



KAIYO Cruise Report

KY15-09

Construction of DONET2 system

Off Kii Channel

Kumano-nada

May. 23 – July. 9, 2015

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

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1. Cruise Information

- Cruise ID KY15-09
- Name of vessel R/V KAIYO
- Title of the cruise Title of the cruise: Construction of DONET2 system
- Title of proposal Construction of DONET2 system
- Cruise period Leg1; May.23 – June.17, 2015
Leg2; June.20 – July.9, 2015
- Ports of call JAMSTEC Yokosuka – Wakayama shimotsu – JAMSTEC Yokosuka
- Research area Off Kii-Channel, Kumano Nada
- Research Map

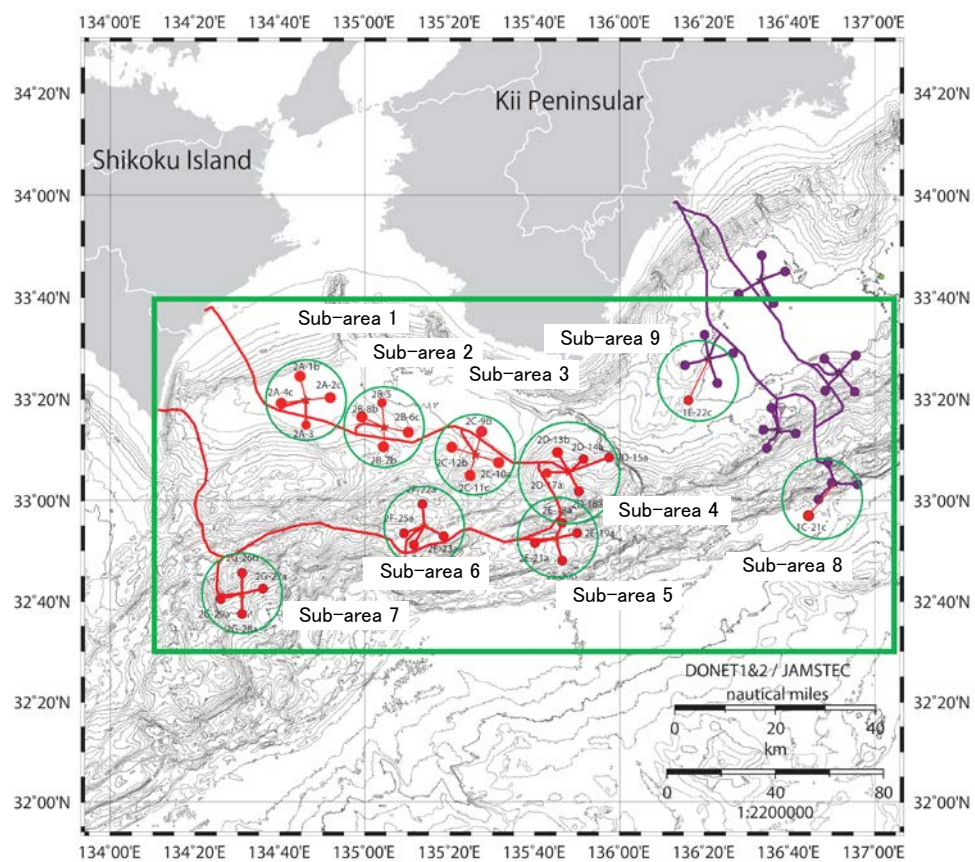


Figure 1.1 Research area and sub-area

2. Science Party

● Chief scientist:	Takashi Yokobiki	[JAMSTEC]
● Representative of the science party:	Shuichi Kodaira	[JAMSTEC]
● Science party:	Jin-Kyu Choi	[JAMSTEC]
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	Takeshi Ohki (Leg1)	[JAMSTEC]
	Isao Okabayashi	[JAMSTEC]
● Marine Technician:	Masayuki Toizumi (Leg1)	[NME]
	Yuji Fuwa (Leg1)	[NME]
	Satsuki Iijima (Leg1)	[NME]
	Tooru Koderu (Leg2)	[NME]
	Hisanori Iwamoto (Leg2)	[NME]
	Toshimasa Nasu (Leg2)	[NME]

3. Background

DONET (Dense Oceanfloor Network System for Earthquakes and Tsunamis) is a submarine cabled observatory network and has been developing for the purpose of monitoring the seismogenic zone around the Nankai Trough. The development of DONET has been carried out since 2006, and the system consists of three major components; the backbone cable system, the science node, and the measurement instrument. The electric power and the communication channels are provided to the underwater equipment through the high reliability backbone cable system that is developed based on submarine telecommunication cable systems. The science node is the device with the role of hub and electric power distributor. The measurement instruments are composed of precision seismometer and pressure gauge to observe small or large earthquakes, slow-slip events on the plate boundary, and tsunamis. The measurement instruments are connected to the science node with the extension cables that is laid on the sea bed using ROV. These components brings to DONET system three key features; Redundancy, Extendable, and Replaceable of the measurement instruments. The first DONET system named DONET1 has been operating with the 250km backbone cable, 5 science nodes and 20 observatories since August 2011. The second DONET project named DONET2 is composed of 320km backbone cable, 7 science nodes, 29 observatories and 2 additional observatories of DONET1. The first laying operation of the DONET2 backbone cable system was carried out from January to February in 2014. In the laying operation, three terminal units in the northern section were installed. The remaining section was installed in 2014 and two landing stations were connected through the backbone cable system. The purpose of this expedition is to connect the measurement instruments to the backbone cable system.

4. Operation list

Table 1 List of KY15-09 Leg1 operation

Date	Area	Dive No.	Operation
23. May, 2015	Yokosuka		Departure
24	Off Kii Channel		Shift
25		Dive#1826	The sediment removal in the caisson; 2F-23
26		Dive#1827	Installation of the measurement instruments; 2E-29
27		Dive#1828	Laying operation of the extension cable; 2G-26
28		Dive#1829	Laying operation of the extension cable; 2F-22
29			Harborage
30		Dive#1830	Laying operation of the extension cable; 2E-19
31		Dive#1831	Installation of the measurement instruments; 1E-22
1. June		Dive#1832	Installation of the measurement instruments; 2E-21
2		Dive#1833	Installation of the measurement instruments; 2F-23
3			Harborage
4			Harborage
5		Dive#1834	Installation of the measurement instruments; 2G-29
6		Dive#1835	The sediment removal in the caisson; 2G-27
7		Dive#1836	Laying operation of the extension cable; 2F-23
8			Harborage
9			Harborage
10		Dive#1837	Laying operation of the extension cable; 2C-9
11		Dive#1838	The sediment removal in the caisson; 2F-24
12		Dive#1839	The sediment removal in the caisson; 2G-28
13		Dive#1840	Laying operation of the extension cable; 2G-29
14			Harborage
15		Dive#1841	Laying operation of the extension cable; 2E-21
16		Dive#1842	Installation of the measurement instruments; 2B-7
17	Wakayama port		Arrival; End of KY15-09Leg1

