doi : 10.17596/0003137

KY11-08 “Cruise Report”

Trial operation of a new sediment sampling

July.5,2011-July.11,2011

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

Contents

1. Cruise Information

Cruise ID: KY11-08

Name of vessel: KAIYO

Title of the cruise: KY11-08

Title of proposal: Trial operation of a new sediment sampling system

Cruise period: 5th – 11th, July 2011

Ports of call: JAMSTEC, Yokosuka -JAMSTEC, Yokosuka

Research area: Sagami Bay and Kumano nada

Research map: Refer to Fig. X

2. Researchers

Chief scientist & Representative of the science party: Toshiya Kanamatsu [IFREE-JAMSTEC]

Vice chief scientist: Takayuki Tomiyama [Kochi Core Institute, JAMSTEC]

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3. Background

3.1. Objectives

KY11-08 was planed for trial operation of a new sediment sampling system. Monitoring behaviors of the system during operations in various sediment settings, and evaluating quality of obtained sediment sample are primal objectives in this cruise. To achieve these issues, sediment sampling by conventional sampling systems such as a piston corer and a multiple corer were carried out in order to compare recovery length and quality of obtained sediment samples between the new system and conventional systems.

Most recent geological records are archived in the very surface sediment, (e.g. climate change, earthquake record etc). The records in the surface sediment, therefore, are very valuable to understand geological phenomena in near-past and contribute to predict phenomena in near-future. However generally the very surface sediment is very soft and easily disturbed by the coring. It makes difficult precise analysis. In order to overcome this situation, we designed a new concept. We have built a proto-sampling system, which can minimize the disturbance of sediment samples. The cruise is planed for the trial operation of this system. During the cruise we measured accelerations and tiling of the system, when the system is penetrating into the surface sediment. Detailed textures of the obtained sample will be examined using X-CT scanner at KCC in order to evaluate artificial disturbance by coring. So we did not split most of sampled cores. Onboard core splitting is restricted to samples Hand2 obtained by the multiple corer.

3.2. Site selection:

For the trails, sampling points, which are covered by enough soft sediment were selected. We reviewed the previous coring operations implemented by JAMSTEC research ships. Taking into account sediment lithology, property of sediment “k”, and water depth, we selected the best places for the trial. We chose potential 14 points in Sagami bay (Table 1) and Kumano-nada (Table 2) in planning phase.

Sagami Bay（Max water depth: 1720m）

S-1	KY03-11 PC11	Within a circle with radius 1 mile, center: 35° 00.18’N , 139° 13.48’E
S-2	KY04-11 PC01	Within a circle with radius 1 mile, center: 35° 04.60’N , 139° 33.22’E
S-3	KY06-02 PC05	Within a circle with radius 1 mile, center: 34° 56.52’N , 139° 12.70’E
S-4	KY07-05 PC08	Within a circle with radius 1 mile, center: 34° 59.98’N , 139° 23.20’E
S-5	KY07-14 GC02	Within a circle with radius 1 mile, center: 35° 05.77’N , 139° 21.50’E
S-6	KY07-14 PC03	Within a circle with radius 1 mile, center: 35° 09.22’N , 139° 26.17’E
S-7	new	Within a circle with radius 1 mile, center: 34° 53.50’N , 139° 21.00’E
S-8	new	Within a circle with radius 1 mile, center: 35° 04.00’N , 139° 21.00’E

(2) Kumono noda（Max water depth: 2800m）

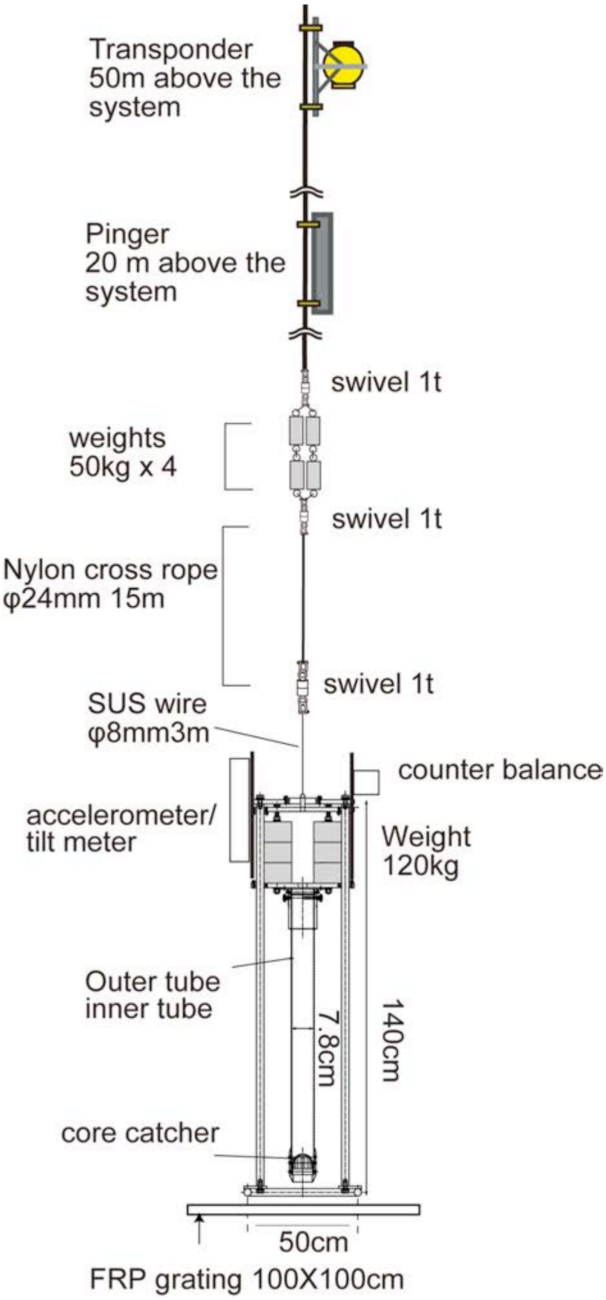
K-1	KY05-14 P03	Within a circle with radius 1 mile, center: 33° 33.00’N , 136° 30.00’E
K-2	KY05-14 P04	Within a circle with radius 1 mile, center: 33° 40.02’N , 136° 24.99’E
K-3	KY06-02 P06	Within a circle with radius 1 mile, center: 33° 28.01’N , 136° 32.00’E
K-4	KY06-02 P08	Within a circle with radius 1 mile, center: 33° 24.01’N , 136° 37.01’E
K-5	KY07-01 PC01	Within a circle with radius 1 mile, center: 33° 39.10’N , 136° 38.52’E
K-6	KY11-05 PC03	Within a circle with radius 1 mile, center: 33° 30.00’N , 136° 36.00’E

4. Methods, Instruments

4.1.General description of the new sampling System

General concept of system (Fig.1)

High energy of free fall of the system will break the surface sediment, then unconsolidated sediment will be highly disturbed. To prevent the high energy penetration of the system into the surface, the system is designed to start penetration after reaching the sea surface by releasing of the tension of the winch cable. To evaluate the quality of the cores, conventional piston corer and multiple corer were taken at the same points to compare the core quality taken by the new system. The system prepared for this cruise is proto-type, especially to observe the behavior during the operation. The specification in the final stage in developing is estimated 1.5 times longer and heavier than the system we used in this cruise.

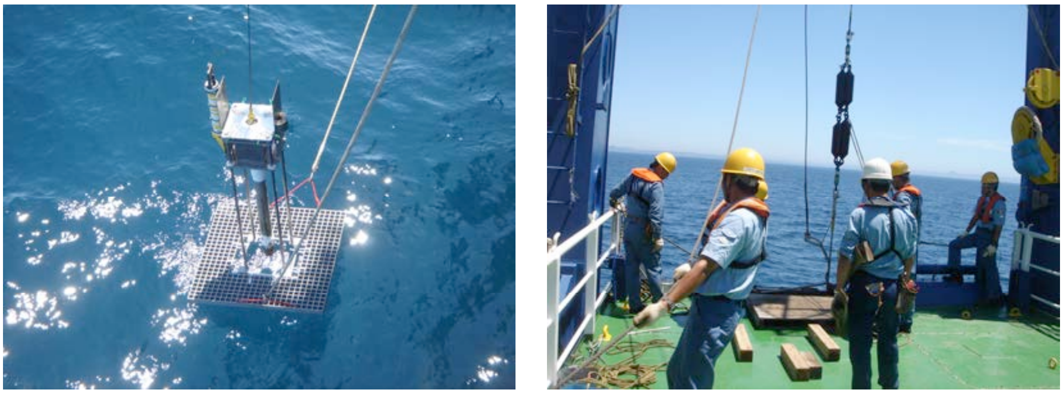


penetrating plates: Two plates equipped with 120 kg weight fall along poles. Pipe to sample sediment is attached to the bottom of the lower plate. ***Foot plate:*** If no enough penetration is realized, the top heavy sampling system is generally difficult to sustain the system with a vertical attitude. Then it will fall down. To prevent this case, a foot plate is attached to the system. Accelerometer and tilt meters are attached to penetrating plate in order to monitor the system behavior.

4.2.Procedure of deploying the new system

Operation for deploying of new system was planed with Marine technicians in MWJ. We decide to take a same manner to deploying method of a multiple corer. The following pictures show the procedure of deploying.

Figs. 2a and 2b: Hoisting the system by a mooring winch



Figs. 2c and 2d Let go to ocean Attach weight at the top of a nylon rope.

Figs. 2e and 2f Attach pinger Attach transponder

5. Operations

KY11-08 cruise started at Yokosuka (Jamstec) on 6th July, and ended at Yokosuka (Jamstec) on 11th July (Figure 3, Table 1). The sea conditions in the survey areas during the cruise allowed to perform all the operations, which were originally planed.

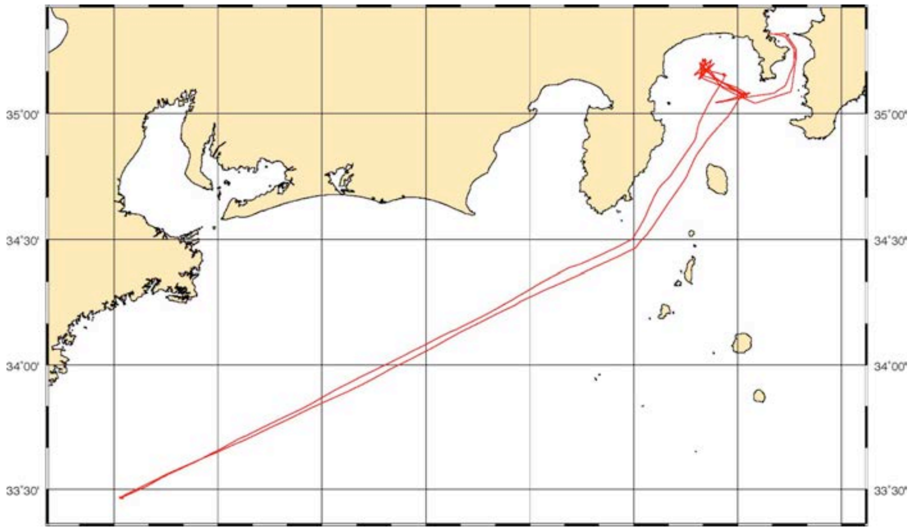


Fig.3: KY11-08 cruise started at Yokosuka (Jamstec) on 6th July, and ended at Yokosuka (Jamstec) on 11th July. Ship truck is indicated in a red line.

Table 1: sampling points for corings

Operation	Date	Area	Latitude	Longitude	Water depth
MC01, NC01	2011/7/6	Sagami bay	35-05.00 N	139-32.00E	734m
MC02, NC02, PC01	2011/7/7	Sagami bay	35°04.50'N	139°32.00'E	750m
MC03, NC03, PC02	2011/7/8	Sagami bay	35°09.22'N	139°26.17'E	912m
MC04, NC04, PC03	2011/7/9	Kumano-nada	33°28.01'N	136°32.00'E	2065m
MC05, NC05, PC04	2011/7/10	Sagami bay	35°04.70'N	139°32.00'E	750m

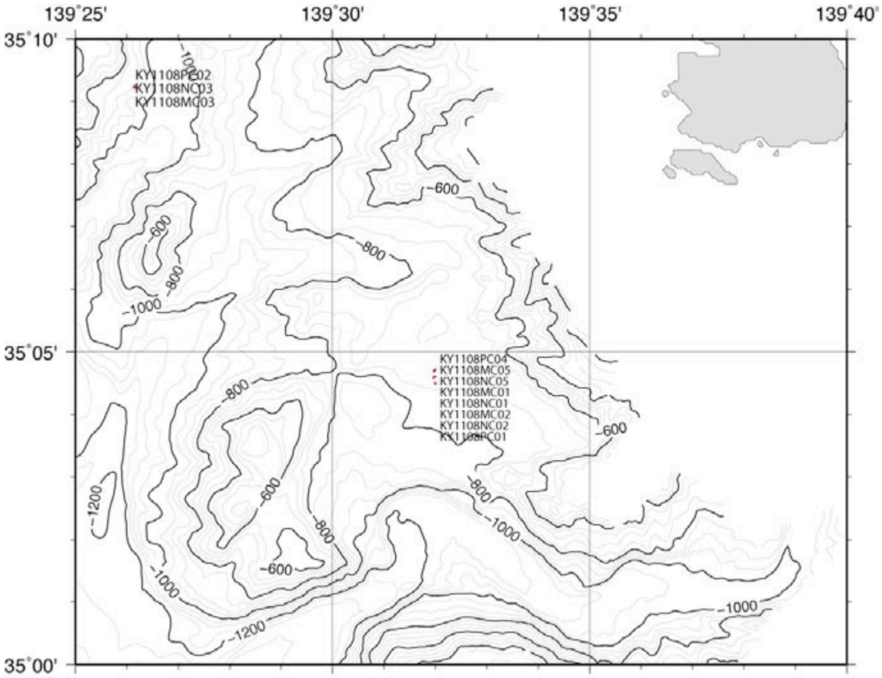


Fig. 4: Sampling points in Sagami Bay.

