle Altitude(m)	Description
11:08	10898	0	Yellow-top (with reflective tape) core deployed over radiolarians (11°20.072'N, 142°11.909'E)
11:15	10898	0	White-top core (yellow handle) deployed over holothurian (11°20.070 'N, 142°11.886'E) note that the top of core may have been disturbed
11:19	10898	0	Bio-traces observed on the seafloor
11:22	10898	0	Moved a short distance, note that navigation is not exact
11:28	10897	0	Blue handled core deployed over holothurian (11°20.070 'N, 142°11.886'E) FAILED
11:32	10897	0	Moved a short distance, white object observed (trash?)
11:33	10897	0	Blue handled core deployed over holothurian (11°20.041 'N, 142°11.896'E)
11:35	10898	0	CTD temp 2.44 C, observing holothurian in core to confirm it is alive
11:39	10897	0	Used suction sampler to collect white polychaete (#1)
11:42	10897	0	Used suction sampler to collect white polychaete (#2)
11:44	10897	0	Moved a short distance
11:45	10897	0	Used suction sampler to collect white polychaete (#3)
11:47	10897	0	Used suction sampler to collect white polychaete (#4)
11:47	10897	0	Used suction sampler to collect white polychaete (#5)
11:49	10897	0	Used suction sampler to collect 2 white polychaetes (#6, 7)
11:50	10897	0	Moved a short distance (11°20.028 'N, 142°11.882'E)
11:51	10897	0	Used suction sampler to collect white polychaete (#8)
11:53	10897	0	Used suction sampler to collect white polychaete (#9)
11:53	10897	0	Used suction sampler to collect swimming amphipod
11:55	10897	0	Used suction sampler to collect white polychaete (#10)
11:56	10897	0	Moved a short distance
11:58	10897	0	Used suction sampler to collect 2 white polychaetes (#11, 12)
12:00	10897	0	Changed to canister 2. Moved a short distance
12:03	10897	0	Used suction sampler to collect 3 white polychaetes (#13, 14, 15)
12:04	10897	0	Used suction sampler to collect 3 white polychaetes (#16, 17, 18)
Time	**Depth (m)**	**Vehicle Altitude(m)**	**Description**
12:06	10897	0	Changed to canister 3

12:23-12:30	10897	0	Continued animal collections by suction sampler (9 white polychaetes) and two white particles
12:31-12:37	10897	0	Changed to canister 4, collected animals with suction sampler, cansiter contains 3 polychaetes
12:38	10898	0	Bio-traces observed on seafloor
12:39-12:43	10898	0	Changed to canister 5, collected animals with suction sampler, canisiter contains 1 holothurian and 2 black objects 11°20.074 'N, 142°11.841'E
12:45	10898	1.5	ROV moving toward baited trap
12:50	10898	1.5	Man-made object on seafloor
12:56	10893	2.5	Jelly (?) or holothurian in water column
13:01	10898	1.5	ROV still moving toward baited trap
13:09	10894	1.5	ROV still moving toward baited trap, holothurian in water column
13:18	10896	1.5	Located baited trap, contains many large amphipods, placed new baited trap on seafloor
13:21	10896	0	Closed trap with sponges
13:25	10896	0	Start ascent (11°20.150'N, 142°11.702'E)

* 184 photographs were taken during this dive.

Linda Kuhnz (MBARI), Tomoyuki Miura (Miyazaki University)
& Jun Hashimoto (Nagasaki University)


KR02-13 Mariana Trench
Dive 276
Date 2002/10/24
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142 11.750E
142 11.800E
142 11.850E
142 11.900E
142 11.950E
142 12.000E
11 20.150N
11 20.100N
11 20.050N
11 20.000N
11 19.950N
-1085m
-1090m
#01
KM
.20
0

(6) *Kaiko* dive #277

Date: 25 October 2002
Site: Western depression, Challenger Deep
Landing (Lat., Long., Time, Depth)**:** 11°20.14'N, 142°11.83'E, 10:55, 10897m
Leaving (Lat., Long., Time, Depth)**:** 11°20.10'N, 142°11.84'E, 12:32, 10896m

Purpose: Recovering a baited trap, biological sampling using suction sampler, collection of bottom sediment and water samples, observation of hadal benthos in the Challenger deep

Payload equipment: a suction sampler (single cannister type), five MBARI-type core samplers, two sterilized core samplers

Video highlights:

(1) 11:17:30 ~ 11:21:30	Sampling a polychaete with a MBARI-type core sampler
(2) 11:39:30 ~ 11:41:20	Sampling a polychaete with a MBARI-type core sampler
(3) 12:12:00 ~ 12:15:00	Sampling amphipods by a suction sampler
(4) 12:12:00 ~ 12:24:00	Recovery of the baited trap deployed during dive #276

Cooperative Scientists:

Name	**Affiliation**	**Specialty**
Onboard scientists of KR02-13	JAMSTEC, Miyazaki University, Chiba University, Nagasaki University, ORI-	Biology Molecular biology
	University of Tokyo, MBARI, KORDI	

Key words: ROV '*Kaiko*', Challenger Deep, suction sampler, baited trap, sterilized core sampler

I. Dive summary

Dive #277 was carried out at the Challenger Deep known as the deepest point in the world to collect and observe benthic organisms.

(1) The baited trap deployed during the dive #276 was recovered and 170 lycianasiid amphipods, three of which have some eggs, and 21amphipods (probably other species) were obtained.
(2) Two sediment sample for microbiological analysis and five sediment core samples were obtained.
(3) A polynoiid polycaete and a holothurian were sampled with MBARI-type core samplers. Three polynoiids were also collected by suction sampler

II. Video Log

Time	Depth (m)	Vehicle Altitude (m)	Description
7:41	0		Surfaced
7:53	150		Started descending
10:40	10766	130	Stopped descending
10:43	10764	133	Vehicle was released from the launcher
10:53	10890	4.4	Bottom in sight, 31m from homer
10:55	10897	0.0	Landed on fine mud bottom (11°20.143'N, 142°11.831'E), observation around vehicle
10:57	10896	0.0	Collected bottom sediment sample with a sterilized core sampler (green)
11:00	10897	0.0	Collected bottom sediment sample with a sterilized core sampler (red)
11:03	10897	0.0	Off bottom and slightly moved
11:04	10897	0.0	Collected a bottom sediment sample with a MBARI-type core sampler (red)
11:08	10896	0.1	Off bottom and slightly moved
11:10	10897	0.0	Collected radiolarians and a bottom sediment sample with a MBARI-type core sampler (green)
11:12	10894	0.4	Off bottom and slightly moved
11:16	10896	0.2	Off bottom and slightly moved

Time	Depth (m)	Vehicle Altitude (m)	Description
11:17	10896	0.0	Collected a polychaete and a bottom sediment sample with a MBARI-type core sampler (yellow)
11:21	10896	0.0	Close-up of a polychaete in the core
11:23	10897	0.0	Polycaete escaped, removed sediment in the core using suction sampler
11:31	10896	0.3	Off bottom and slightly moved
11:32	10896	0.0	Collected a holothurian and a bottom sediment sample with a MBARI-type core sampler (yellow)
11:38	10896	0.0	Failed to collect a polychaete and a bottom sediment sample with a MBARI-type core sampler (white)
11:39	10896	0.0	Collect a polychaete and a bottom sediment sample with a MBARI-type core samper (white)
11:41	10896	0.0	Close-up of a polychaete in the core
11:43	10896	0.3	Off bottom and slightly moved, 66.3m from homer
11:46	10896	0.0	Observation around vehicle
11:47	10895	1.1	Off bottom and moved north, 70m from homer
11:50	10895	0.6	62m from homer
11:52	10896	0.0	Collect radiolarians and a bottom sediment sample with a MBARI-type core sampler (black)
11:53	10896	0.0	Close-up of a radiolarian in the core
11:56	10895	0.0	Off bottom looking for baited trap
12:00	10895	0.0	(11°20.140'N, 142°11.820'E)
12:06	10895	1.5	Still looking
12:10	10893	0.0	Baited trap deployed during the last dive in sight
12:11	10896	0.0	Landing in the front of the trap (11°20.098'N, 142°11.840'E)
12:12	10896	0.0	Collected amphipods around the trap by suction sampler
12:15	10897	0.0	Recovered ROV homer
12:17	10896	0.0	Collected small amphipods in the trap by suction sampler
12:19	10896	0.0	Closed and recovered baited trap
12:32	10896	0.0	Left bottom