Table 2 List of KY15-09 Leg2 operation

Date	Area	Dive No.	Operation
20. June, 2015	Wakayama port		Departure
21	Off Kii Channel	Dive#1843	The caisson installation; 2C-10
22		Dive#1844	The caisson installation; 2E-20
23		Dive#1845	The caisson installation; 1C-21
24		Dive#1846	Installation of the measurement instruments; 2E-20
25		Dive#1847	Installation of the measurement instruments; 2G-28
		Dive#1848	Installation of the measurement instruments; 2G-27
26			Harborage
27			Harborage
28			Harborage
29		Dive#1849	Laying operation of the extension cable; 2C-12
30		Dive#1850	Laying operation of the extension cable; 2B-7
1. July			Harborage
2			Harborage
3			Harborage
4		Dive#1851	Installation of the measurement instruments; 2F-24
		Dive#1852	Installation of the measurement instruments; 2B-7
5			Harborage
6		Dive#1853	Laying operation of the extension cable; 2C-10
7			Umbilical cable maintenance
8			Shift
9	Yokosuka		Arrival; End of KY15-09Leg2

5. Dive Summary

5.1. DIVE #1826 on May. 25, 2015: Sediment removal at 2F-23

In this dive, the preparations which install measurement instrument in a caisson were carried out. The tilting angle of the caisson was measured to make sure whether it is suitable for installation of the seismometer package. It was confirmed that the tilting angle is less than 10 degrees and this indicates that the caisson can be used for housing the seismometer package. After measuring the tilting angle, the sediments in the caisson were removed using the vacuum system mounted on the ROV Hyper Dolphin and then a cover plate was placed on the caisson. The position of the caisson is 32-52.961N, 135-18.495E, Depth: 2647m.



(a) Before operation



(b) Measuring the tilting angle



(c) After sediment removal



(d) Placing a cover plate on the caisson

Fig. 5.1. Measuring the tilting angle and sediment removal at 2F-23.

5.2. DIVE #1827 on May. 26, 2015: Installation of the measurement instrument at 2E-19

In this dive, we installed an observatory system at the caisson 2E-19. The observatory system consists of a seismometer, a pressure sensor package, and a battery package. First, the seismic sensor package was installed inside the caisson. Next, the pressure package was deployed next to the seismic package. These two sensors are initially connected. The battery package was then deployed next the pressure package and connected.

Observatory site 2E-19

Depth 3,456m

Position: 32-53.517N, 135-50.013E

Homer ID: 70



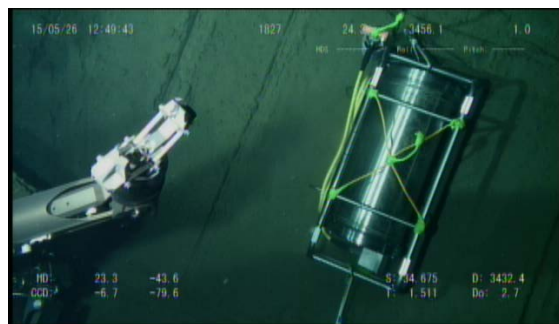
(a) Before installation



(b) Installation of the seismometer



(c) The pressure sensor package

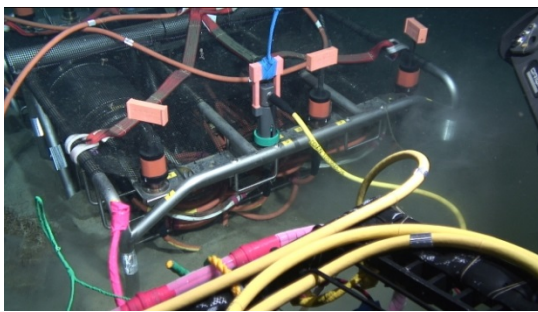


(d) The external battery

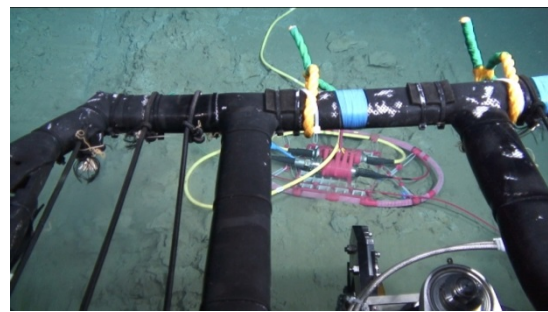
Fig 5.2. Installation of the measurement instruments at 2E-19

5.3. DIVE #1828 on May. 27, 2015: Laying operation of the extension cable at 2G-26

The cable-laying operation from the “Node2G” to the observatory “2G-26” was carried out using the automated cable-laying system. After landing on near the node, the ROV first put the underwater mateable connector linking to the upper end of the cable on the cable bobbin into the port 5 of the “Node2G” (Fig.5.3 a). After that, the junction box was put on the seafloor (Fig. 5.3 b). Then, the cable laying operation was started (Fig.5.3 c). The ROV laid down the cable from the “Node2G” to the observatory “2G-26”, and then the cable bobbin was put on the seafloor near the observatory “2G-26” (Fig.5.3 d). At last, the ROV connected the cable from “Node 2G” to the observatory “2G-26” (Fig.5.4 e). The length of the laid cable was 8,116 [m], the traveled distance was 7,775 [m].



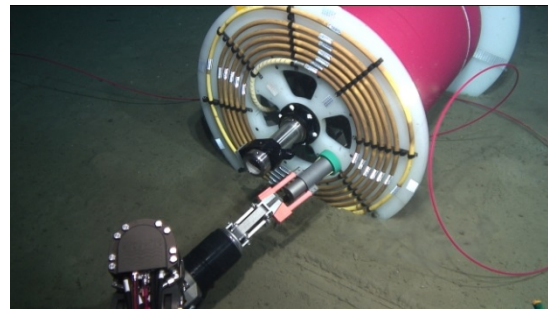
(a) Connection with the node (Port No.5)



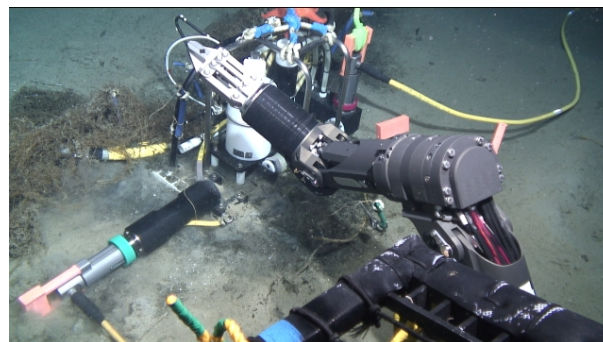
(b) The junction box



(c) Cable laying Operation



(d) Cable bobbin

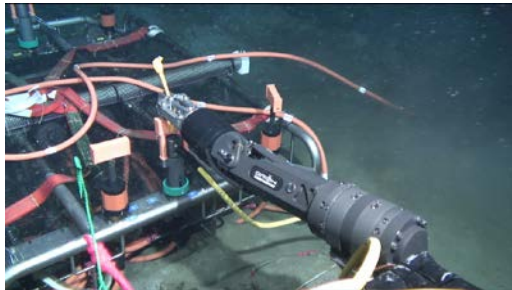


(e) The cable from “Node 2G” was connected to observatory “2G-26”

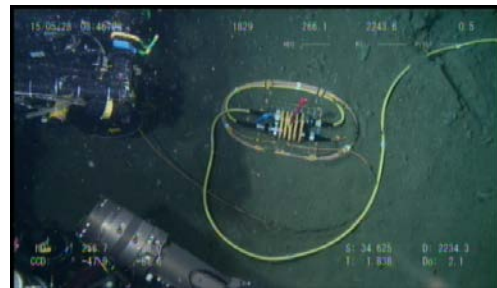
Fig.5.3. Cable Laying operation of the extension cable at 2G-26

5.4. DIVE #1829 on May. 28, 2015: Laying operation of the extension cable at 2F-22

The cable-laying operation from Node 2F to the observatory 2F-22 was carried out using the automated cable-laying system. After landing near Node 2F, the ROV first put the underwater mateable connector linking to the forefront of the cable on the cable bobbin into the port 6 of the node. After that, the junction box was placed on the seafloor and the cable-laying operation was started. After arriving at near the observatory 2F-22, the ROV placed the cable bobbin on the seafloor and connected the cable from Node 2F with the observatory 2F-22 using the underwater mateable connector. It was confirmed that there is no problem in communication between the observatory 2F-22 and the landing station. The length of the dispensed cable was approximately 8409m and the traveled distance was approximately 8098m.