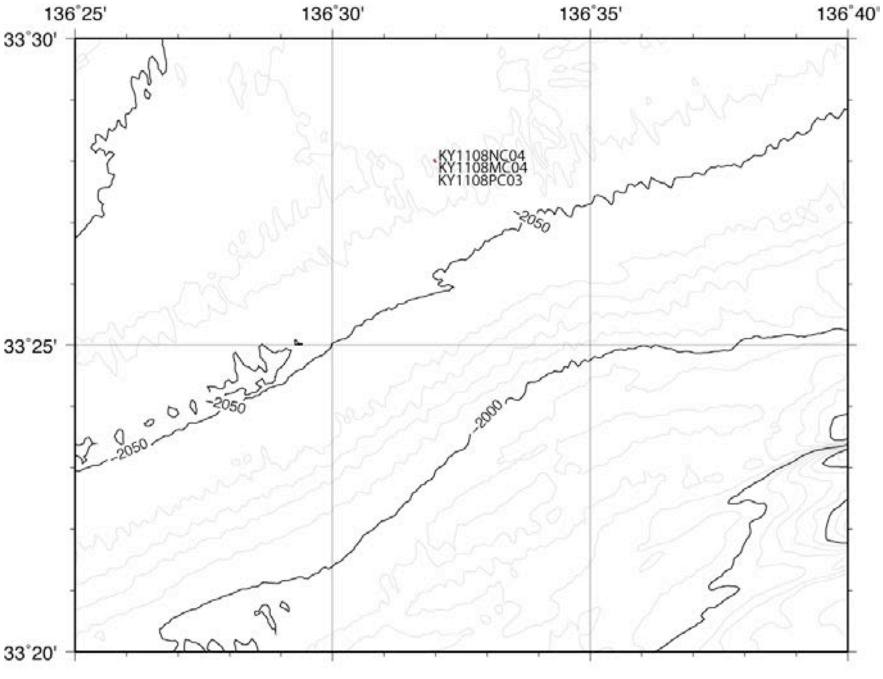


Fig. 5: Sampling points in Kumano-nada.

6. Results

6.1. Summary of the new system behavior

The following behaviors were observed during the new system operations.

1. The new system penetration into sediment with 1G in vertical direction and 0G in horizontal direction (See Figs 6).
2. No tilting during the penetration was recognized (See Figs 6).
3. No pipe rotation during the penetration was found (See Figs 6).
4. Generally longer recovery of sediment than gravity type core and multiple corer (See Tables 3).
5. The new system did not fall down despite short penetration. It could provide the better core quality, than piston or gravity corers , when the penetrations are very shallow.

6.2 Coring points

We performed 4 sets of the new system, a multiple corer, and piston corer in same positions.

One set of the new system and a multiple corer was performed (Table 2).

Table 2, Setting of test points

area	number of times	Water depth (m)	K value	Litho facies of surface sediment
S-2	3	745	0.060	Silty clay /clay
S-6	1	912	0.737	Silty clay
K-3	1	2060	0.024	Clay

6.3. Summary of core

Summary of obtained core samples are described in tables Tables 3A, 3B, and 3C.

Table 3A: KY11-08 coring summary of multiple corer

Core ID	Point	Lat	Long	WD	Recovery length(cm)			
					H2	H3	H6	H7
MC01	S-2	35-04.5999N	139-32. 0090E	736	34.0	39.0	38.0	48.0
MC02	S-2	35-04.5001N	139-31.9934E	743	38.0	39.0	38.0	49.0
MC03	S-6	35-09.2291N	139-26.1570E	906	33.0	35.0	32.0	38.0
MC04	K-3	33-28.0121N	136-31.9924E	2063	39.0	45.5	40.5	49.5
MC05	S-2	35-04.7142N	139-32.0069E	744	37.0	39.0	38.0	47.0

Table 3B: KY11-08 coring summary of new corer

Core ID	Area	Date (UTC)	Lat	Long	WD	PEN	RECO
NC01	S-2	2011/7/6	35° 04.60N	139° 31.99E	734	-	70.0
NC02	S-2	2011/7/7	35° 04.49N	139° 32.00E	748	-	46.0
NC03	S-6	2011/7/8	35° 09.22N	139° 26.13E	915	25.0	15.0
NC04	K-3	2011/7/9	33° 28.02N	136° 31.98E	2066	95.0	72.0
NC05	S-2	2011/7/10	35° 04.70N	139° 32.01E	1187	65.0	50.0

＊Latitude、Longitude: data from transponder except NC02(ship position)

NC03: sandy sediment

Table 3C: KY11-08 coring summary of piston corer and its pilot corer

Core ID	area	Date	Lat	Long	WD	PC pipe	PL type	RECO	PL pipe
PC01	S-2	2011/7/7	35-04.49'N	139-32.01'E	743	5	Φ74mm	45	100
PC02	S-6	2011/7/8	35-09.22'N	139-26.17'E	914	5	Φ74mm	2	70
PC03	K-3	2011/7/9	33-28.01'N	136-31.98'E	2065	5	Φ74mm	58	150
PC04	S-2	2011/7/10	35-04.71'N	139-31.99'E	729	5	Φ74mm	40	100

＊Latitude、Longitude: data from transponder except PC01(ship position)

PC02 inner tube of PV was deformed.

PC03 small sulfurous smell in sediment

Notes for Tables 3A, 3B, 3C: Lat: Latitude, Long: Longitude

WD: water depth (m), PEN: penetration (cm), RECO: recovery (m)

6.4. Tension record of winch wire during operation

All tension behaviors of a winch wire during coring operations were recoded (Figs. 6a-n). In practice phase, the system must be operated by monitoring of the tension meter. The observable tension change, which is signature of hitting sea bottom, should be ensured in this cruise. In this operation, we could identify clear tension changes upto 2000m-depth. However considering an operation in the deeper water depth (e.g. 7000-m) or in condition during bad weather, it is expected that background tension noises arisen from heaving of a ship increase. In such cases, it could be difficult to observe a clear tension change. Probably additional weight to the system can solve this problem.