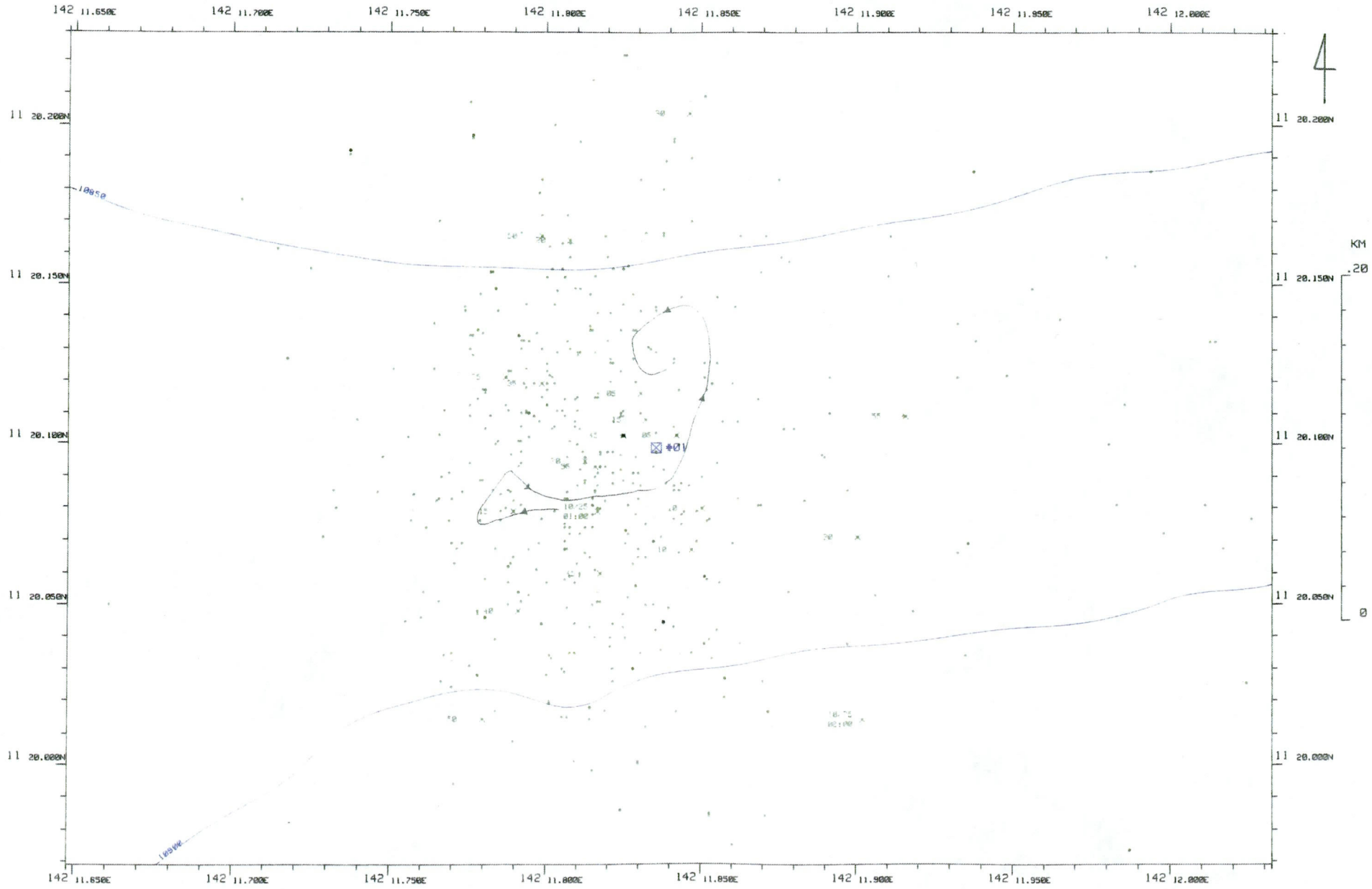
Shigeaki Kojima (ORI, University of Tokyo) & Kurt Buck (MBARI)

KR02-13 Mariana Trench

Dive 277

Date 2002/10/25

Scale (1/ 2000)



Summery of biological surveys

(1) Hadal macrobenthic organisms found in the Challenger Deep

During the dives of ROV 'Kaiko', we observed elapsipodid holothurians, white polychaetes, gammarid amphipods, unknown tubes erected from the bottom, black bifid tentacle-like animal (echiurans?). Occasional paired linear bio-traces were observed. Holothurians and polychaetes are common on the seafloor in this area. We have not yet determined an accurate density of these animals, however we can recognize at least ten white polychaetes and about five holothurians while the ROV runs each 10 m. Most of these hadal macrobenthic organisms were collected using a suction sampler.

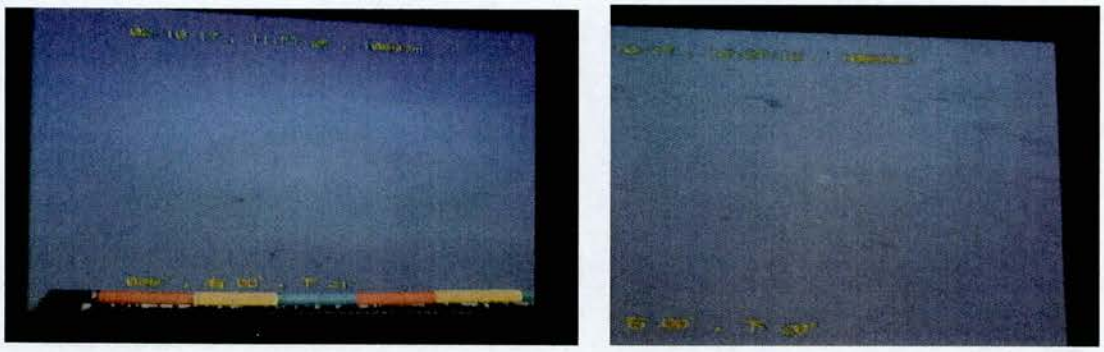


Photo: (Left) Two unknown organisms on the center of the monitor look like echiuran bifid tentacles; (Right) Polychaete worm with white body and brilliant seta bundle.

The white polychaete worms recognized on the monitor belong to a species in the family Polynoidae (English common name: scale worm). The specimens collected during dive 272 (2-day dive) were moderately damaged and lacked all elytra (scale-like parapodial structure). The elytrophore (dorsal swollen part of parapodia) were also very difficult to observe after recovery and thus we identified as them as a hesionid polychaete at first. Another polychaete of this species was collected in good condition (its elytra were in the same sample cylinder of the suction sampler) during dive 274. This polynoid has about 10 pairs of elytra (according to the number of elytrophores), remarkably long occipital and parapodial dorsal cirri, 10 acorn-shaped papillae on both dorsal and ventral sides of the proboscis, and 17 setigerous segments (8 segments including peristomial tentacular segment). All these characters suggest that it belongs

to the polynoid subfamily Macelicephallinae.

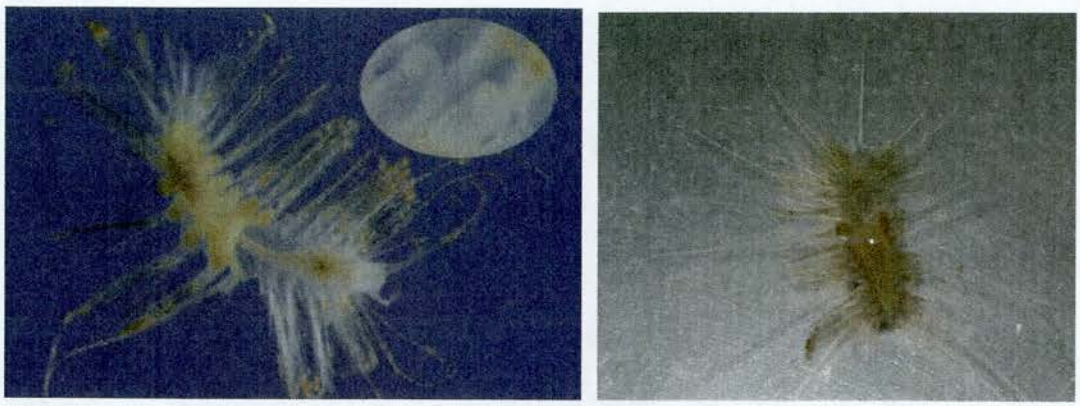


Photo: (Left) Polynoid worm collected during dive 274 (elytrophores of setigers 4 &5 were enlarged); (Right) Polynoid polychaete collected during dive 272 (occipital and parapodial cirri were intact before fixation).