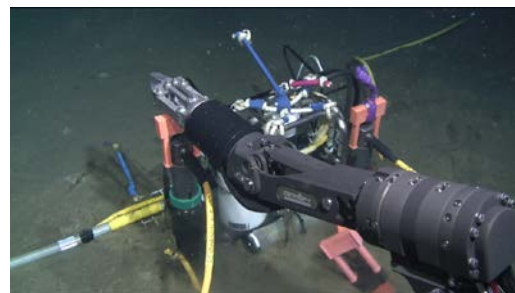
(a) Connection with Node 2F



(b) Placing the junction box on the seafloor



(c) Placing the cable bobbin on the seafloor

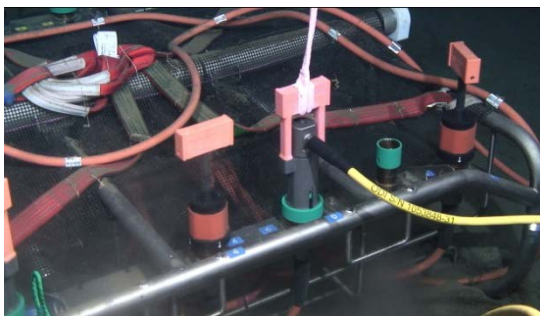


(d) Connection with the observatory

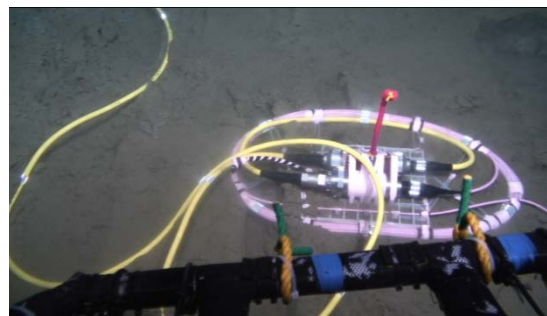
Fig.5.4. Cable Laying operation of the extension cable at 2F-22

5.5. DIVE #1830 on May. 30, 2015: Laying operation of the extension cable at 2E-19

The cable-laying operation from the “Node2E” to the observatory “2E-19” was carried out using the automated cable-laying system. After landing on near the node, the ROV first put the underwater mateable connector linking to the forefront of the cable on the cable bobbin into the port 6 of the “Node2E” (Fig.5.5a). After that, the junction box was put on the seafloor (Fig.5.5b). Then, the cable laying operation was started (Fig.5.5c). The ROV laid down the cable from the “Node2E” to the observatory “2E-19”, and then the cable bobbin was put on the seafloor near the observatory “2E-19” (Fig.5.5d). At last, the ROV connected the cable from “Node 2E” to the observatory “2E-19” (Fig.5.5e). The length of the laid cable was 8,477 [m], the traveled distance was 7,935 [m].



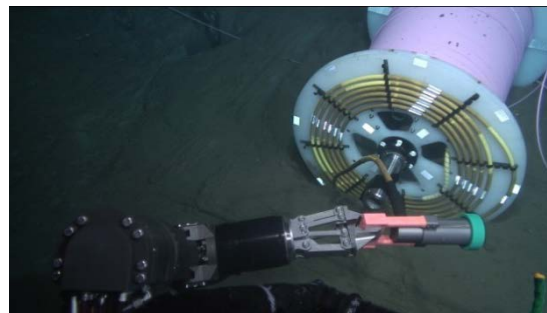
(a) Connection with the node (Port No.6)



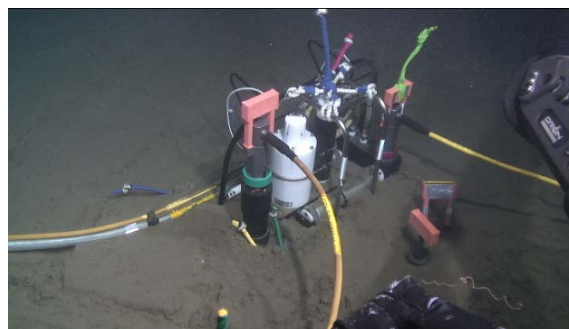
(b) Installation of the junction box



(c) Cable laying Operation



(d) Cable bobbin with cable on the seafloor



(e) The cable from “Node 2E” was connected to observatory “2E-19”

Fig.5.5. Cable Laying operation of the extension cable at 2E-19

5.6. DIVE #1831 on May. 31, 2015: Installation of the measurement instrument at 1E-22

In this dive, we installed an observatory system into the caisson at the point 1E-22 using an ROV Hyper Dolphin. The observatory system consists of the three parts; a seismic sensor package, a pressure sensor package and a battery package. First the seismic sensor package was installed inside the caisson. The pressure sensor package was then deployed on the seafloor next to the seismic package. The battery package was connected to the pressure sensor package. These three packages are connected by cables. An ROV Homer (ID: 54) was placed near the pressure sensor package. Finally the cover plate was collected before leaving the point.



(a) Seismometer package



(b) Pressure sensor package



(c) Battery package



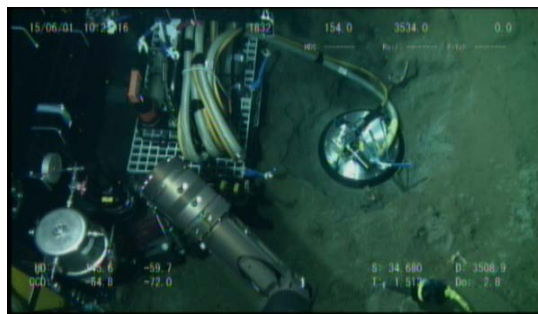
(d) Connection with the battery package

Fig. 5.6. Installation of the measurement instrument at 1E-22

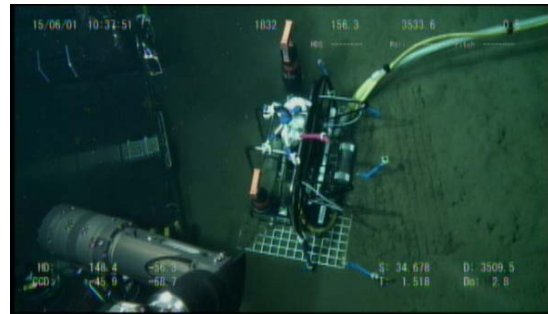
5.7. DIVE #1832 on June. 1, 2015: Installation of the measurement instrument at 2E-21

In this dive, we installed an observatory system into the caisson at 2E-21 using an ROV Hyper Dolphin. The observatory system consists of the three parts; seismic sensor package, a pressure sensor package and a battery package. First the seismic sensor package was installed inside the caisson by using the ROV. The pressure sensor package was then deployed on the seafloor next to the seismic package. In addition, the battery package was deployed next to the pressure package. These three packages are connected by cables. The miniature transponder (ID: 59) was deployed close to the pressure sensor package. Finally the caisson cover was collected before leaving the point.