MC01, NC01	2011/7/6	Sagami bay	35-05.00 N	139-32.00E	734m

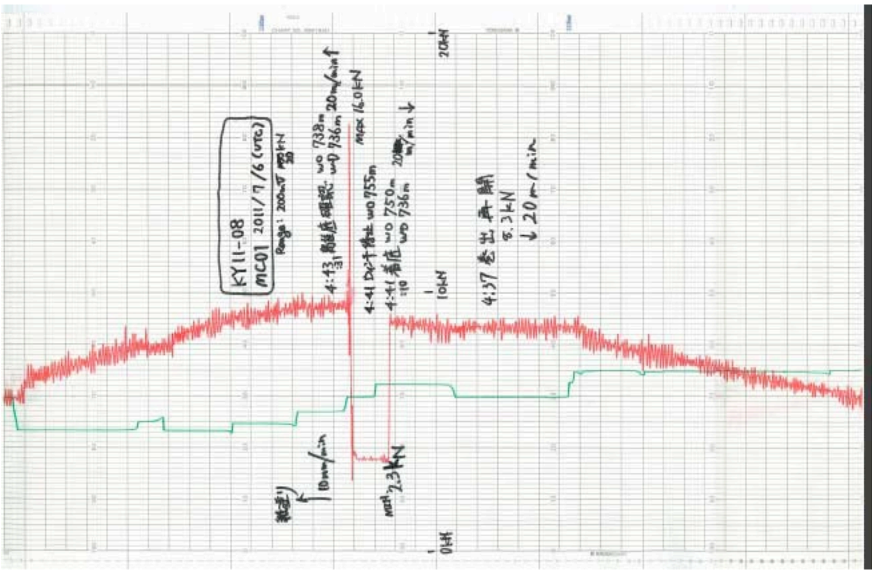


Fig. 6a tension record of winch wire during operation of MC01

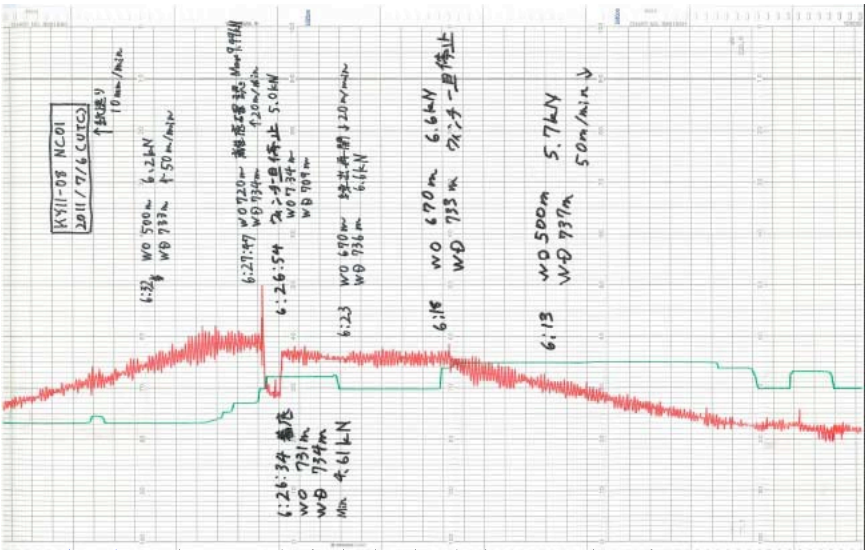


Fig. 6b tension record of winch wire during operation of NC01

MC02, NC02, PC01	2011/7/7	Sagami bay	35°04.50'N	139°32.00'E	750m

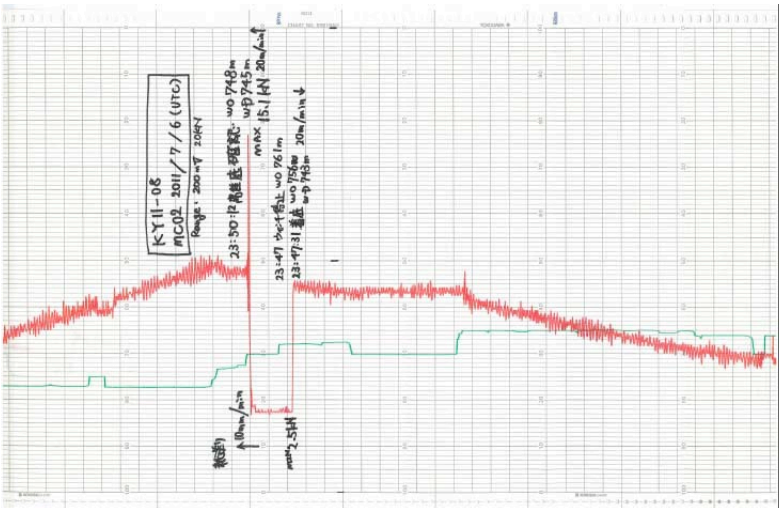


Fig. 6c tension record of winch wire during operation of MC02

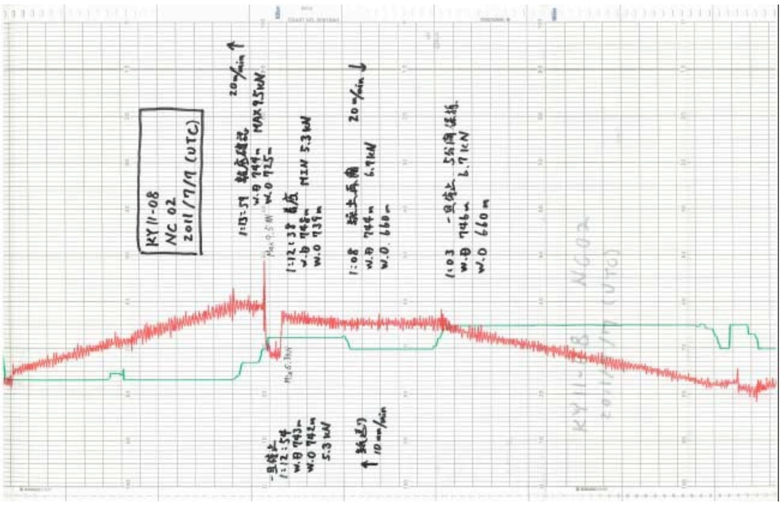


Fig. 6d tension record of winch wire during operation of NC02

Fig. 6e tension record of winch wire during operation of PC01

MC03, NC03, PC02	2011/7/8	Sagami bay	35°09.22'N	139°26.17'E	912m

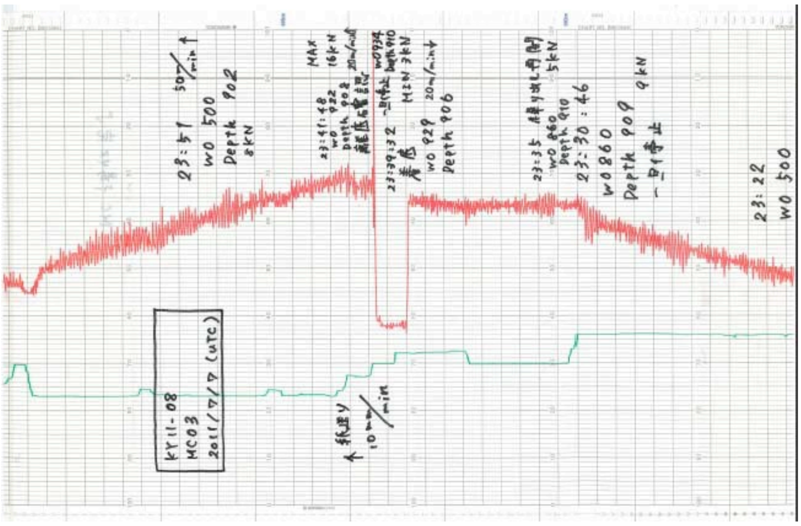


Fig. 6f tension record of winch wire during operation of MC03

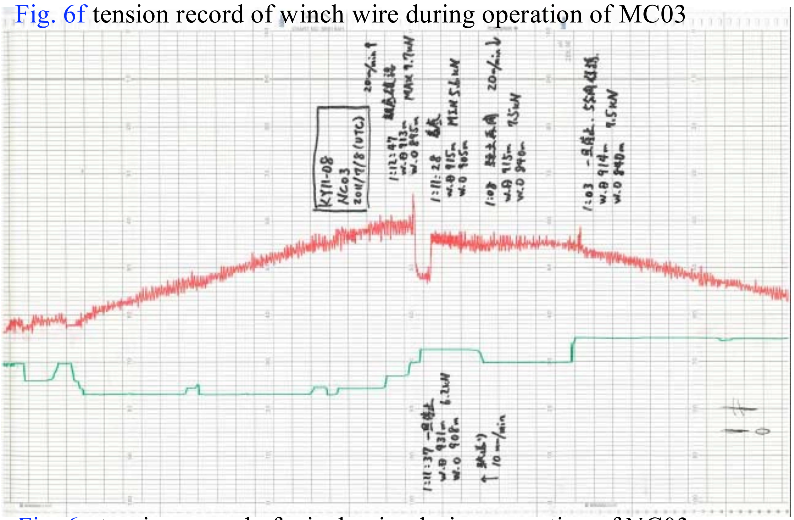


Fig. 6g tension record of winch wire during operation of NC03

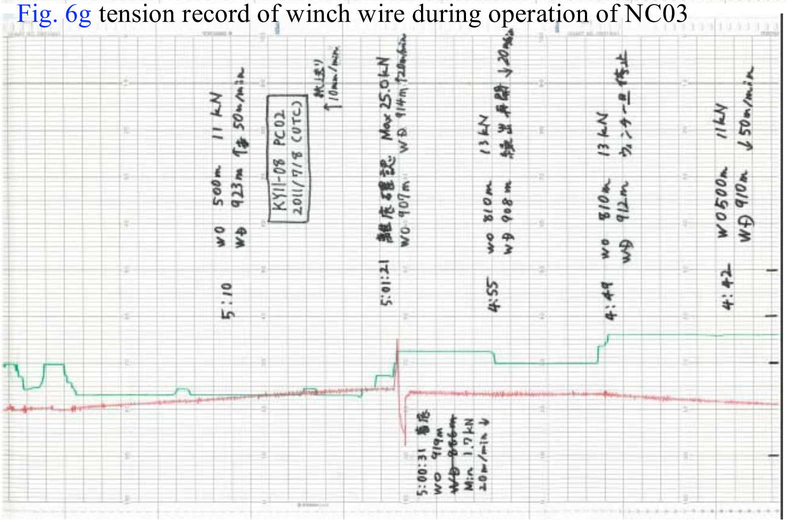


Fig. 6h tension record of winch wire during operation of PC02

MC04, NC04, PC03	2011/7/9	Kumano-nada	33°28.01'N	136°32.00'E	2065m

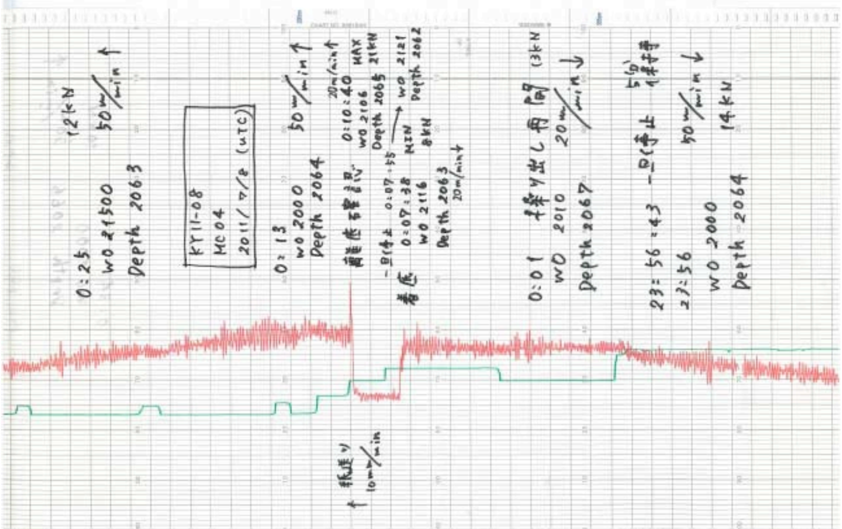


Fig. 6i tension record of winch wire during operation of MC04

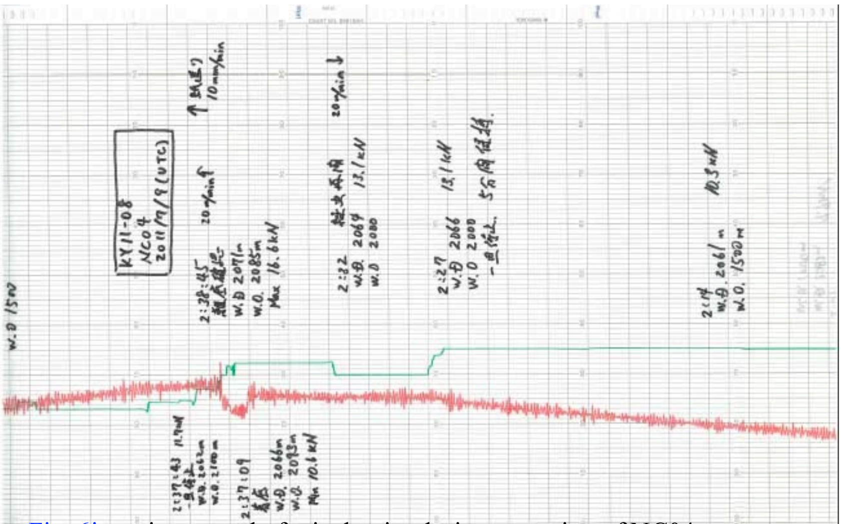


Fig. 6j tension record of winch wire during operation of NC04

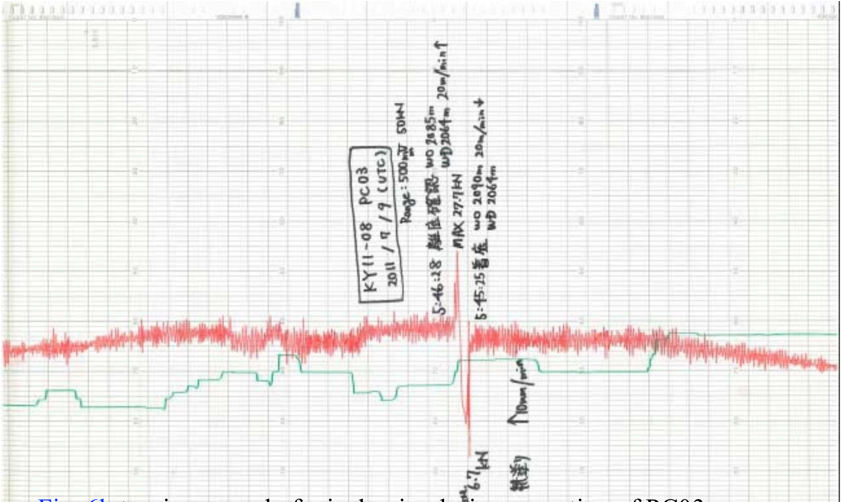


Fig. 6k tension record of winch wire during operation of PC03

MC05, NC05, PC04	2011/7/10	Sagami bay	35°04.70'N	139°32.00'E	750m

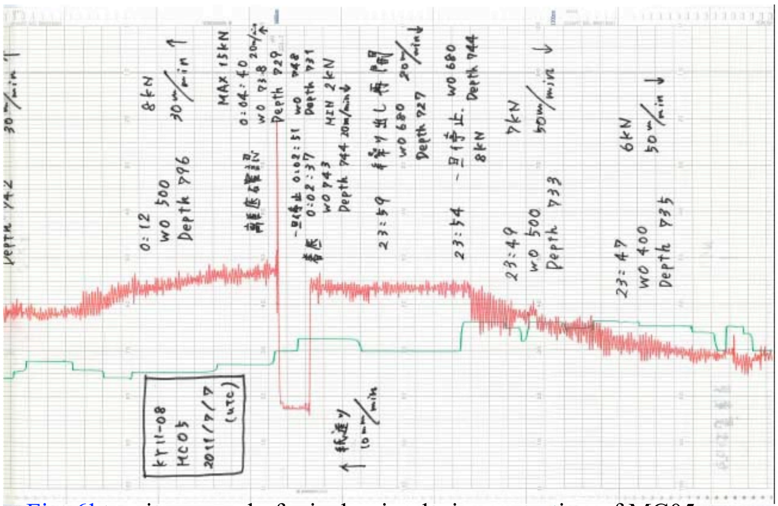


Fig. 6l tension record of winch wire during operation of MC05

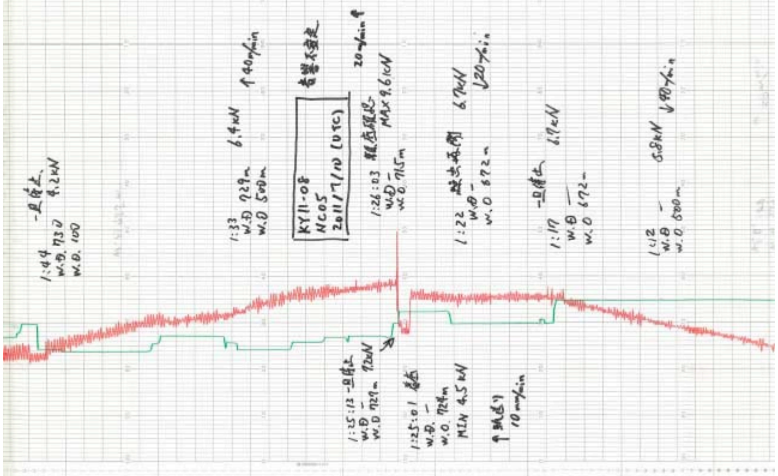


Fig. 6m tension record of winch wire during operation of NC05

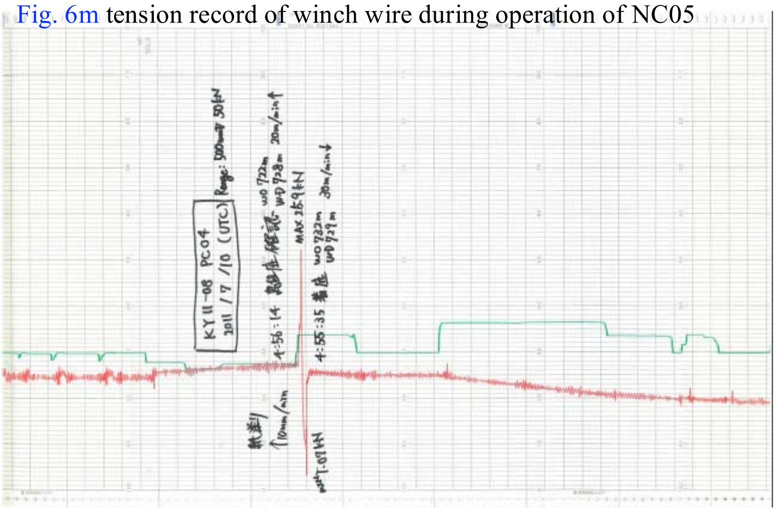


Fig. 6n tension record of winch wire during operation of PC04

6.5. Result of measures of acceleration and tilting of a new system

Depth, acceleration of X, Y, and Z, and tilting of X and Y axes and compass direction were measured in each operation of the new system are shown in Figs 7a-e on the following pages. The new system penetration into sediment with 1G in vertical direction and 0G in horizontal directions. No tilting during the penetration was recognized. No pipe rotation during the penetration was found. Red boxes shown in each figures indicate durations of penetration of the systems.

