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ROV Hyper Dolphin & R/V Natsushima CRUISE

NT10-E01

North Knoll of the Iheya Ridge, Okinawa Trough Japan

Environmental assessment investigation for the IODP by the Chikyu

ONBOARD REPORT

Chief Scientist
Katsunori Fujikura (JAMSTEC)

By JAMSTEC BioGeos & CDEX

28 August - 4 September, 2010

CONTENTS

1. Cruise information

1.1. Cruise number: NT10-E01

1.2. Ship name: R/V Natsushima, ROV Hyper Dolphin

1.3. Title of the cruise: Environmental assessment investigation for the IODP by the Chikyu in the North Knoll of the Iheya Ridge, Okinawa Trough Japan.

1.4. Proposals:

1) Environmental assessment investigation for the IODP by the Chikyu in the North Knoll of the Iheya Ridge, Okinawa Trough Japan. JAMSTEC domestic investigation.

Ocean Drilling investigation by the Chikyu will be conducted in the early September 2010 at the hydrothermal vent sites, the North Knoll of the Iheya Ridge in the Okinawa Trough. Ocean Drilling investigation can be thought to give the production of the accumulation thing, a vent water activities style a change, and it is expected to influence an environment and an ecosystem. It is the most important doing assessment in advance when it is expected to exert artificial disturbance on the natural environment. And, an environment before and after drilling and a change in the ecosystem are interesting even if the experiment to understand the succession process of the vent ecosystems is taken. Therefore, the purpose of this investigation is environmental assessment investigation for the IODP by the Chikyu. First, before science drilling by "Chikyu" done in September, we try to have data on the biological distribution, the chemical environment, physics environment and the geological environment.

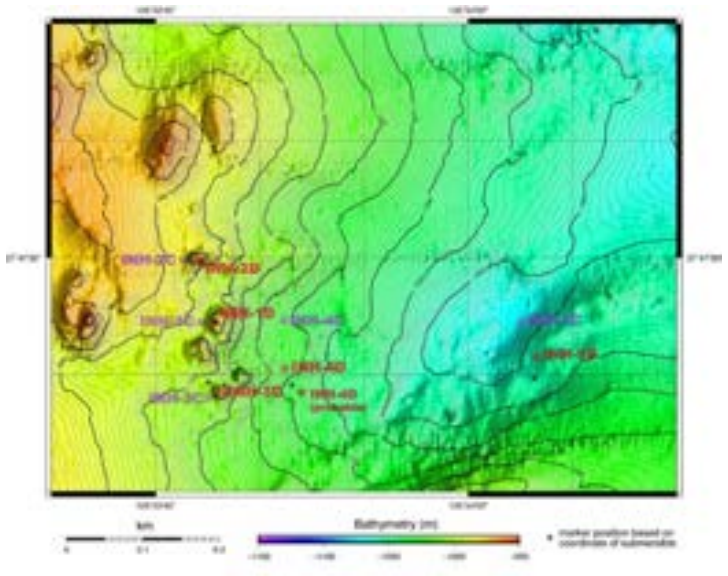
1.5. Cruise period: 2010/8/28-2010/9/4

1.6. Port call:

Departure---JAMSTEC, 2010/8/28

Arrival--- Naha, Okinawa 2010/9/4

1.7. Research area: North Knoll of the Iheya Ridge, Okinawa Trough



2. Researchers

2.1 Chief Scientist

Katsunori Fujikura／JAMSTEC BioGeos

2.2 Science party

Fujikura, Katsunori

Furushima, Yasuo

Yamaki, Aska

Takahashi, Yoshimi

Hirayama, Hisako

Kobayashi, Mariko

Kawagucci, Shinsuke

Okano, Tadashi

Takaesu, Morihumi

3. Science

3.1. Biology

Distribution pattern (Fujikura)

INH-1D site

There is the most active vents in here. The max. temp. of vent fluid was measured at least 293 ° C from the chimney. No sediment was observed. *Lepetodrilus nux, Alvinocais* sp. and *Shinkaia crosnieri* were distributed very close to vent chimnies. Around them, *Bathyacmaea secunda, Alvinocais longirostris, Bathymodiolus platifrons, B. septemdierum* and *Provanna* sp. aff. *glabra* were lived on the outcrop mound.