2E-21 position: 32-51.616N, 135-40.022E



(a) Installing the seismic sensor package



(b) The pressure sensor package



(c) The battery package



(d) The battery package and the sensor was connected

Fig. 5.7. Installation of the measurement instrument at 2F-22

5.8. DIVE #1833 on June. 2, 2015: Installation of the measurement instrument at 2F-23

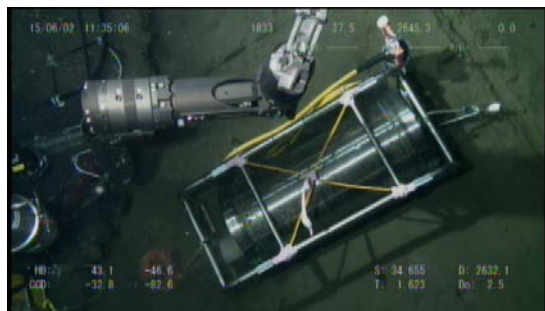
In this dive, we installed measurement instrument at 2F-23. The measurement instrument is composed of a seismometer package, a pressure sensor package, and a battery package. First, the seismometer package was inserted inside the caisson and the pressure sensor package was placed on the seafloor at a distance of approximately 10m from the seismometer package. And then, the battery package was put on the seafloor next to the pressure sensor package. Finally, the ROV Hyper Dolphin connected the battery package to the pressure sensor package using the underwater mateable connector. In addition, the covering plate placed on the caisson was recovered.



(a) Seismometer package



(b) Pressure sensor package



(c) The battery package



(d) Connection with the battery package

Fig. 5.8. Installation of the measurement instrument at 2F-23

5.9. DIVE #1834 on June. 5, 2015: Installation of the measurement instrument at 2G-29

In this dive, we installed an observatory system into the caisson at the point 2G-29 using an ROV Hyper Dolphin. The observatory system consists of the three parts; seismic sensor package, a pressure sensor package and a battery package. First the seismic sensor package was installed inside the caisson. The pressure sensor package was then deployed on the seafloor next to the seismic package. In addition, the battery package was deployed next to the pressure package. These three packages are connected by cables. The miniature transponder (ID: 60) was deployed close to the pressure sensor package. Finally the used caisson cover was collected before leaving the point.

2G-29 position: 32-40.511N, 134-26.004E



(a) The lid on the caisson was covered with seaweed



(b) seismic sensor package



(c) Pressure sensor package



(d) External battery

Fig. 5.9. Installation of the measurement instrument at 2G-29

5.10. DIVE #1835 on June. 6, 2015: Sediment removal at 2G-27

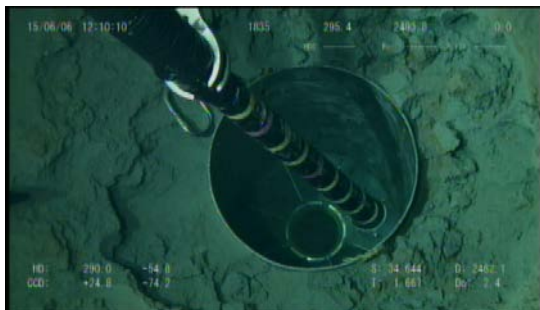
In this dive, the preparations which install measurement instrument in a caisson were carried out. After landing, the ROV moved toward the caisson at 2G-27. The tilting angle of the caisson was measured to make sure whether it is suitable for installation of the seismometer package. It was confirmed that the tilting angle is less than 10 degrees and this indicates that the caisson can be used for housing the seismometer package. After measuring the tilting angle, the sediments in the caisson were removed using the vacuum system mounted on the ROV and then a cover plate was placed on the caisson. In addition, an additional ROV-Homer (ID: 21) and a buoy were installed for easy homing. The position of the caisson is (2G-27: 32-42.525N, 134-35.979E, Depth: 2494m).



(a) Before sediment removal



(b) Measuring the tilting angle



(c) After sediment removal

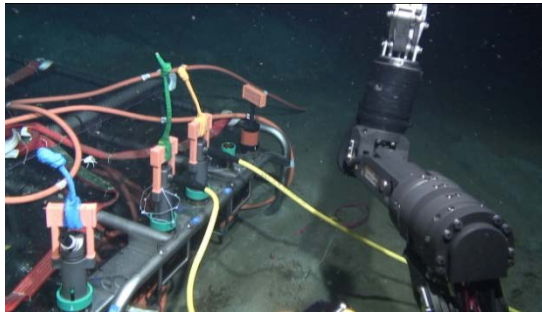


(d) Placing a cover plate on the caisson

Fig. 5.10. Measuring the tilting angle and sediment removal at 2G-27

5.11. DIVE #1836 on June.7, 2015: Cable-laying operation at 2F-23

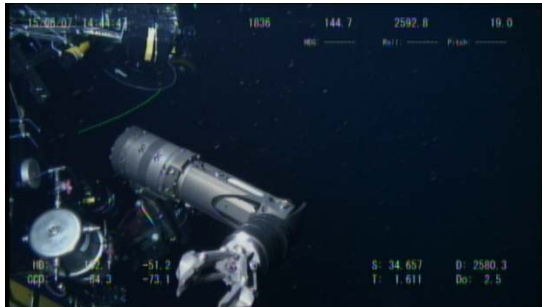
The cable-laying operation from Node 2F to the observatory 2F-23 was carried out using the automated cable-laying system. After landing near Node 2F, the ROV first put the underwater mateable connector linking to the upper end of the cable on the cable bobbin into the port 4 of the node. After that, the junction box was placed on the seafloor and the cable-laying operation was started. After arriving at near the observatory 2F-23, the ROV placed the cable bobbin on the seafloor and connected the cable with the observatory 2F-23 using the underwater mateable connector. It was confirmed that there is no problem in communication between the observatory 2F-23 and the landing station. The length of the dispensed cable was approximately 8,236m and the traveled distance was approximately 7,797m.



