doi : 10.17596/0003604

An outline of the interdisciplinary survey on a new type intra-plate volcanism -"Petit-spot" in the NW Pacific-

KR05-10 "Petit-spot multidisciplinary survey"

August 1 – 12, 2005

Hakodate – Yokosuka

Cruise Report:

Natsue Abe, Naoto Hirano and Onboard Scientific party

Summary of the Petit-spot cruises

Several very young volcanoes (< 1 Ma) were discovered on the Early Cretaceous (~135 Ma) NW Pacific Plate. They are very small knolls on the abyssal plane (~ 6000 m water depth) and erupted strong to moderate alkaline basalt, generally including deep-seated xenoliths. This volcanic field is far from any trenches and also spreading centers, therefore these are classified as a kind of intra-oceanic plate volcanism. In this area, however, there are neither any hotspots nor large igneous province previous reported. Therefore, this volcanic activity is not adequate for any existence volcanic models on the earth. Then, we named this special volcanism “Petit spot”. To understand this “petit-spot” volcanism, we’ve been taking interdisciplinary surveys. The main results of these surveys using JAMSTEC four cruises (KR03-07, KR04-08, YK05-06 and KR05-10).

On this cruise (KR05-10) we had Magnetotelluric soudings (MT) experiment, Single Channel Seismic Reflection survey, Heat Flow Piston Core samplings and a dredge. The preliminary results of onboard studies and several shore-based researches are listed below.

1) Volcanic rocks were sampled from three small knolls by dredges and submersible dives. They are highly vesicular, and generally include peridotite xenoliths and peridotitic xenocrysts.

2) Terrestrial Heat Flow was measured at two points with piston coring on the pelagic sediments.

3) Seabeam mapping shows there are a lot of small knolls assumed young volcanoes. The arrangement and the size of the knolls imply that this volcanic field is a monogenic volcanic cluster, which are often observed in the intra-continental plate.

4) Single Channel Seismic (SCS) Reflection survey profiles suggest that main body of the young volcano exists between pelagic sediment and oceanic basement.

5) Magnetotelluric soundings (MT) experiment using ocean bottom electromagnetometers (OBEM) implies the maximum electric conductivity observed around 100-130 km depth.

In addition to these results, some seismic activities (M3 – 5) were observed in this area by world network of seismic stations for this quarter century. As a whole, “petit spot” volcanism is quite unique and highly remarkable phenomenon.

KR05-10 Cruise Report

Contents

1. Scientific Objectives

Oceanic lithosphere is one of the most important components of the heat and substances circulation on Earth, which is convecting from the earth surface to the deep mantle. The structure is known as the "ophiolites sequence" at least fast spreading ridge. Recently new type volcanisms are found mainly near the East Pacific Rise; e.g., off-ridge (YK04-07) and far-ridge volcanism, and small-scale hotspot tracks (e.g., Pukapuka ridge; Janney et al., 2000). Then, the construction of the oceanic lithosphere is more complex than simple "ophiolites sequence". The petit-spot volcanism is one of such new type volcanism, which was found on the Northwestern Pacific (Hirano et al., submitted to Nature).

Hirano et al. (2001) reported the presence of anomalously young alkali-basalt lavas (5.95±0.31 Ma Ar-Ar age) on the subducting, ~130 Ma Pacific Plate. Volcanic eruption of the newly discovered lava field occurred on approximately 600 km ESE off the northern Japan Trench based on the present absolute motion of the Pacific Plate (Gripp and Gordon, 1990). Hirano et al. (2001) argued that the alkali-basalt eruption occurs as a melt extraction directory from asthenosphere, because of a fracturation of the old and cold oceanic plate. To verify this model, the first cruise (KR03-07; by Prof. Ogawa) took SeaBeam and geophysical mapping on the 600 km ESE off the northern Japan Trench are, followed by KR04-08 (Dr. Hirano), which found one small knoll (Yukawa knoll) on the area as the young alkaline volcano. The chemistry of the Yukawa alkali-basalt suggests that this small knoll is also same origin of the northern Japan Trench alkaline basalts, which are from the deeper than 70km deep with garnet-peridotite residue and quite low degree of melting of peridotite similar to MORB source. Therefore, this type of volcano is definitely different from the existing paradime; hot-plume related hotspot or LIPs, subduction zone and mid-oceanic ridge volcanism. Then, we named it "petit-spot" volcanism as a new type of volcanism separated from hotspot activity.

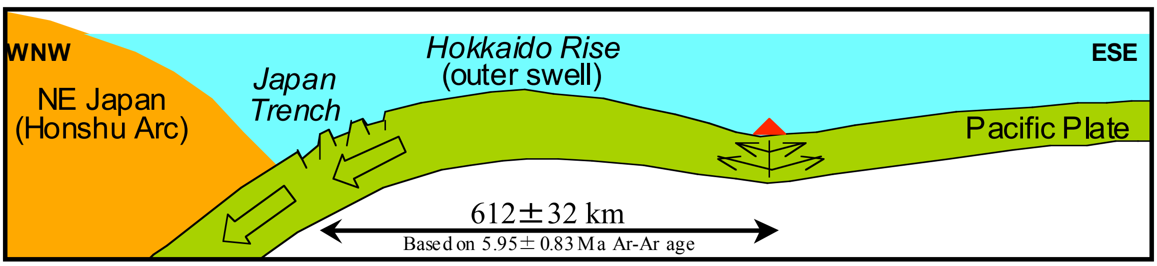

Figure 1-1. Possible eruption in the trench and outer-rise systems (Hirano et al., 2001). We call such volcano "Petit-Spot".

This cruise was taken as pare cruises with YK05-06 (by Dr. Hirano) on the same survey area. YK05-06 and KR05-10 were designed to make the petit-spot volcanism clear using not only petrological and geological tool but also many geophysical data; e.g., MT method and single channel seismic experiment (c.f., Abe et al., 2005). The scientific prospectus are 1) to take the electric conductivity data beneath the petit-spot area, 2) to take SCS reflection experiment and the images on the oceanic crust in the survey area, 3) to take thermal conductivity data on the petit-spot volcano, 4) to take sediment sample near the petit-spot volcano and 5) to take rock samples of the petit-spot basalts and the oceanic lithospheric xenoliths.

References

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Hirano, N., Kawamura, K., Hattori, M., Saito K. and Ogawa, Y. (2001): A new type of intra-plate volcanism; young alkali-basalts discovered from the subducting Pacific Plate, northern Japan Trench. Geophys. Res. Lett., 28, 2719-2722.

Hirano, N., Takahashi, E., Yamamoto, J., Machida, S., Abe, N., Ingle, S., Kaneoka, I., Hirata, T., Kimura, J., Ishii, T., Ogawa, Y. and Suyehiro, K. (2006) Evidence for partial melt in Earth's asthenosphere: volcanism in response to plate flexure during subduction of the Cretaceous Pacific Plate. submitted to Nature.

Jannery, P.E., Macdougall, J.D., Natland, J.H, Lynch, M.A. (2000) geochemical evidence from the Pukapuka volcanic ridge system for a shallow enriched mantle domain beneath the South Pacific Superswell. Earth Planet. Sci. Lett. 181, 47-60.

2. Cruise Log

2-1. Ship Log

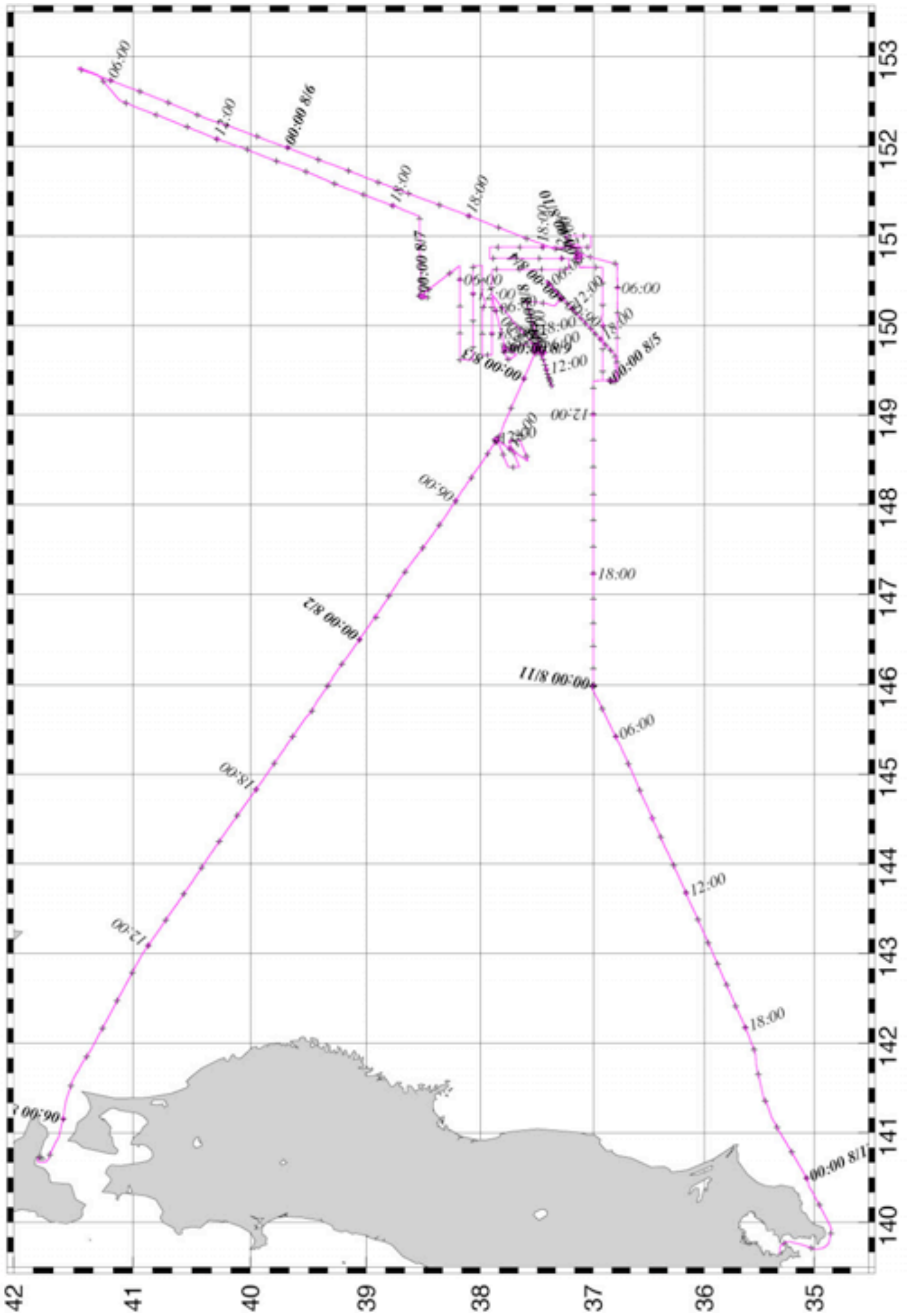

Figure 2-1. Ship Track of KR05-10 cruise.

2-2. Survey Areas

The mission for the Petit-Spot Expedition was set up the Petit-spot area for some operations (B and B'-area) and 1 broad area for SeaBeam survey.

The SeaBeam survey area was set up broadly for seabeam and some geophysical survey, which is the range of 34° to 41 °N and 142° to 153° E excluding the near shore area to 15 mile form NE Japan.

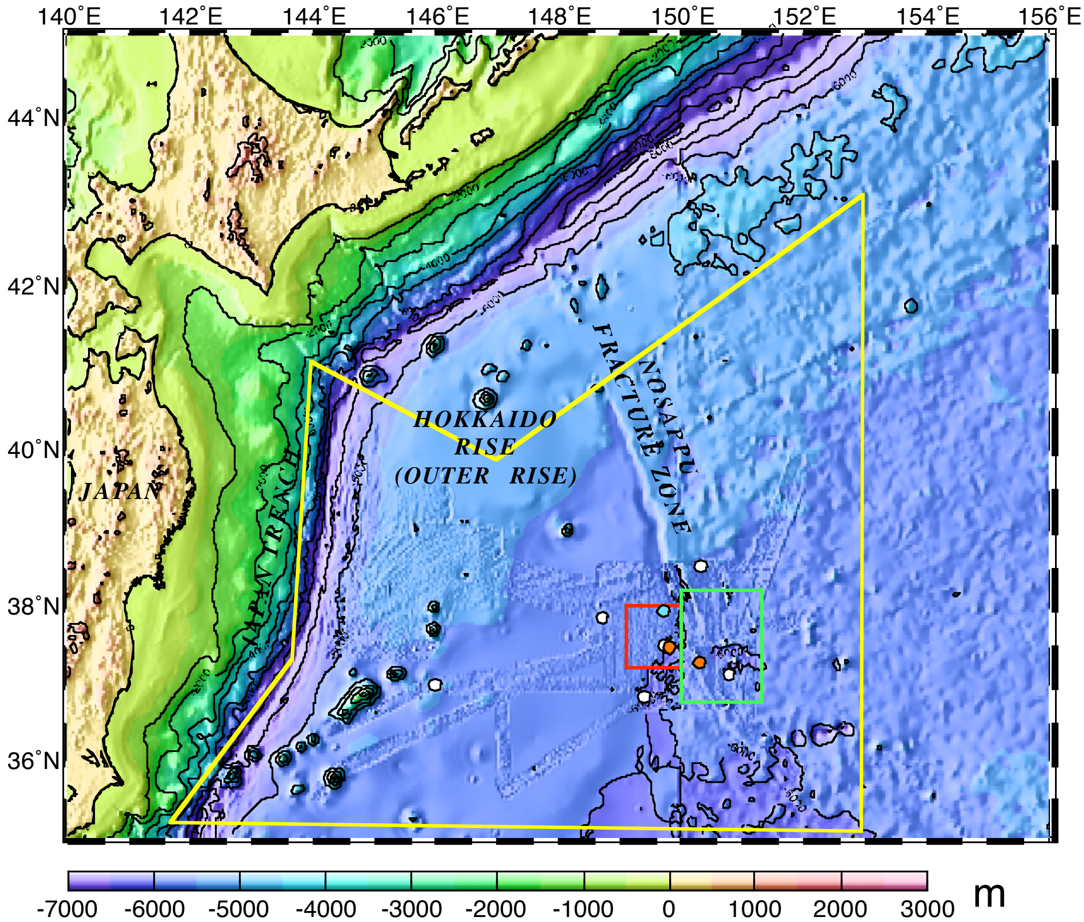

Figure 2-2. Index map of the survey area. Bathymetric data are from our swath bathymetry, JTOPO30 (west of 150°E), and ETOPO2 (east of 150°E). The red square shows the survey area B and yellow square shows the survey area B'. The white circles point the OBEM experiments and the orange circles are HF-PC experiment points. The blue circle is the dredge point. Yellow line shows the survey area. B: Around 150^{O}E area. It is near the Nossappu Fracture Zone. B': Southern of Nossappu Fracture Zone area

B and B'-area (around 150^{o} E near the Nossappu Fracture Zone)

B-area is in the range of 37^{o} 10' to 37^{o} 50' and 149^{o} 20' to 150^{o} 10' and is set up for 2 dredges and 2 piston cores. KR03-07 cruise on last year swath-mapped this B-area in the NW Pacific to the east of the Hokkaido Rise. This area was originally chosen as to be the potential place for the magmatism for the Miyako Knolls. At the same time this area corresponds to the SES extension of the Hokkaido Fracture Zone. Therefore, the deepest, complicated topography was anticipated. Side-scan image of the KR03-07 data may show the presence of the Petit-Spot as the young volcanoes (Figure 2-3).

The mapped area has the diagonal line between 37^{o} 42'N, 150^{o} 30'E, and 30^{o} 00'N, 149^{o} 00'E. The data show that the remarkable straight line from NWN to SES runs in the eastern part of the area. Sharp ridges with seamounts or knolls are also around the line, arranging en echelon. Soon after we passed some N-S lines with 6.5 mi spacing, we recognized this pattern is composed of en echelon ridges of L or "KU" in hiragana. Some reveres "Sadogashima" shape ridges (Sadogashima in the Japan Sea is of S-shape; reverse of which is of Z-shape) were also found. Also the knolls have often moats or wholes around them. The NWS-SES trending lines are sharp enough to think to be faults, cutting or demarcating the ridges. However, some NE-SW trending faults also cut the former trend. Thus we recognized at least three trends of ridges or faults; N20W, N60W, and N45E. The plausible idea to explain such arrangement is these are products of magma intrusion into three trends, and because the NWN trend is on the fracture zone, the N60W trend might be of extension fracture or Riedel shear (R1) under a left-lateral strike-slip (sinistral) shear regime. According to Nakanishi's NW Pacific magnetic lineament map (Nakanishi and Winterer, 1990), it is known that the Hokkaido Fracture Zone has approximately 400 to 600 km apparent displacement-bearing right-lateral strike-slip (dextral) dislocation. As known the NW Pacific Japanese lineament is of Jurassic-Cretaceous- Paleogene plate, younger toward NW. Therefore, the plausible spreading ridge which produced this lineament was already subducted along the NW Pacific convergent margin. This indicate that when the spreading ridge was there, the ridge-ridge transform fault had inversely left-lateral (Figure. 2-3).