KY11-08 NC01

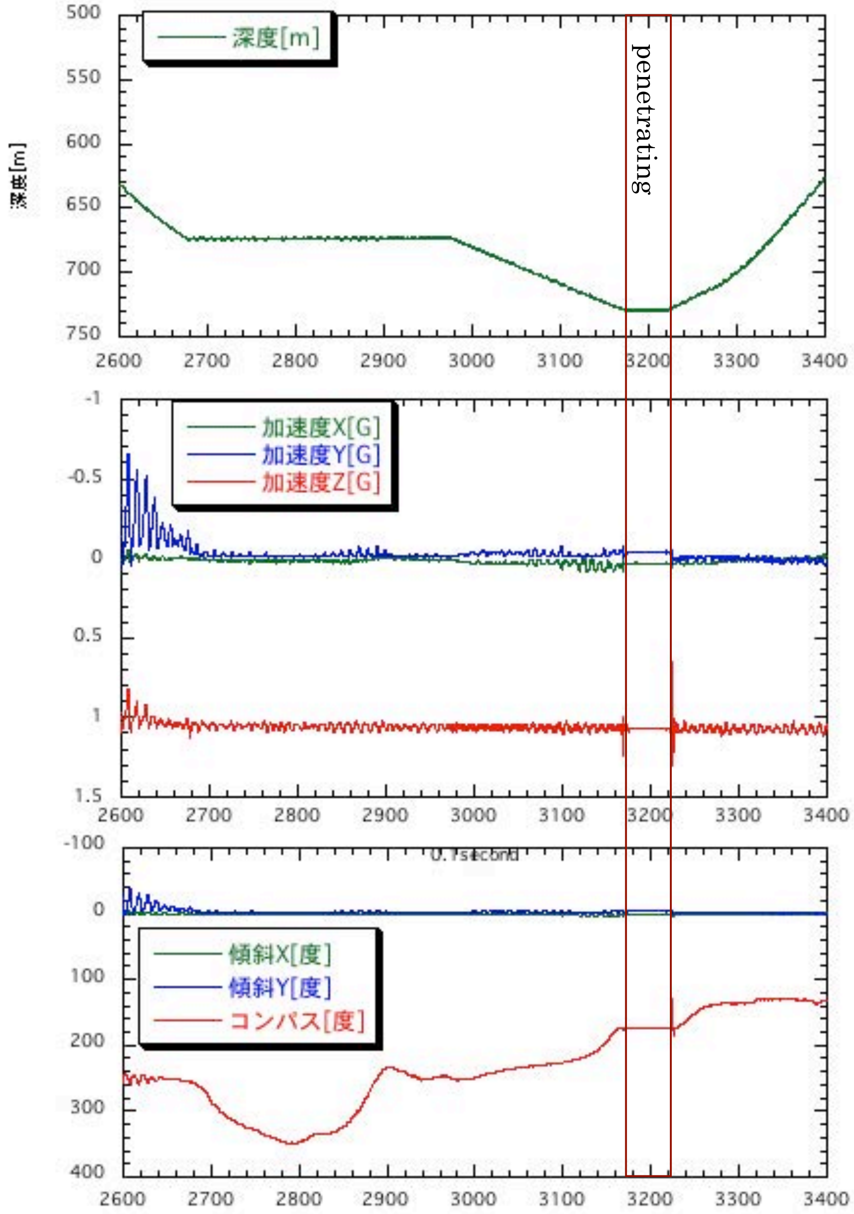


Fig.7a time (0.1 second) vs. depth, acceleration of X, Y, and Z, and tilting of X and Y axes and compass direction KY11-08-NC01

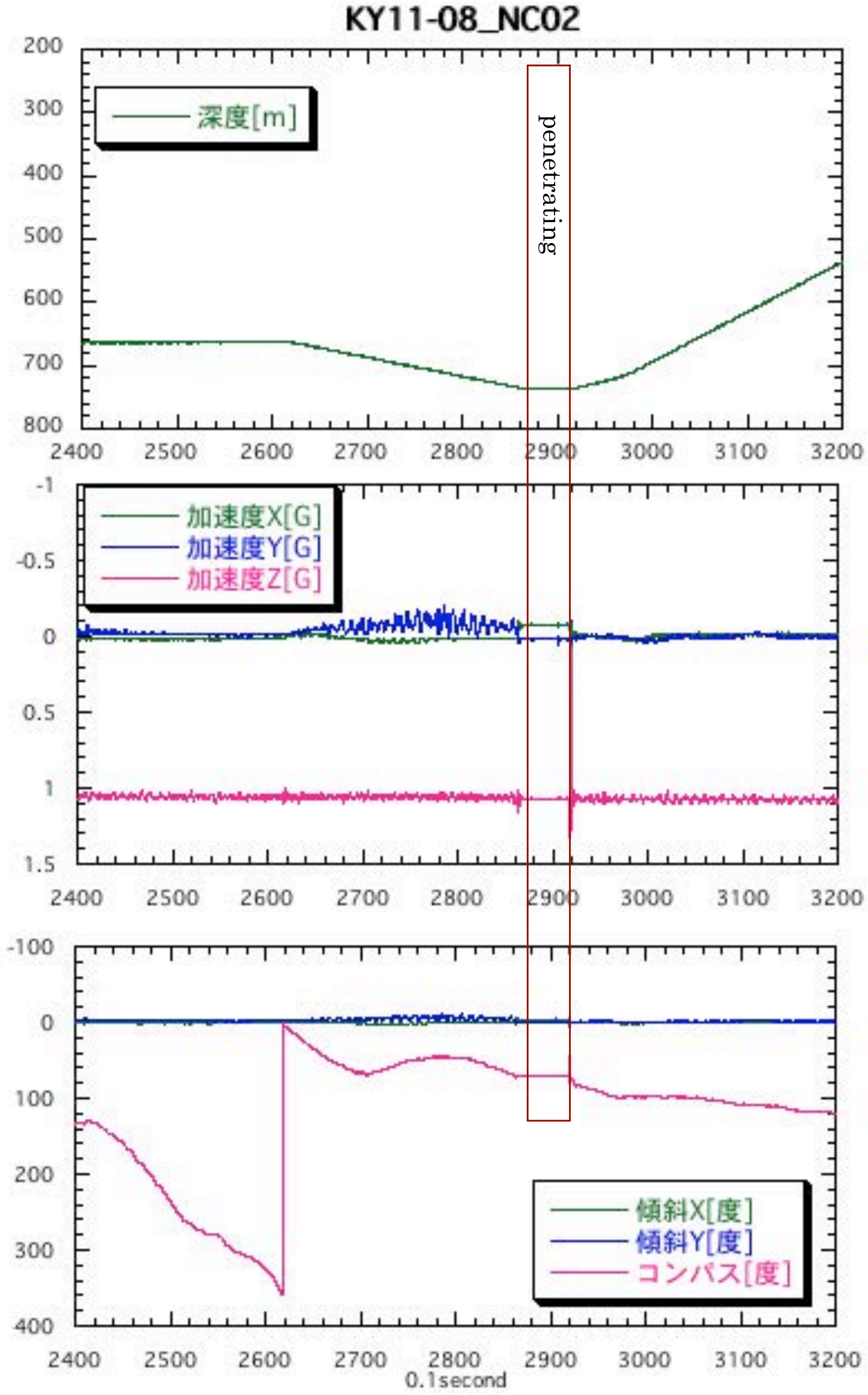


Fig.7b time (0.1 second) vs. depth, acceleration of X, Y, and Z, and tilting of X and Y axes and compass direction KY11-08-NC02.

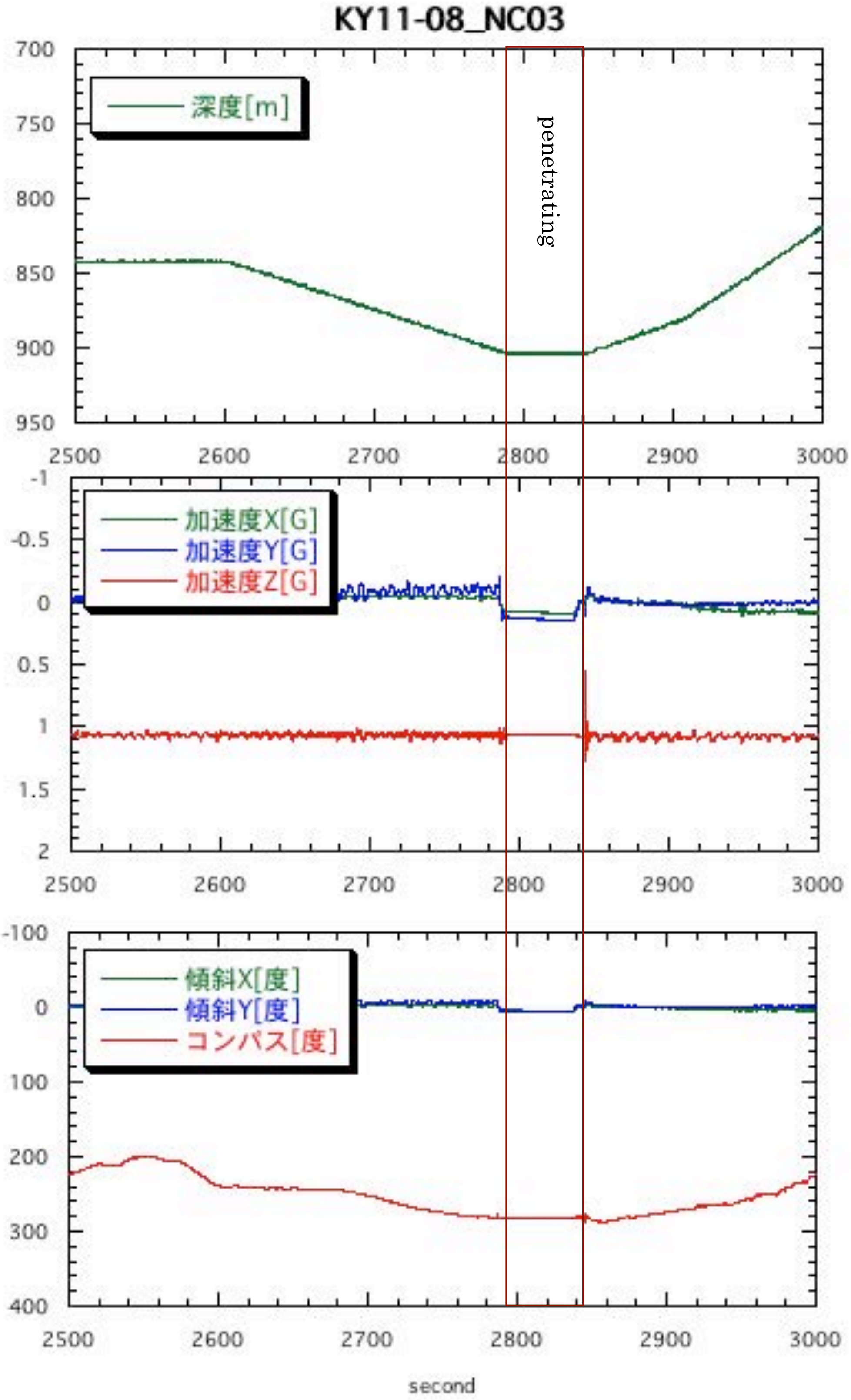


Fig.7c time (0.1 second) vs. depth, acceleration of X, Y, and Z, and tilting of X and Y axes and compass direction KY11-08-NC03.

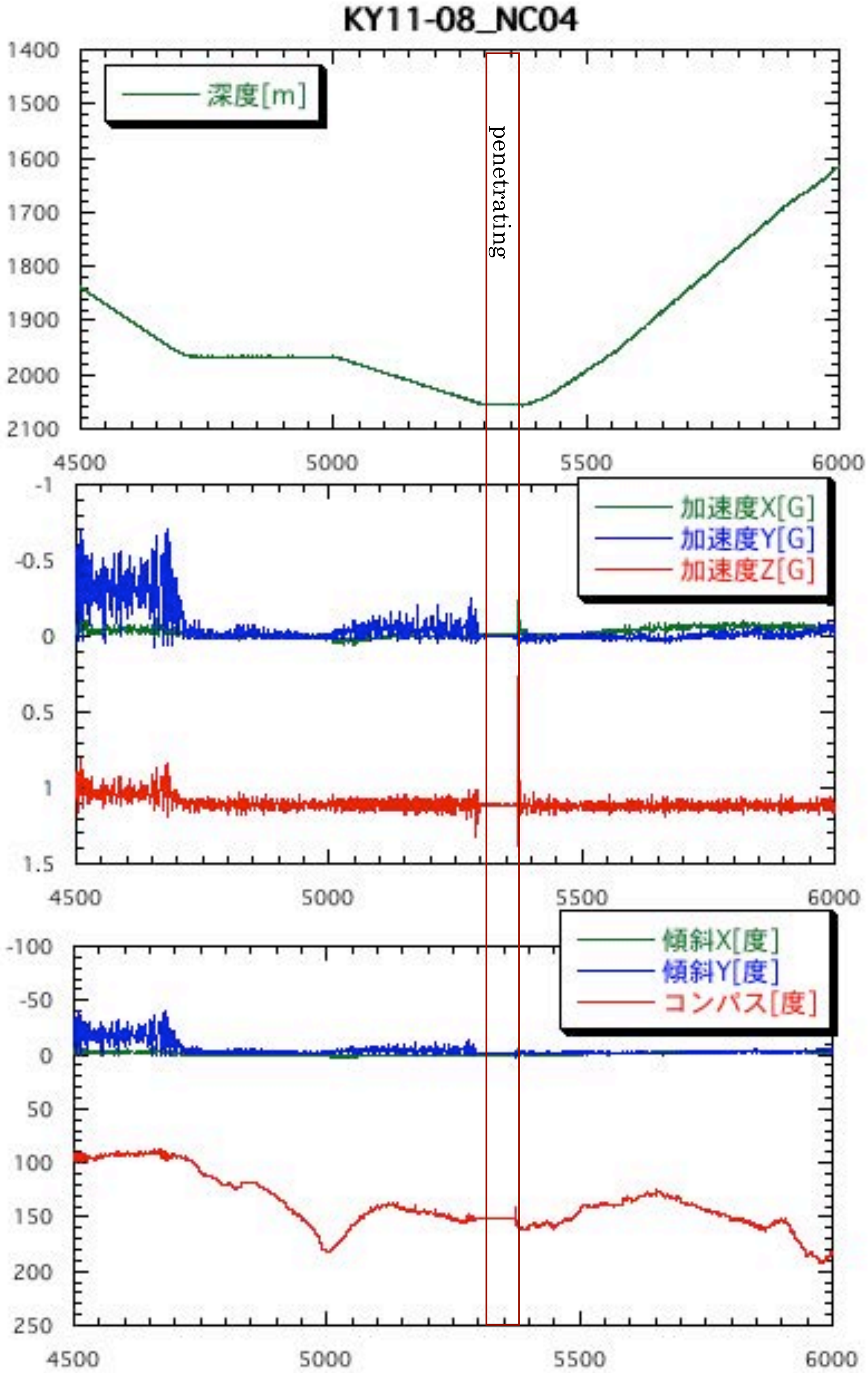


Fig.7d time (0.1 second) vs. depth, acceleration of X, Y, and Z, and tilting of X and Y axes and compass direction KY11-08-NC04