(a) Connection with the node (Port No.4)



(b) Installation of the junction box



(c) Cable laying Operation



(d) Cable bobbin with cable on the seafloor

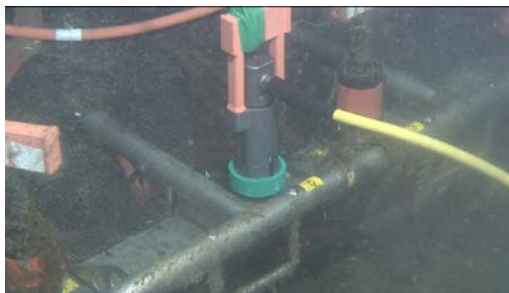


(e) The cable from “Node 2F” was connected to observatory “2F-23”

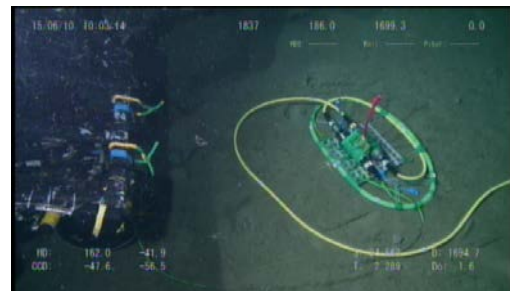
Fig 5.11. Cable-laying operation from Node 2F to the observatory 2F-23

5.12. DIVE #1837 on June.10, 2015: Cable-laying operation at 2C-9

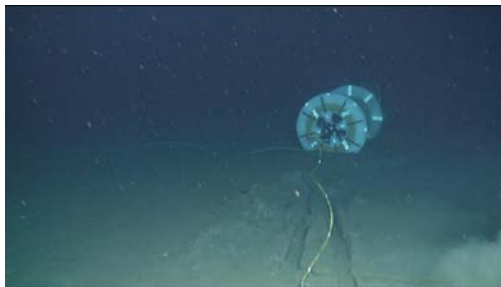
The cable-laying operation from Node 2C to the observatory 2C-9 was carried out using the automated cable-laying system. After landing near Node 2C, the ROV first put the underwater mateable connector linking to the upper end of the cable into the port 5 of the node. After that, the junction box was placed on the seafloor and the cable-laying operation was started. After arriving at near the observatory 2C-9, the ROV placed the cable bobbin on the seafloor and connected the cable with the observatory 2C-9 using the underwater mateable connector. It was confirmed that there is no problem in communication between the observatory 2C-9 and the landing station. The length of the laid cable was approximately 9443m and the traveled distance was approximately 9159m.



(a) Connection with the Node 2C



(b) Installation of the junction box



(c) Placing the cable bobbin



(d) Connection with the observatory

Fig 5.12. Cable-laying operation from Node 2C to the observatory 2C-9

5.13. DIVE #1838 on June. 11, 2015: Sediment removal at 2F-24

In this dive, the preparations which install measurement instrument in a caisson were carried out. After landing, the ROV moved toward the caisson at 2F-24. The tilting angle of the caisson was measured to make sure whether it is suitable for installation of the seismometer package. It was confirmed that the tilting angle is less than 10 degrees and this indicates that the caisson can be used for housing the seismometer package. After measuring the tilting angle, the sediments in the caisson were removed using the vacuum system mounted on the ROV and then a cover plate was placed on the caisson.

The position of the caisson is (2F-24: 32-51.273N, 135-11.493E, Depth: 2,394m).



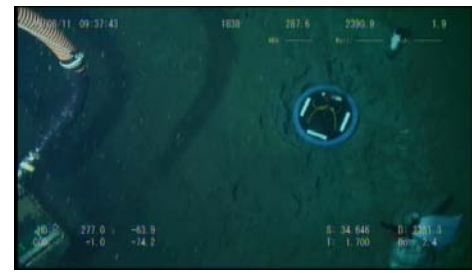
(a) Before sediment removal



(b) Measuring the tilting angle



(c) After sediment removal



(d) Placing a cover plate on the caisson

Fig. 5.13. Measuring the tilting angle and sediment removal at 2F-24

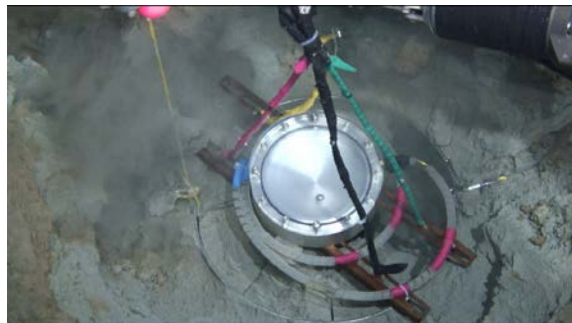
5.14. DIVE #1839 on June. 12, 2015: Sediment removal at 2G-28

In this dive, the preparations which install measurement instrument in a caisson were carried out. After landing, the ROV moved toward the caisson at 2C-28. The tilting angle of the caisson was measured to make sure whether it is suitable for installation of the seismometer package. It was confirmed that the tilting angle is less than 10 degrees and this indicates that the caisson can be used for housing the seismometer package. After measuring the tilting angle, the sediments in the caisson were removed using the vacuum system mounted on the ROV and then a cover plate was placed on the caisson.

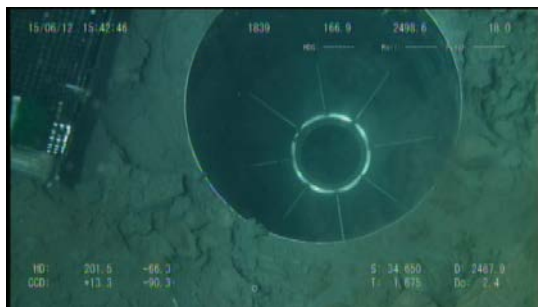
The position of the caisson is (2G-28: 32-37.509N, 135-30.982E, Depth: 2,499m).



(a) Before sediment removal



(b) Measuring the tilting angle



(c) After sediment removal



(d) Placing a cover plate on the caisson

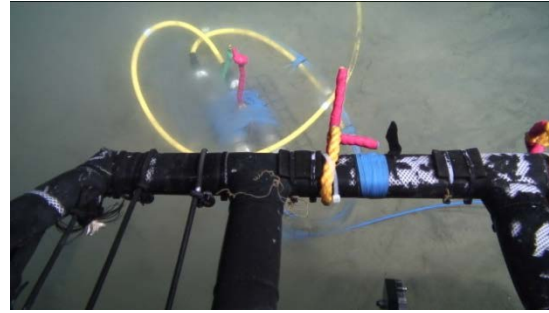
Fig. 5.14. Measuring the tilting angle and sediment removal at 2G-28

5.15. DIVE #1840 on June.13, 2015: Cable-laying operation at 2G-29

The cable-laying operation from Node 2G to the observatory 2G-29 was carried out using the automated cable-laying system. After landing near Node 2G, the ROV first put the underwater mateable connector linking to the upper end of the cable on the cable bobbin into the port 3 of the node. After that, the junction box was placed on the seafloor and the cable-laying operation was started. After arriving at near the observatory 2G-29, the ROV placed the cable bobbin on the seafloor and connected the cable with the observatory 2G-29 using the underwater mateable connector. It was confirmed that there is no problem in communication between the observatory 2G-29 and the landing station. The length of the laid cable was approximately 8,536m and the traveled distance was approximately 8,061m.