Another polychaete species was collected during dive 274. The worms were found making aggregated tube mats on a sunken containerboard. The tube was covered with fine mud similar to the surrounding sediment. This polychaete species belongs to the family Ampharetidae.

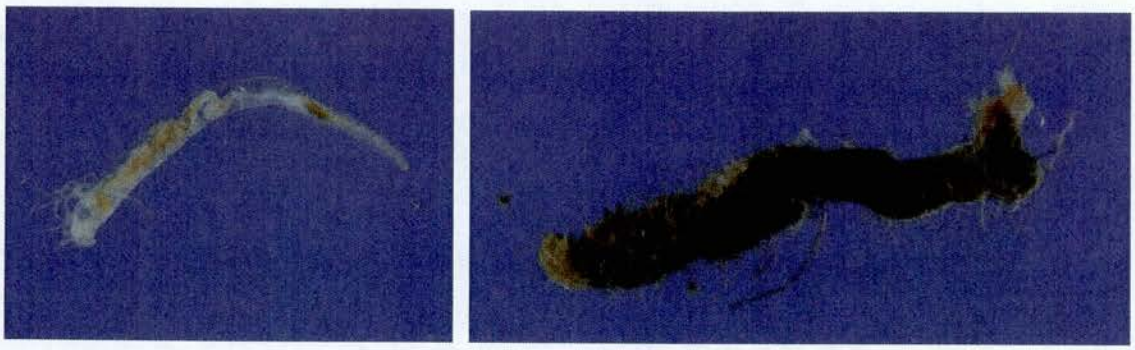


Photo: (Left) Ampharetid worm; (Right) Tube.

The holothurians we found in the Challenger Deep are characterized by the lack of respiratory tree which can normally be observed mid-body if present. Thus we have determined that this species belongs in the order Elapsipodida. These holoturians are very fragile and the tube feet and anterior tentacles were lost during ascent. We could find however 6 pairs of tube feet and 9 anterior tentacles in a specimen collected by a MBARI mud core sampler Photo).


Photo: (Left) Elapsipodid holoturian collected by a suction sampler; (Right) Holoturian specimen in a MBARI core.

The baited traps deployed during dives 272, 273 and 274 were recovered during succeeding dives. Many amphipods and small copepods were observed and recorded by VCR in and around the baited trap before recovery. We could recognize three morphologically different amphipods: white and slender (not recovered?), white round, and reddish round. The last two species were collected and photographed. One has been identified as *Hirondellea gigas,* but the other needs further taxonomic study.



Photo:(Left) *Hirondellea gigas* ; (Middle)Reddish type; (Right) Slender type.

Tomoyuki Miura (Miyazaki university)

(2) Meiobenthological work

Meiobenthos, the sediment inhabited animal groups sieved with mesh aperture between 1 mm and 32μm, are very important in these ecosystems because of this extremely high density and diversity. Meiobenthos were reported to be in the range of $10^6 \sim 10^7$ / m^2 in the continental shelf area and in the deep sea $10^4 \sim 10^5$ / m^2. Thus, total energy usage of this animal group is five times higher than that of macrobenthos and ATP amounts in total body of meiobenthos and microorganisms are almost similar. During the last decade, meiobenthos have been examined as one of the important animal group to environmental condition of marine benthic ecosystem because comparatively short generation time cause rapid response of the populations to variable environments.

Meiofauna sampling was carried out at the Challenger Deep known as the deepest point in the world. The sediment samples collected by MBARI-type push corers (inner-diameter 7.0 cm) from Challenger Deep in Mariana Trench were treated in several ways. The sediment collected on Dive 272, 273 and 274 (Dive 272: 11°20,191'N, 142°13,230'E, 10,890m; Dive 273: 11°20,209'N, 142°11,784'E, 10,894m; Dive 274: 11°20,157'N, 142°11,751'E, 10,892m) were used subcorer (inner-diameter 3.4 cm) in MBARI tube and sliced into various depths (0~0.25cm, 0.25~0.5cm, 0.5~0.75cm, 0.75~1.0cm, 1.0~1.5cm, 1.5~2.0cm, 2.0~2.5cm, 2.5~3.0cm, 3.0~4.0cm, 4.0~5.0cm, 5.0~6.0cm, 6.0~7.0cm, 7.0~8.0cm, 8.0~9.0cm, 9.0~10.0cm,) to know their vertical distribution and ecological characteristics. However, sediments collected during Dive 275 through Dive 277 (Dive 275: 11°20,093'N, 142°11,803'E, 10,896m; Dive 276: 11°20,072'N, 142°11,909'E, 10,898m; Dive 277: 11°20,058'N, 142°11,860'E, 10,897m), were used MBARI push corers and also sliced into various depths. Then the sediment samples were fixed with several fixatives (5% neutralized formalin mixed with rose bengal, 70% ethanol and 2.5% glutaraldehyde in 0.2M cacodylate buffer). The other sediment samples were refrigerated in –80°C deep freezer to analysis of organic material and environmental factors. And also the sediment samples (about 20 ml) were aliquoted into sterile conical tube and preserved at - 80°C deep freezer for microbiology. The microbiological (prokaryotic) community structure of those sediments will be studied in Microbiology Lab. Korea Ocean Research & Development Institute (KORDI) by using molecular biological techniques based on 16S rRNA genes analysis.

As this is the first time ever challenger deep samples were collected for meiobenthos, it is difficult to say at this point about our future course of the study. But it is possible to find out the specialty in their community structure and spatial distribution of meiobenthos inhabiting in most deep sediment when compared to other site. And also,

we would like to have a systematic approach to know the taxonomy of meiobenthos that might lead to the discovery of new Phyla.

In addition, the refrigerated samples of meiofauna allows histological, molecular and bio-technology works.

Sample list for meiobenthos studies is shown in Table 1.

Table 1. Samples of meiofauna used by KAIKO around Challenger Deep in Mariana Trench

Dive. No.	Quant. /Qual.	Procedure	Contents	Position & depth
Dive 272	Quant.	Subcorer (3.4cm)	Sliced to 15 layers and fixed with neutralized formalin mixed with rose Bengal	11°20,191'N, 142°13,230'E
	Qual.	Conical tube	Surface sediment → -80°C deep freezer	
	Qual.	250 ml bottle	Surface sediment layer (upper 1cm) → fixed with Glutaraldehyde, Cacodylate and Paraformaldehyde mixture.	10,890m
	Qual.	250ml bottle (2)	i) 0-5 cm sediment ii) 5-10 cm sediment → 70% Etoh	
Dive 273	Quant.	Subcorer (3.4cm)	Sliced to 15 layers and fixed with neutralized formalin mixed with rose Bengal	11°20,209'N, 142°11,784'E,
	Quant.	Conical tube	5 layers of sediment (between MBARI corer to subcorer, 0-1cm to 4-5 cm) → -80°C deep freezer	10,894m
	Quant.	250ml bottle	5-10 cm sediment → 5% formalin	
Dive 274	Quant.	Subcorer	Sliced to 15 layers and fixed with neutralized formalin mixed with rose Bengal	11°20,157'N, 142°11,751'E,
	Quant.	Vinyl	5 layers of sediment (between MBARI corer to subcorer, 0-5cm) →-80°C deep freezer	10,892m
	Quant.	250ml bottle	5-10 cm sediment →-80°C deep freezer	
	Quant.	Vinyl	10-20 cm sediment →-80°C deep freezer	
	Qual.	250ml bottle	Sediment in the tube of suction sampler collected with 63um mesh sieve → 5%	

			formalin mixed with Rose Bengal	
Dive 275	Quant. Quant. Quant Quant.	Two MBARI corer (7.0cm) MBARI tube (vinyl) 250ml bottle 1 liter bottle (Kitazato)	Sliced to 15 layers and fixed with neutralized formalin mixed with rose Bengal Sliced to 15 layers of sediment for analysis →-80°C deep freezer Sediment fixed with Glutaraldehyde, Cacodylate and Paraformaldehyde mixture 3-19 cm sediment fixed with neutralized formalin mixed with rose Bengal (0-3cm sliced for foraminifera, Dr. Kitazato san)	11°20,093'N, 142°11,803'E, 10,896m
Dive 276	Quant. Qual.	MBARI push corer Vinyl	Sliced to 15 layers and fixed with neutralized formalin mixed with rose Bengal 10-18 cm sediment → 5% formalin	11°20,072'N, 142°11,909'E, 10,898m
Dive 277	Quant. Quant.	MBARI push corer (conical tube) Vinyl	0-5 cm sediment →-80°C deep freezer Under 5cm sediment sliced into various depths →-80°C deep freezer	11°20,058'N, 142°11,860'E 10,897m