INH-4D site

Some active vent sites were found. Distribution pattern was similar to those of INH-1D site. *Paralvinella hessleri* were very dominant and very close living to each vents.

INH-5D site

Some sediments covered areas were found in this filed due to not so steep. A couple of dead shell aggregation of *Calyptogena okutanii* were found and living specimens were very rare. Some active vent sites were observed here. Distribution pattern was similar to those of INH-1D and 4D sites. *Alaysia* sp. and *Ashinkailepas seepiophilia* were occurred in here.

Faunal composition and Genetic diversity (Fujikura)

To analysis faunal composition and genetic diversity of vent endemic mega-benthic species, following species were preserved in -80 ° C and 99.5% ethanol. *: collected as sample, ** observation only. Detail sample list is attached as Appendix.

Polifera

Hexactinellida

**Euplectellidae gen. sp.

Mollusca

Gastropoda

**Bathyacmaea secunda*

* *Lepetodrilus nux*

**Margarites ryukyuensis*

* *Iheyaspira lequios*

* *Shinkailepas* sp.

**Provanna* sp. aff. *glabra*

* *Cantrainea jamsteci*

**Buccinidae gen. sp.

*unidentified gastropoda spp.

Mollusca

Bivalvia

**Bathymodiolus japonicus*

**Bathymodiolus platifrons*

**Calyptogena okutanii*

*Thyasiridae gen. sp.

*Solemyidae gen sp.

*unidentified Bivalvia spp.

Annelida

Polychaeta

Alaysia sp.

**Brachipolynoe pettiboneae* (maybe in mantle cavity of *Bathymodiolus* spp.)

**Paralvinella hessleri*

* Cirratulidae gen. et sp.

*unidentified Polychaeta spp.

Arthropoda

Maxillopoda

**Ashinkailepas seepiophilia*

Arthropoda

*Amphipoda spp.

Malacostraca

*Gammaridae gen. sp.

**Alvinocais* sp.

**Alvinocais longirostris*

***Paralomis verrilli*

* *Paralomis* sp.

**Munidopsis* sp.

**Shinkaia crosnieri*

Echinodermata

Asteroidea

**Mediaster* sp. aff. *brachiatus*

Ophiuroidea

*unidentified Ophiuroidea spp.

Holothuroidea

*unidentified Holothuroidea sp.

Vertebrata

Osteichthyes

***Synaphobranchus affinis*

***?Ilyophis brunneus*

*Zoarcidae gen. sp.

Microbe NT10-E01 (Hirayama)

Bathymodiolus mussels are among the dominant chemosynthetic animals found at Iheya North hydrothermal vent field. Previous studies have revealed the phylogenies of the

methane-oxidizing symbionts of *Bathymodiolus* mussels; however little is still known about the physiology of the symbionts. This is partly due to the fact that the symbionts are resistant to be cultivated in a laboratory so far. In this study, I will try to cultivate the methane oxidizing symbionts of *Bathymodiolus japonicus* collected in this expedition by using a newly developed continuous-flow system.

3.2. Environment

Geochemical (Kawagucci & Kobayashi)

Vent fluids were collected using WHATS in 4 bottles from top of chimney at the INH-1D.

Physics (Furushima)

In the Okinawa Trough northern part IHEYA ridge, we carried out physical environmental measurement to evaluate the influence that sediment with sea bottom drilling caused to deep sea ecosystem (deep sea bottom environment). Therefore measurement apparatus were established mainly to examine the next matter.