We can easily reconstruct the relevant shear regime with extension fracture, Riedel shears etc. Possibly the N60 W trending ridges are products of magmatism along such extension fractures, whereas the N20W (NWN) trend ridges paralleling the fracture zone would be products along the leaky transform fault. This kind of leaky fault might be of two or more sets (Figure 2-3). The N45E trend may be of the ridge trend itself, forming normal faults or others. The ridge and faults area is concentrated in the western part of the area B, so that this part should be the most adequate target for the future study.

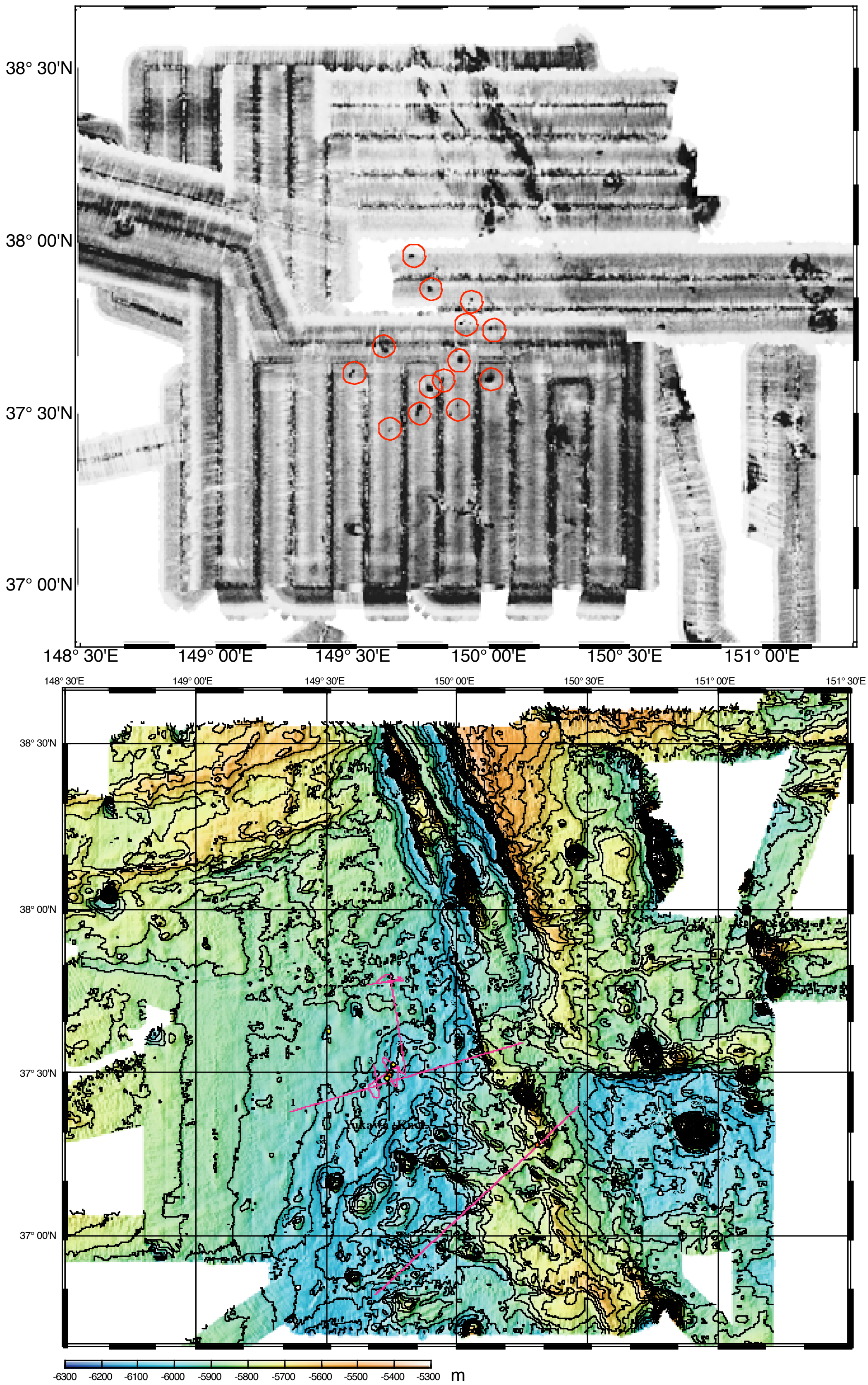

Figure 2-3. The map showing B-area. The bottom and upper figures show the bathymetry and side scan image of this area, respectively.

船名　かいれい　オペレーター　竹友　（記入 森）

航海名　KR05-10

日付　y 2005 / m ~~8~~ / d 4　LST　UTC + ~~10~~ 9 h.

コアNo.　PC- 01

調査海域　北西太平洋　海域　英名: Northwest Pacific

採取地点　St.

コアラーの種類　みらい20mPC用　コアラーの重量　900 kg

パイプ長　5 m　アウター方式 / インナー方式

パイプ数　1 本

パイロットコアラーの種類　ユーイング型 / アシュラ型　パイロット重量　50 kg

パイロットワイヤー長　13.3 m　パイロット取付位置　天秤の先端から 1 番目

メインワイヤー長　12.25 m　フリーフォール　4.3 m

ゼロ調整（線長0m）の位置　天秤 / 観測ウィンチワイヤー先端

追加装備　~~方位傾斜計~~ / トラン~~スポ~~ンダー（沖電機） / 誤作動~~防止~~装置 / HFセンサー

トランスポンダー「かいれい」搭載 14kHz

測地系　WGS84

天候　晴　有義波高　1 m（表示計 / 目視）

風向　91 deg　風速　5.5 m/s

流向　20.6 deg　流速　1.0 knt

） ゼロ調時

	時間	水深	緯度	経度	船首方位
ゼロ調整	10:00	5729 m	37 - 16.8864	150 - 18.4983	154.8 deg
着底	12:04:36	5731 m	37 - 16.8359	150 - 18.5042	157.0 deg
離底	12:20:32	5733 m	37 - 16.8376	150 - 18.5098	158.2 deg
線長0m	13:47	5730 m	37 - 16.9938	150 - 18.7884	90.7 deg

予定点:　水深 5740 m　緯度 37°16.85'N　経度 150°18.15'E　←MAP上で読みとった値

SBPパターン:

コメント:　~~5740m~~ 観測ウィンチワイヤー先端より50m上にトランスポンダー取り付け。

船内時間は UTC +10h.

ピストンコア ログシート Ver.040729

Cruise Name: KR05-10　Core Name: PC- 01　y/m/d: 2005 / 8 / 4　Page: 1 / 3

時間 (UTC +9~~10~~h.)	水深 (m)	線長 (m)	張力 (kN)	線速 (m/min)	繰出/巻上 (↓/↑)	記事 (作業開始、着水、着底、離底、揚収、ウインチ停止など)
9:35	5732					作業開始, PCともへ
39						天秤とりつけ完了
〃						観測ウィンチ巻き上げ
40						〃 停止
〃						揚収ウィンチ巻き上げ
41						〃 停止, PC台車はずす
42						Aフレームふり出し
45						観測ウィンチ巻き上げ
46						揚収ウィンチ~~巻き上げ~~繰り出し
47			3			揚収ウィンチとりはずし, PCのテンション観測ウィンチへ
48	5732		3			汎用ウィンチでユーイング吊り上げ
49	5732		3			ユーイングとりつけ開始
50	5731		3			〃 完了
51	5731		4			PC安全ピン抜く
52	5731		6		↓	Aフレームふり出し, 観測ウィンチ繰り出し
53			7		↓	天秤着水
55	5733		7	0	–	観測ウィンチ停止
56			0	0	–	PCのテンション汎用ウィンチへ
58	5731		6		↑	観測ウィンチ巻き上げ, PCのテンション観測ウィンチへ
10:00	5729	0	6	0	↓ –	0調整 観測ウィンチ繰り出し
:02			6	27	↓	観測ウィンチ繰り出し
05	5733	43	7	0	–	〃 停止, トラポンとりつけ開始
09	5734	43	7	0	–	トラポンとりつけ完了
09	5734	43	7	0	–	Aフレームふり出し
10	5729	43	~~[illegible]~~ 7		↓	観測ウィンチ繰り出し
~~15~~ 12	5734	~~21~~ 52	7	21	↓	トラポン着水
19	5730	200	7	>20	↓	ウィンチ増速 (50m/minまで)
26	32	500	9	>50	↓	〃 (60m/minまで)
27	32	590	10	60	↓	〃 完了

※1t ≒ 9.8kN

ピストンコア ログシート Ver.040729

Cruise Name: KR05-10　Core Name: PC-01　y m d: 2005 / 8 / 4　Page: 2 / 3

時間 (UTC +9 ~~hr.~~)	水深 (m)	線長 (m)	張力 (kN)	線速 (m/min)	繰出/巻上 (↓/↑)	記事 (作業開始、着水、着底、離底、揚収、ウインチ停止など)
10:34	5730	1000	12	59.7	↓	
:42	5728	1500	15	61.2	↓	
:51	5731	2000	18	59.8	↓	
:59	5731	2500	20	61.3	↓	
11:07	5733	3000	25	60.1	↓	
:16	5731	3500	28	61.2	↓	
:24	5732	4000	36	60.6	↓	
:32	5731	4500	38	59.8	↓	
:40	5733	5000	40	61.0	↓	
:49	5731	5500	46	60.1	↓	
:52	~~5694~~ 5732	5670	48	0	−	観測ウインチ停止
12:03	5731	〃	〃	20	↓	〃 繰り出し
:04 36	5731	5689	~~(45)~~ 43	〃	↓	着底
:04 48	〃	5692	40	0	−	ウインチ停止
:06	5732	5694	40	~~2~~	↓	2m 〃 繰り出し, すぐ停止
:09	5730	5696	40		↓	2m 〃 , 〃
:19	5729	〃	〃	10	↑	ウインチまき上げ (10m/min)
:20	5733	5685	55	10	↑	張力最大 (55kN)
:20 32	5733	5682	46	10	↑	離底確認
:20	5731	5677	49	~~20~~ >10	↑	ウインチ増速 (60m/minまで)
:25	5731	5500	49	62	↑	
:33	5732	5000	50	65.5	↑	
:40	5734	4490	50	67.0	↑	
:47	5734	4000	44	70.0	↑	
:54	5731	3500	40	71.7	↑	
13:01	5729	3000	34	74.2	↑	
:08	5730	2500	33	75.7	↑	
:15	5734	2000	27	74.7	↑	
:21	5734	1500	23	73.9	↑	

※1t ≒ 9.8kN

Marine Works JAPAN LTD.

ピストンコア ログシート　Ver.040729

Cruise Name: KR05-10　Core Name: PC-01　y m d: 2005 / 8 / 4　Page: 3 / 3

時間 (UTC +9 h.)	水深 (m)	線長 (m)	張力 (kN)	線速 (m/min)	繰出/巻上 (↓/↑)	記事 (作業開始、着水、着底、離底、揚収、ウインチ停止など)
13:28	5733	1000	20	72.9	↑	
:35	5737	500	18	73.2	↑	
:41	5735	100	14	56.7	↑	
:42	5738	~~25~~ 52	13	51.7	↑	トラポン水面
:43	5739	25	13	0	−	ウィンチ停止、Aフレームふり込み
:45		25		0	−	トラポン取りはずし開始
:46	5738	25	13	0	−	〃 完了
〃	5734	25	13	24.5	↑	観測ウィンチ巻き上げ
:49	5736	−27	12	0	−	〃 停止
:51	5736	−25	0	0	−	PCのテンション、汎用ウィンチへ、シャックルとりはずし
52	5731	−26	9	0	−	〃 観測ウィンチへ
54	5730		9	8.5	↑	観測ウィンチ巻き上げ
55		−49			↑	天秤 水面
56	5729	−52	9	0	−	観測ウィンチ停止、
58						コーイングのテンション、汎用ウィンチへ
〃						〃 水面
59						〃 on Deck
14:01						PCのテンション、汎用ウィンチへ
:02						天秤 とりはずし完了
:0						汎用ウィンチ巻き上げ
:08						〃 停止、錘デッキの高さ
:09						PCのテンション、揚収ウィンチへ
:12						Aフレームふり込み
:13						PC on Deck
13:47	5730	0	13	24.6	↑	~~ゼロ調~~ 線長ゼロ

※1t ≒ 9.8kN

Marine Works JAPAN LTD.

船名 かいれい　　オペレーター 竹友　（記入 森）

航海名 KR05-10

日付 y 2005 / m 8 / d 8　　LST ~~LST~~ UTC + 10 h.

コアNo. PC- 02

調査海域 北西太平洋 海域　英名: Northwest Pacific

採取地点 St.

コアラーの種類 みらい20mPC用　　コアラーの重量 900 kg

パイプ長 5 m　　アウター方式 / インナー方式

パイプ数 1 本

パイロットコアラーの種類 ユーイング型 / アシュラ型　パイロット重量 50 kg

パイロットワイヤー長 12.2 m　　パイロット取付位置 天秤の先端から 1 番目

メインワイヤー長 12.25 m　　フリーフォール 3.3 m

ゼロ調整(線長0m)の位置 天秤 / 観測ウィンチワイヤー先端

追加装備 方位傾斜計 / トランスポンダー(沖電機製14kHz) / 誤作動防止装置 / HFセンサー

測地系 WGS84

天候 晴のち雨のち晴　　有義波高 0.5 m（表示計 / 目視）

風向 216 deg　　風速 5.6 m/s

流向 276.5 deg　　流速 0.3 knt　　ゼロ調時

	時間	水深	緯度	経度	船首方位
ゼロ調整	9:30:00	5963 m	37 - 29.5419	149 - 44.4269	165.0 deg
着底	11:42:07	5945 m	37 - 29.4316	149 - 44.7700	39.9 deg
離底	11:59:40	5944 m	37 - 29.4532	149 - 44.7891	43.8 deg
線長0m	13:30:42	5945 m	37 - 29.6082	149 - 44.7763	75.0 deg

予定点: 水深 5950 m　緯度 37°29.58 N　経度 149° 44.65 E

SBPパターン: 海底下2～3mに強い反射面. 音波の透過深度は約50m

コメント: LSTはUTC+10h.

観測ウィンチワイヤー先端より ~~50~~ 59 m上にトランスポンダー取り付け。

ピストンコア ログシート　　　　　　　　　　　　　　　　　　　　Ver.040729

Cruise Name: KR05-10　　Core Name: PC- 02　　y m d: 2005 / 8 / 8　　Page: 1 / 3

時間 (UTC +~~9~~10h.)	水深 (m)	線長 (m)	張力 (kN)	線速 (m/min)	繰出/巻上 (↓/↑)	記事 (作業開始、着水、着底、離底、揚収、ウインチ停止など)
9:06						作業開始，PCともへ
:12						天秤とりつけ完了
:17						揚収ウィンチ巻き上げ，台車はずす
:18						注水開始
:19						〃 完了
:20						揚収ウィンチ巻き上げ，Aフレームふり出し
:21						〃 繰り出し，すぐ停止
:21						観測ウィンチ巻き上げ
:22			7			PC ~~本~~のテンション，観測ウィンチへ
:23						汎用ウィンチでユーイング吊り上げ
:25						ユーイング取付け完了
:27						PC 安全ピン抜く
〃					↓	観測ウィンチ~~巻き~~繰り出し
:28	5963				↓	天秤 水面
:29				0	−	観測ウィンチ先端水面，ウィンチ停止
:30:00	5963	0	5	0	−	ゼロ調
〃					↑	観測ウィンチ巻き上げ，Aフレームふり出し
:32	5961	-8	7	0	−	〃 停止， 停止
〃	5961	-7	0	0	−	PCのテンション，汎用ウィンチへ
〃				0	−	観測ウィンチにスイベル取り付け
:34				0	−	〃 完了
〃	5961	-8	7	9	↑	PCのテンション，観測ウィンチへ
:36	5965	-8	6	~20	↓	観測ウィンチ繰り出し
:39	5963	50	7	0	−	〃 停止，トラポン取り付け
:42	5960	50	7	0	−	トラポンとりつけ完了
〃	5960	50	7	23	↓	Aフレームふり出し，観測ウィンチ繰り出し
:44	5960	59	7	0	−	〃 停止， 〃 停止
〃	〃	59	7	0	−	トラポン 水面
:45	〃	59	7	20	↓	観測ウィンチ繰り出し

※1t ≒ 9.8kN

(LSTは UTC+10h.)