Dongsung Kim and Wongi Min (KORDI)

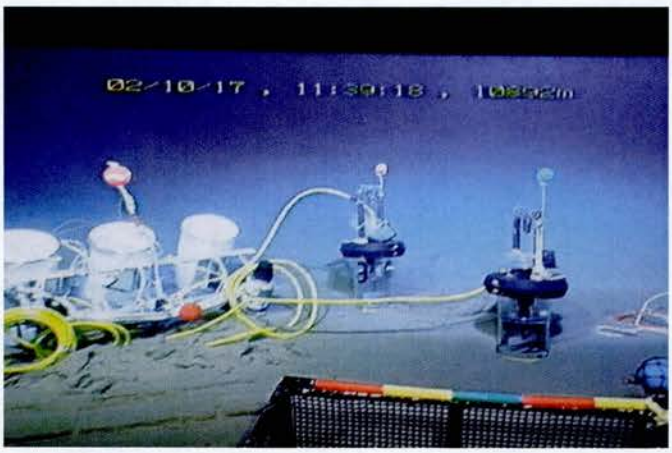
(3) Benthic Respiration Rates

The carbon demand of the seafloor community can be estimated by measuring the rate of oxygen consumption either directly, using respiration chambers, or indirectly, from the shape of oxygen profiles through the sediment column. Both techniques were used during this cruise.

Benthic Respiration System

A benthic respiration system (BRS) was deployed at 10924 m early in the dive series (Kaiko dive #272) in the western basin of the Challenger Deep, and recovered 6 days later, during dive #275). The BRS has three respiration chambers, each with a stirring bar and oxygen sensor (Figure). Three chambers were inserted into the sediment, enclosing ~75 cm^2 of seafloor and ~ 1 l of water.

Oxygen optrodes, based on the fluorescence of a ruthenium-based metal complex were used to sense oxygen concentrations. These sensors fluoresce at 610 nm when illuminated by light at 450 nm. This fluorescence is quenched by the presence of oxygen. Thus, as oxygen concentrations decrease in the chambers through consumption by the seafloor community, the signal strength of each optrode increases. Calibration of the optrodes before and after deployment is used to confirm changes in oxygen concentration within respiration chambers.



Due to the great depth of deployment, it appears that extreme hydrostatic pressure resulted in failure of the mating connectors of the respiration chambers and the pressure housing of the BRS. Failure of the connectors led to electrical shortages of power and signal cables to seawater, power loss from the batteries, and possibly, unreliable measurements of oxygen consumption by the BRS. These data will be analyzed further after the cruise.

Sediment Oxygen Profiles

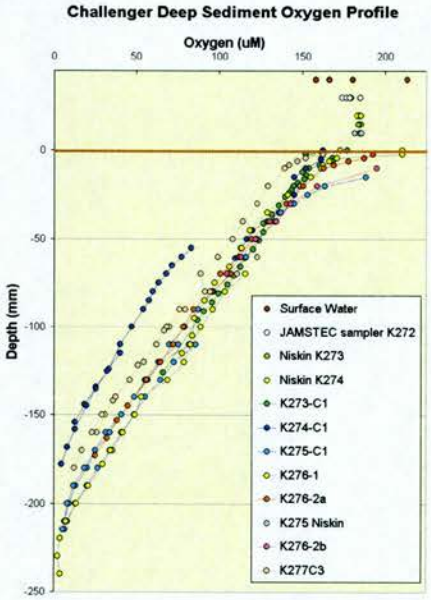
Oxygen profiles of the sediment column were performed using a Unisense oxygen electrode. Profiles were performed on 7 cores (Figure). Each core yielded one or two replicate oxygen profiles from 0 to 200 mm depth in the sediment. Results of these profiles, illustrated in Figure 2, show the deep (~180 – 200 mm) redox boundary in Challenger Deep sediments. This great depth of the oxic zone in these sediments indicates low oxygen consumption by the sediment community and high rates of oxygen diffusion within the sediments. Further analyses of these profiles will provide quantitative estimates of the oxygen demand and carbon demand of the sediment community.

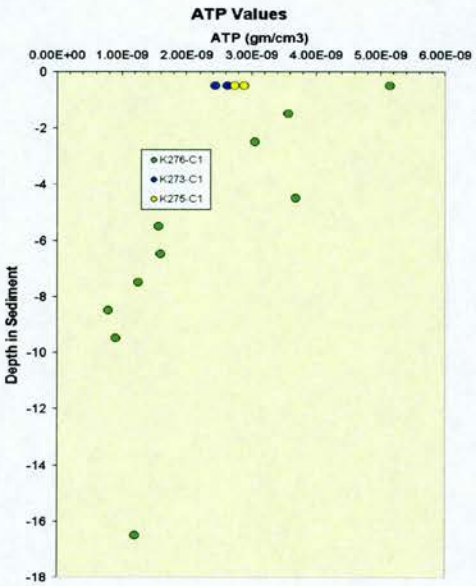
Organic Tracer Studies

A variety of tracers were collected for further analyses. These included samples for CHN, stable carbon and nitrogen isotopes, sediment grain size, total microbial abundance, plant pigment concentrations, and meiofauna counts. Approximately 5 sets of tracer samples were obtained from tube cores collected during KR02-13.

ATP concentrations on the sediment surface and through the sediment column were measured for a few MBARI-type cores. ATP measurements estimate the total organismal ATP volume of the sample, which is dominated by microbial ATP. As expected, the ATP concentration of surface sediments was considerably higher than the underlying sediment (Figure).

Radioisotope Samples





^{210}Pb and ^{234}Th are naturally occurring radioisotopes used to estimate the rates of bioturbation in sediments. We collected sediment samples from a few sediment cores for the analyses of these isotopes, in hopes of estimated bioturbation rates. Samples were collected in 1 cm intervals from the surface to 10 cm deep, and each 5 cm interval beneath 10 cm, to the bottom of the core. These samples will be analyzed upon return to the laboratory.

Amphipod Enzyme Analyses

Samples of the hadal amphipod (*Hirondellea gigas*) were frozen as soon as possible following the recovery of the ROV to the surface, for analysis of enzyme levels in amphipod tissues. Citrate synthase is an enzyme typically considered to be an indicator of

aerobic activity potential. Greater levels of CS are found in animals with higher rates of aerobic activity. Concentration of this enzyme are typically lower in deep-sea animals. Measurements of CS activity in *Hirondellea gigas*. will be compared to bathyal and shallow-water amphipods.

Macrofaunal Samples

Several cores were collected and sieved for subsequent analyses of infaunal macrofauna. These cores were sieved through 0.25 mm mesh.

Summary of geophysical measurements

To reveal the tectonic history of the oceanic plate around the South Mariana Trench, bathymetric, geomagnetic, and gravity measurements were conducted at an interval of the "KAIKO" dives (Fig.1). We obtained bathymetric data using the multi-narrow beam echo sounder, SEA BEAM 2112. The swath width of SEA BEAM 2112 is about twice of the center depth. We measured the geomagnetic and gravity field by the towed proton magnetometer as well as the shipboard three-components magnetometer (STCM) and the onboard gravimeter, respectively. The ship speed during the measurements was about 12 knot. The track interval is 13-18 km. We show the preliminary result of the bathymetric measurement in this report.

Bathymetric features around the Challenger Deep was exposed by the bathymetric measurement in the KR9805 cruise by R/V "*Kairei*". We surveyed the western area of the previous surveyed area. Fig. 2 is a part of result of the bathymetric measurement. The trench axis deepens to the east from 8000 m to 10000 m. The strike of the trench is N70°E, which is different from that of Challenger Deep. There are many linear scarps south of the trench, which have three different strikes, N50°E, N70°E, and E-W. Most of the scarps has a more than 500 m height.