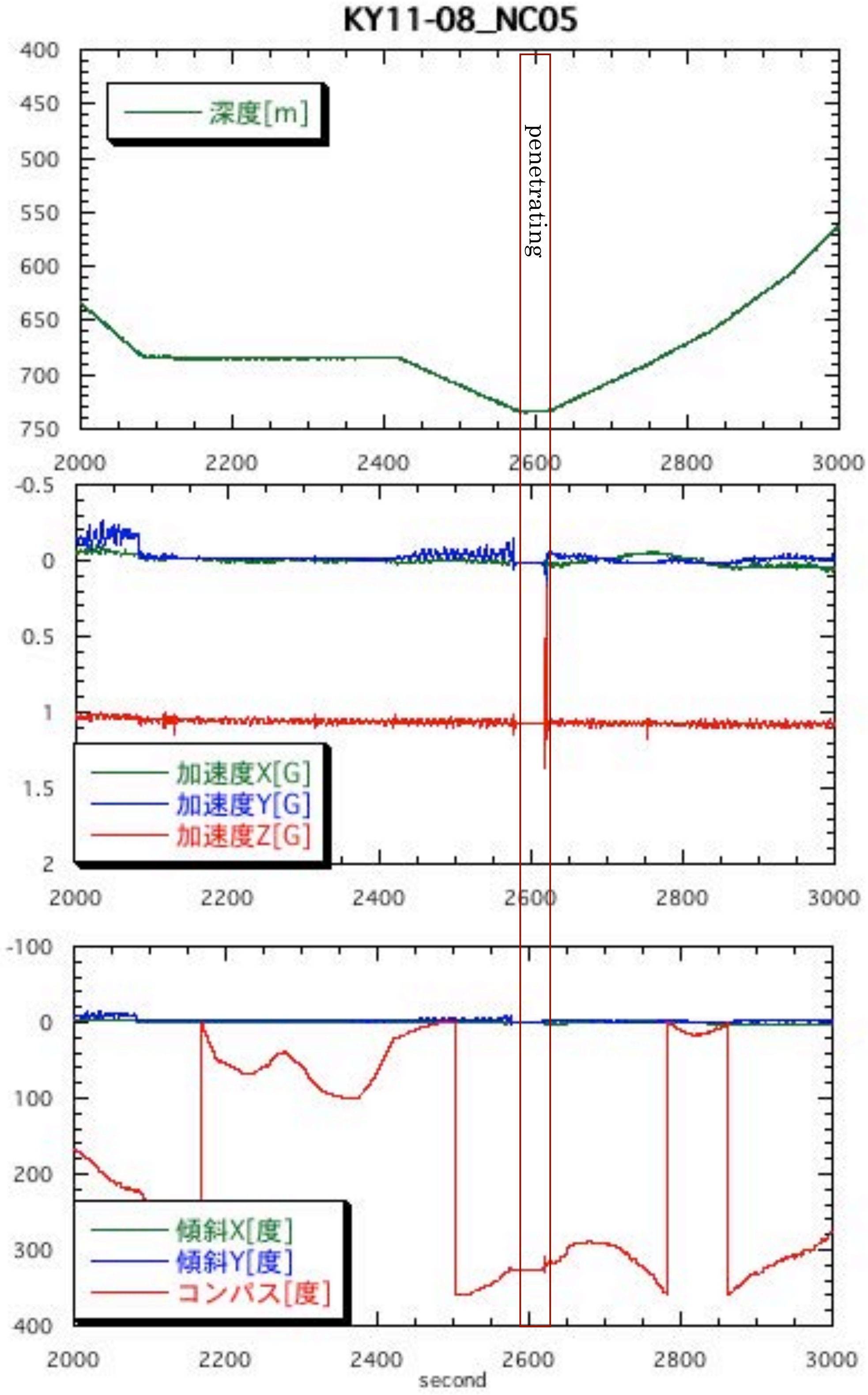


Fig.7e time (0.1 second) vs. depth, acceleration of X, Y, and Z, and tilting of X and Y axes and compass direction KY11-08-NC03

6.6. Core photo and of L*, a*, and b*, and vane shear strength of multiple corer

Because detailed textures of the obtained sample will be examined using X-CT scanner at KCC in order to evaluate artificial disturbance by coring, we did not split most of sampled cores. Onboard core splitting is restricted to samples Hand2 obtained by the multiple corer. We observed lithologies and measure change of L*, a*, and b*, and vane shear strength on Hand2 cores (Figs 8a-e).

MC01-H02A

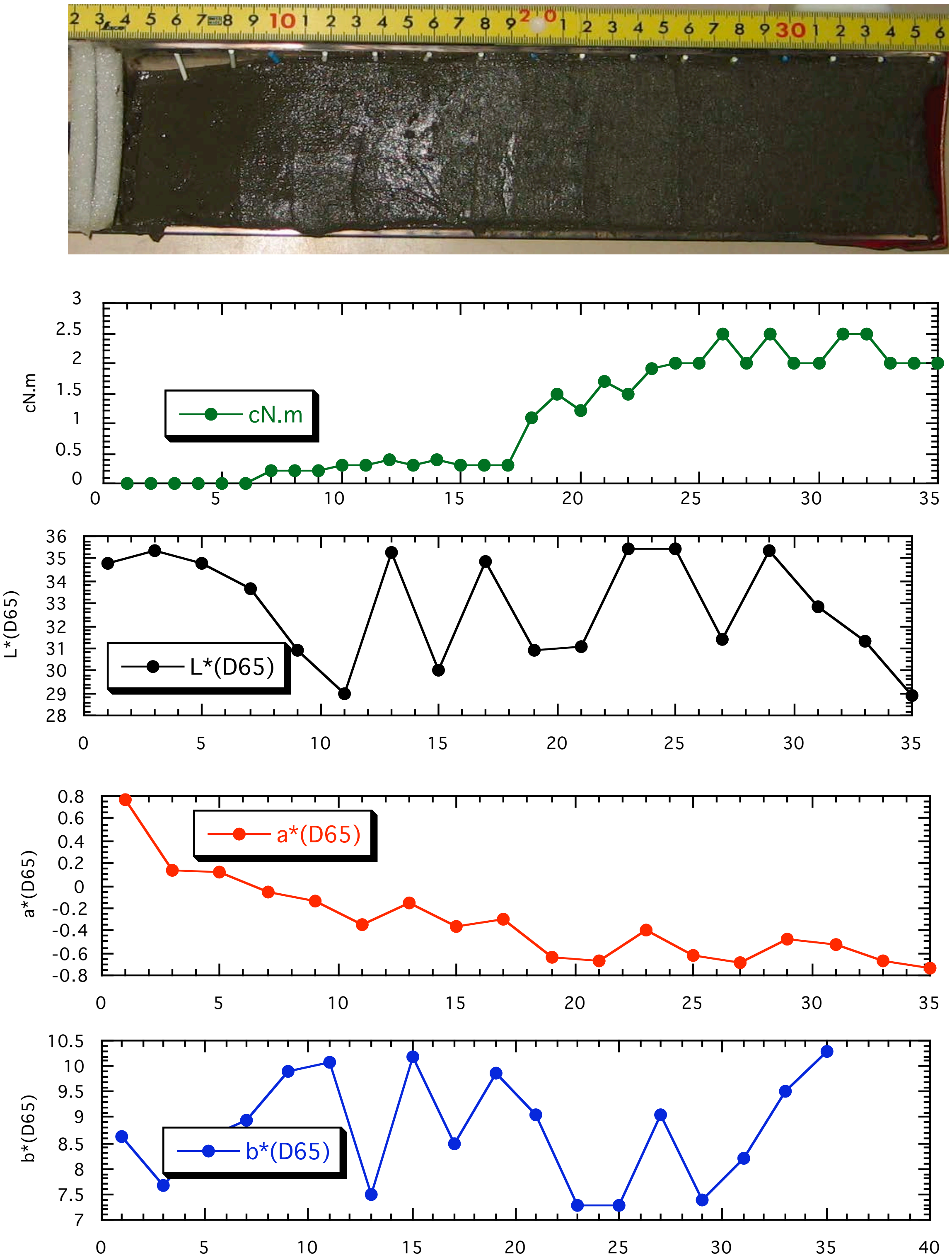


Fig 8a Core photo, L*, a*, b* and vane shear strength of MC01-H2.