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ピストンコア ログシート

Ver.040729

Cruise Name KR05-10 | Core Name PC- 02 | y m d 2005 / 8 / 8 | Page 2 / 3

時間 (UTC +10h.)	水深 (m)	線長 (m)	張力 (kN)	線速 (m/min)	繰出/巻上 (↓/↑)	記事 (作業開始、着水、着底、離底、揚収、ウインチ停止など)
9:52	5962	200	8	>20	↓	ウィンチ増速（50m/minまで）
:54	5961		8	50	↓	〃 完了
:59	5960	500	9	>50	↓	ウィンチ増速（60m/minまで）
〃				50	↓	〃 完了
10:07	5957	1000	12	60	↓	
:15	5963	1500	15	60	↓	
:23	5958	2000	18	61	↓	
:32	5958	2500	22	60	↓	
:40	5959	3000	26	61	↓	
:48	5960	3500	30	61	↓	
:56	5943	4000	33	60	↓	
11:05	5943	4500	37	60	↓	
:13	5946	5000	41	61	↓	
:22	5946	5500	44	60	↓	
:28	5947	58~~80~~ 60	47	0	−	ウィンチ停止（10分間）HFホバ
:38	5943	5860	49	~20	↓	ウィンチ繰出し
:42:07	5945	5922	42	20	↓	着底
:42:22	5948	5927	40	0	−	ウィンチ停止 ↓5m 繰出し
:46	5945	5929	40	~12	↓	2m 繰り出し、すぐ停止
:57	5950	5929	40	~10	↑	ウィンチ巻き上げ
:59	5945	5917	max 56	10	↑	張力最大
:59:40	5944	5910	53	10	↑	離底確認
〃				~60	↑	ウィンチ増速（60m/minまで）
12:08	~~5500~~ 5945	5500	51	62	↑	
:15	5943	5000	51	65	↑	
:23	5943	4500	48	67	↑	
:30	5943	4000	41	70	↑	
:37	5942	3500	39	71	↑	
:44	5942	3000	35	74	↑	

※1t ≒ 9.8kN

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ピストンコア ログシート Ver.040729

Cruise Name KR05-10 | Core Name PC-02 | y m d 2005 / 8 / 8 | Page 3 / 3

時間 (UTC +9h)	水深 (m)	線長 (m)	張力 (kN)	線速 (m/min)	繰出/巻上 (↓/↑)	記事 (作業開始、着水、着底、離底、揚収、ウインチ停止など)
12:51	5941	2500	31	73	↑	
:58	5941	2000	29	73	↑	
13:05	5944	1500	25	74	↑	
:11	5945	1000	20	74	↑	
:18	5945	500	17	74	↑	
:24	5947	59	13	75	↑	トラポン水面
〃	5949	38	12	0	–	観測ウィンチ停止
〃				0	–	Aフレームふり込み
:27	5943	36	13	0	–	トラポン取りはずし
:28				0	–	〃 完了
〃	5942			20	↑	Aフレームふり出し, 観測ウィンチ巻き上げ
13:30:42	5940	0	12	25	↑	線長ゼロ
:31	5940	-22	12	0	–	観測ウィンチ停止, Aフレームふり込み
:33	5944	-21	0	~12	↓	〃 繰り出し, PCのテンション汎用ウィンチへ
〃		-21	0	0	–	スイベル取りはずし
:34	5945	-21	12	~6	↑	観測ウィンチ巻き上げ, PCのテンション観測ウィンチへ
:35	5944	-22	9	~20	↑	Aフレームふり出し, 観測ウィンチ巻き上げ
:36	5941	-42	9	11	↑	天秤水面
:37	5949	-47	9	0	–	観測ウィンチ停止
:38	5944	-48	9	0	–	ユーイングとりはずし, 汎用ウィンチで吊り上げ
:40	5939	-48	9	0	–	〃 on Deck
〃						揚収ウィンチ ~~繰り出し~~ 繰り出し
:41	5943	-44	0	~10	↓	観測ウィンチ 〃 PCのテンション汎用ウィンチへ
:44		-20				〃 カラ, 天秤とナイロンエイトロープとりはずし
:45						汎用ウィンチ巻き上げ
:46	5942					PC水面
:49						揚収ウィンチ巻き上げ
:50						Aフレームふり込み
:52						PC On Deck

※1t ≒ 9.8kN

Marine Works JAPAN LTD.

Ver. 040729

「かいれい」ドレッジ インベントリシート

航海名: KR05-10

調査海域: 北西太平洋(湯川海丘 西側斜面)

英名: Northwest Pacific Yukawa knoll

採集日: 2005 年 8 月 9 日 (火)

ドレッジ No. # D-01 オペレーター 町田(東大)

● 目標測線 (W → E)

始点: 緯度 34°47.20N; 経度 149°44.96E; 水深 5850 m

終点: 緯度 37°47.25N; 経度 149°45.25E; 水深 5740 m

採集目標物: 玄武岩(アルカリ玄武岩)

天候: 曇

風向: 61 deg, 風速: 5.1 m/s

流向: 272.7 deg, 流速: 1.4 knt

ゼロ調時

• ゼロ調整位置 (時刻: 9:30:06)
緯度 37°47.1829N; 経度 149°44.7450E; 水深 5896 m

• 着底位置 (時刻: 11:01:48)
緯度 37°47.1844N; 経度 149°44.8970E; 水深 5828 m
線長 5740 m

• 曳航方向(対地進路):
約 70 deg (対地船速: 0.7 knt)

• 離底確認位置 (時刻: 11:59:10)
緯度 37°47.2721N; 経度 149°45.3853; 水深 5786 m
線長 5500 m

• ゼロ調位置水面 (時刻: 13:22:51)
緯度 37°47.2750; 経度 149°454818; 水深 5848 m

採集岩石: ドレッジャー本体には岩石なし。孫ドレッジャーには酸化泥層。

コメント: SBP: 山体の反射面なし、露岩の存在を示唆。
水深表示は、しばしば大きくジャンプした。

「かいれい」　ドレッジ　ログシート　Ver. 040729

航海名：KR05-10

調査海域：北西太平洋（湯川海丘 西側斜面）英名：Northwest Pacific

日付：2005年8月9日（火）　1/2

ドレッジNo. D-01　記録者：森・小泉

時間 (UTC+10 h.)	水深 (m)	線長 (m)	張力 (kN)	線速 (m/min)	繰出/巻上	対地進路 (deg)	対地速度 (knt)	記事
9:13	5871					65	0.2	作業開始，ドレッジ吊り上げ
:15								ドレッジ水面
:16								リードワイヤー先端(下端)水面
:24								汎用ウインチ停止
:26	5899		2			190	0.1	テンションを観測ウインチワイヤへ
:28	5876		1	15	↓			観測ウインチ繰り出し
:30:06	5896	0	2	0	−	20	0.1	ゼロ調整
〃				~70	↓			観測ウインチ繰り出し（70m/min まで）
:38	5902	500	4	71	↓	180	0.1	
:45	5886	1000	6	70	↓	90	0.2	
:52	5892	1500	8	71	↓	63	0.2	
:59	5882	2000	12	71	↓	220	0.1	
10:07	5877	2500	14	71	↓	92	0.1	
:14	5892	3000	16	70	↓	200	0.0	
:21	5879	3500	21	70	↓	80	0.1	
:28	5892	4000	24	69	↓	69	0.2	
:36	5885	4500	29	66	↓	194	0.2	
:43	5872	5000	31	65	↓	75	0.3	
:51	-	5500	35	49	↓	61	0.4	
:53	5864	5550	39	0	−	79	0.4	観測ウインチ停止（5分間）
:58	-	〃	38	~70	↓	64	0.2	〃 繰り出し
:59	-				↓	65	0.2	Ship Start
11:01:48	5828	5740	34	60	↓	60	0.5	着底
〃			32	30	↓	72	0.8	観測ウインチ減速（30m/min）
:05	5783	5860	37	0	−	77	0.4	観測ウインチ停止
:15	5761	5860	38	0	−	80	0.8	
:20	5714	5860	38	0	−	75	0.8	
:25	5709	5860	38	0	−	72	0.7	
:30	5734	5860	38	0	−	75	~0.5	船速減速（0.5 kntまで）
:31	5456	5860	41	10	↑	66	0.4	〃 完了，観測ウインチ
:32			42	10	↑			ヒット　巻き上げ
:35			43	10	↑			〃
:38			48	10	↑	92	0.4	〃
:39	-	5782	44	10	↑	71	0.2	船停止
:40	5791	5775	48	10	↑	112	0.1	ヒット
:41	5810	5770	50	15	↑	173	0.3	〃

「かいれい」 ドレッジ ログシート

Ver. 040729

航海名：KR05-10

調査海域：北西太平洋（湯川海丘 西側斜面） 英名：Northwest Pacific

日付：2005年8月9日（火）

ドレッジNo. D-01 記録者：小泉・森 2/2

時間 (UTC+10 h.)	水深 (m)	線長 (m)	張力 (kN)	線速 (m/min)	繰出/巻上	進路 (deg)	対地速度 (knt)	記事
11:53	5786	55	51	15	↑	70	0.2	ヒット
~~10:56:46~~	~~5791~~	~~5532~~	~~45~~	~~15~~	↑	~~250~~		~~離底確認~~
:59:10	5786	5500	42	15	↑	13.8	0.2	離底確認
12:02	5767	5445	40	~30	↑	42	0.0	観測ウィンチ 増速（30m/min巻）
:10	5851	5200	41	~60	↑	240	0.1	〃 （60m/min巻）
:14	5832	5000	41	66	↑	64	0.1	
:22	5769	4500	36	67	↑	38	0.0	
:29	5810	4000	37	70	↑	168	0.2	
:36	5777	3500	32	72	↑	115	0.1	
:43	5781	3000	29	74	↑	45	0.2	
:49	5826	2500	23	≒76	↑	5.3	0.1	
:56	5855	2000	24	77	↑	56	0.3	
13:02	5889	1500	18	75	↑	40	0.1	
:09	5856	1000	13	77	↑	94	0.2	
:16	5899	500	10	75	↑	142	0.2	
:21:51	5848	0	6	31	↑	238	0.8	ゼロ調位置
:23	5809	-11	5	0	—	244	1.0	観測ウィンチ停止，Aフレームふり込み
:26			5					汎用ウィンチ とりつけ
:26	5811	-12	1					テンションを汎用ウィンチへ
:28								汎用ウィンチ 巻き上げ
:36								錘水面
〃								汎用ウィンチ 停止
:39								ドレッジ水面
:40								ドレッジ On Deck
:41								錘 On Deck

2-5. OBEM positioning and recovery log

Kiyoshi Baba & Masahiro Ichiki

In this cruise, we planed to identify the position of six ocean bottom electromagnetometers (OBEMs), which were deployed during the cruise “R/V Yokosuka KR05-06” in May 2005, and to recover four of the OBEMs. We succeeded all the recoveries but failed the positioning of the other two OBEMs.

The OBEMs equip an acoustic communication system, which is produced by Kaiyo Denshi Co., Ltd. or Nichiu Giken, Co., Ltd. (See section 4-3-2 for detail of specifications of the OBEMs). For the positioning of the OBEMs, we send an acoustic signal from vessel to an OBEM and listen to the response from the OBEM. Travel time of the acoustic signal provides us slant range between the vessel and the OBEM. Measuring the slant ranges at three different locations, we estimate the position of the OBEM on the seafloor. For the OBEMs equipped with acoustic transponder of Kaiyo Denshi, positioning using a super short base line (SSBL) system is attempted.

2-5-1. Site NWP0504 – positioning and recovery of OBEM-JM4

Aug./02/2005 18:30 – 22:00 (LT +10:00)

18:30 Positioning using SSBL system was attempted first.
The response from the OBEM was not acquired clearly.

21:05 Gave up SSBL positioning and switched to normal positioning using
transducer equipped on the base of the vessel.

22:00 Succeeded the positioning.

Aug./03/2005 04:50 – 07:46 (LT +10:00)

04:54 Sent release command

05:03 Confirmed that the OBEM started ascending.

07:25 The OBEM reached to sea surface. Received radio beacon signal.

07:46 The OBEM on deck

08:23 Compared the OBEM clock with a reference (GPS).

08:30 Shutdown the OBEM.

2-5-2. Site NWP0506 – positioning and recovery of OBEM-TT8

Aug./03/2005 11:15 – 20:00 (LT+10:00)

11:15 Start normal positioning using Nichiu Giken transducer and control unit.

12:51 Succeeded the positioning and sent the release command.

13:01 Confirmed that the OBEM started ascending.

15:30 The OBEM reached to sea surface. Received radio beacon signal.

15:45 The OBEM on deck

16:13 Compared the OBEM clock with a reference (GPS).

16:15 Shutdown the OBEM.

2-5-3. Site NWP0503 – positioning and recovery of OBEM-JM2

Aug./05/2005 08:20 – 12:40 (LT +10:00)

08:20 Start trying SSBL positioning.

The response from OBEM was not acquired.

08:48 Switch to normal positioning using carry-on transducer.

09:49 Succeeded the positioning.

09:50 Sent release command.

09:57 Confirmed that the OBEM started ascending.

12:24 The OBEM reached to sea surface. Received radio beacon signal.

12:40 The OBEM on deck

13:08 Compared the OBEM clock with a reference (GPS).

13:11 Shutdown the OBEM.

2-5-4. Site NWP0502 – positioning of OBEM-JM5

Aug./05/2005 20:20 – 22:00 (LT +10:00)

20:20 Start trying SSBL positioning.

The response from OBEM was not acquired.

Switched to normal positioning using carry-on transducer from four vessel locations where were 500 m apart from the deployment point.

The response was never acquired.
22:00 Gave up the positioning

Aug./10/2005 08:20 – 13:10 (LT +10:00)
08:20 Tried to measure the slant range at eight vessel locations where were 2
nm apart from the deployment point.
The response from the OBEM was never acquired.
13:10 Gave up the positioning.

2-5-5. Site NWP0505 – positioning and recovery of OBEM-JM1

Aug./07/2005 08:15 – 13:21 (LT + 10:00)
08:15 Started normal positioning using carry-on transducer.
Measured slant ranges at three different locations where were 1 nm
apart from the deployment position.
09:30 Succeeded the positioning
09:30 Sent release command.
09:42 Confirmed that the OBEM started ascending.
12:01 The OBEM reached to sea surface. Received radio beacon signal.
12:56 The OBEM on deck
13:18 Compared the OBEM clock with a reference (GPS).
13:21 Shutdown the OBEM.

2-5-6. Site NWP0501 – positioning and recovery of OBEM-JM6

Aug./11/2005 08:08 – 13:07 (LT +09:00)
08:08 Start SSBL positioning.
The response from the OBEM was not acquired.
08:30 Switch to normal positioning using carry-on transducer.
The response was frequently acquired.
The slant range was never measured.
09:25 Moved to different locations and try measuring.
The response was not acquired.

Decided to release anchor and recover the OBEM because disorder of

the OBEM transponder may occur.

10:26 Sent release command.

The response from the OBEM was received.

But the slant range was not obtained.

11:12 Slant range of 3901 m was obtained.

Confirmed that the OBEM was ascending.

12:30 SSBL system started obtaining the OBEM position and depth.

12:53 The OBEM reached to sea surface. Received radio beacon signal.

13:07 The OBEM on deck

13:58 Compared the OBEM clock with a reference (GPS).

14:13 Shutdown the OBEM.