(1) Quantitative assessment of sediment

(2) Water temperature fluctuation and alimentation near sea bottom

(3) Fluid environment

(1) Quantitative assessment of sediment

It is thought that sediment scattered by sea bottom drilling has an influence on organisms such as *Calyptogena* spp. inhabiting deep-sea floor. Therefore, we produced temporarily-type sediment trap (figure 1) and established it in deep-sea organism habitat near sea bottom drilling point and carried out a measurement of alimentation of suspended matter. Sediment trap will recovery in February, 2011. The main body is closed the cap of a silicon stopper at the time of recovery, and alimentation during an establishment period is measured in a laboratory.

A position of two points that installed temporarily-type sediment trap as follows.

S-1…27° 47.439′ N, 126° 53.838′ E, Depth:1022m (photo. 1)

S-2…27° 47.355′ N, 126° 53.991′ E, Depth:1056m (photo. 2)

Specifications of temporarily-type sediment trap as follows.

① The main body (Figure 1)

Transparence acrylic pipe: diameter 80mm, inside diameter 70mm, length 500mm

Transparence acrylic pipe mouth: taper machining

Transparence acrylic pipe basilar part: thickness 10mm (with threaded hole fixing a plumb)

Transparence acrylic pipe bottom: Fixes a circular lead board in a screw (Regulation

of weight is possible)

② Silicon stopper (Figure 1)

Diameter of a silicon stopper: equal to transparence acrylic pipe mouth

Grip hand part of a silicon stopper: 20cm (silicon with a screw stick)

Pressure regulation hole of a silicon stopper

Silicon cover on the silicon stopper upper part

③ Mount (Figure 1)

Main body: Steel (bottom face 250mm*250mm, upper surface 150mm*150mm, height 200mm)

Main body upper surface : hole of a diameter of 100mm, handle of a semicircle type of a diameter of 40mm in four corners

Whole of main body: Paints it to reduce deterioration by seawater.

In addition, attached a grip made by stainless in the upper part when we installed sediment trap by Hyper Dolphin (refers to photo 1 or photo 2).

(2) Water temperature fluctuation and alimentation near sea bottom

We produced a marker (photograph 3~6) with small size thermometer, and it was installed to observe effect of accumulation with sea bottom drilling for simplicity and to measure environment (water temperature) fluctuation of sea bottom. The marker was made with a rope (diameter: 3mm) of 50cm that wrote down memory (as for every 1cm) in lead for fishing (about 500g). In addition, rubber bulb of a diameter of 60mm was installed in the upper part so that a rope became approximately perpendicular. The thermometer was fixed for an anchor with MDS-MkV/T (size: φ18mm*80mm, measurement range: -4 - 40 degrees Celsius, resist pressure: 2,000m) made in JFE ADVANTECH CO., LTD..

The marker with small thermometer established it to four points of follows.

H1178-T1…27° 47.428′ N, 126° 53.875′ E, Depth:1030m serial number: 101669

H1178-T2…27° 47.439′ N, 126° 53.838′ E, Depth:1022m serial number: 101673

H1178-T3…27° 47.464′ N, 126° 53.805′ E, Depth:989m serial number: 101960

H1178-T4…27° 47.355′ N, 126° 53.991′ E, Depth:1056m serial number: 102558

These markers will recovery in Feb., 2011. A measurement result to be provided from these thermometers will show a difference of water temperature fluctuation of sea bottom in before and after of drilling.

(3) Fluid environment

It is important to know fluctuation of a fluid environment nearly sea floor to regard effect of sedimentation to occur at sea bottom drilling. However, we were not able to install ADCP (Acoustic Doppler Current Profiler) by effect of bad weather (bad hydrographic conditions) this time. Flow near deep-sea floor is along bottom topography and a flow having tidal periodicity (fluctuation) is measured (for example, Hatoma knoll, off Hatsushima Island at

Sagami Bay). Perhaps we can expect that a flow in northern part IHEYA ridge tends to be similar. Therefore it will be necessary to carry out a current measurement in a short term if there is an opportunity.