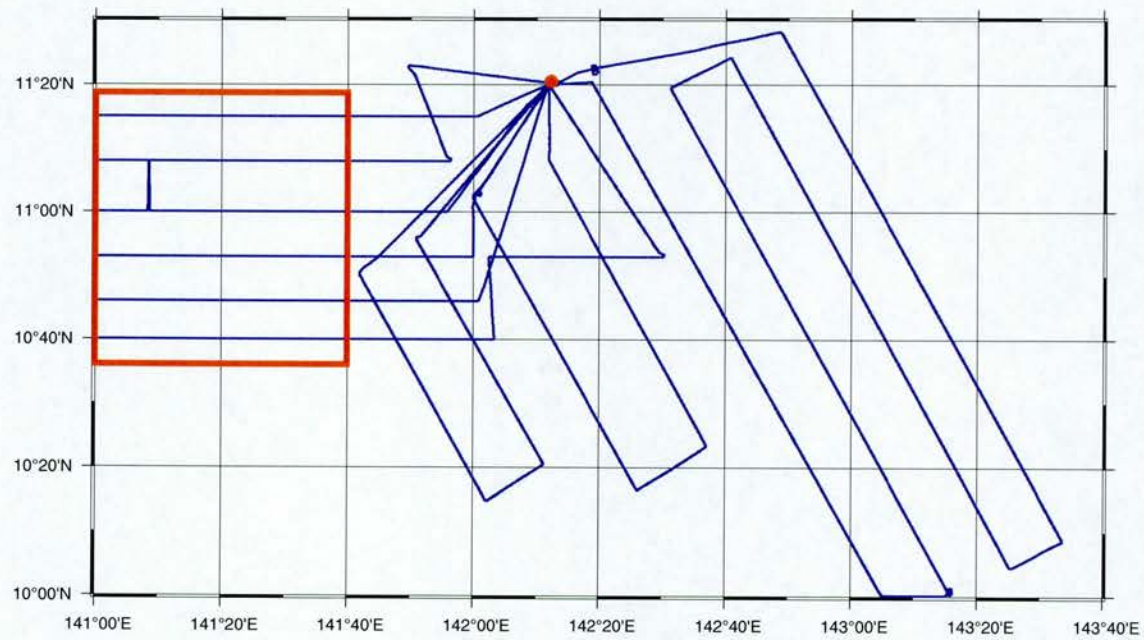


Fig. 1. Track lines of the geophysical measurements. The red circle is the "KAIKO" dive site. The red rectangle represents the area of Fig.2.

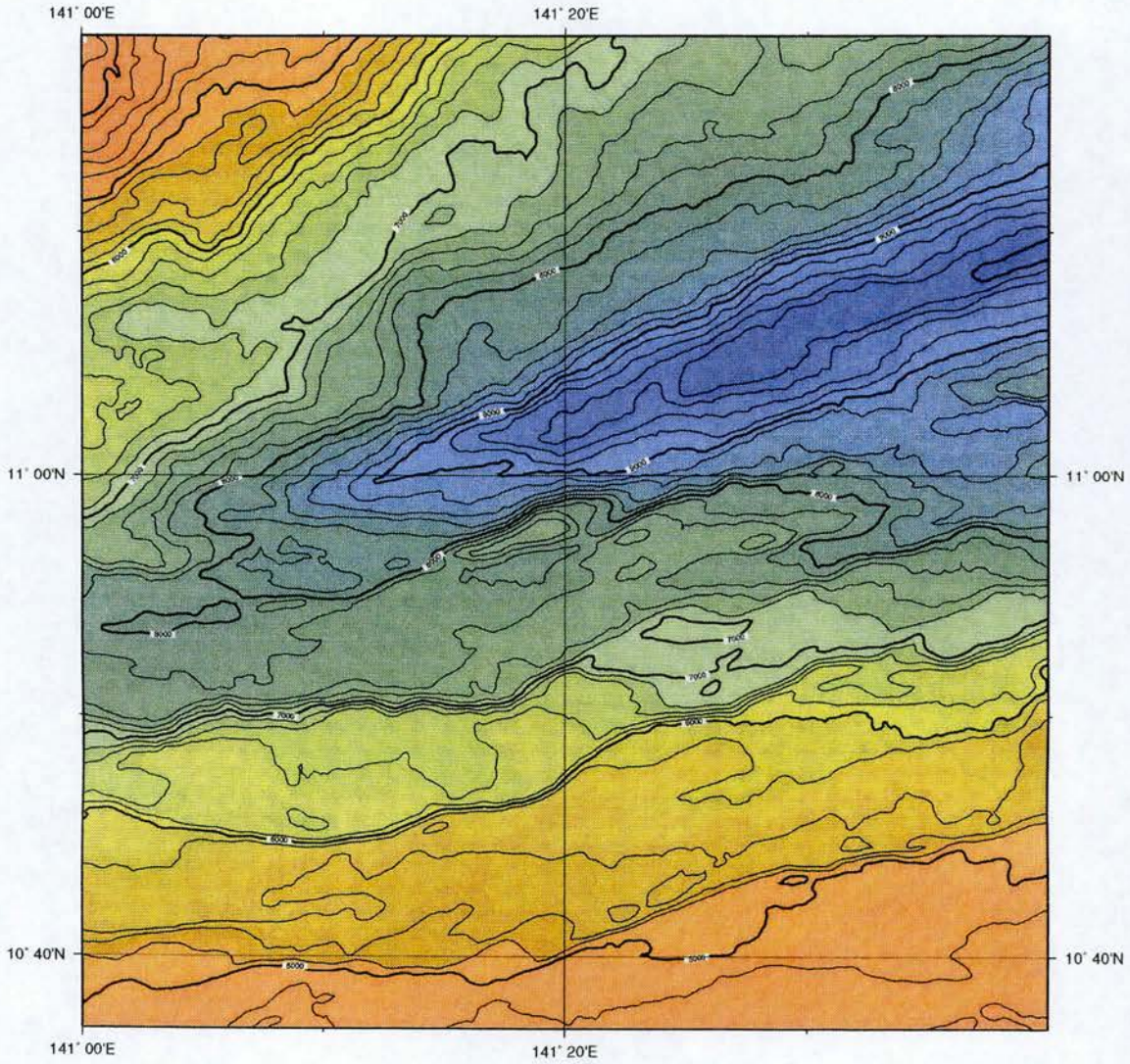


Fig. 2. Bathymetric map of the western part of the South Mariana Trench.

Masao Nakanishi (Chiba University)

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Publication policy of the *Kaiko/Kairei* Cruise '02 in the Challenger Deep

No publication without the agreement of J. Hashimoto (Chief Scientist) and Shinji Tsuchida (JAMSTEC).
Priority for the cruise participants.
No diffusion of data to industries, universities and other institutions within two years after the completion of the cruise.

Ⅰ. General description

1. Jun Hashimoto *et al.*, Hadal biological community in the Challenger Deep.

Ⅱ. Taxonomy

1. Dongsung Kim *et al.*, Taxonomic study of meiofauna in the Mariana Trench.
2. Tomoyuki Miura *et al.*, Polynoid polychaetes found in the Challenger Deep during JAMSTEC R/V Kairei Cruise KR02-13

Ⅲ.Physiology

1. James Barry et al, Aerobic activity potential in a hadal amphipod, *Hirundellea gigas*, from the Challenger Deep, Marianas Trench.

Ⅳ. Ecology

1. Dongsung Kim *et al.*, Community structure of meiobenthos inhabited in the Mariana Trench..
2. Shinji Tsuchida *et al.*, Description and population biology of the deep-sea amphipod *Hirondellea gigas*.
3. Hiroshi Kitazato (JAMSTEC) and Andrew J. Gooday (Southampton Oceanography Centre, UK), Biodiversity of soft-walled, monothalamous benthic foraminiferans in the Mariana Trench.
4. James Barry et al. Sediment community carbon demand in the Challenger Deep
5. James Barry et al. Bioturbation rates in the Challenger Deep estimated from natural radioisotopes

V. Molecular Biology

1. Shigeaki Kojima *et al.*, Genetic diversity of dominant species in the Mariana Trench.
2. Shinji Tsuchida *et al.*, Genetic diversity of the deep-sea amphipod *Hirondellea gigas*.