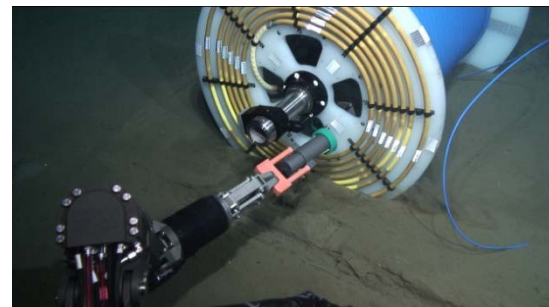
(a) Connection with the Node 2G



(b) Installation of the junction box



(c) Cable laying operation



(d) Cable bobbin

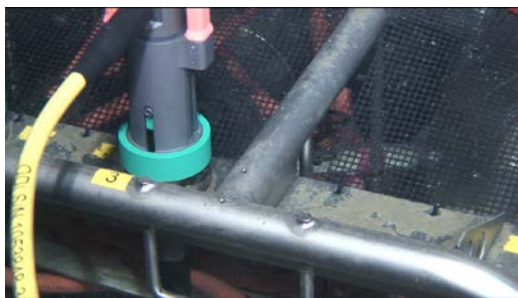


(e) Connection with the observatory

Fig 5.15. Cable-laying operation from Node 2G to the observatory 2G-29

5.16. DIVE #1841 on June.15, 2015: Cable-laying operation at 2E-21

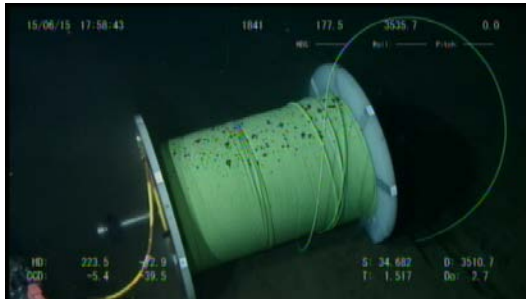
The cable-laying operation from Node 2E to the observatory 2E-21 was carried out using the automated cable-laying system. After landing near Node 2E, the ROV first put the underwater mateable connector linking to the forefront of the cable on the cable bobbin into the port 3 of the node 2E. After that, the junction box was placed on the seafloor and the cable-laying operation was started. After arriving at near the observatory 2E-21, the ROV placed the cable bobbin on the seafloor and connected the cable from Node 2E with the observatory 2E-21 using the underwater mateable connector. It was confirmed that there is no problem in communication between the observatory 2E-21 and the landing station. The length of the laid cable was approximately 8,470m and the traveled distance was approximately 8,028m.



(a) Connection with the Node 2E



(b) Installation of the junction box



(c) Placing the cable bobbin



(d) Connection with the observatory

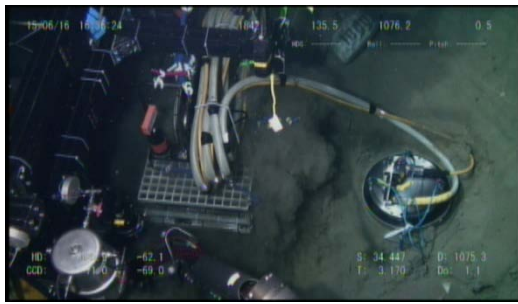
Fig 5.16. Cable-laying operation from Node 2E to the observatory 2E-21

5.17. DIVE #1842 on June. 16, 2015: Installation of the measurement instrument at 2B-7

In this dive, we installed an observatory system into the caisson at the point 2B-7 using an ROV Hyper Dolphin (HPD). The observatory system consists of the three parts; seismic sensor package, a pressure sensor package and a battery package. First the seismic sensor package was installed inside the caisson. The pressure sensor package was then deployed on the seafloor next to the seismic package. The battery package was connected to the pressure sensor package. These three packages are connected by cables. An ROV Homer (ID: 46) was placed near the pressure sensor package. Finally the cover plate was collected before leaving the point.

2B-7 position (33-10.528N 135-05.779E)

Homer ID: 54



(a) Seismic sensor package



(b) Pressure sensor package



(c) External battery



(d) Battery package was connected to the pressure sensor package

Fig. 5.17. Installation of the measurement instrument at 2B-7

In this dive, a caisson was installed at 2C-10 using a hydraulic hammer. At first, the HPD cut the belt that fixed the caisson and the hammer. The caisson and the hammer were then put on the seafloor and started the installation of the caisson. When the caisson was stuck down to half, the pins which fixed the caisson and the hammer were removed. By carrying out the installation work further, the caisson was completely buried under the seafloor. After the caisson installation, the tilting angle of the caisson was checked and it was confirmed that the tilting angle is less than 10 degrees. And then, the sediments inside the caisson was removed using the vacuum system. At last, a covering plate was put on the caisson, and a ROV-Homer (ID: 19) was placed near the caisson.

The position of the caisson is (33-07.506N, 135-31.495E, Depth: 1720m).



(a) Caisson installation operation



(b) Sediment removal operation



(c) After cleaning inside the caisson



(d) Placing a covering plate on the caisson

Fig. 5.18. Caisson installation at 2C-10

5.19. DIVE #1844 on June. 22, 2015: Caisson installation at 2E-20

In this dive, a caisson was installed at 2E-20 using a hydraulic hammer. At first, the HPD cut the belt that fixed the caisson and the hammer. The caisson and the hammer were then put on the seafloor and started the installation of the caisson. When the caisson was stuck down to half, the pins which fixed the caisson and the hammer were removed. By carrying out the installation work further, the caisson was completely buried under the seafloor. After the caisson installation, the tilting angle of the caisson was checked and it was confirmed that the tilting angle is less than 10 degrees. And then, the sediments inside the caisson were removed using the vacuum system. At last, a covering plate was put on the caisson, and a ROV-Homer (ID: 61) was placed near the caisson.

The position of the caisson is (32-48.090N, 135-46.421E, Depth: 3,602m).



(a) Caisson installation operation



(b) Sediment removal operation



(c) Inside the caisson after cleaning



(d) Placing a covering plate on the caisson

Fig. 5.19. Caisson installation at 2E-20

5.20. DIVE #1845 on June. 23, 2015: Caisson installation at 1C-21

In this dive, a caisson was installed at 1C-21 using a hydraulic hammer. At first, the HPD cut the belt that fixed the caisson and the hammer. The caisson and the hammer were then put on the seafloor and started the installation of the caisson. When the caisson was stuck down to half, the pins which fixed the caisson and the hammer were removed. By carrying out the installation work further, the caisson was completely buried under the seafloor. After the caisson installation, the tilting angle of the caisson was checked and it was confirmed that the tilting angle is less than 10 degrees. And then, the sediments inside the caisson were removed using the vacuum system. At last, a covering plate was put on the caisson, and a ROV-Homer (ID: 43) was placed near the caisson.

The position of the caisson is (32-57.073N, 135-44.544E, Depth: 4,455m).



(a) Caisson installation operation



(b) Sediment removal operation



(c) After cleaning inside the caisson

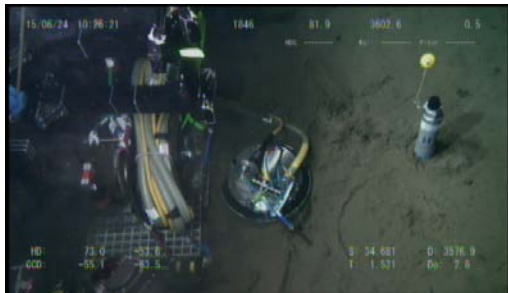


(d) Placing a covering plate on the caisson

Fig. 5.20. Caisson installation at 1C-21

5.21. DIVE #1846 on June. 24, 2015: Installation of the measurement instrument at 2E-20

In this dive, we installed observation equipment at 2E-20. The observation equipment is composed of a seismometer package, a pressure sensor package, and a battery equipment. First, the seismometer package was inserted inside the caisson and the pressure sensor package was placed on the seafloor at a distance of approximately 7m from the seismometer package. And then, the battery equipment was put on the seafloor next to the pressure sensor package. Finally, the HPD connected the battery equipment to the pressure sensor package linking with the seismometer package using the underwater mateable connector. In addition, the covering plate placed on the caisson was recovered.