KR0510-1 LOG

TIME (UTC)		Lat		Lon		Depth	Gyro	COG	LOG	SOG	W.Dir	W.Sp	C.Dir	C.Sp	Delph Shot	Streamer Depth	Remarks
		deg	minute	deg	minute												
2005.8.3	8:44	37	22.9354	149	21.7306	5926	39.1	74.3	2.3	4.1	74.0	8.3	176.3	2.9	1	8.5	F.S.P. (=F.G.S.P)
	8:50	37	22.9973	149	22.0083	5834	35.4	71.2	2.1	4.1	74.0	7.9	176.3	3.0	26	8.7	Schedule Line Start
	9:00	37	23.1029	149	22.4430	5942	34.0	70.3	2.1	4.1	72.0	9.0	175.6	3.0	65	7.6	
	9:30	37	23.4069	149	23.7143	5943	37.1	72.4	2.1	4.1	79.0	9.3	176.0	3.1	184	8.0	
	10:00	37	23.7059	149	24.9924	5950	36.4	74.7	2.1	4.0	81.0	9.9	173.5	3.1	303	7.5	
	10:30	37	24.0195	149	26.3106	5948	38.2	75.2	2.2	4.0	81.0	9.0	173.1	3.1	423	8.1	
	11:00	37	24.3301	149	27.6280	5949	35.1	71.8	2.3	4.2	77.0	9.2	170.3	3.1	545	8.0	
	11:30	37	24.6547	149	29.0250	5961	32.5	71.9	2.3	4.0	86.0	8.5	169.3	2.7	663	6.6	
	12:00	37	24.9947	149	30.4816	5970	33.5	75.5	2.3	3.8	84.0	7.4	169.1	3.0	783	11.9	
	12:30	37	25.3587	149	32.0450	5967	35.8	77.7	2.4	3.7	90.0	8.0	168.6	2.9	903	9.9	
	13:00	37	25.7486	149	33.6143	5953	46.3	76.9	2.9	3.8	97.0	8.6	168.5	2.7	1022	9.0	
	13:30	37	26.1724	149	35.4775	5972	49.6	74.7	3.1	3.9	98.0	7.5	165.9	2.5	1137	7.6	
	14:00	37	26.6300	149	37.4053	5986	48.2	72.8	3.4	4.0	102.0	8.2	162.1	2.5	1253	7.2	
	14:30	37	27.1124	149	39.4449	5973	48.1	71.0	3.5	4.0	97.0	6.8	157.1	2.3	1372	10.6	
	15:00	37	27.6173	149	41.6137	5957	49.2	74.7	3.5	3.9	91.0	5.9	156.4	2.2	1493	10.2	
	15:30	37	28.1430	149	43.8304	5986	51.1	72.6	3.9	4.1	98.0	6.4	155.9	2.1	1612	11.6	
	16:00	37	28.6702	149	46.0526	6000	51.7	70.7	3.7	3.9	104.0	7.6	156.7	2.1	1732	11.7	
	16:30	37	29.2439	149	48.4872	6029	61.5	74.4	3.8	3.5	102.0	6.6	148.0	1.7	1859	12.6	
	17:00	37	29.7848	149	50.8133	6054	62.3	73.8	4.0	3.8	97.0	6.7	145.8	1.3	1972	13.4	
	17:30	37	30.3524	149	53.2160	6013	67.9	76.5	4.0	3.5	100.0	6.4	137.0	1.3	2088	11.5	
	18:00	37	30.9184	149	55.6158	6021	70.0	75.2	4.0	3.5	87.0	5.7	133.2	0.9	2208	10.9	
	18:30	37	31.4989	149	58.0761	6013	69.0	72.9	4.0	3.6	80.0	5.6	123.6	0.7	2328	11.0	
	19:00	37	32.0579	150	0.4719	6013	72.5	72.8	4.0	3.5	103.0	6.9	121.7	0.4	2448	10.1	
	19:30	37	32.6261	150	2.8835	6022	79.9	74.1	4.0	3.4	108.0	7.2	78.4	0.5	2568	10.5	
	20:00	37	33.1797	150	5.2706	5954	80.3	74.2	4.0	3.5	104.0	7.5	56.6	0.4	2688	10.3	
	20:30	37	33.7579	150	7.7400	5802	87.8	74.1	3.9	3.4	106.0	8.4	26.1	0.8	2807	10.4	
	21:00	37	34.3237	150	10.1252	5840	89.1	74.2	3.8	3.4	108.0	7.0	20.0	1.1	2921	10.2	
	21:30	37	34.8831	150	12.4986	5865	90.2	73.3	4.0	3.7	103.0	6.9	16.2	1.1	3037	10.6	
	21:36	37	35.0010	150	12.9935	5872	91.0	73.7	4.0	3.6	101.0	6.7	18.6	1.1	3061	10.3	Schedule Line Passag
	22:00	37	35.4530	150	14.9764	5870	84.2	71.9	4.0	3.7	92.0	6.1	14.2	0.9	3158	10.7	L.S.P. (=L.G.S.P)

Depth: Water Depth
GYRO: GYRO Compuss
COG: Course of GYRO
SOG: Bottom Speed of the Vessel
LOG: Water Speed of the Vessel
W.Dir: Water Direction
W.Sp: Water Speed
C.Dir: Current Direction
C.Sp: Current Speed
Delph Shot: Shot Point Number
Streamer: Streamer Depth

KR0510-2 LOG

TIME (UTC)		Lat		Lon		Depth	Gyro	COG	LOG	SOG	W.Dir	W.Sp	C.Dir	C.Sp	Delph Shot	Streamer Depth	Remarks
		deg	minute	deg	minute												
2005.8.4	6:55	37	23.8347	150	28.0586	5867	211.2	225.3	3.7	4.1	123.0	5.0	5.8	0.5	1	13.1	F.S.P. (=F.G.S.P)
	7:15	37	22.9967	150	27.0007	5945	214.2	225.7	3.6	4.0	137.0	6.1	0.9	0.5	100	12.8	Schedule Line Start
	7:30	37	22.3856	150	26.1915	5939	215.3	224.7	3.6	4.0	135.0	5.9	27.2	0.5	175	9.6	
	8:00	37	21.1762	150	24.5382	5884	218.7	228.0	3.9	4.1	145.0	3.4	3.5	0.4	325	7.2	
	8:30	37	19.9051	150	22.8272	5850	219.7	228.0	3.6	4.2	134.0	3.7	4.8	0.5	475	7.3	
	9:00	37	18.6702	150	21.1442	5738	216.0	228.3	3.6	4.1	146.0	5.1	4.1	0.6	625	7.8	
	9:30	37	17.3857	150	19.4313	5699	212.6	225.3	3.4	4.0	146.0	5.3	358.7	0.7	777	8.5	
	10:00	37	16.2405	150	17.8771	5754	216.0	227.7	3.6	4.2	152.0	6.1	4.2	0.7	925	8.4	
	10:30	37	15.0367	150	16.2569	5797	219.2	227.5	3.5	4.2	156.0	6.9	2.1	0.7	1075	8.1	
	11:00	37	13.8381	150	14.6450	5822	223.9	229.9	3.7	4.1	168.0	6.4	5.4	0.5	1225	8.7	
	11:30	37	12.6123	150	12.9855	5850	222.6	230.2	3.5	4.2	168.0	6.2	6.8	0.6	1375	8.6	
	12:00	37	11.4240	150	11.4091	5798	218.6	223.3	3.4	3.6	166.0	6.4	15.0	0.5	1525	8.8	
	12:30	37	10.2790	150	9.8685	5850	222.6	228.5	3.4	3.7	171.0	7.8	25.0	0.4	1675	8.8	
	13:00	37	9.0756	150	8.2221	5804	221.9	223.5	3.6	4.0	173.0	7.2	44.9	0.3	1825	8.8	
	13:30	37	7.8191	150	6.5382	5877	222.0	224.0	3.7	3.7	173.0	7.7	14.6	0.1	1975	9.6	
	14:00	37	6.5568	150	4.8431	5843	224.7	225.6	3.7	3.9	176.0	7.0	102.0	0.1	2125	7.7	
	14:30	37	5.2980	150	3.1610	5985	224.1	225.4	3.6	4.0	173.0	7.6	49.7	0.2	2274	8.4	
	15:00	37	3.9942	150	1.3989	5968	226.6	226.3	3.7	3.8	168.0	8.9	131.2	0.3	2424	8.8	
	15:30	37	2.7363	149	59.6914	5925	227.1	227.2	3.7	3.7	173.0	9.5	169.8	0.5	2574	8.8	
	16:00	37	1.4089	149	57.9223	5897	225.7	227.8	3.8	3.6	173.0	9.7	158.3	0.5	2724	8.4	
	16:30	37	0.0699	149	56.1379	5976	227.9	227.2	3.9	3.7	175.0	7.9	157.8	0.6	2874	7.8	
	17:00	36	58.7184	149	54.2960	6018	226.5	227.5	3.9	3.8	173.0	6.2	154.5	0.7	3024	9.8	
	17:30	36	57.3809	149	52.5325	6028	233.7	226.2	3.9	3.4	186.0	6.5	163.7	0.9	3174	9.2	
	17:40	36	56.9413	149	51.9197	6022	234.6	228.7	4.0	3.7	186.0	5.9	165.3	0.9	3225	9.7	Schedule Line Passage
	18:00	36	56.0525	149	50.7340	6017	237.6	227.9	3.9	3.5	178.0	6.7	170.3	0.8	3324	9.4	
	18:30	36	54.6519	149	48.8365	5987	234.0	225.1	4.3	3.6	178.0	6.5	178.5	1.0	3474	9.9	
	19:00	36	53.2727	149	46.9936	5955	234.9	223.1	4.2	3.6	174.0	6.1	176.1	1.1	3624	9.4	
	19:30	36	51.8544	149	45.0792	5959	236.0	226.5	4.2	3.7	170.0	6.5	176.9	0.9	3774	9.6	
	20:00	36	50.4840	149	43.2574	6042	235.2	225.1	4.2	3.2	161.0	5.5	183.8	1.1	3924	9.9	
	20:30	36	49.0330	149	41.3066	6058	234.9	225.8	4.1	3.3	164.0	6.3	187.8	1.1	4074	9.4	L.S.P. (=L.G.S.P)

Depth: Water Depth
GYRO: GYRO Compuss
COG: Course of GYRO
SOG: Bottom Speed of the Vessel
LOG: Water Speed of the Vessel
W.Dir: Water Direction
W.Sp: Water Speed
C.Dir: Current Direction
C.Sp: Current Speed
Delph Shot: Shot Point Number
Streamer: Streamer Depth

KR0510-3 LOG

TIME (UTC)		Lat		Lon		Depth	Gyro	COG	LOG	SOG	W.Dir	W.Sp	C.Dir	C.Sp	Delph Shot	Streamer Depth	Remarks
		deg	minute	deg	minute												
2005.8.8	4:50	37	31.4248	149	41.1158	5952	173.2	176.1	4.7	5.0	245.0	8.2	261.7	1.0	1	8.5	F.S.P.
	4:58	37	30.7731	149	41.2153	5967	163.5	170.2	4.8	5.1	244.0	4.4	268.5	1.1	47	9.8	F.G.S.P.
	5:00	37	30.6230	149	41.2444	5974	160.7	172.1	4.7	5.2	253.0	3.1	268.9	1.2	60	10.8	
	5:32	37	28.2721	149	41.7216	5835	161.9	172.6	4.1	4.1	202.0	4.3	270.1	1.1	252	9.3	
	5:35	37	28.0350	149	41.7583	5904	159.7	172.1	4.1	4.4	211.0	4.6	272.7	1.0	273	9.0	Cross Point (KR0510-1)
	6:00	37	26.4576	149	42.1222	5955	162.2	173.1	4.2	4.5	228.0	4.8	277.4	0.8	419	9.6	
	6:05	37	26.0606	149	42.1947	5972	155.6	166.7	4.0	4.4	222.0	4.2	276.7	0.8	456	9.7	L.S.P.

Depth: Water Depth
GYRO: GYRO Compuss
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SOG: Bottom Speed of the Vessel
LOG: Water Speed of the Vessel
W.Dir: Water Direction
W.Sp: Water Speed
C.Dir: Current Direction
C.Sp: Current Speed
Delph Shot: Shot Point Number
Streamer: Streamer Depth

KR0510-4 LOG

TIME (UTC)		Lat		Lon		Depth	Gyro	COG	LOG	SOG	W.Dir	W.Sp	C.Dir	C.Sp	Delph Shot	Streamer Depth	Remarks
		deg	minute	deg	minute												
2005.8.8	6:12	37	25.5747	149	42.1800	5978	206.4	207.1	4.8	4.4	239.0	5.9	284.5	0.8	1	10.5	F.S.P.
	6:17	37	25.3698	149	41.8172	5979	249.5	248.8	5.0	4.5	241.0	6.4	286.0	0.7	30	10.2	Turning Round End
	7:05	37	28.0039	149	40.4505	5985	61.4	54.4	3.8	4.4	204.0	2.7	273.3	0.7	317	9.1	F.G.S.P.
	7:23	37	28.6319	149	41.6451	5919	62.7	55.4	3.7	4.3	208.0	2.9	282.1	0.8	426	9.2	Cross Point (KR0510-3)
	7:30	37	28.8733	149	42.1061	5962	62.7	55.0	3.8	4.6	226.0	3.6	276.9	0.8	468	9.0	
	8:00	37	29.9620	149	44.1203	5992	62.4	54.2	3.9	4.3	252.0	4.2	271.3	0.6	644	9.2	
	8:03	37	30.0866	149	44.3238	5984	63.9	55.6	3.8	4.3	251.0	3.9	276.5	0.7	664	8.6	Cross Point (KR0510-5)
	8:30	37	31.0578	149	46.1287	5998	66.0	57.2	3.7	4.4	277.0	3.2	279.4	1.1	823	9.5	
	8:30	37	31.0704	149	46.1529	5994	66.4	57.4	3.7	4.5	273.0	3.4	280.1	1.1	826	9.0	Cross Point (KR0510-6)
	8:33	37	31.1704	149	46.3405	5997	68.9	56.3	3.9	4.6	281.0	3.9	285.9	1.0	830	9.0	L.S.P.

Depth: Water Depth
GYRO: GYRO Compuss
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SOG: Bottom Speed of the Vessel
LOG: Water Speed of the Vessel
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W.Sp: Water Speed
C.Dir: Current Direction
C.Sp: Current Speed
Delph Shot: Shot Point Number
Streamer: Streamer Depth

KR0510-5 LOG

TIME (UTC)		Lat		Lon		Depth	Gyro	COG	LOG	SOG	W.Dir	W.Sp	C.Dir	C.Sp	Delph Shot	Streamer Depth	Remarks
		deg	minute	deg	minute												
2005.8.8	8:38	37	31.0847	149	46.6972	6000	120.9	122.7	3.4	4.6	214.0	3.9	286.7	1.2	1	10.1	F.S.P.
	8:42	37	30.9238	149	46.8406	5996	179.8	174.3	3.5	4.2	226.0	5.3	288.9	1.1	22	10.0	Turning Round Start
	8:46	37	30.6471	149	46.7180	5997	184.1	198.0	4.0	4.7	234.0	7.3	294.9	1.1	49	9.8	Cross Point (KR0510-6)
	9:00	37	29.6976	149	46.5589	5993	182.6	188.5	4.1	4.2	234.0	8.2	294.9	0.8	133	10.1	
	9:14	37	28.8079	149	46.3899	599	181.2	189.1	3.9	3.6	233.0	7.7	281.7	0.9	215	10.4	Cross Point (KR0510-1)
	9:30	37	27.7836	149	46.1978	6001	181.3	186.5	4.0	4.0	236.0	7.4	272.6	0.9	308	11.8	Turning Round End
	9:41	37	27.9457	149	45.5262	5991	338.0	331.2	4.4	3.9	274.0	7.0	287.4	0.7	376	10.4	F.G.S.P.
	9:50	37	28.5089	149	45.2290	5976	346.5	339.0	4.2	3.7	274.0	8.6	280.2	0.8	428	10.5	Cross Point (KR0510-1)
	10:00	37	29.1517	149	44.8565	5955	341.0	332.9	4.1	3.3	276.0	7.3	294.8	0.8	488	11.3	
	10:14	37	30.0016	149	44.3944	5920	345.5	337.6	3.9	3.3	290.9	0.8	290.9	0.8	574	10.1	Cross Point (KR0510-4)
	10:30	37	30.9399	149	43.8828	5996	343.7	337.5	3.4	3.2	256.0	5.5	271.9	0.6	670	10.7	
	10:51	37	32.1228	149	43.1868	5967	353.0	336.2	4.0	4.0	3.8	5.7	274.7	1.0	800	10.4	L.S.P. (Turning Round Start)

Depth:Water Depth
GYRO:GYRO Compuss
COG:Course of GYRO
SOG:Bottom Speed of the Vessel
LOG:Water Speed of the Vessel
W.Dir:Water Direction
W.Sp:Water Speed
C.Dir:Current Direction
C.Sp:Current Speed
Delph Shot:Shot Point Number
Streamer:Streamer Depth

KR0510-6 LOG

TIME (UTC)		Lat		Lon		Depth	Gyro	COG	LOG	SOG	W.Dir	W.Sp	C.Dir	C.Sp	Delph Shot	Streamer Depth	Remarks
		deg	minute	deg	minute												
2005.8.8	10:54	37	32.3249	149	43.1039	5969	5.3	346.7	3.7	3.9	265.0	6.1	266.6	1.0	1	10.8	F.S.P.
	11:00	37	32.5987	149	43.1080	5973	31.3	18.5	3.1	3.7	264.0	7.1	261.5	1.0	31	10.7	
	11:17	37	32.4803	149	44.0233	5978	115.4	117.8	3.6	4.5	243.0	5.7	259.4	1.2	138	8.0	F.G.S.P. (Turning Round End)
	11:30	37	31.9781	149	44.7231	6017	120.2	129.2	3.9	4.8	236.0	6.1	267.7	1.2	211	8.1	
	12:00	37	30.6800	149	46.5674	5995	126.2	129.7	4.2	5.2	270.0	6.8	258.8	1.0	391	9.7	
	12:18	37	29.8479	149	47.7044	6004	131.2	135.7	3.8	4.8	274.0	6.2	280.3	1.2	504	9.7	L.S.P. (Turning Round Start)

Depth: Water Depth
GYRO: GYRO Compuss
COG: Course of GYRO
SOG: Bottom Speed of the Vessel
LOG: Water Speed of the Vessel
W.Dir: Water Direction
W.Sp: Water Speed
C.Dir: Current Direction
C.Sp: Current Speed
Delph Shot: Shot Point Number
Streamer: Streamer Depth