MC02-H02A

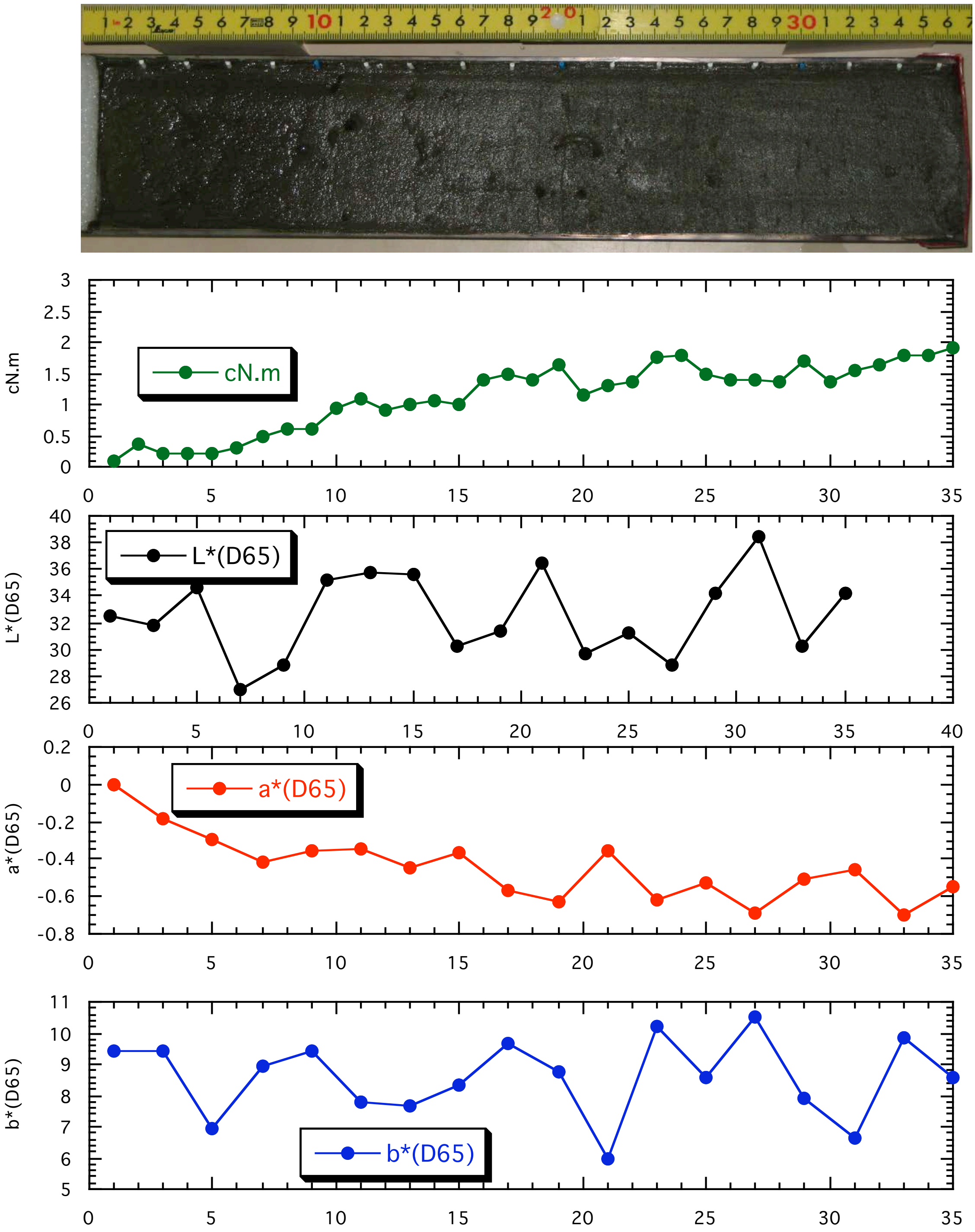


Fig 8b Core photo, L*, a*, b* and vane shear strength of MC02-H2

MC03-H02A

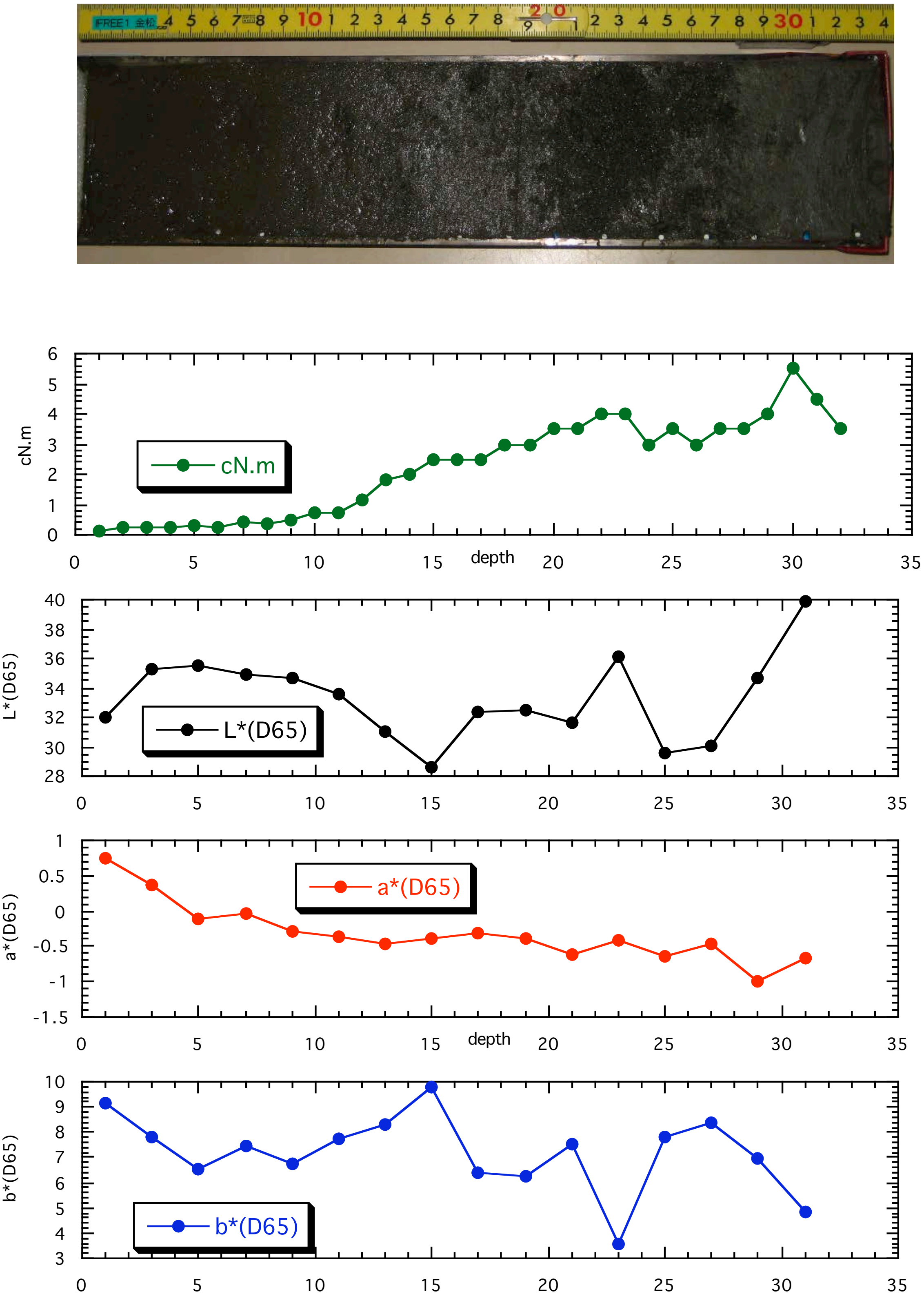


Fig 8c Core photo, L*, a*, b* and vane shear strength of MC03-H2

MC04-H02A

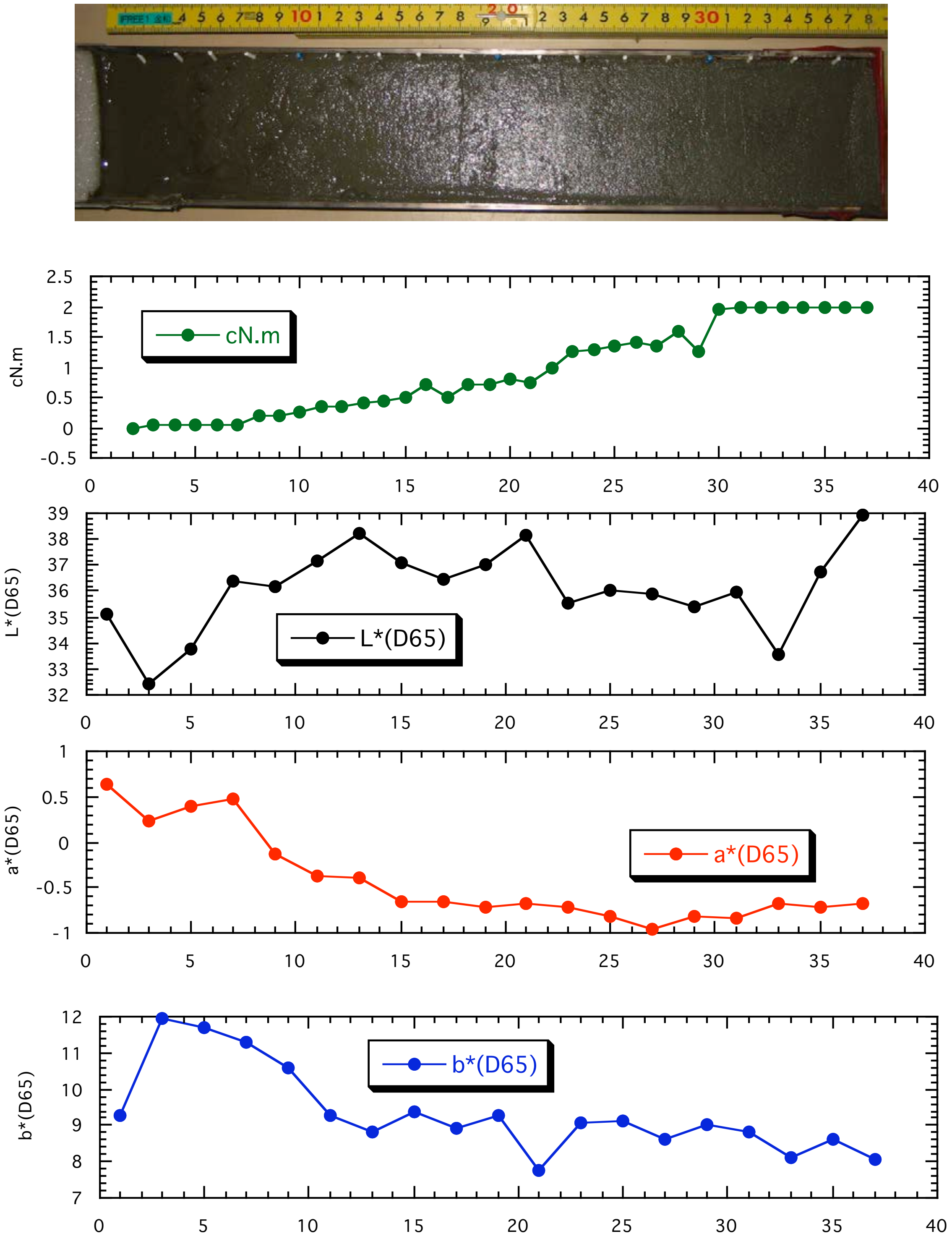


Fig 8d Core photo, L*, a*, b* and vane shear strength of MC04-H2

MC05-H02A

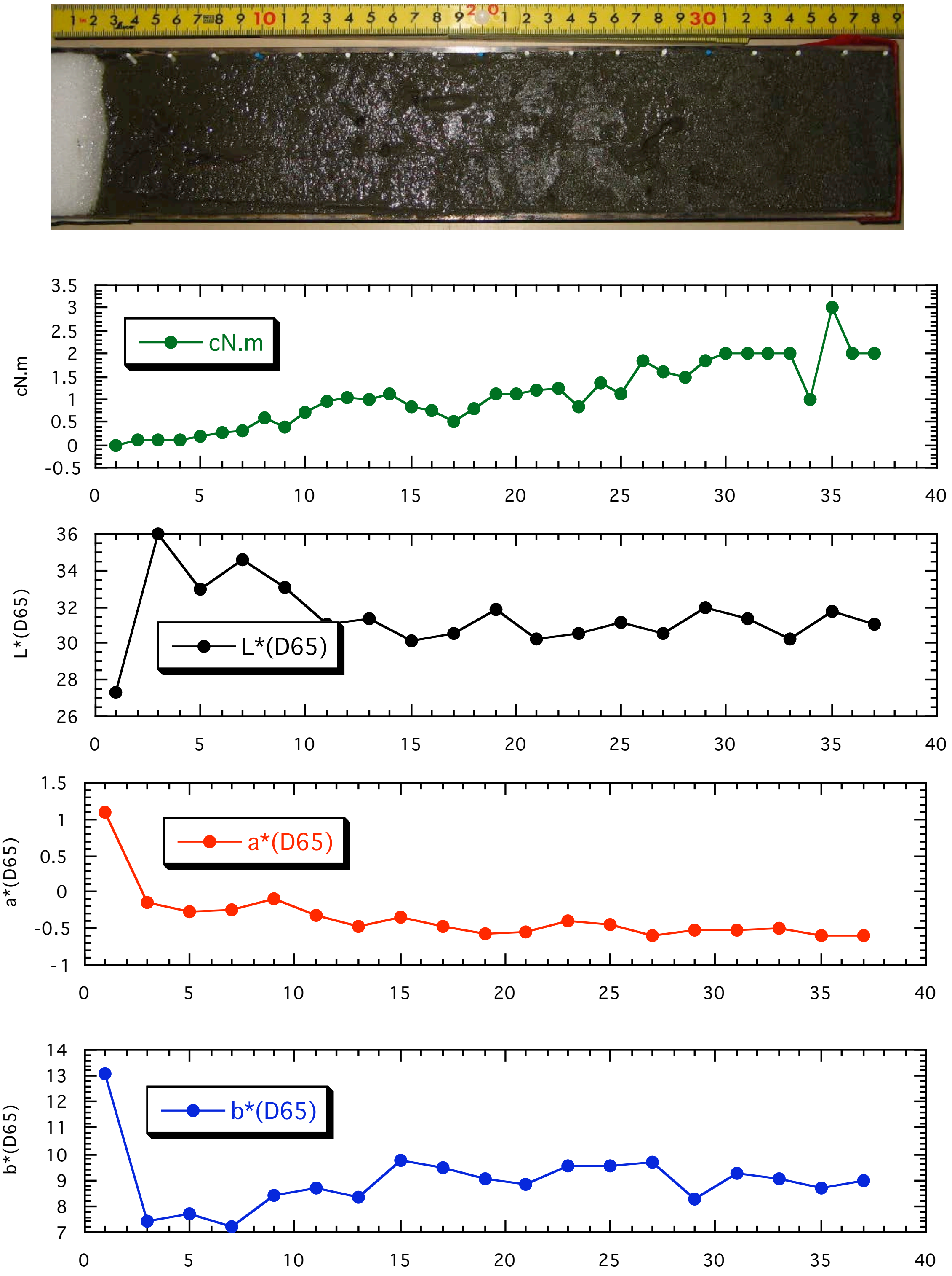


Fig 8e Core photo, L*, a*, b* and vane shear strength of MC05-H2

6.7. Magnetic susceptibility

Magnetic susceptibility of whole round cores were measured to compare between cores obtained a new system, multiple corer, and piston-corer (Figs 9). The variation will be interpreted in detail after X-CT scanning.