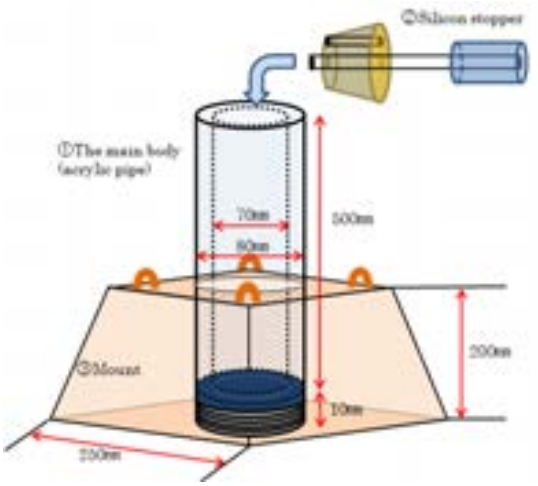


Figure1 Temporarily-type sediment trap

4. Dive Results

4.1. List of all the dives & event sites (Hirayama)

DIVE NUMBER : HPD#1178
DIVE SITE : Iheya North Knoll
DATE : 2010/09/03

Time (LCT)	Dep. (m)	Lat.	Long.	Placed object	Site description
8:32	1029.5	27°47.428'N	126°53.875'E	マーカー H1178-T1-1669 (温度計下 4 桁 No)	Event mark #27 付近と思われる。ゴエモン&ヒバリガイ
8:39	1023.4	27°47.427'N	126°53.847'E	マーカー H1178-1	event mark #4 (INH-4D) 付近。ゴエモン&ヒバリガイ
9:15	1021.0	27°47.439'N	126°53.838'E	セディメントトラップ S-1 マーカー H1178-T2-1673 (温度計下 4 桁 No)	INH-1A (NBC チムニー) の南東 70m くらいの砂地
10:43	979.4	27°47.464'N	126°53.805'E	マーカー H1178-T3-1960 (温度計下 4 桁 No)	INH-1A(NBC チムニー) 頂上の熱水噴出孔周辺
11:28	991.8	27°47.413'N	126°53.803'E	マーカー H1178-2	INH-3A (SBC チムニー) 頂上
12:29	1062.7	27°47.431'N	126°54.028'E	マーカー H1178-5	シンカイヒバリガイで覆われた岩
12:56	1056.0	27°47.443'N	126°54.055'E	マーカー H1178-3	ハオリムシサイト、硫黄析出、ヒバリガイ
14:19	1022.0	27°47.352'N	126°53.978'E	マーカー H1178-4	シロウリガイサイト
15:02	1056.4	27°47.416'N	126°54.034'E	マーカー H1178-T4-2558 (温度計下 4 桁 No) セディメントトラップ S-2	H1104-1 マーカー (2010/4 月設置)サイト。INH-5D 付近のシロウリガイサイト

4.2. Preliminary dive results

#1178 (Kawagucci)

Date: 2010.9.3

Site: The North Knoll of the Iheya Ridge, Okinawa Trough.

Landing: Time 08:10 Lat 27° 47.424' N, Long 126° 53.914' E, Depth 1045m (WGS84)

Leaving: Time 15:16 Lat 27° 47.355' N, Long 126° 53.991' E, Depth 1056m (WGS84)