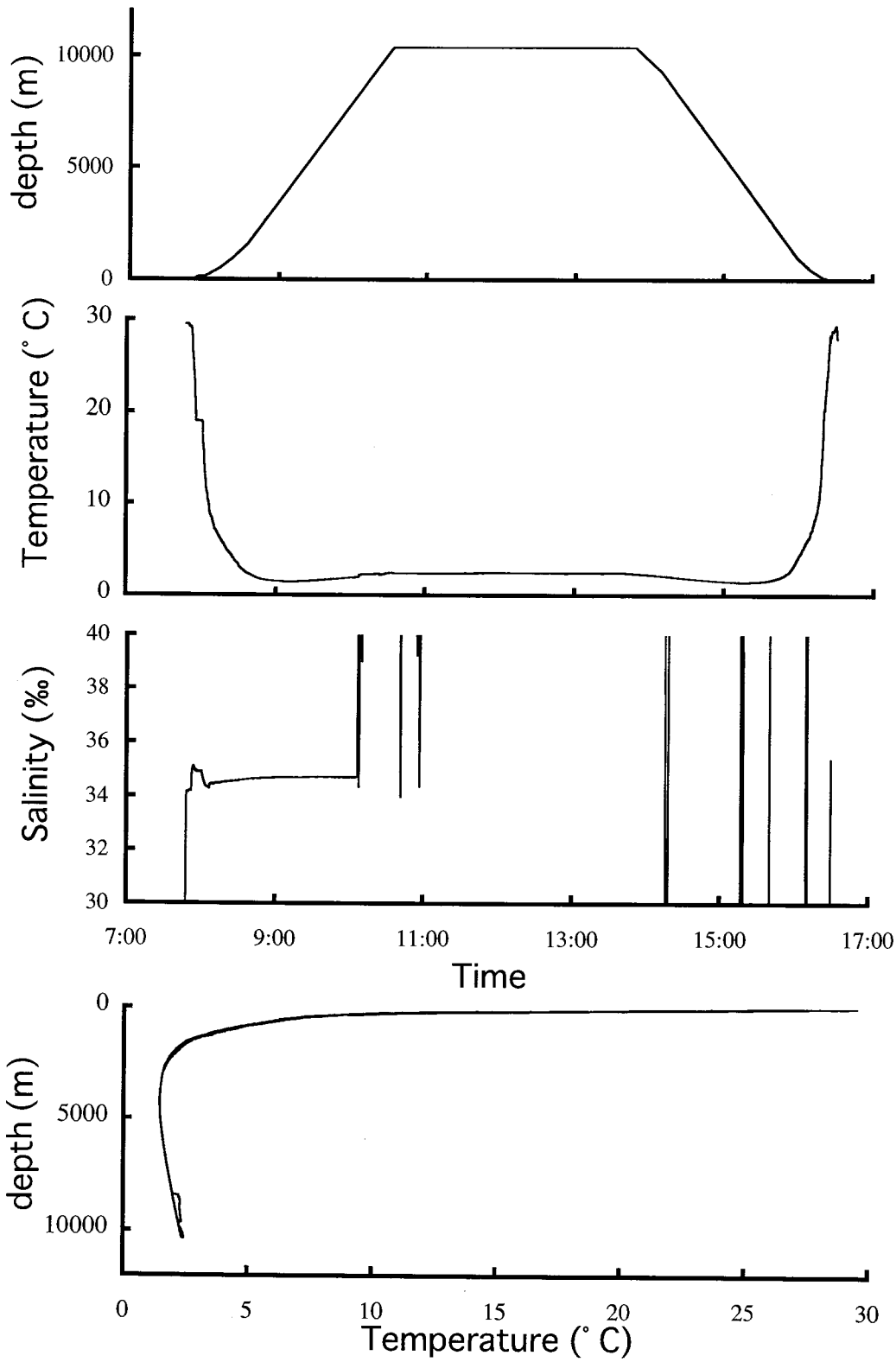
VI. Geophysics

1.Masao Nakanishi, Topographic expression of the South Mariana Trench

Species Name	No. of Inds.	Locality	Date	Collecting Method	Preservation Method	Remarks
Hirondellea gaigas	4	Challenger Deep, Mariana Trench	2002.10.20	10K#273	99.5%Ethanol fixation	Collected by baited trap
Hirondellea gaigas	5	Challenger Deep, Mariana Trench	2002.10.20	10K#273	-80 deg. C freeze	Collected by baited trap
Polynoidae gen. sp.	3	Challenger Deep, Mariana Trench	2002.10.20	10K#273	5% Formalin fixation	Canister No. 5
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.20	10K#273	5% Formalin fixation	Canister No.1
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.20	10K#273	5% Formalin fixation	Canister No.2
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.20	10K#273	5% Formalin fixation	Canister No. 3
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.20	10K#273	5% Formalin fixation	Canister No. 4
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.20	10K#273	5% Formalin fixation	Out of bottles in the Canister
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.20	10K#273	5% Formalin fixation	In the MBARI core
Unidentified plankton		Challenger Deep, Mariana Trench	2002.10.20	10K#273	5% Formalin fixation	Collected by 1mm mesh bottle in the baited trap
Unidentified plankton		Challenger Deep, Mariana Trench	2002.10.20	10K#273	5% Formalin fixation	Collected by 2mm mesh bottle in the baited trap
Unidentified plankton		Challenger Deep, Mariana Trench	2002.10.20	10K#273	5% Formalin fixation	Collected by 4mm mesh bottle in the baited trap
Ampharetidae gen. sp.	2	Challenger Deep, Mariana Trench	2002.10.22	10K#274	5% Formalin fixation	Cnister No.1
Ampharetidae gen. sp.	1	Challenger Deep, Mariana Trench	2002.10.22	10K#274	5% Formalin fixation	Cnister No.1
Ampharetidae gen. sp.	1	Challenger Deep, Mariana Trench	2002.10.22	10K#274	5% Formalin fixation	Cnister No.4
Holothurian	1	Challenger Deep, Mariana Trench	2002.10.22	10K#274	5% Formalin fixation	Cnister No.2
Holothurian	1	Challenger Deep, Mariana Trench	2002.10.22	10K#274	5% Formalin fixation	Cnister No.3
Holothurian	1	Challenger Deep, Mariana Trench	2002.10.22	10K#274	-80 deg. C freeze	Cnister No.4
Holothurian	1	Challenger Deep, Mariana Trench	2002.10.22	10K#274	5% Formalin fixation	Cnister No.5
Polynoidae gen. sp.	1	Challenger Deep, Mariana Trench	2002.10.22	10K#274	5% Formalin fixation	Cnister No.2
Polynoidae gen. sp.	1	Challenger Deep, Mariana Trench	2002.10.22	10K#274	-80 deg. C freeze	Cnister No.3
Polynoidae gen. sp.	1	Challenger Deep, Mariana Trench	2002.10.22	10K#274	5% Formalin fixation	Cnister No.4
Polynoidae gen. sp.	1	Challenger Deep, Mariana Trench	2002.10.22	10K#274	-80 deg. C freeze	Cnister No.4
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.22	10K#274	5% Formalin fixation	Cnister No.1
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.22	10K#274	5% Formalin fixation	Cnister No.2
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.22	10K#274	5% Formalin fixation	Cnister No.3
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.22	10K#274	5% Formalin fixation	Cnister No.4
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.22	10K#274	5% Formalin fixation	Out of bottles in the Canister
Hirondellea gaigas	9	Challenger Deep, Mariana Trench	2002.10.23	10K#275	99.5%Ethanol fixation	Collected by baited trap
Hirondellea gaigas	8	Challenger Deep, Mariana Trench	2002.10.23	10K#275	-80 deg. C freeze	Collected by baited trap
Holothurian	1	Challenger Deep, Mariana Trench	2002.10.23	10K#275	5% Formalin fixation	Collected by MBARI Core