MC01, NC01

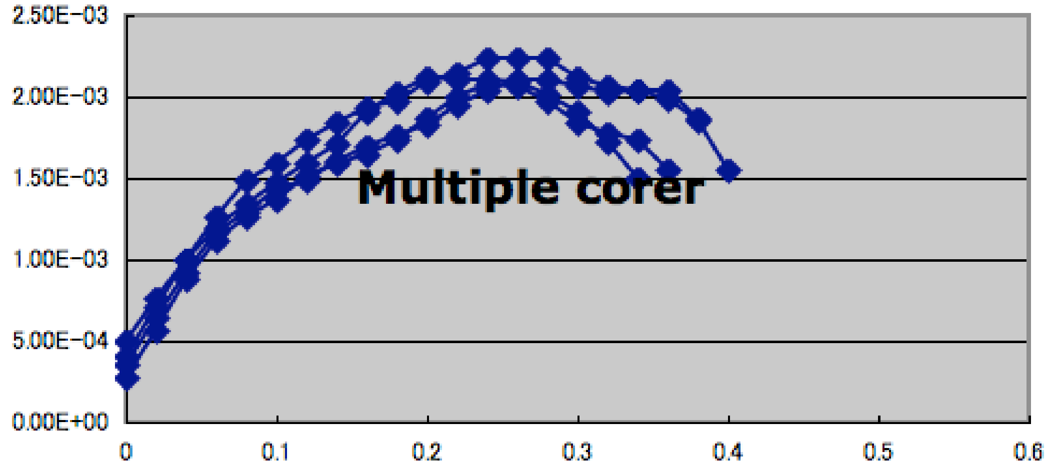


Fig 9a Magnetic susceptibility of MC01

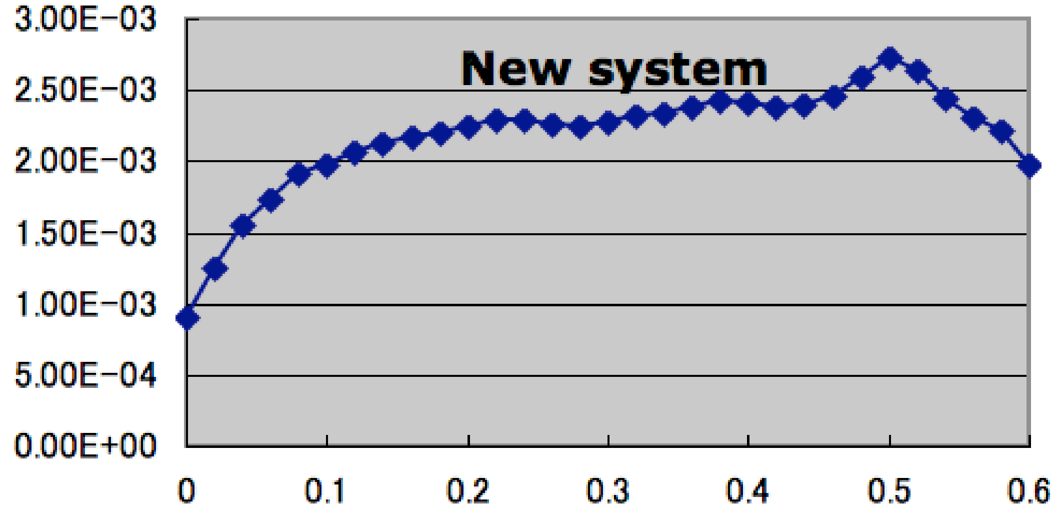


Fig 9b Magnetic susceptibility of NC01

MC02, NC02, PC01, PL0

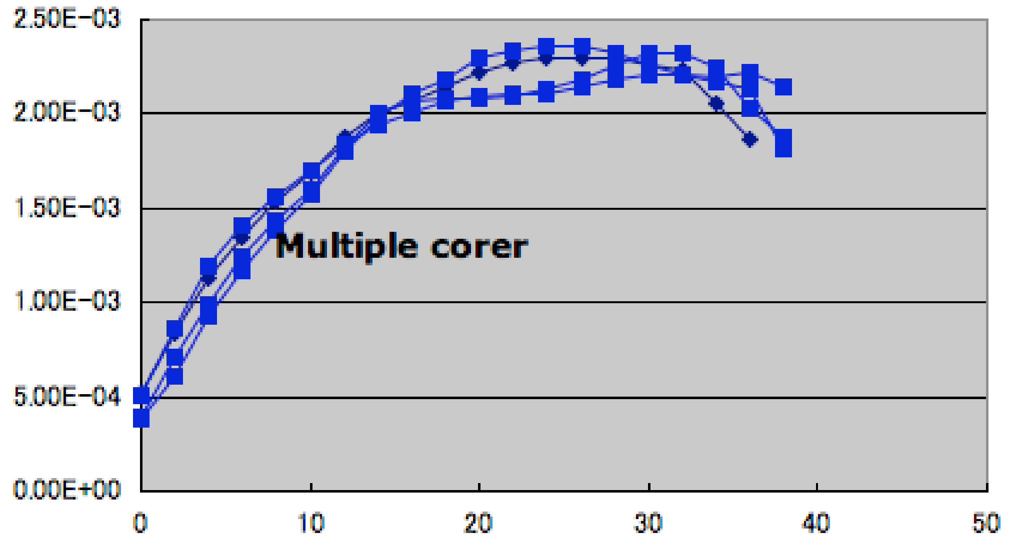


Fig 9c Magnetic susceptibility of MC02

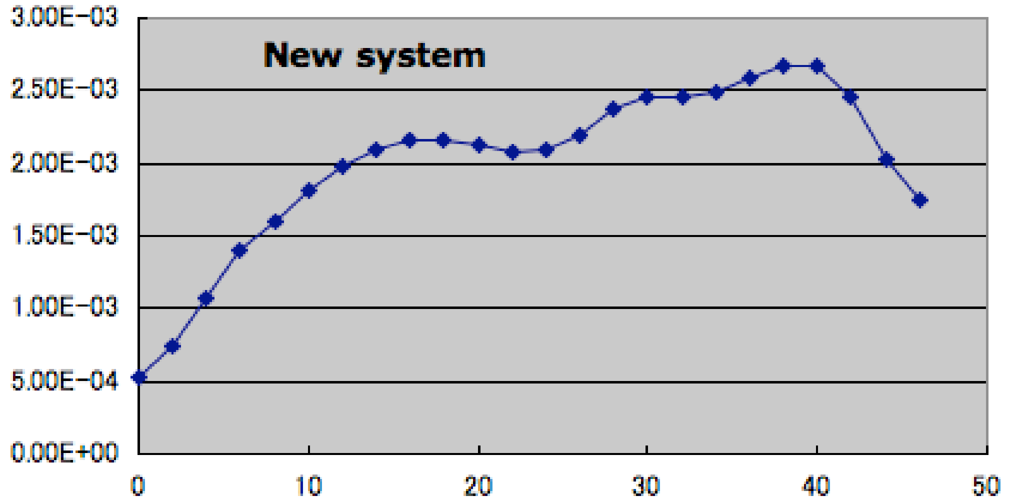


Fig 9d Magnetic susceptibility of NC02

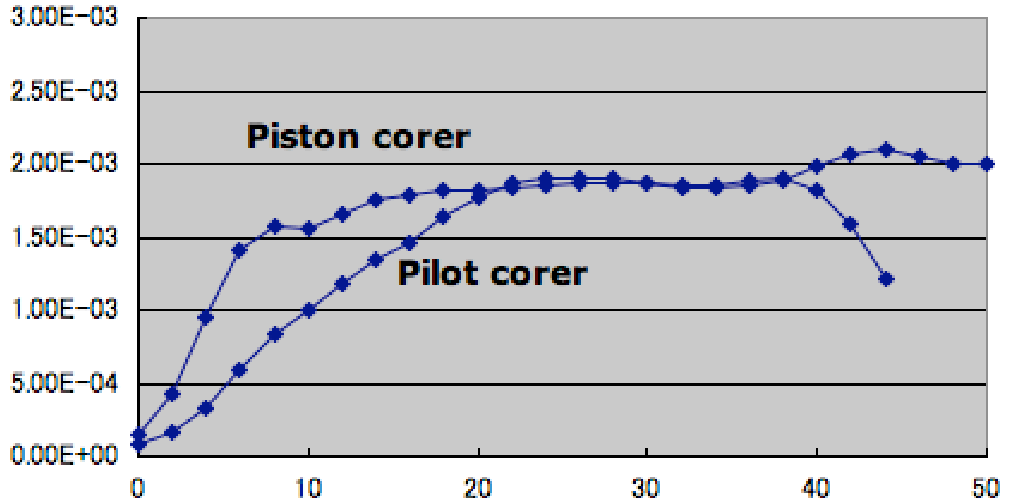


Fig 9e Magnetic susceptibility of PC01 and PL01

MC03, NC03, PC02

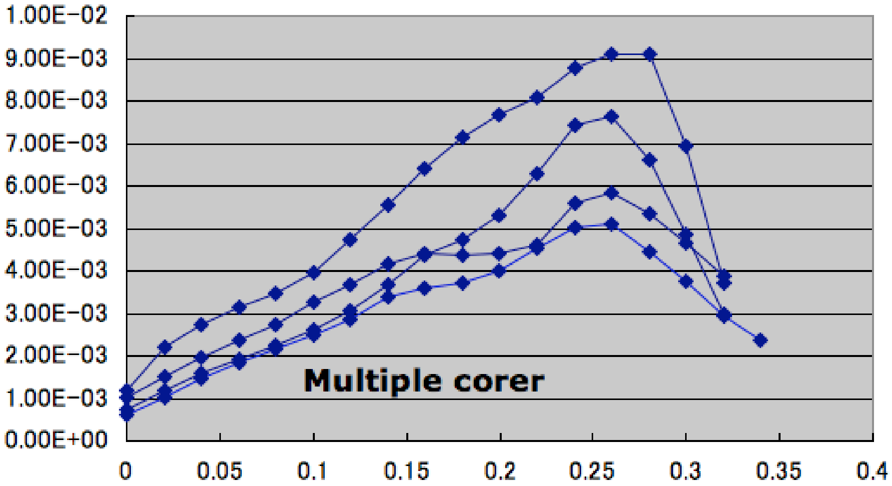


Fig 9f Magnetic susceptibility of MC03

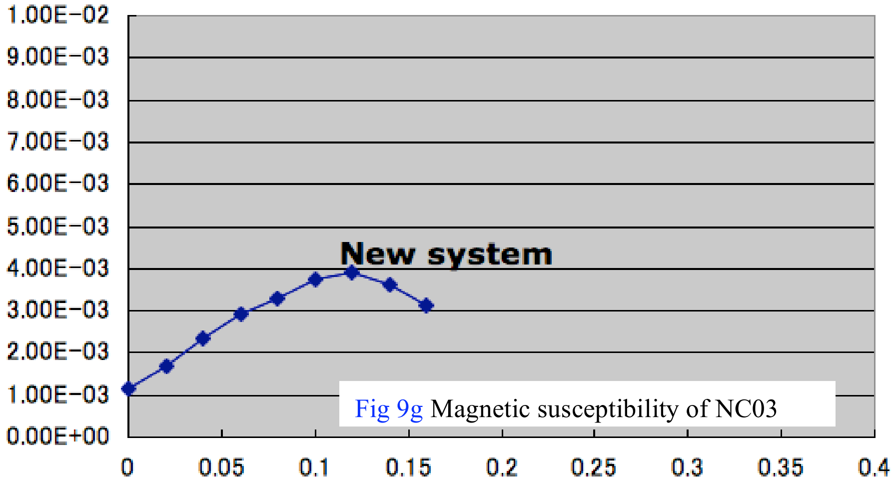


Fig 9g Magnetic susceptibility of NC03

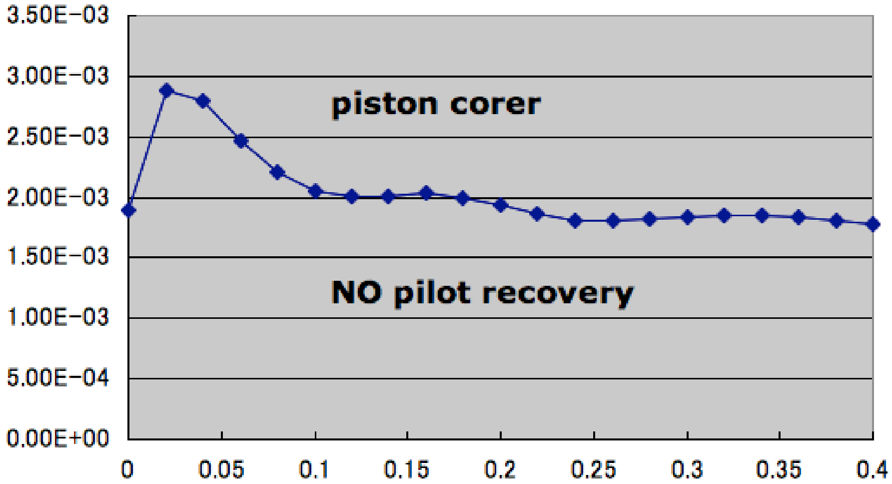


Fig 9h Magnetic susceptibility of PC02

MC04, NC04, PC03, PL03

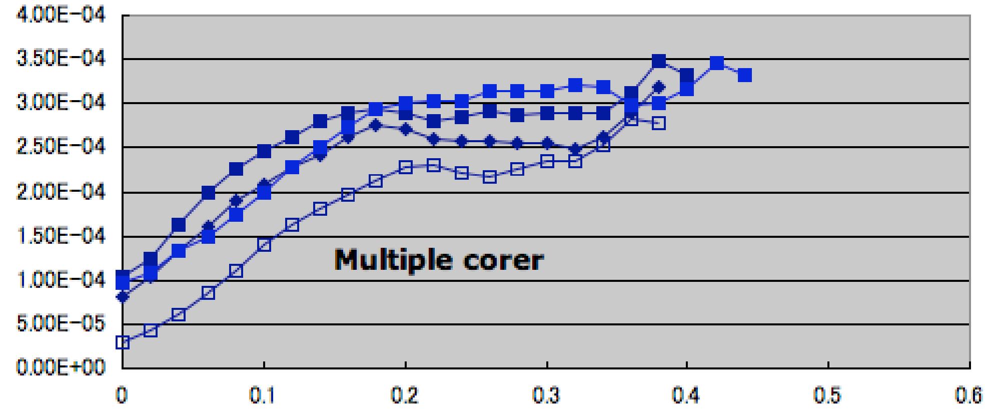


Fig 9i Magnetic susceptibility of MC04

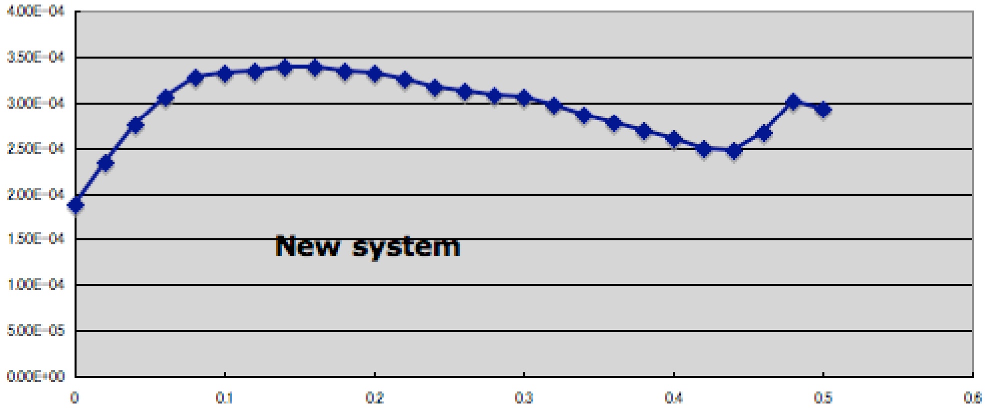


Fig 9j Magnetic susceptibility of NC04

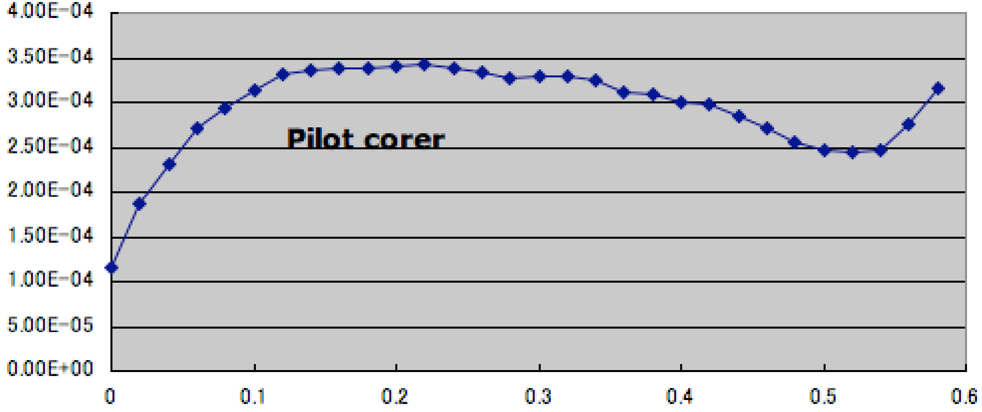


Fig 9k Magnetic susceptibility of PL03

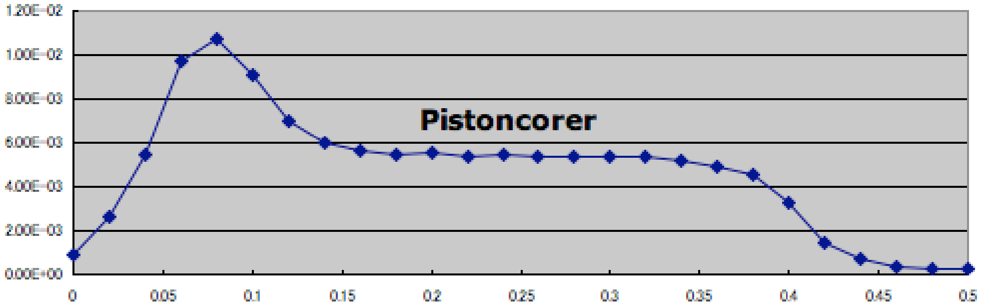


Fig 9l Magnetic susceptibility of PC03

MC05, NC05, PC04, PL04

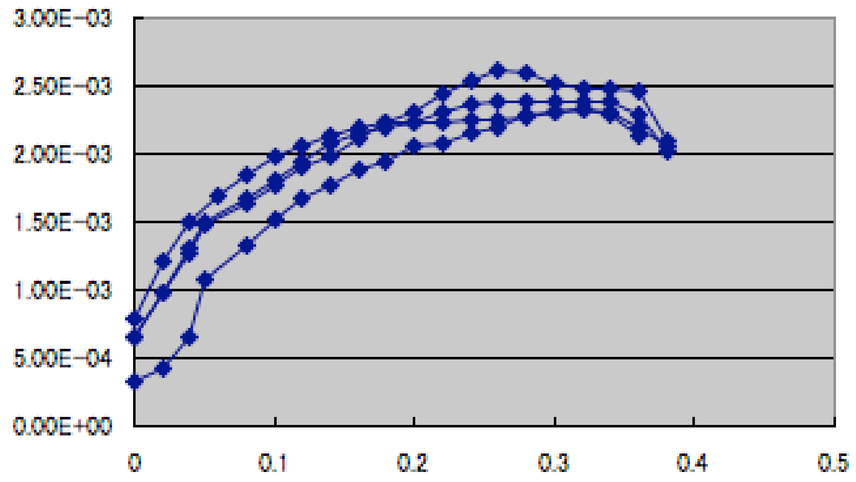


Fig 9m Magnetic susceptibility of MC05

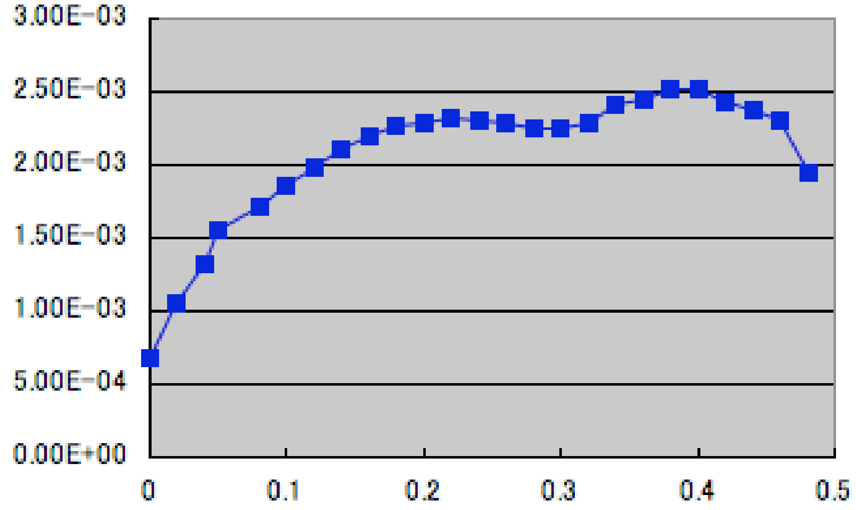


Fig 9o Magnetic susceptibility of NC05

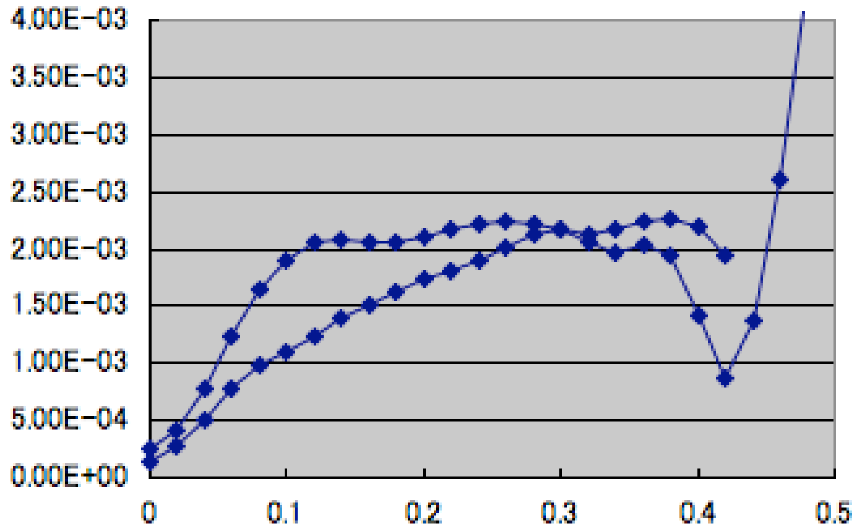


Fig 9n Magnetic susceptibility of PC04 and PL04

6.8 Core description.

Core descriptions were restricted only on split cores (mainly H2 core sampled by multiple corer). The other descriptions will be performed after KCC CT-scanning.

Graphic Lithology

Cruise: KY11-08 Core: MC01-H02 Section: ___ [✓ A] / W

Remarks: 2011/07/06

	GRAPHIC LITHOLOGY	SEDIMENT STRUCTURE	COLOR	LITHOLOGIC DESCRIPTION
			5Y 2/2	0~4 Soupy. (flowed into working half)
10			10YR 5/6	10, 11.5, 12 Yellowish brown fragile fragment. (fossils?)
			7.5Y 2/2	
20				22 Slightly darker patch.
			7.5Y 2/2	26 Slightly darker patch.
30			7.5Y 2/2	
36.5				36.5 Core bottom.
40				
				Olive-black sandy silt
50				
60				
70				
80				
90				
100 (cm)				

section length: 36.5

depth range in core: 0 ~36.5 cm

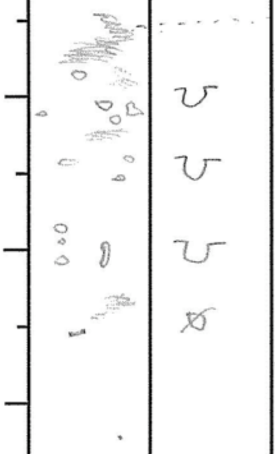
Observer: T. Tomiyama

Graphic Lithology

Cruise: KY11-08 Core: MC02-H02 Section: ___ [✓ A] / W

Remarks: 2011/07/07

GRAPHIC LITHOLOGY | SEDIMENT STRUCTURE



	COLOR	LITHOLOGIC DESCRIPTION
0	5Y3/1	
	5Y2/1	5~10 Slightly darker spots.
	5Y3/2	
10		12~14 Slightly darker spot.
		9~22 Burrows with ~3mm diameter.
20	7.5Y3/2	
		26 Shell fragment.
	7.5Y3/2	
30		
36.5		36.5 core bottom.

Olive-black sandy silt with a few black spots and vacant burrows

40

50

60

70

80

90

100
(cm)

section length: 36.5

depth range in core: 0 ~ 36.5 cm

Observer: T. Tomiyama

Graphic Lithology

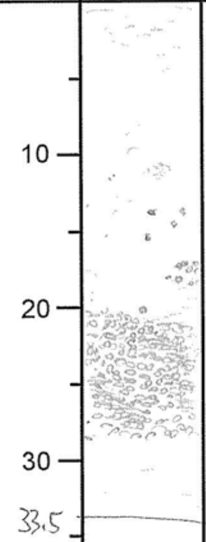
Cruise: KY11-08