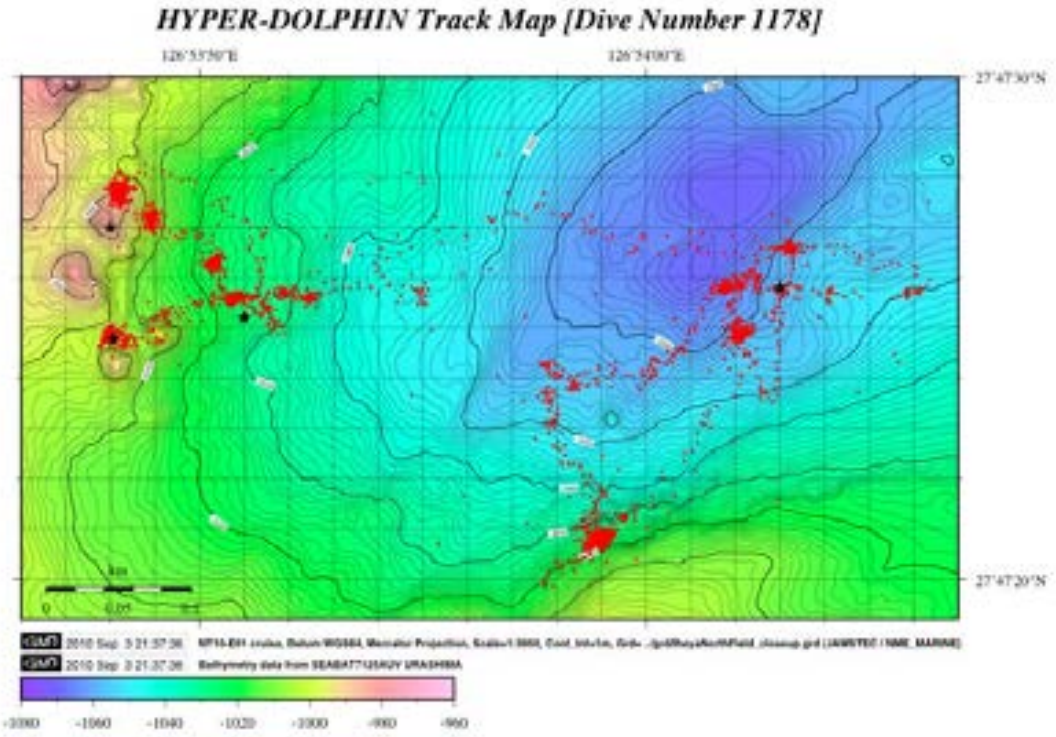
Purpose: Environmental assessment investigation for the IODP by the Chikyu in the North Knoll of the Iheya Ridge, Okinawa Trough Japan

Mission & Results:

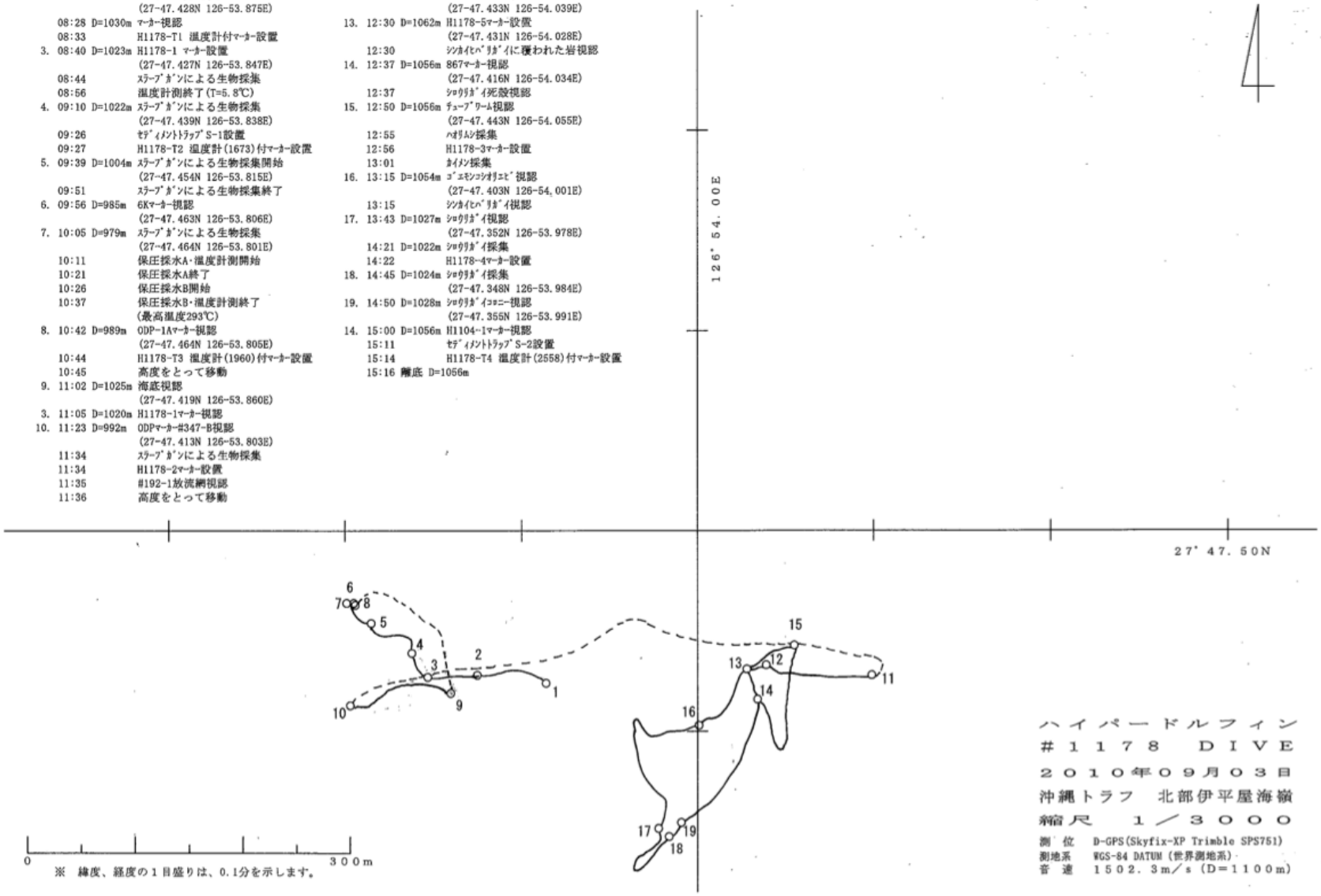
Four thermometer-mounted markers (named 1178-T1~T4) and other four simple markers (named 1178-1~4) were placed.

Hydrothermal fluid venting at the NBC site was taken through the RGC temperature probe unit by an ese-WHATS system. Maximum fluid temperature was 293oC. Geochemical composition will be analyzed at onshore laboratory.

Benthic macrofauna lived at the Iheya-North hydrothermal field were cyclopaedically taken.
Two sediment traps were deployed on the seafloor.
Visual observation on the seafloor at the western inside wall of the Iheya-North knoll was carried out to describe distribution of venting sites and animal colonies.