Species Name	No. of Inds.	Locality	Date	Collecting Method	Preservation Method	Remarks
Unidentified plankton		Challenger Deep, Mariana Trench	2002.10.23	10K#275	3% Formalin fixation	Collected by 1mm mesh bottle in the baited trap
Unidentified plankton		Challenger Deep, Mariana Trench	2002.10.23	10K#275	3% Formalin fixation	Collected by 2mm mesh bottle in the baited trap
Unidentified plankton		Challenger Deep, Mariana Trench	2002.10.23	10K#275	3% Formalin fixation	Collected by 4mm mesh bottle in the baited trap
Unidentified plankton		Challenger Deep, Mariana Trench	2002.10.23	10K#275	3% Formalin fixation	Collected by baited trap
Hirondellea gaigas	81	Challenger Deep, Mariana Trench	2002.10.24	10K#276	99.5%Ethanol fixation	Collected by baited trap
Hirondellea gaigas	11	Challenger Deep, Mariana Trench	2002.10.24	10K#276	99.5%Ethanol fixation	Exoskelton only
Hirondellea gaigas	80	Challenger Deep, Mariana Trench	2002.10.24	10K#276	-80 deg. C freeze	Collected by baited trap
Hirondellea gaigas	6	Challenger Deep, Mariana Trench	2002.10.24	10K#276	-80 deg. C freeze	Collected by baited trap
Holothurian	1	Challenger Deep, Mariana Trench	2002.10.24	10K#276	5% Formalin fixation	Collected by MBRI Core (yellow)
Holothurian	1	Challenger Deep, Mariana Trench	2002.10.24	10K#276	5% Formalin fixation	Collected by MBRI Core (blue)
Holothurian	1	Challenger Deep, Mariana Trench	2002.10.24	10K#276	-80 deg. C freeze	Out of bottles in the Canister
Holothurian	1	Challenger Deep, Mariana Trench	2002.10.24	10K#276	5% Formalin fixation	Canister No.1
Polynoidae gen. sp.	3	Challenger Deep, Mariana Trench	2002.10.24	10K#276	5% Formalin fixation	Canister No.1
Polynoidae gen. sp.	1	Challenger Deep, Mariana Trench	2002.10.24	10K#276	-80 deg. C freeze	Canister No.1
Polynoidae gen. sp.	4	Challenger Deep, Mariana Trench	2002.10.24	10K#276	5% Formalin fixation	Canister No.2
Polynoidae gen. sp.	4	Challenger Deep, Mariana Trench	2002.10.24	10K#276	-80 deg. C freeze	Canister No.2
Polynoidae gen. sp.	4	Challenger Deep, Mariana Trench	2002.10.24	10K#276	5% Formalin fixation	Canister No.3
Polynoidae gen. sp.	4	Challenger Deep, Mariana Trench	2002.10.24	10K#276	-80 deg. C freeze	Canister No.3
Polynoidae gen. sp.	1	Challenger Deep, Mariana Trench	2002.10.24	10K#276	5% Formalin fixation	Canister No.4
Polynoidae gen. sp.	1	Challenger Deep, Mariana Trench	2002.10.24	10K#276	-80 deg. C freeze	Canister No.4
Polynoidae gen. sp.	4	Challenger Deep, Mariana Trench	2002.10.24	10K#276	5% Formalin fixation	Out of bottles in the Canister
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.24	10K#276	5% Formalin fixation	Canister No.1
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.24	10K#276	5% Formalin fixation	Canister No.2
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.24	10K#276	5% Formalin fixation	Canister No.3
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.24	10K#276	5% Formalin fixation	Canister No.4
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.24	10K#276	5% Formalin fixation	Canister No.5
Hirondellea gaigas	1	Challenger Deep, Mariana Trench	2002.10.25	10K#277	99.5%Ethanol fixation	Collected by baited trap
Hirondellea gaigas	3	Challenger Deep, Mariana Trench	2002.10.25	10K#277	5% Formalin fixation	Collected by baited trap
Hirondellea gaigas	60	Challenger Deep, Mariana Trench	2002.10.25	10K#277	99.5%Ethanol fixation	Collected by baited trap
Hirondellea gaigas	5	Challenger Deep, Mariana Trench	2002.10.25	10K#277	99.5%Ethanol fixation	Collected by baited trap
Hirondellea gaigas	37	Challenger Deep, Mariana Trench	2002.10.25	10K#277	-80 deg. C freeze	Collected by baited trap

Species Name	No. of Inds.	Locality	Date	Collecting Method	Preservation Method	Remarks
Hirondellea gaigas	59	Challenger Deep, Mariana Trench	2002.10.25	10K#277	-80 deg. C freeze	Collected by baited trap
Holothurian	1	Challenger Deep, Mariana Trench	2002.10.25	10K#277	3% Formalin fixation	Collected by MBRI Core (yellow)
Polynoidae gen. sp.	3	Challenger Deep, Mariana Trench	2002.10.25	10K#277	-80 deg. C freeze	in Canister
Polynoidae gen. sp.	1	Challenger Deep, Mariana Trench	2002.10.25	10K#277	5% Formalin fixation	Collected by MBRI Core (white)
Unidentified amphipod	11	Challenger Deep, Mariana Trench	2002.10.25	10K#277	99.5%Ethanol fixation	Collected by baited trap
Unidentified amphipod	10	Challenger Deep, Mariana Trench	2002.10.25	10K#277	-80 deg. C freeze	Collected by baited trap
Unidentified animals		Challenger Deep, Mariana Trench	2002.10.25	10K#277	99.5%Ethanol fixation	in Canister



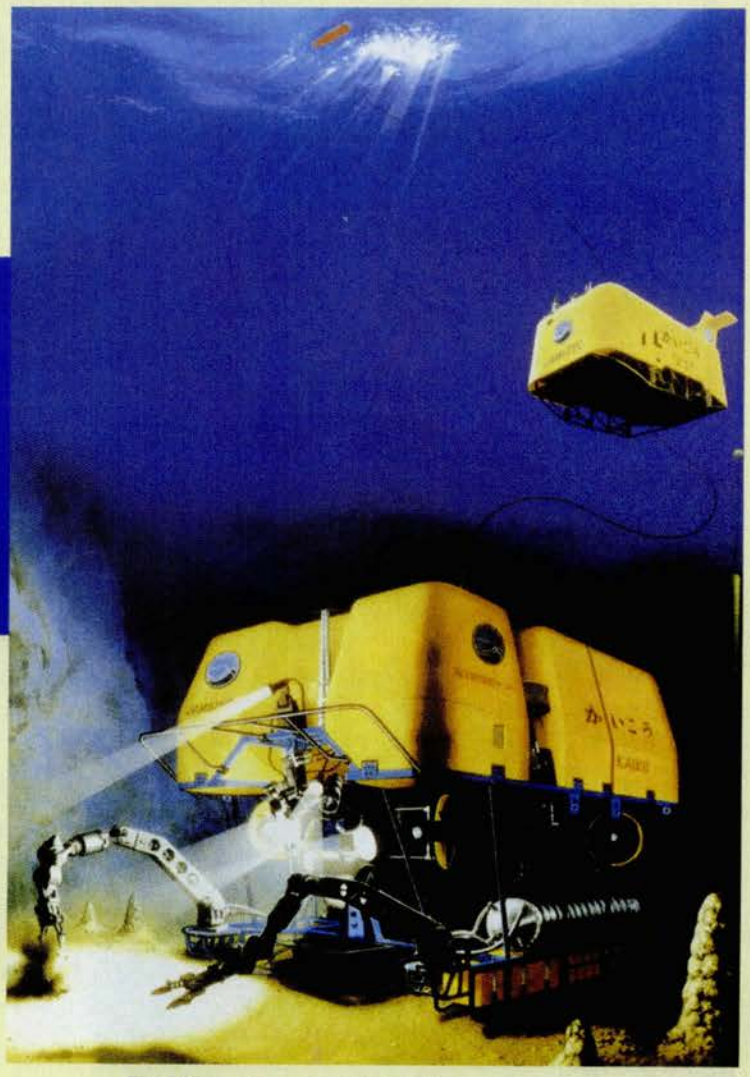
Kaiko #274 CTD profiling data (SBE-19 attached to the launcher)

The 10,000m Class Deep Sea ROV *KAIKO*

かいこう

KAIKO

Capable of Diving to the Deepest Point of the Earth's Ocean Floor



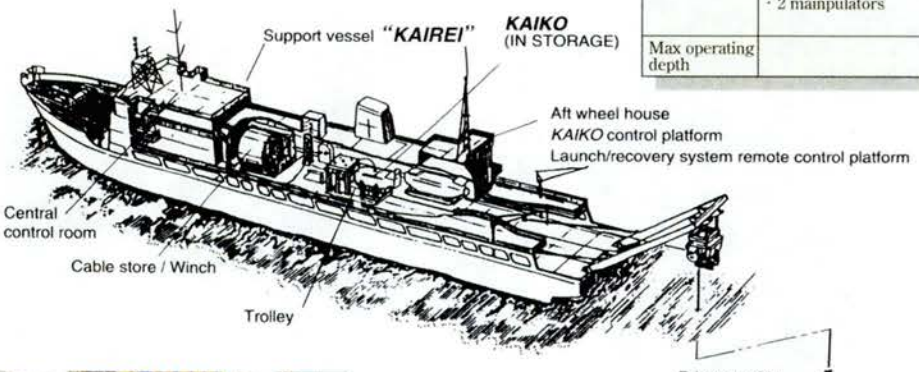
KAIKO means 'trench' in Japanese.