KR0510-7 LOG

TIME (UTC)		Lat		Lon		Depth	Gyro	COG	LOG	SOG	W.Dir	W.Sp	C.Dir	C.Sp	Delph Shot	Streamer Depth	Remarks
		deg	minute	deg	minute												
2005.8.8	12:23	37	29.6428	149	47.9707	6003	117.6	127.8	3.9	5.2	270.0	5.9	281.7	1.2	1	10.1	F.S.P.
	12:52	37	31.3381	149	48.0466	6004	8.2	352.9	4.0	3.9	288.0	7.1	270.9	1.2	173	13.3	Turning Round End
	12:56	37	31.6282	149	47.9871	5993	6.1	349.6	3.8	3.4	295.0	6.8	280.1	1.4	200	13.2	F.G.S.P.
	13:00	37	31.8227	149	47.9582	5994	7.4	353.6	3.7	3.5	296.0	8.1	276.9	1.3	219	12.2	
	13:30	37	35.4598	149	47.6077	5915	4.4	353.8	3.7	3.7	309.0	6.2	278.1	1.4	400	8.3	
	14:00	37	35.4598	149	47.1986	5978	15.5	351.5	3.8	3.6	316.0	5.4	280.9	1.6	579	10.1	
	14:30	37	37.9895	149	46.8596	5984	14.8	351.0	3.8	3.4	323.0	6.2	275.9	1.7	760	9.7	
	15:00	37	39.1909	149	46.4844	5929	13.9	354.3	3.9	4.2	319.0	6.3	273.0	1.6	940	9.4	
	15:30	37	40.9741	149	46.1193	5914	12.8	354.1	3.5	3.7	322.0	5.6	267.9	1.6	1120	9.5	
	16:00	37	42.6885	149	45.7608	5898	13.4	351.0	3.4	3.4	352.0	7.8	268.1	1.5	1300	9.0	
	16:30	37	44.4581	149	45.4086	5904	11.0	350.3	3.7	4.5	342.0	8.9	249.6	1.5	1480	8.2	
	17:00	37	46.2079	149	45.0742	5889	10.0	350.9	3.8	4.2	336.0	7.1	253.4	1.6	1660	9.1	
	17:13	37	47.0295	149	44.8922	5889	11.6	351.5	3.5	4.0	340.0	6.3	246.3	1.7	1741	10.0	Cross Point (KR0510-8)
	17:33	37	48.1559	149	44.6615	5960	12.0	348.7	3.5	4.0	349.0	7.4	250.1	1.7	1860	9.3	L.S.P. (Transit Start)

Depth:Water Depth
GYRO:GYRO Compuss
COG:Course of GYRO
SOG:Bottom Speed of the Vessel
LOG:Water Speed of the Vessel
W.Dir:Water Direction
W.Sp:Water Speed
C.Dir:Current Direction
C.Sp:Current Speed
Delph Shot:Shot Point Number
Streamer:Streamer Depth

KR0510-8 LOG

TIME (UTC)		Lat		Lon		Depth	Gyro	COG	LOG	SOG	W.Dir	W.Sp	C.Dir	C.Sp	Delph Shot	Streamer Depth	Remarks
		deg	minute	deg	minute												
2005.8.8	17:37	37	48.3304	149	44.4789	5948	315.4	298.4	4.1	3.3	338.0	5.9	250.6	1.7	1	11.7	F.S.P.
	18:00	37	47.5436	149	42.4865	5908	223.1	230.3	4.8	4.9	312.0	2.7	251.5	2.1	136	11.9	
	18:14	37	46.8614	149	41.7325	5906	107.4	182.9	2.2	2.3	33.0	2.4	251.6	2.2	215	11.6	Turning Round End
	18:30	37	46.8543	149	42.6102	5923	74.7	80.6	3.9	5.9	41.0	4.8	247.7	2.0	320	6.3	
	18:33	37	46.9012	149	42.9795	5922	78.1	82.5	4.2	6.1	39.0	4.6	248.9	2.0	341	6.6	F.G.S.P.
	18:59	37	47.0691	149	44.9821	5874	86.2	86.2	3.9	5.7	40.0	5.7	251.0	2.0	492	8.8	Cross Point (KR0510-7)
	19:00	37	47.0709	149	45.0160	5859	86.0	86.0	3.8	5.8	45.0	5.6	251.1	2.0	495	8.9	
	19:20	37	47.2118	149	46.6995	5930	76.1	83.7	4.1	5.9	34.0	5.4	248.1	1.8	617	8.7	
	19:30	37	47.2909	149	47.5152	5933	76.3	83.0	4.0	5.8	22.0	6.1	247.0	1.8	675	9.0	
	19:34	37	47.3718	149	47.8240	5935	25.9	38.2	3.6	4.9	9.0	6.5	245.7	1.8	700	7.5	L.S.P.
	19:35	37	47.4858	149	47.7578	5931	325.5	323.9	4.8	4.9	357.0	6.5	249.7	1.6	710	4.5	Turning Round Start

Depth: Water Depth
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SOG: Bottom Speed of the Vessel
LOG: Water Speed of the Vessel
W.Dir: Water Direction
W.Sp: Water Speed
C.Dir: Current Direction
C.Sp: Current Speed
Delph Shot: Shot Point Number
Streamer: Streamer Depth

KR0510-9 LOG

TIME (UTC)		Lat		Lon		Depth	Gyro	COG	LOG	SOG	W.Dir	W.Sp	C.Dir	C.Sp	Delph Shot	Streamer Depth	Remarks
		deg	minute	deg	minute												
2005.8.8	19:38	37	47.5912	149	47.3820	5931	#####	#####	6.7	5.6	327.0	6.5	254.3	1.7	1	8.9	F.S.P.
	20:00	37	47.8771	149	47.2089	5922	#####	#####	3.5	4.8	22.0	4.5	256.2	1.9	126	8.5	
	20:06	37	47.5002	149	46.9651	5930	#####	#####	4.4	2.7	331.0	6.0	261.3	1.7	166	10.4	Turning Round End
	20:12	37	47.3789	149	46.5038	5921	#####	#####	4.3	2.5	325.0	5.6	263.8	1.8	200	10.6	F.G.S.P.
	20:29	37	47.1748	149	44.9624	5823	#####	#####	4.4	2.4	333.0	6.5	260.1	1.9	302	9.5	Cross Point (KR0510-7)
	20:30	37	47.1655	149	44.8994	5840	#####	#####	4.3	2.4	329.0	6.3	259.7	1.9	307.0	9.5	
	20:52	37	46.8974	149	42.8526	5924	#####	#####	4.3	2.4	357.0	5.3	266.4	2.0	442.0	11.2	Shchedule Line Passage
	21:00	37	46.8015	149	42.1817	5921	#####	#####	4.3	2.4	358.0	4.7	270.8	2.0	486	11.0	
	21:30	37	46.4493	149	39.4459	5892	#####	#####	4.5	2.5	4.0	5.0	275.3	1.9	667	10.5	L.S.P.

Depth: Water Depth
GYRO: GYRO Compuss
COG: Course of GYRO
SOG: Bottom Speed of the Vessel
LOG: Water Speed of the Vessel
W.Dir: Water Direction
W.Sp: Water Speed
C.Dir: Current Direction
C.Sp: Current Speed
Delph Shot: Shot Point Number
Streamer: Streamer Depth

NME SINGLE CHANNEL SEISMIC SURVEY GENERAL INFORMATION

KR05-10

GENERAL

CLIENT	JAMSTEC	
CRUISE	KR05-10	
AREA	Northwest Pacific Ocean	
LINE	KR0510-1	
DIRECTION (°)	73.3	
DATE(UTC)	2005.8.3	
WEATHER	Cloudy →Fog	
WIND	ENE Moderate breeze → ENE Gentle breeze	
SEA CONDITION	Sea slight → Sea smooth	
FIRST GOOD SHOT POINT	SP No.	1
	N	37° 22.9258′
	E	149° 21.7224′
	Time (UTC)	8:44:23
	Water Depth (m)	5926
LAST GOOD SHOT POINT	SP No.	3158
	N	37° 35.4403′
	E	150° 14.9158′
	Time(UTC)	22:00:22
	Water Depth (m)	5871

SOURCE

GUN TYPE	G.I GUN (Seismic Systems,Inc.)
SHOT TYPE	Harmonic
SHOT MODE	Time
SHOT INTERVAL (ms)	15000
NUMBER OF STRINGS	1
TOTAL VOLUME	355cu.in ([G] 250cu.in, [I] 105cu.in)
CONFIGURATION	355cu.in × 1
GUN DEPTH (m)	10.0
AIR PRESSURE (Mpa)	14.0 (142.8kg/cm^2)
GUN CONTROLLER	GI-01 FIRING CONTROLLER
GUN TOWING WIRE LENGTH (m)	30

RECEIVER

RECEIVER TYPE	S.I.G.16.48.65 Streamer
HYDROPHONE	SIG 16
NUMBER OF CHANNEL (ch)	1
No. of HYDROPHONE IN GROUP	48
SENSITIVITY	-90db, re1V/u bar, ±1db
CABLE DEPTH (m)	9.8
ACTIVE SECTION (m)	65
LEAD-IN SECTION(m)	135

RECORDING

RECORDING SYSTEM	Delph Seismic +
SAMPLE FREQUENCY (Hz)	1000
RECORDING LENGTH (msec)	8000
WATER DELAY (msec)	6000
RECORDING FORMAT	SEGY float IEEE
ANALOG PREAMP	5000mV
SYSTEM DELAY (msec)	120 (from start recording to G firing)
GPS SYSTEM	SkyFix DGPS (No.1 Antenna, StarFix)

DATA

SEISMIC DATA	KR0510-1.SEG
	KR0510-1.sgy
NAVIGATION DATA	KR0510-1.txt

REMARKS

SHIP SPEED	
Doppler Sonar Ship Speed (knot)	3.8
Ground & Ship Speed (knot)	3.3
SP1506	Cross Point (KR0510-3_SP309)
SP1690	Cross Point (KR0510-5_SP425)

PROCESSING

・Apply Static Shifts → Time Variant Bandpass → Sliding Window AGC

OBSERVER

T.Kodera , K.Suzuki, S.Okada, M.Sano, N.Noguchi

NME SINGLE CHANNEL SEISMIC SURVEY GENERAL INFORMATION

KR05-10

GENERAL

CLIENT	JAMSTEC	
CRUISE	KR05-10	
AREA	Northwest Pacific Ocean	
LINE	KR0510-2	
DIRECTION (°)	227.3	
DATE(UTC)	2005.8.4	
WEATHER	Fine but Cloudy → Fog	
WIND	E Moderate breeze → SSE Moderate breeze	
SEA CONDITION	Sea slight → Sea smooth	
FIRST GOOD SHOT POINT	SP No.	1
	N	37° 23.8576'
	E	150° 28.0828'
	Time (UTC)	6:55:17
	Water Depth (m)	5970
LAST GOOD SHOT POINT	SP No.	4076
	N	36° 49.1227'
	E	149° 41.4249'
	Time(UTC)	20:30:16
	Water Depth (m)	6058

SOURCE

GUN TYPE	G.I GUN (Seismic Systems,Inc.)
SHOT TYPE	Harmonic
SHOT MODE	Time
SHOT INTERVAL (ms)	12000
NUMBER OF STRINGS	1
TOTAL VOLUME	355cu.in ([G] 250cu.in, [I] 105cu.in)
CONFIGURATION	355cu.in × 1
GUN DEPTH (m)	10.0
AIR PRESSURE (Mpa)	14.0 (142.8kg/cm^2)
GUN CONTROLLER	GI-01 FIRING CONTROLLER
GUN TOWING WIRE LENGTH (m)	30

RECEIVER

RECEIVER TYPE	S.I.G.16.48.65 Streamer
HYDROPHONE	SIG 16
NUMBER OF CHANNEL (ch)	1
No. of HYDROPHONE IN GROUP	48
SENSITIVITY	-90db, re1V/u bar, ±1db
CABLE DEPTH (m)	9.1
ACTIVE SECTION (m)	65
LEAD-IN SECTION(m)	135

RECORDING

RECORDING SYSTEM	Delph Seismic +
SAMPLE FREQUENCY (Hz)	1000
RECORDING LENGTH (msec)	5000
WATER DELAY (msec)	6000
RECORDING FORMAT	SEGY float IEEE
ANALOG PREAMP	5000mV
SYSTEM DELAY (msec)	120 (from start recording to G firing)
GPS SYSTEM	SkyFix DGPS (No.1 Antenna. StarFix)

DATA

SEISMIC DATA	KR0510-2.SEG
	KR0510-2.sgy
NAVIGATION DATA	KR0510-2.txt

REMARKS

SHIP SPEED	
Doppler Sonar Ship Speed (knot)	3.8
Ground & Ship Speed (knot)	3.7

PROCESSING

・Apply Static Shifts → Time Variant Bandpass → Sliding Window A

OBSERVER

T.Kodera , K.Suzuki, S.Okada, M.Sano, N.Noguchi

NME SINGLE CHANNEL SEISMIC SURVEY GENERAL INFORMATION

KR05-10

GENERAL

CLIENT	JAMSTEC	
CRUISE	KR05-10	
AREA	Northwest Pacific Ocean	
LINE	KR0510-3	
DIRECTION (°)	170.5	
DATE(UTC)	2005.8.8	
WEATHER	Overcast →Rain	
WIND	SSW Moderate breeze → SW Gentle breeze	
SEA CONDITION	Sea smooth	
FIRST GOOD SHOT POINT	SP No.	47
	N	37° 30.8148′
	E	149° 41.2032′
	Time (UTC)	4:57:55
	Water Depth (m)	5971
LAST GOOD SHOT POINT	SP No.	456
	N	37° 26.0425′
	E	149° 42.1946′
	Time(UTC)	6:06:15
	Water Depth (m)	5962

SOURCE

GUN TYPE	G.I GUN (Seismic Systems,Inc.)
SHOT TYPE	Harmonic
SHOT MODE	Time
SHOT INTERVAL (ms)	10000
NUMBER OF STRINGS	1
TOTAL VOLUME	355cu.in ([G] 250cu.in, [I] 105cu.in)
CONFIGURATION	355cu.in × 1
GUN DEPTH (m)	10.0
AIR PRESSURE (Mpa)	14.0 (142.8kg/cm^2)
GUN CONTROLLER	GI-01 FIRING CONTROLLER
GUN TOWING WIRE LENGTH (m)	30

RECEIVER

RECEIVER TYPE	S.I.G.16.48.65 Streamer
HYDROPHONE	SIG 16
NUMBER OF CHANNEL (ch)	1
No. of HYDROPHONE IN GROUP	48
SENSITIVITY	-90db, re1V/u bar, ±1db
CABLE DEPTH (m)	9.5
ACTIVE SECTION (m)	65
LEAD-IN SECTION(m)	135

RECORDING

RECORDING SYSTEM	Delph Seismic +
SAMPLE FREQUENCY (Hz)	1000
RECORDING LENGTH (msec)	9500
WATER DELAY (msec)	0
RECORDING FORMAT	SEGY float IEEE
ANALOG PREAMP	5000mV
SYSTEM DELAY (msec)	120 (from start recording to G firing)
GPS SYSTEM	SkyFix DGPS (No.1 Antenna: StarFix)

DATA

SEISMIC DATA	KR0510-3.SEG
	KR0510-3.sgy
NAVIGATION DATA	KR0510-3.txt

REMARKS

SHIP SPEED	
Doppler Sonar Ship Speed (knot)	4.6
Ground & Ship Speed (knot)	4.3
SP222	Cross point (KR0510-4_SP429)
SP309	Cross point (KR0510-1_SP1506)

PROCESSING

・Apply Static Shifts → Time Variant Bandpass → Sliding Window AGC

OBSERVER

T.Kodera , K.Suzuki, S.Okada, M.Sano, N.Noguchi

NME SINGLE CHANNEL SEISMIC SURVEY GENERAL INFORMATION

KR05-10

GENERAL

CLIENT	JAMSTEC	
CRUISE	KR05-10	
AREA	Northwest Pacific Ocean	
LINE	KR0510-4	
DIRECTION (°)	55.9	
DATE(UTC)	2005.8.8	
WEATHER	Rain → Overcast	
WIND	SW Gentle breeze → WSW Moderate breeze	
SEA CONDITION	Sea smooth	
FIRST GOOD SHOT POINT	SP No.	317
	N	37° 27.9976′
	E	149° 40.4363′
	Time (UTC)	7:05:24
	Water Depth (m)	5985
LAST GOOD SHOT POINT	SP No.	830
	N	37° 31.0926′
	E	149° 46.1872′
	Time(UTC)	8:31:04
	Water Depth (m)	5998

SOURCE

GUN TYPE	G.I GUN (Seismic Systems,Inc.)
SHOT TYPE	Harmonic
SHOT MODE	Time
SHOT INTERVAL (ms)	10000
NUMBER OF STRINGS	1
TOTAL VOLUME	355cu.in ([G] 250cu.in, [I] 105cu.in)
CONFIGURATION	355cu.in × 1
GUN DEPTH (m)	10.0
AIR PRESSURE (Mpa)	14.0 (142.8kg/cm^2)
GUN CONTROLLER	GI-01 FIRING CONTROLLER
GUN TOWING WIRE LENGTH (m)	30

RECEIVER

RECEIVER TYPE	S.I.G.16.48.65 Streamer
HYDROPHONE	SIG 16
NUMBER OF CHANNEL (ch)	1
No. of HYDROPHONE IN GROUP	48
SENSITIVITY	-90db, re1V/u bar, ±1db
CABLE DEPTH (m)	9.2
ACTIVE SECTION (m)	65
LEAD-IN SECTION(m)	135

RECORDING

RECORDING SYSTEM	Delph Seismic +
SAMPLE FREQUENCY (Hz)	1000
RECORDING LENGTH (msec)	9500
WATER DELAY (msec)	0
RECORDING FORMAT	SEGY float IEEE
ANALOG PREAMP	5000mV
SYSTEM DELAY (msec)	120 (from start recording to G firing)
GPS SYSTEM	SkyFix DGPS (No.1 Antenna. StarFix)