1. 08:10 着底 D=1045m
(27-47.424N 126-53.914E)
2. 08:24 D=1031m ｼﾝｶｲｾﾝｼｮｳｳｶｲ視認
(27-47.428N 126-53.875E)
08:28 D=1030m ﾏｰｶｰ視認
08:33 H1178-T1 温度計付ﾏｰｶｰ設置
3. 08:40 D=1023m H1178-1 ﾏｰｶｰ設置
(27-47.427N 126-53.847E)
08:44 ｽﾗｰﾌﾟｶﾞﾝによる生物採集
08:56 温度計測終了(T=5.8℃)
4. 09:10 D=1022m ｽﾗｰﾌﾟｶﾞﾝによる生物採集
(27-47.439N 126-53.838E)
09:26 ｾﾃﾞｨﾒﾝﾄﾄﾗｯﾌﾟS-1設置
09:27 H1178-T2 温度計(1673)付ﾏｰｶｰ設置
5. 09:39 D=1004m ｽﾗｰﾌﾟｶﾞﾝによる生物採集開始
(27-47.454N 126-53.815E)
09:51 ｽﾗｰﾌﾟｶﾞﾝによる生物採集終了
6. 09:56 D=985m 6Kﾏｰｶｰ視認
(27-47.463N 126-53.806E)
7. 10:05 D=979m ｽﾗｰﾌﾟｶﾞﾝによる生物採集
(27-47.464N 126-53.801E)
10:11 保圧採水A・温度計測開始
10:21 保圧採水A終了
10:26 保圧採水B開始
10:37 保圧採水B・温度計測終了
(最高温度293℃)
8. 10:42 D=989m ODP-1Aﾏｰｶｰ視認
(27-47.464N 126-53.805E)
10:44 H1178-T3 温度計(1960)付ﾏｰｶｰ設置
10:45 高度をとって移動
9. 11:02 D=1025m 海底視認
(27-47.419N 126-53.860E)
3. 11:05 D=1020m H1178-1ﾏｰｶｰ視認
10. 11:23 D=992m ODPﾏｰｶｰ#347-B視認
(27-47.413N 126-53.803E)
11:34 ｽﾗｰﾌﾟｶﾞﾝによる生物採集
11:34 H1178-2ﾏｰｶｰ設置
11:35 #192-1放流網視認
11:36 高度をとって移動
11. 12:04 D=1045m 海底視認
(27-47.428N 126-54.099E)
12. 12:17 D=1058m ｼﾝｶｲﾋﾊﾞﾘｶﾞｲ視認
(27-47.433N 126-54.039E)
13. 12:30 D=1062m H1178-5ﾏｰｶｰ設置
(27-47.431N 126-54.028E)
12:30 ｼﾝｶｲﾋﾊﾞﾘｶﾞｲに覆われた岩視認
14. 12:37 D=1056m 867ﾏｰｶｰ視認
(27-47.416N 126-54.034E)
12:37 ｼｮｳﾘｶﾞｲ死殻視認
15. 12:50 D=1056m ﾁｭｰﾌﾞﾜｰﾑ視認
(27-47.443N 126-54.055E)
12:55 ﾍｵﾘﾑｼ採集
12:56 H1178-3ﾏｰｶｰ設置
13:01 ｶｲﾒﾝ採集
16. 13:15 D=1054m ｺﾞｴﾓﾝｺｼｵﾘｴﾋﾞ視認
(27-47.403N 126-54.001E)
13:15 ｼﾝｶｲﾋﾊﾞﾘｶﾞｲ視認
17. 13:43 D=1027m ｼｮｳﾘｶﾞｲ視認
(27-47.352N 126-53.978E)
14:21 D=1022m ｼｮｳﾘｶﾞｲ採集
14:22 H1178-4ﾏｰｶｰ設置
18. 14:45 D=1024m ｼｮｳﾘｶﾞｲ採集
(27-47.348N 126-53.984E)
19. 14:50 D=1028m ｼｮｳﾘｶﾞｲｺﾛﾆｰ視認
(27-47.355N 126-53.991E)
14. 15:00 D=1056m H1104-1ﾏｰｶｰ視認
15:11 ｾﾃﾞｨﾒﾝﾄﾄﾗｯﾌﾟS-2設置
15:14 H1178-T4 温度計(2558)付ﾏｰｶｰ設置
15:16 離底 D=1056m



※ 緯度、経度の１目盛りは、0.1分を示します。

ハイパードルフィン
＃１１７８ ＤＩＶＥ
２０１０年０９月０３日
沖縄トラフ 北部伊平屋海嶺
縮尺 １／３０００
測 位 D-GPS(Skyfix-XP Trimble SPS751)
測地系 WGS-84 DATUM (世界測地系)
音 速 １５０２．３m／s (D＝１１００m)