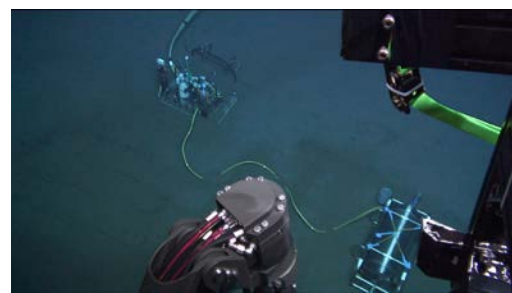
(a) Seismometer package



(b) Pressure sensor package



(c) Battery equipment



(d) After connection with the battery equipment

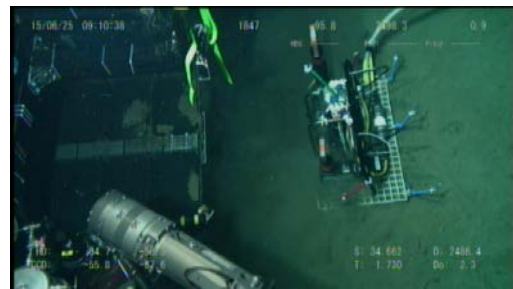
Fig.5.21 Installation of the measurement instrument at 2E-20.

5.22. DIVE #1847 on June 25, 2015: Installation of the measurement instrument at 2G-28

In this dive, we installed observation equipment at 2G-28. The observation equipment is composed of a seismometer package, a pressure sensor package, and a battery equipment. First, the seismometer package was inserted inside the caisson and the pressure sensor package was placed on the seafloor at a distance of approximately 7m from the seismometer package. And then, the battery equipment was put on the seafloor next to the pressure sensor package. Finally, the HPD connected the battery equipment to the pressure sensor package linking with the seismometer package using the underwater mateable connector. In addition, the covering plate placed on the caisson was recovered.



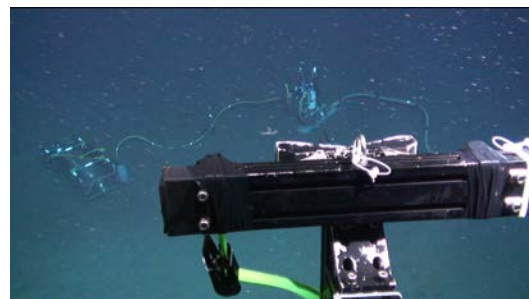
(a) Seismometer package



(b) Pressure sensor package



(c) Battery equipment



(d) After connection with the battery equipment

Fig.5.22: Installation of the measurement instrument at 2G-28.

5.23. DIVE #1848 on June 25, 2015: Installation of the measurement instrument at 2G-27

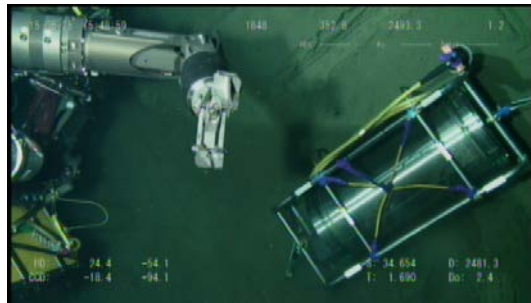
In this dive, we installed observation equipment at 2G-27. The observation equipment is composed of a seismometer package, a pressure sensor package, and a battery equipment. First, the seismometer package was inserted inside the caisson and the pressure sensor package was placed on the seafloor at a distance of approximately 7m from the seismometer package. And then, the battery equipment was put on the seafloor next to the pressure sensor package. Finally, the HPD connected the battery equipment to the pressure sensor package linking with the seismometer package using the underwater mateable connector. In addition, the covering plate placed on the caisson and the ROV-Homer ID 21 were recovered.



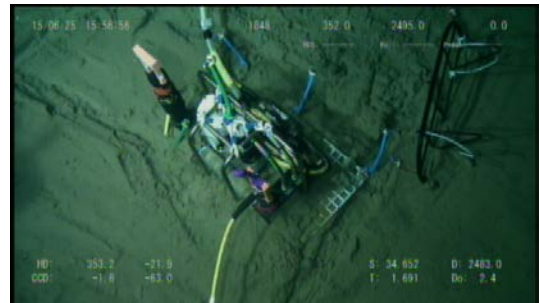
(a) Seismometer package



(b) Pressure sensor package



(c) Battery equipment

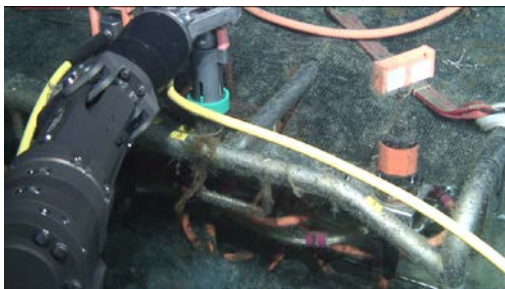


(d) After connection with the battery equipment

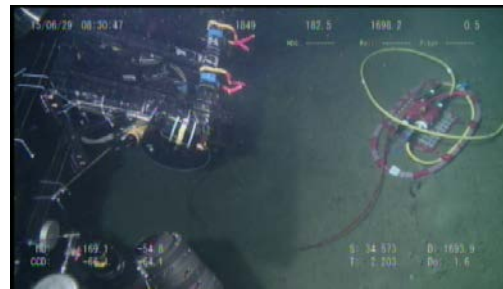
Fig 5.23: Installation of the measurement instrument at 2G-27.

5.24. DIVE #1849 on June 29, 2015: Cable-laying operation at 2C-12

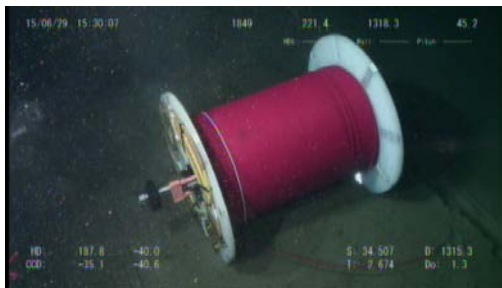
The cable-laying operation from Node 2C to the observatory 2C-12 was carried out using the automated cable-laying system. The ROV first put the underwater mateable connector linking to the forefront of the cable on the cable bobbin into the port 3 of Node 2C. After that, the junction box was placed on the seafloor. After the cable-laying operation, the ROV placed the cable bobbin on the seafloor and connected the cable from Node 2C with the observatory 2C-12 using the underwater mateable connector mounted on the cable bobbin. The communication between the observatory 2C-12 and the landing station was confirmed at the landing station. The length of the dispensed cable was approximately 9269m and the traveled distance was approximately 9039m.