DATA

SEISMIC DATA	KR0510-4.SEG
	KR0510-4.sgy
NAVIGATION DATA	KR0510-4.txt

OBSERVER

T.Kodera , K.Suzuki, S.Okada, M.Sano, N.Noguchi

REMARKS

SHIP SPEED	
Doppler Sonar Ship Speed (knot)	4.4
Ground & Ship Speed (knot)	3.9
SP429	Cross point (KR0510-3_SP222)
SP667	Cross point (KR0510-5_SP585)
SP818	Cross point (KR0510-6_SP345)

PROCESSING

・Apply Static Shifts → Time Variant Bandpass → Sliding Window AGC

NME SINGLE CHANNEL SEISMIC SURVEY GENERAL INFORMATION

KR05-10

GENERAL

CLIENT	JAMSTEC	
CRUISE	KR05-10	
AREA	Northwest Pacific Ocean	
LINE	KR0510-5	
DIRECTION (°)	335.9	
DATE(UTC)	2005.8.8	
WEATHER	Overcast	
WIND	WSW Moderate breeze → WSW Moderate breeze	
SEA CONDITION	Sea smooth	
FIRST GOOD SHOT POINT	SP No.	376
	N	37° 27.9334′
	E	149° 45.5322′
	Time (UTC)	9:41:19
	Water Depth (m)	5991
LAST GOOD SHOT POINT	SP No.	800
	N	37° 32.1324′
	E	149° 43.1764′
	Time(UTC)	10:51:59
	Water Depth (m)	5967

SOURCE

GUN TYPE	G.I GUN (Seismic Systems,Inc.)
SHOT TYPE	Harmonic
SHOT MODE	Time
SHOT INTERVAL (ms)	10000
NUMBER OF STRINGS	1
TOTAL VOLUME	355cu.in ([G] 250cu.in, [I] 105cu.in)
CONFIGURATION	355cu.in × 1
GUN DEPTH (m)	10.0
AIR PRESSURE (Mpa)	14.0 (142.8kg/cm^2)
GUN CONTROLLER	GI-01 FIRING CONTROLLER
GUN TOWING WIRE LENGTH (m)	30

RECEIVER

RECEIVER TYPE	S.I.G.16.48.65 Streamer
HYDROPHONE	SIG 16
NUMBER OF CHANNEL (ch)	1
No. of HYDROPHONE IN GROUP	48
SENSITIVITY	-90db, re1V/u bar, ±1db
CABLE DEPTH (m)	10.5
ACTIVE SECTION (m)	65
LEAD-IN SECTION(m)	135

RECORDING

RECORDING SYSTEM	Delph Seismic +
SAMPLE FREQUENCY (Hz)	1000
RECORDING LENGTH (msec)	9500
WATER DELAY (msec)	0
RECORDING FORMAT	SEGY float IEEE
ANALOG PREAMP	5000mV
SYSTEM DELAY (msec)	120 (from start recording to G firing)
GPS SYSTEM	SkyFix DGPS (No.1 Antenna. StarFix)

DATA

SEISMIC DATA	KR0510-5.SEG
	KR0510-5.sgy
NAVIGATION DATA	KR0510-5.txt

REMARKS

SHIP SPEED	
Doppler Sonar Ship Speed (knot)	3.5
Ground & Ship Speed (knot)	3.9
SP425	Cross point (KR0510-1_SP1690)
SP585	Cross point (KR0510-4_SP667)

PROCESSING

・Apply Static Shifts → Time Variant Bandpass → Sliding Window A

OBSERVER

T.Kodera , K.Suzuki, S.Okada, M.Sano, N.Noguchi

NME SINGLE CHANNEL SEISMIC SURVEY GENERAL INFORMATION

KR05-10

GENERAL

CLIENT	JAMSTEC	
CRUISE	KR05-10	
AREA	Northwest Pacific Ocean	
LINE	KR0510-6	
DIRECTION (°)	131.7	
DATE(UTC)	2005.8.8	
WEATHER	Overcast	
WIND	WSW Moderate breeze → WNW Gentle breeze	
SEA CONDITION	Sea smooth	
FIRST GOOD SHOT POINT	SP No.	138
	N	37° 32.4931′
	E	149° 43.9867′
	Time (UTC)	11:17:44
	Water Depth (m)	5969
LAST GOOD SHOT POINT	SP No.	504
	N	37° 29.8715′
	E	149° 47.6751′
	Time(UTC)	12:18:44
	Water Depth (m)	6004

SOURCE

GUN TYPE	G.I GUN (Seismic Systems,Inc.)
SHOT TYPE	Harmonic
SHOT MODE	Time
SHOT INTERVAL (ms)	10000
NUMBER OF STRINGS	1
TOTAL VOLUME	355cu.in ([G] 250cu.in, [I] 105cu.in)
CONFIGURATION	355cu.in × 1
GUN DEPTH (m)	10.0
AIR PRESSURE (Mpa)	14.0 (142.8kg/cm^2)
GUN CONTROLLER	GI-01 FIRING CONTROLLER
GUN TOWING WIRE LENGTH (m)	30

RECEIVER

RECEIVER TYPE	S.I.G.16.48.65 Streamer
HYDROPHONE	SIG 16
NUMBER OF CHANNEL (ch)	1
No. of HYDROPHONE IN GROUP	48
SENSITIVITY	-90db, re1V/u bar, ±1db
CABLE DEPTH (m)	9.5
ACTIVE SECTION (m)	65
LEAD-IN SECTION(m)	135

RECORDING

RECORDING SYSTEM	Delph Seismic +
SAMPLE FREQUENCY (Hz)	1000
RECORDING LENGTH (msec)	9500
WATER DELAY (msec)	0
RECORDING FORMAT	SEGY float IEEE
ANALOG PREAMP	5000mV
SYSTEM DELAY (msec)	120 (from start recording to G firing)
GPS SYSTEM	SkyFix DGPS (No.1 Antenna StarFix)

DATA

SEISMIC DATA	KR0510-6.SEG
	KR0510-6.sgy
NAVIGATION DATA	KR0510-6.txt

OBSERVER

T.Kodera , K.Suzuki, S.Okada, M.Sano, N.Noguchi

REMARKS

SHIP SPEED	
Doppler Sonar Ship Speed (knot)	4.8
Ground & Ship Speed (knot)	3.9
SP345	Cross point (KR0510-4_SP818)

PROCESSING

・Apply Static Shifts → Time Variant Bandpass → Sliding Window A

NME SINGLE CHANNEL SEISMIC SURVEY GENERAL INFORMATION

KR05-10

GENERAL

CLIENT	JAMSTEC	
CRUISE	KR05-10	
AREA	Northwest Pacific Ocean	
LINE	KR0510-7	
DIRECTION (°)	350.9	
DATE(UTC)	2005.8.8	
WEATHER	Overcast	
WIND	WNW Gentle breeze → NNW Gentle breeze	
SEA CONDITION	Sea smooth	
FIRST GOOD SHOT POINT	SP No.	200
	N	37° 31.6094′
	E	149° 47.9866′
	Time (UTC)	12:56:38
	Water Depth (m)	5993
LAST GOOD SHOT POINT	SP No.	1860
	N	37° 48.1235′
	E	149° 44.6623′
	Time(UTC)	17:33:18
	Water Depth (m)	5960

SOURCE

GUN TYPE	G.I GUN (Seismic Systems,Inc.)
SHOT TYPE	Harmonic
SHOT MODE	Time
SHOT INTERVAL (ms)	10000
NUMBER OF STRINGS	1
TOTAL VOLUME	355cu.in ([G] 250cu.in, [I] 105cu.in)
CONFIGURATION	355cu.in × 1
GUN DEPTH (m)	10.0
AIR PRESSURE (Mpa)	14.0 (142.8kg/cm^2)
GUN CONTROLLER	GI-01 FIRING CONTROLLER
GUN TOWING WIRE LENGTH (m)	30

RECEIVER

RECEIVER TYPE	S.I.G.16.48.65 Streamer
HYDROPHONE	SIG 16
NUMBER OF CHANNEL (ch)	1
No. of HYDROPHONE IN GROUP	48
SENSITIVITY	-90db, re1V/u bar, ±1db
CABLE DEPTH (m)	10.1
ACTIVE SECTION (m)	65
LEAD-IN SECTION(m)	135

RECORDING

RECORDING SYSTEM	Delph Seismic +
SAMPLE FREQUENCY (Hz)	1000
RECORDING LENGTH (msec)	9500
WATER DELAY (msec)	0
RECORDING FORMAT	SEGY float IEEE
ANALOG PREAMP	5000mV
SYSTEM DELAY (msec)	120 (from start recording to G firing)
GPS SYSTEM	SkyFix DGPS (No.1 Antenna. StarFix)

DATA

SEISMIC DATA	KR0510-7.SEG
	KR0510-7.sgy
NAVIGATION DATA	KR0510-7.txt

REMARKS

SHIP SPEED	
Doppler Sonar Ship Speed (knot	3.8
Ground & Ship Speed (knot)	3.6
SP1747	Cross point (KR0510-8_SP486)
SP1757	Cross point (KR0510-9_SP310)

PROCESSING

・Apply Static Shifts → Time Variant Bandpass → Sliding Window

OBSERVER

T.Kodera , K.Suzuki, S.Okada, M.Sano, N.Noguchi

NME SINGLE CHANNEL SEISMIC SURVEY GENERAL INFORMATION

KR05-10

GENERAL

CLIENT	JAMSTEC	
CRUISE	KR05-10	
AREA	Northwest Pacific Ocean	
LINE	KR0510-8	
DIRECTION (°)	83.1	
DATE(UTC)	2005.8.8	
WEATHER	Overcast	
WIND	NNW Gentle breeze	
SEA CONDITION	Sea smooth	
FIRST GOOD SHOT POINT	SP No.	341
	N	37° 46.8986′
	E	149° 42.9662′
	Time (UTC)	18:34:19
	Water Depth (m)	5874
LAST GOOD SHOT POINT	SP No.	700
	N	37° 47.3596′
	E	149° 47.8164′
	Time(UTC)	19:34:09
	Water Depth (m)	5935

SOURCE

GUN TYPE	G.I GUN (Seismic Systems,Inc.)
SHOT TYPE	Harmonic
SHOT MODE	Time
SHOT INTERVAL (ms)	10000
NUMBER OF STRINGS	1
TOTAL VOLUME	355cu.in ([G] 250cu.in, [I] 105cu.in)
CONFIGURATION	355cu.in × 1
GUN DEPTH (m)	10.0
AIR PRESSURE (Mpa)	14.0 (142.8kg/cm^2)
GUN CONTROLLER	GI-01 FIRING CONTROLLER
GUN TOWING WIRE LENGTH (m)	30

RECEIVER

RECEIVER TYPE	S.I.G 16.48.65 Streamer
HYDROPHONE	SIG 16
NUMBER OF CHANNEL (ch)	1
No. of HYDROPHONE IN GROUP	48
SENSITIVITY	-90db, re1V/u bar, ±1db
CABLE DEPTH (m)	8.7
ACTIVE SECTION (m)	65
LEAD-IN SECTION(m)	135

RECORDING

RECORDING SYSTEM	Delph Seismic +
SAMPLE FREQUENCY (Hz)	1000
RECORDING LENGTH (msec)	9500
WATER DELAY (msec)	0
RECORDING FORMAT	SEGY float IEEE
ANALOG PREAMP	5000mV
SYSTEM DELAY (msec)	120 (from start recording to G firing)
GPS SYSTEM	SkyFix DGPS (No.1 Antenna. StarFix)

DATA

SEISMIC DATA	KR0510-8.SEG
	KR0510-8.sgy
NAVIGATION DATA	KR0510-8.txt

REMARKS

SHIP SPEED	
Doppler Sonar Ship Speed (knot	5.8
Ground & Ship Speed (knot)	3.9
SP486	Cross point (KR0510-7_SP1747

PROCESSING

・Apply Static Shifts → Time Variant Bandpass → Sliding Windo

OBSERVER

T.Kodera , K.Suzuki, S.Okada, M.Sano, N.Noguchi

NME SINGLE CHANNEL SEISMIC SURVEY GENERAL INFORMATION

KR05-10

GENERAL

CLIENT	JAMSTEC	
CRUISE	KR05-10	
AREA	Northwest Pacific Ocean	
LINE	KR0510-8	
DIRECTION (°)	260.5	
DATE(UTC)	2005.8.8	
WEATHER	Overcast → Cloudy	
WIND	NNW Gentle breeze → NZE Gentle breeze	
SEA CONDITION	Sea smooth	
FIRST GOOD SHOT POINT	SP No.	200
	N	37° 47.3781′
	E	149° 46.5101′
	Time (UTC)	20:12:11
	Water Depth (m)	5930
LAST GOOD SHOT POINT	SP No.	667
	N	37° 46.4482′
	E	149° 39.4809′
	Time(UTC)	21:30:01
	Water Depth (m)	5892

SOURCE

GUN TYPE	G.I GUN (Seismic Systems,Inc.)
SHOT TYPE	Harmonic
SHOT MODE	Time
SHOT INTERVAL (ms)	10000
NUMBER OF STRINGS	1
TOTAL VOLUME	355cu.in ([G] 250cu.in, [I] 105cu.in)
CONFIGURATION	355cu.in × 1
GUN DEPTH (m)	10.0
AIR PRESSURE (Mpa)	14.0 (142.8kg/cm^2)
GUN CONTROLLER	GI-01 FIRING CONTROLLER
GUN TOWING WIRE LENGTH (m)	30

RECEIVER

RECEIVER TYPE	S.I.G.16.48.65 Streamer
HYDROPHONE	SIG 16
NUMBER OF CHANNEL (ch)	1
No. of HYDROPHONE IN GROUP	48
SENSITIVITY	-90db, re1V/u bar, ±1db
CABLE DEPTH (m)	10.0
ACTIVE SECTION (m)	65
LEAD-IN SECTION(m)	135

RECORDING

RECORDING SYSTEM	Delph Seismic +
SAMPLE FREQUENCY (Hz)	1000
RECORDING LENGTH (msec)	9500
WATER DELAY (msec)	0
RECORDING FORMAT	SEGY float IEEE
ANALOG PREAMP	5000mV
SYSTEM DELAY (msec)	120 (from start recording to G firing)
GPS SYSTEM	SkyFix DGPS (No.1 Antenna. StarFix)

DATA

SEISMIC DATA	KR0510-9.SEG
	KR0510-9.sgy
NAVIGATION DATA	KR0510-9.txt

REMARKS

SHIP SPEED	
Doppler Sonar Ship Speed (knot)	2.4
Ground & Ship Speed (knot)	4.3
SP310	Cross point (KR0510-7_SP1757)

PROCESSING

・Apply Static Shifts → Time Variant Bandpass → Sliding Window AG

OBSERVER

T.Kodera , K.Suzuki, S.Okada, M.Sano, N.Noguchi

Participants for KR05-10

Scientists

Name	Belonging	Affiliation		E-mail
		Department	Address	
	Telephone number			
Natsue Abe	JAMSTEC	Research Scientist		
		IFREE		
	(Chief scientist and Representative of the Science Party)			
Naoto Hirano	Tokyo Institute of Technology	Post Doctoral Fellow		
		Graduate School of Science and Technology		
Shiki Machida	Ocean Research Institute	Researcher		
	University of Tokyo	Post Doctoral Fellow		
Toshiya Fujiwara	JAMSTEC	Research Scientist		
		IFREE		
Masahiro Ichiki	JAMSTEC	Research Scientist		
		IFREE		
Kiyoshi Baba	Earthquake Research Institute	Research Associate		
	University of Tokyo	Ocean Hemisphere Research Center		
Takahiro Suzuki	University of Tsukuba	Guraduate student (M2)		
		Graduate School of Science and Technology		
Ryota Mori	University of Tsukuba	Guraduate student (M2)		
		Graduate School of Science and Technology		
Ayu Takahashi	University of Tokyo	Guraduate student (M2)		
		Department of Earth and Planetary Science, Graduate School of Science		

Marine Technician

Syohei Taketomo	Marine Works Japan LTD.	Observational technician		
		Marine Geology Section, Office of Marine Research, Department of Marine Science		
Naohito Mori	Marine Works Japan LTD.	Observational technician		
		Marine Geology Section, Office of Marine Research, Department of Marine Science		
Toru Koizumi	Marine Works Japan LTD.	Observational technician		
		Marine Geology Section, Office of Marine Research, Department of Marine Science		
Toru Kodera	Nihon Marine enterprise	Observational technician		
		Department of Marine Science		
Keigo Suzuki	Nihon Marine enterprise	Observational technician		
		Department of Marine Science		
Satoshi Okada	Nihon Marine enterprise	Observational technician		
		Department of Marine Science		
Mamoru Sano	Nihon Marine enterprise	Observational technician		
		Department of Marine Science		
Naoto Noguchi	Nihon Marine enterprise	Observational technician		
		Department of Marine Science		

4. Observations

4-1. R/V *KAIREI*

Integrated research vessel exploring the ridges and trenches

The deep sea research vessel "KAIREI" is designed to survey of deep sea floor and sub-seafloor structures about arc-trench-backarc systems, ridge systems and basic oceanic crustal structure. R/V "KAIREI" is the exclusive mother ship for the 10,000m class remotely operated vehicle "KAIKO" (meaning "trench") which entered service in 1995. In adittion, R/V "KAIREI" is equipped with modern geophysical and geological instruments such as a 120 channel seismic profiler to map detailed structures of subduction zones, piston core and dredge samplers for studying sedimentary environment on the deep sea bottom, quaternary faults and so on geological and geophysical features. The R/V "KAIREI" is available for integrated research projects on ridges and trenches, and all the other sea floor areas of the world.