Core: MC03-H02

Section: ____

[✓ A]/ W

Remarks: 2011/07/08



SEDIMENT STRUCTURE

COLOR	LITHOLOGIC DESCRIPTION
5Y2/2	0-11 Sandy silt
	11-20 Sandy silt with scoria-like sand.
5Y 3/1	27 Scoria patch
matrix 7.5Y3/2	20-28 coarse scoria rich sand in sandy silt matrix.
scoria 2.5GY2/1	28-33.5 Silty Clay
	33.5 Core bottom.

Olive-black silty clay to sandy silt with a scoria-rich layer.

section length: 33.5

depth range in core: 0 ~ 33.5 cm

Observer: T. Tomiyama

Graphic Lithology

Cruise: KY11-08 Core: MC04-H02 Section: ____ [✓ A] / W

Remarks: 2011/07/09

	GRAPHIC LITHOLOGY	SEDIMENT STRUCTURE	COLOR	LITHOLOGIC DESCRIPTION
			5Y3/2	0-6 Soupy
			2.5Y3/2	5-6 slightly brownish. layer
10			5Y3/2	8-9 slightly darker layer
			7.5Y3/2	16-17 slightly darker patch.
20			7.5Y3/2	
			7.5Y4/1	24-25 Lighter layer
30			7.5Y3/2	
			7.5Y3/2	31-34 Slightly darker patch
38 40				38 Core bottom.
				Olive-black silty clay with a few layers of different colors.
50				
60				
70				
80				
90				
100 (cm)				

section length: 38

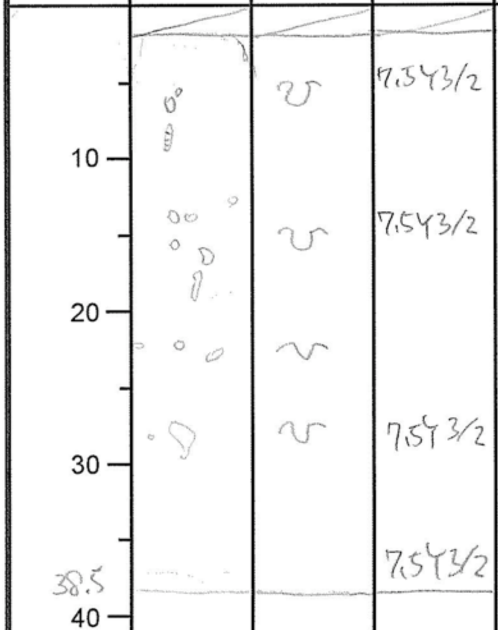
depth range in core: 0 ~ 38 cm

Observer: T. Tomiyama

Graphic Lithology

Cruise: KY11-08 Core: MC05-H02 Section: ___ [✓ A] / W

	GRAPHIC LITHOLOGY	SEDIMENT STRUCTURE	COLOR	Remarks: 2011/07/10



LITHOLOGIC DESCRIPTION

0-2.5 Soupy Sediments were Plowed into the working half. Replaced by poly-ethilen foam.

2.5-6 Soupy.

7-8 Burrows.

8-9 Worm carcase.

13-30 Burrows.

38.5 Core bottom.

Olive-black sandy silt with burrows.

50
60
70
80
90
100
(cm)

section length: 38.5

depth range in core: 0 ~38.5 cm

Observer: T.Tomiyama

Graphic Lithology

Cruise: KY11-08 Core: PC 02 Section: 01 [✓ A] / W

Remarks: 2011/07/08

	GRAPHIC LITHOLOGY	SEDIMENT STRUCTURE	COLOR	LITHOLOGIC DESCRIPTION
10 20 30 40 50 60 70 80 90 100 (cm)		Disturbed	matrix: 7.5Y2/2 Sand: 2.5GY2/1	0-10 Dark colored coarse sand (scoria?) in Sandy-silt matrix. 10 Section bottom. This section was heavily disturbed and contaminated during band-saw cutting of outer pipe and subsequent pushing-out from stacked inner tube. Black coarse sand with olive-black Sandy-silt matrix

section length: 10cm

depth range in core: 0 ~ 10 cm

Observer: T. Tomiyama

7. Acknowledgment

We would like to thank Captain and his ship crews of KAIYO for excellent operations. We especially thank Ken Yastu for treating logistic issues of our cruise, and other persons who support our cruise in various aspects in Marine Technology and Engineering Center.

8. Notice on Using

Notice on using: Insert the following notice to users regarding the data and samples obtained.

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.
Users of data or results on this cruise report are requested to submit their results to the Data Management Group of JAMSTEC.