(a) Connection with Node 2C



(b) Placing the junction box on the seafloor



(c) Placing the cable bobbin on the seafloor

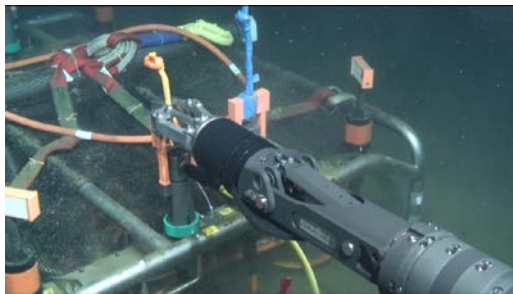


(d) Connection with the observatory

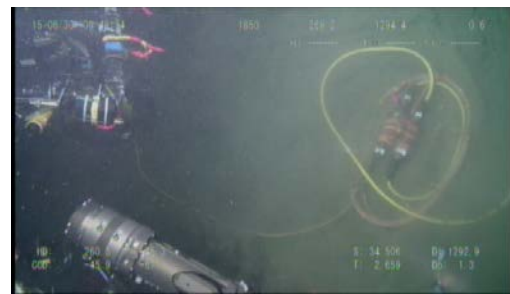
Fig. 5.24: Cable-laying operation from Node 2C to the observatory 2C-12.

5.25. DIVE #1850 on June 30, 2015: Cable-laying operation at 2B-7

The cable-laying operation from Node 2B to the observatory 2B-7 was carried out using the automated cable-laying system. The ROV first put the underwater mateable connector linking to the forefront of the cable on the cable bobbin into the port 5 of Node 2B. And then, the junction box was placed on the seafloor. After the cable-laying operation, the ROV placed the cable bobbin on the seafloor and connected the cable from Node 2B with the observatory 2B-7 using the underwater mateable connector mounted on the cable bobbin. The communication between the observatory 2B-7 and the landing station was confirmed at the landing station. The length of the dispensed cable was approximately 7962m and the traveled distance was approximately 7688m.



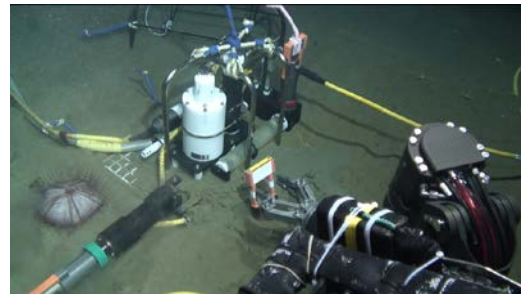
(a) Connection with Node 2B



(b) The junction box placed on the seafloor



(c) The cable bobbin placed on the seafloor



(d) Connection with the observatory

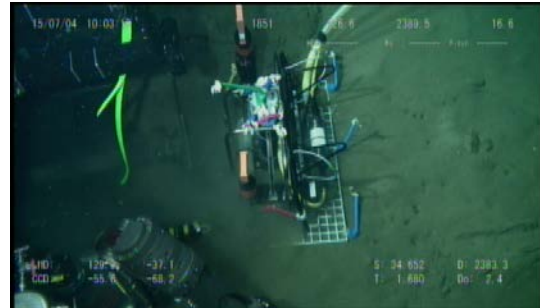
Fig. 5.25 : Cable-laying operation from Node 2B to the observatory 2B-7.

5.26. DIVE #1851 on July 4, 2015: Installation of the measurement instrument at 2F-24

In this dive, we installed observation equipment at 2F-24. The observation equipment is composed of a seismometer package, a pressure sensor package, and a battery equipment. First, the seismometer package was inserted inside the caisson and the pressure sensor package was placed on the seafloor at a distance of approximately 7m from the seismometer package. And then, the battery equipment was put on the seafloor next to the pressure sensor package. Finally, the HPD connected the battery equipment to the pressure sensor package linking with the seismometer package using the underwater mateable connector. In addition, the covering plate placed on the caisson was recovered.



(a) Seismometer package



(b) Pressure sensor package



(c) Battery equipment



(d) After connection with the battery equipment

Fig 5.26: Installation of the measurement instrument at 2F-24.

5.27. DIVE #1852 on July 4, 2015: Installation of the measurement instrument at 2C-10

In this dive, we installed observation equipment at 2C-10. The observation equipment is composed of a seismometer package, a pressure sensor package, and a battery equipment. First, the seismometer package was inserted inside the caisson and the pressure sensor package was placed on the seafloor at a distance of approximately 7m from the seismometer package. And then, the battery equipment was put on the seafloor next to the pressure sensor package. Finally, the HPD connected the battery equipment to the pressure sensor package linking with the seismometer package using the underwater mateable connector. In addition, the covering plate placed on the caisson was recovered.



(a) Seismometer package



(b) Pressure sensor package



(c) Battery equipment



(d) After connection with the battery equipment

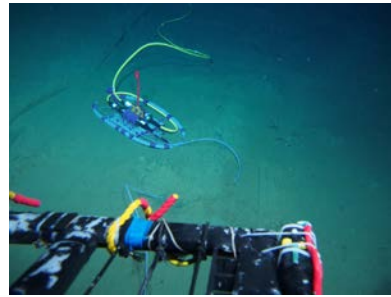
Fig. 5.27: Installation of the measurement instrument at 2C-10.

5.28. DIVE #1853 on July 6, 2015: Cable-laying operation at 2C-10

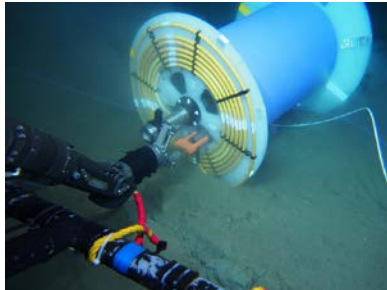
The cable-laying operation from Node 2C to the observatory 2C-10 was carried out using the automated cable-laying system. The ROV first put the underwater mateable connector linking to the forefront of the cable on the cable bobbin into the port 6 of Node 2C. And then, the junction box was placed on the seafloor. After the cable-laying operation, the ROV placed the cable bobbin on the seafloor and connected the cable from Node 2C with the observatory 2C-10 using the underwater mateable connector mounted on the cable bobbin. The communication between the observatory 2C-10 and the landing station was confirmed at the landing station. The length of the dispensed cable was approximately 9500m and the traveled distance was approximately 8952m.



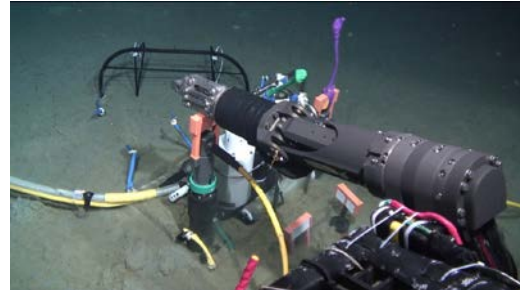
(a) Connection with Node 2C



(b) The junction box placed on the seafloor



(c) The cable bobbin placed on the seafloor



(d) Connection with the observatory

Fig. 5.28: Cable-laying operation at 2C-10.

6. Notice on Using

This cruise report is a preliminary documentation as of the end of the cruise.

This report may not be corrected even if changes on contents (i.e. taxonomic classifications) may be found after its publication. This report may also be changed without notice. Data on this cruise report may be raw or unprocessed. If you are going to use or refer to the data written on this report, please ask the Chief Scientist for latest information.

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