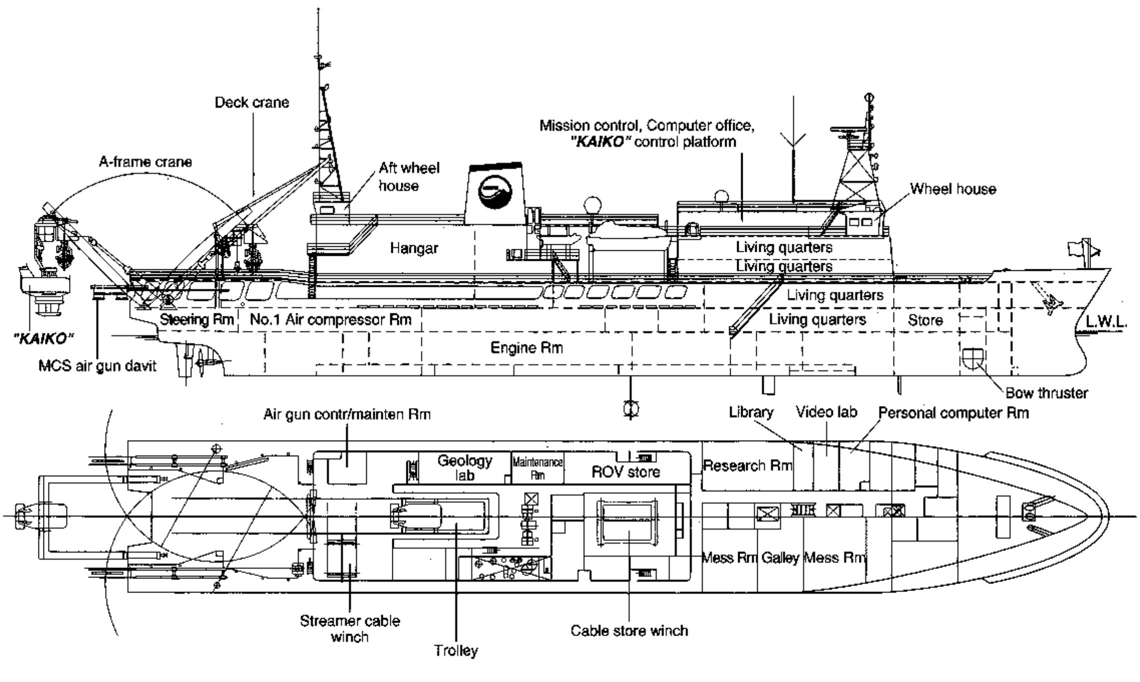


Figure 4-1. “R/V KAIREI” General Arrangement

The principal particulars of the “ R/V Kairei ”

Total Length	105.0m
Total Breadth	16.0m
Total Depth	7.3m
Draft Depth	4.6m
Gross tonnage	4,628tons
Service Speed	16.7knot
Endurance	Approx. 9,600nautical miles (approx.17,800km)
Main Engine	Diesel engines,2*approx. 2,206kW* 600 rpm
Propulsion system	Twin CPP,2*Bow thruster*Joystick control system
Complement	Crew 29, Scientist and others 31 / Total 60
	Since March, 1977

Exploration support equipments

Acoustic navigation device

Multi-Narrow Beam Echo Sounder (Seabeam 2100)

Radio navigation device (GPS etc)

XBT

Local Area Network system

Satellite image receiving device (NOAA, GMS etc)

Laboratories, etc...

Mission control & computer office

Geophysics laboratory

Chemistry & biology laboratory

Research room

Geology laboratory

Gravity meter room

Video laboratory

Personal computer room

Library

4-2. Geophysical instruments by Fujiwara

4-2-1. Gravimeter

Onboard gravity measurement was performed using a BODENSEEWERK KSS31 marine gravimeter system, which was installed in the gravimeter room. According to "Sea State" filtering (low-pass filtering to cancel out gravity effect by ship's movement), the gravity data delays 76 seconds. "Sea State 2" was selected in this cruise. The gravity data were logged per minute in this cruise.

The system incorporates ship's position, speed, and heading through the local area network in the ship, and performs the Etovös correction on-line. The measured gravity value (-1432.4 mGal) at the JAMSTEC pier in Yokosuka at the beginning of this cruise is tied to an absolute gravity value (979758.7 mGal), which value was determined by the previous on-land gravity measurements. The final "gravity tie" must be done in consideration of sensor drift of the gravimeter during the cruise by measurements before departure and after arrival at the pier. Therefore, accurate gravity data processing (readjustment of time difference, Etovös, drift, and reference gravity corrections) should be done after the cruise.

4-2-2. Proton Precession Magnetometer

The total magnetic field measurements were collected by a surface-towed proton precession magnetometer, PRTO10 (Kawasaki Geological Engineering Corporation). The PROTO10 consists of two main units, the sensor and the control units. The sensor, which is towed about 300 m behind the ship, detects intensity of the total geomagnetic field as an electronic signals induced by the precession of proton. The control unit is installed in the dry laboratory. The control unit can set parameters, measurement interval, charge time, capacity of condenser, and so on. The interval of measurement during this cruise was 20 seconds. The data file is renewed everyday.

4-2-3. Shipboard three-component magnetometer

A shipboard three-component magnetometer system, SFG1214 (Tierra Tecnica), was used to measure the three components of the geomagnetic field. Three-axes flux-gate sensors with ring-cored coils were fixed on the roof of the bridge (about 2 m from the roof). Outputs of the sensors were digitized by a 20-bit A/D converter (1 nT/LSB), and sampled at eight times per second. Ship's heading data were also sampled at 8Hz, which were transmitted directly from a gyrocompass for navigation in the bridge. Roll and pitch data of 8 Hz were provided from an attitude sensor (TVM-4) installed on the floor of the gravity meter room. Ship's position and speed data were taken from LAN every second. Logging of these data was carried out using a computer. The data file is renewed everyday. "Figure-8 turns" (a ship runs along an 8-shaped track consisting of two circles) for calibration of the ship's magnetic effect was performed three times during this cruise.

Date	Position
6/14/07:28-07:41(UTC)	39°27.7'N, 144°18.9'E
6/22/05:03-05:21(UTC)	37°26.9'N, 149°42.2'E
6/24/09:00-09:21(UTC)	36°00.0'N, 145°00.0'E ??

4-3. Ocean Bottom Electro-Magnetometer (OBEM)

Kiyoshi Baba & Masahiro Ichiki

Ocean bottom electromagnetometer (OBEM) is an instrument to measure variations of magnetic and electric fields on seafloor. The OBEMs used in this study are the third and fourth generations of the two-glass-sphere type's OBEM made by Tierra Tecnica Ltd., which are called OBEM2001 and OBEM2005, respectively (Figure 4-3-2-1). The one glass sphere houses fluxgate magnetic field sensors for three components, instrument tilt sensors and the data logger. Those are powered by lithium batteries packed in the other glass sphere. An acoustic transponder is also housed in the battery glass sphere. Silver–silver chloride electrodes are attached to the end of each pipe. The data are recorded on a compact flash memory card. Table 4-3-2-1 shows that the specification of the digital recording system of OBEM.

The OBEMs are equipped with acoustic communication system, lead weight, radio beacon and flushing light (Tables 4-3-2-2 and 4-3-2-3). In recovery time, the OBEM releases the weight according to acoustic command from ship, and then pops up by self-buoyancy. The equipped acoustic system is different depending on OBEM. The acoustic system produced by Kaiyo Denshi Co., Ltd. can be applied to SSBL system, which enables us real time determination of instrument position. The radio beacon and flushing light have pressure switch which is turned off under water pressure. Once the OBEM reaches to sea surface, they start working and help our finding the OBEM. The flushing light has a light sensor which works when it is dark. It is very useful to find the OBEM in nighttime. The OBEMs also mount a recovery buoy-rope system (Figure 4-3-3-2). The buoy becomes free from a bucket when a weight is released, and it drags a rope stored in a bucket. It is for easier recovery of OBEMs at the time of their retrieval. We can easily catch the OBEM from shipboard by catching the buoy and hauling on the rope.

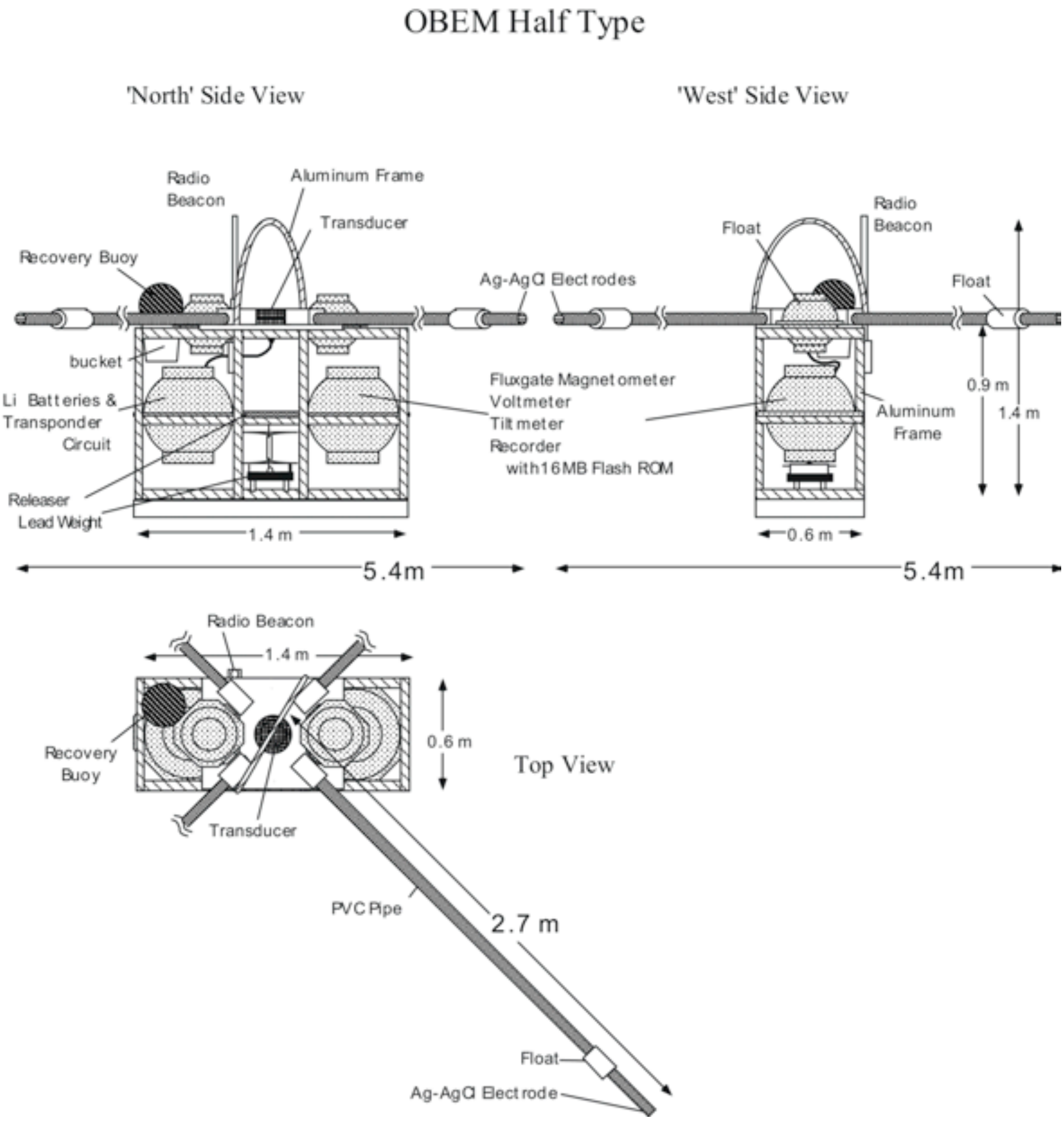


Figure 4-3-1. Sketch of OBEM

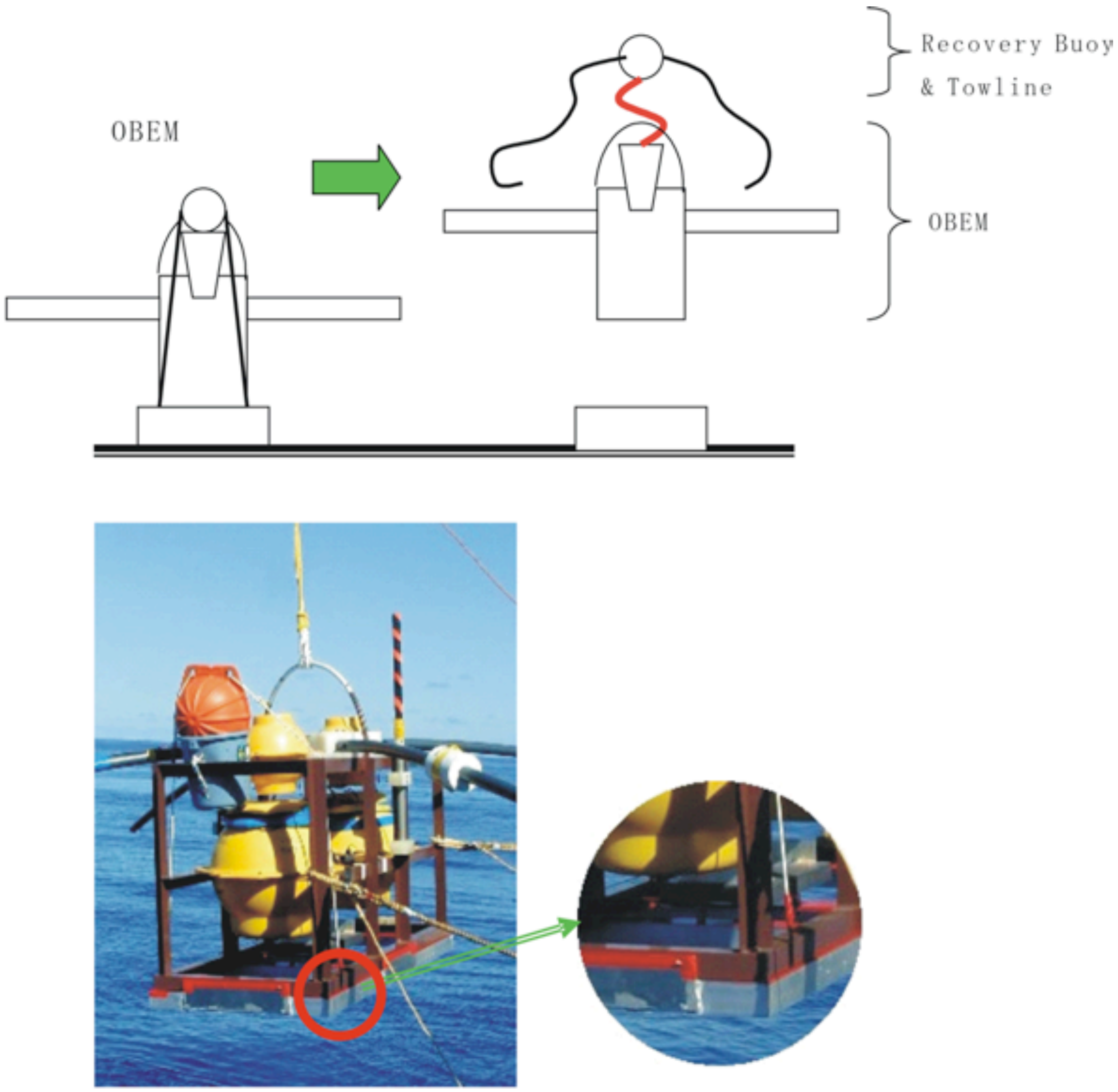


Figure 4-3-2. Recovery buoy-rope system. The stopper is fixed between lead weight and OBEM aluminous frame. Once the lead weight is released, the stopper becomes free and the buoy rises ahead of the OBEM body.

Tierra Tecnica OBEM2001 (TT8, JM1, JM2, JM4, and JM5)				
Measurement field	**A/D transform**	**Dynamic range**	**Resolution**	**Note**
Magnetic field	16 bits	± 327.68 nT	10 pT	N,E positive
Electric field	16 bits	± 10mV	0.305176 _V	S,W positive
Instrument tilt	16 bits	± 8.192 deg.	約 0.00025 deg.	N down, W down positive
Temperature	18000 digits	-55∽125 °C	0.01 °C	

Tierra Tecnica OBEM2005 (JM6)				
Measurement field	**A/D transform**	**Dynamic range**	**Resolution**	**Note**
Magnetic field	16 bits	± 327.68 nT	10 pT	N,E positive
Electric field	16 bits	± 10mV	0.305176 _V	S,W positive
Instrument tilt	16 bits	約 ± 8.5 deg.	約 0.00026 deg.	N down, W down positive
Temperature	18000 digits	-55∽125 °C	0.01 °C	

Table 4-3-1. Specification of digital recording system of OBEM.