KAIKO Control Platform

Four operators steer *KAIKO* while monitoring video and other information sent real time from *KAIKO*'s TV camera and sensors.

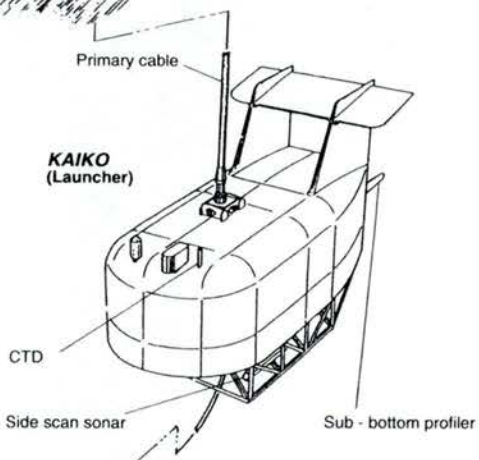
Principal Items of Vehicle and Launcher

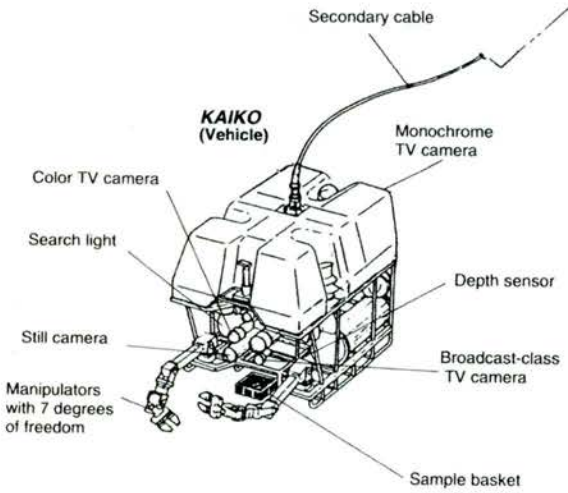
	Vehicle	Launcher
Dimensions L×W×H (m)	3.1×2.0×2.3	5.2×2.6×2.0
Weight	5.4 tons in air -10kg in water	5.1 tons in air 3.1 tons in water
Power	Electro-hydraulic (45kw)	—
Speed	2 knots	1.5 knots (tow speed)
Propulsion	4 horizontal thrusters 3 vertical thrusters	—
Equipment	· Broardcast-class TV camera · 3 color TV camera · Monochrome TV camera · Still camera · Obstacle avoidance sonar · Altitude sonar · Depth sensor · 2 mainpulators	· Side scan sonar (range:1,000m each side) · Sub-bottom Profiler · CTD · Obstacle avoidance sonar · Altitude sonar · Depth sensor · LBL receiver · SSBL receiver
Max operating depth	About 11,000m	



Cable Store/Winch

A reel of 12,000m primary cable
Drum Width: 4,500mm
Drum Diameter: 4,544mm





■CTD

To measure seawater Conductivity, Temperature and Depth

■Side Scan Sonar

To measure sea floor topography by transmitting fan beam underwater acoustic waves and receiving the reflections.

■Sub-Bottom Profiler

To measure the stratum about 30m down beneath the sea floor using underwater acoustic waves.

TOWARD UNDERSTANDING
OCEAN-BOTTOM DYNAMICS

DEEP SEA RESEARCH VESSEL

かいれい

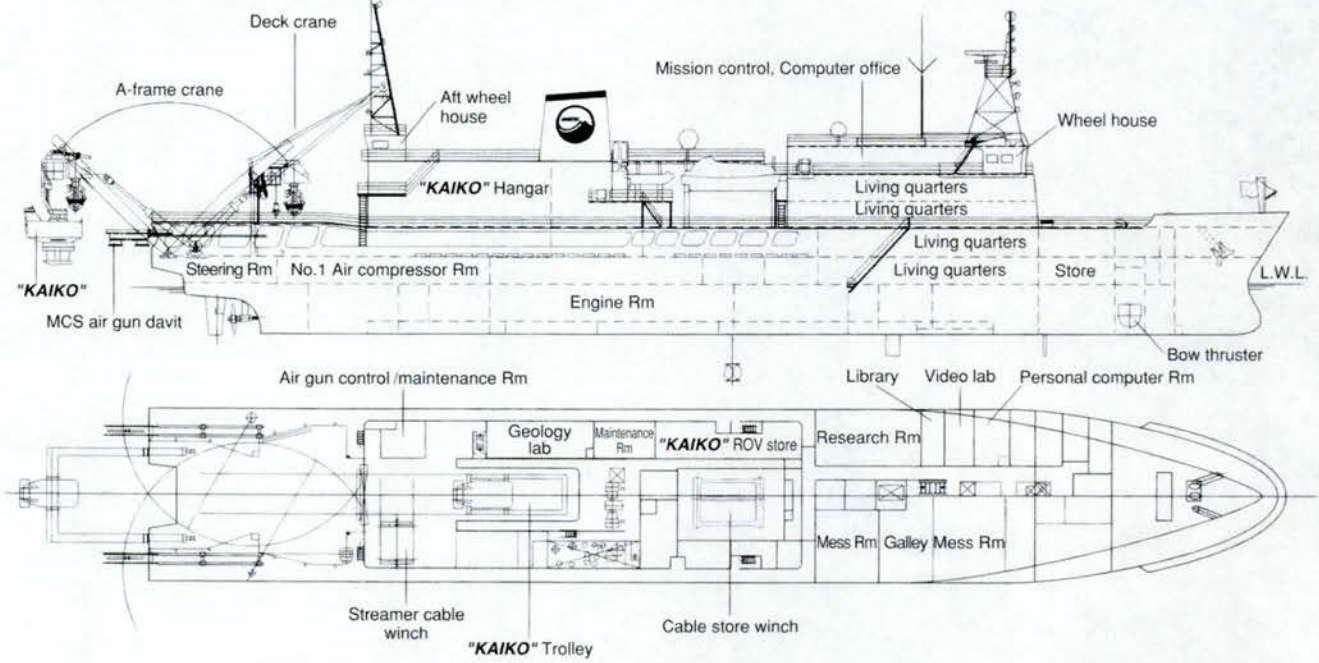
KAIREI

"KAIREI" meaning "oceanic ridge" in Japanese, an elongated, steep-sided elevation or a mountain ridge on the ocean floor formed by volcanic activity, etc.

INTEGRATED RESEARCH VESSEL CAPABLE OF EXPLORING THE WORLD'S DEEPEST SEA TRENCHES

The deep sea research vessel ***"KAIREI"*** is designed to engage in surveying deep sea bottoms such as trenches by serving as the exclusive mother ship for the 10,000m class remotely operated vehicle ***"KAIKO"*** (meaning "trench") which entered service in 1995. In addition, ***"KAIREI"*** is equipped with varied devices (e.g., a multi-channel seismic profiler capable of exploring complex structures of plate subduction zones) for studying deep sea bottom surface layers, faults and other geological morphologies, making it fit for integrated research in trenches and other sea floor areas of the world.

General Arrangement



Principal Particulars, etc.

Principal Particulars	Length	105m
	Breadth	16.0m
	Depth	7.3m
	Draft	4.5m
	Gross tonnage	4,628T
	Service speed	16.7 knots
	Endurance	app. 9,600 nautical miles (app. 17,800 km)
	Main engine	Diesel engines, 2 x app. 2,206 kW x 600 rpm
	Propulsion system	Twin CPP, Bow thruster, Joystick control system
	Complement	Crew 29, Scientists and others 31 /Total 60
Completion		March, 1997