OBEM ID	Maker	Frequency	Command code
TT8	Nichiyu Giken	****	3F
JM1	Nichiyu Giken	****	3H
JM2	Kaiyo Denshi	Tx: 13.5kHz Rx: 11.029kHz	1C-1
JM4	Kaiyo Denshi	Tx: 14.0kHz Rx: 11.029kHz	1A-2
JM5	Kaiyo Denshi	Tx: 14.5kHz Rx: 11.029kHz	1B-3
JM6	Kaiyo Denshi	Tx: 14.5kHz Rx: 10.563kHz	2C-3

Table 4-3-2. Acoustic communication system equipped on OBEM.

OBEM ID	Flashing light		Radio Beacon			
	Type	Serial No.	Type	Serial No.	Frequency	Code
TT8	ST-400A	S12-021	RF-700A3	S12-029	43.528MHz	JS1364
JM1	ST-400A	S12-017	RF-700A3	S12-032	43.528MHz	JS1367
JM2	ST-400A	S12-016	RF-700A3	S12-031	43.528MHz	JS1366
JM4	ST-400A	S12-018	RF-700A3	S12-033	43.528MHz	JS1368
JM5	ST-400A	S12-020	RF-700A3	S12-028	43.528MHz	JS1363
JM6	ST-400A	S12-019	RF-700A3	S12-030	43.528MHz	JS1365

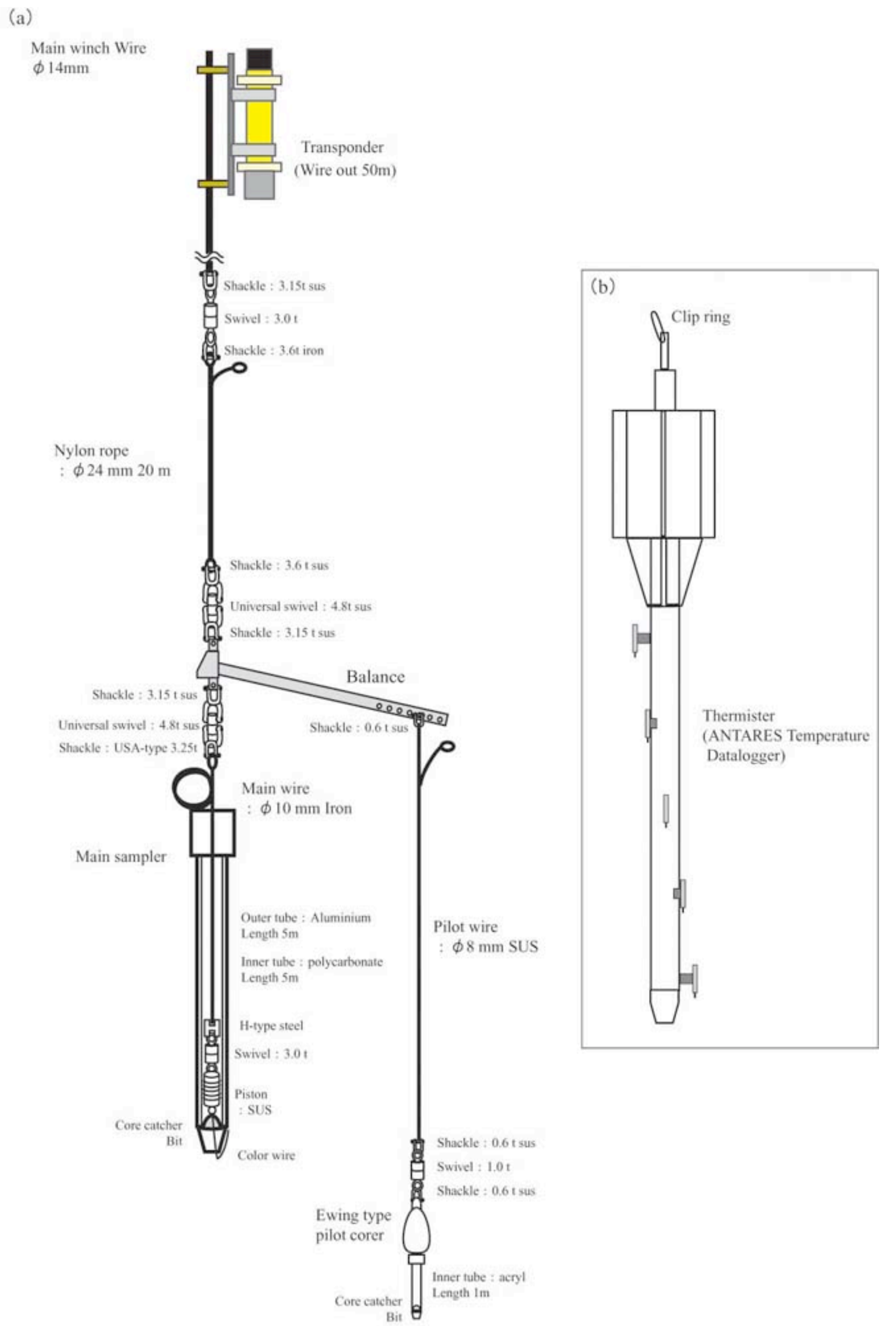
Table 4-3-3. Specifications of flashing light and radio beacon equipped on OBEM. Both are made by NOVATECH.

4-4. Piston coring system

Y. Taketomo, T. Mori and T. Koizumi (Marine Works Japan Ltd.)

Instrumentation

Piston core system was used during this cruise, a heat-flow piston corer with stainless steel barrel and inner core liner. The general outlines of these systems are shown in Fig..



(a)Piston corer system, (b)Position of five Thermisters

Fig.

Piston core and heat flow system

The piston core system was used for the combined operation of measuring heat flow and recovering sediments. The barrel was attached to a piston core head of 900 kg weight. This system has a space for a mounting the heat flow data logger to record the temperatures at 5 thermisters mounted helical on the outside of barrel, between the base of the weight stand and the core catcher bit. Each thermister recorded the data by itself. This system also mounted transponder at main wire to obtain the water depth of this equipment. The total weight stand of the head is approximately 900 kg. The aluminum barrel with this system is 5 m in length and liner is used for recovering sediments. The balance and pilot core is same as for the piston core system. 20 m nylon rope was placed between the balance and main wire for additional wire out and/or increased tension after hitting sea bottom. Because the system must be kept in the sediment for 15 minutes to obtain stable temperature, additional wire out must be avoided to pulling the barrel out of the sea floor by either heaving or drifting of the ship during the measurement.

General Operation

Preparation for the piston coring

After barrels are attached to the head (weight stand), the main wire is connected, through the barrel, to the piston at the bottom of the barrel, and to the balance at the weight stand. The core catcher and bit are then attached. The balance is connected to the end of the main wire. The entire assemblage is carried under the A flame using a cart and is lifted over the edge of the deck by the main winch, A flame and capstan winches, the pilot core and it's wire are then connected to the balance. During the launch into the sea we have to add a large amount of water into the barrel from the top to prevent the piston moving due to water pressure from below. The system is then lowered through the water to the sea floor.

Aft. wheel house

When the sampling site is reached, the operation of the ship is transferred to the aft. wheel house which overlooks the aft working deck.

From this room the ship can be fully managed, the winch is operated, all equipment handling is fully observed and the wire out and wire tension are displayed, all operations can easily managed. Therefore, the operator technician, the ship’s operator and winch operator are in this room, working jointly, during the piston core operation. After stopping the ship at the site, the ship keeps its position by bow and stern thrusters throughout the operation.

Hit the bottom and off the bottom

The piston core system starts lowering at a winch speed of 60 m/min. The piston core is stopped at a depth about 50 m above the sea floor for 10 minutes to reduce any pendulum motion and to calibrate the thermisters on the outside of barrel. This also reduce possible swing of the core after pullout, which could cause lose of the samples.

After 10 minutes standing 50 m above sea floor to confirm that the system is stabilized, the wire is stored out at a speed of about 20m/min., at the same time carefully watching the pen recorder of the strain gauge tension meter. When the piston core touches the bottom the tension will abruptly decrease by the amount of the piston core weight. Therefore, it is easy to detect the bottom hit.

Immediately after confirmation that the core hit bottom wire out is stopped and keep the position for 15 minutes. And then, rewinding of the wire is started at a dead slow speed (10 m/min.), until the tension gauge indicate that the core has lifted off the bottom. The tension meter shows a small increase in tension when the core is being pulled out of the sea floor and then a steady value. After we can recognize absolutely that the piston core is above the sea floor, the winch to keep speed is increased to 60m/min., and then gradually to maximum rate.

Sediment core treatment

The inner tube of the piston core filled by sediments was cut into 1m lengths for each section using a handy cutter. The sections were longitudinally cut into working and archive halves by a splitting devise with a stainless wire.

4-5. Dredge system

Y. Taketomo, T. Mori and T. Koizumi. (Marine Works Japan, Ltd.)

The assemblages of the dredge used during KR05-10 cruise are illustrated in Fig., showing the main wire, lead wire, chain, weight, life wire, fuse wire and main chain-bag dredge (Nalwalk).

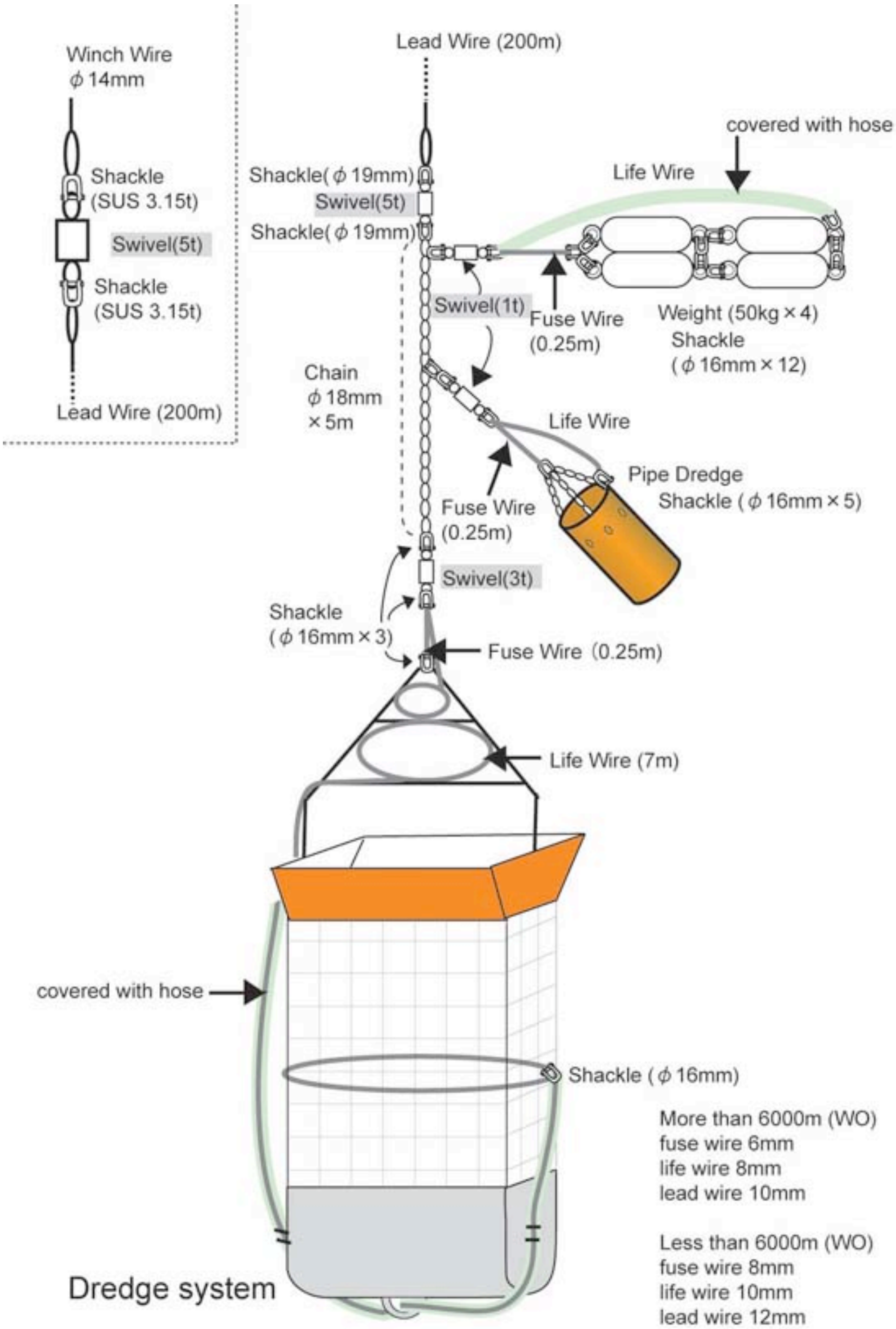


Fig.

Main wire: Diameter of main wire is 14 mm, 8000 m long. It is 0.651 kg weight per one meter (i.e. about 0.6kN for 1000 m in the sea water) and having a 96.6kN breaking force.

Lead wire: this wire is prepared for protection against damage to the main wire, joined by shackles (3.13t SUS) and swivel (5t). It is iron wire of 12 mm diameter (in case of more than 6000m, 10mm diameter has to be used), 200 m long and a 71kN (10mm diameter: 49.3kN) breaking force.

Chain: Chain (18 mm diameter, 5 m long) is used to stabilize the dredge assemblage and was joined to the lead wire with a swivel (5t) and shackles (ϕ 19).

Weight(50kg per each): The weight is used to assure the dredge is on the bottom as can be observed by the tension meter in the operation room, and linked by shackles(ϕ 16) to the chain together with a swivel (1t), fuse wire (6 or 8mm diameter, 0.25m long) and life wires (8 or 10mm diameter).

Life wire(chain-bag): End of the life wire (8 or 10mm diameter, 7 m long) is connected parallel with fuse wire, and the other end is connected with the middle part of the chain-bag. In the case of fuse wire is broken by a big bite or anchoring, life wire works as fuse wire, and keep the sample in the lower part of chain-bag with box type bucket.

Fuse wire: fuse wire (6 or 8mm diameter, 0.25m long) is prepared to release the dredge form big bites that might damage the main wire. It is jointed to the chain with a swivel (1t) and shackles in the dredge assemblages.

Chain-bag dredge: The square type dredge (Nalwalk) consists of box type jaw (60*45 cm mouth, 60*27 cm throat), handle (26mm diameter, 85cm long) and steel chain-bag (6 mm diameter, 100cm long) with box type bucket (27*60*50cm) made from stainless steel (5mm thick). The bucket can recover all kinds of sediments on sea floor, it was jointed with shackles to the 0.25 m fuse wire.

In case of wire out length are more than 6000 m, JAMSTEC decided that fuse/life/lead wire should be use 6/8/10mm in diameter respectively, in order to protect the main wire from own weight more than 6000m. Otherwise, wire out length are less than 6000 m, fuse/life/lead wire should be use 8/10/12mm in diameter respectively.

About details of wire diameter and breaking force are written in below.

Diameter	Breaking Force
6mm	17.7kN
8mm	31.6kN
10mm	49.3kN
12mm	71.0kN

Appendix (heat flow)

by Hirano, Abe

Temperature gradient in sediments are measured using heat flow system of ANTARES Temperature Datalogger (ANTARES Datasystem GmbH). Eight ANTARES loggers of Channel 1-8 are set on piston core barrel by approximately 60 cm intervals. Channel 1 is bottom, and Channel 8 is top. Particularly, the ANTARES of Channel 1 is located 50 cm from tip of core bit.

The ANTARES is 160 mm in length and 15 mm in diameter. Water pressure resistant is 6000 m. Procedures of setting to core barrel and data export to computer is shown as follows.

Procedure of setting to core barrel.

1. Set ANTARES datalogger into ANTARES holder. If the datalogger moves easily by loose-fitting due to enough space between the datalogger and holder, the datalogger would be fixed using rubber bands. Finally, holder cap is closed.
2. Set ANTARES holder on core barrel using hoops. Narrow bar side of the holder faces to bottom direction. The hoop is tightened using electric driver.
3. Tie vinyl tape on the hoop and holder cap.
4. Measure distances between holder and holder, and between holder and tip of core bit.

地殻熱流量測定

ピストンコアラーのバレルに数個の小型温度計を取り付け、海底面に突き刺し堆積物中の温度を測定する。この結果から地殻熱流量を求める.

小型温度計本体

＜小型温度計 ANTARES Temperature Datalogger
(ANTARES Datensysteme GmbH 製) ＞

耐圧容器	ステンレス製
耐圧水深	6000m
長さ	160 mm (サーミスタープローブ : 20 mm)
直径	15 mm (サーミスタープローブ : 4 mm)

小型温度計の取り付け方

1 小型温度計を専用のホルダーに入れる。
2 金輪を用いてバレルに固定する。
このとき温度センサー(細くなっている側)を下向きに取り付ける。
また、各小型温度計は一直線上に配置するのではなく千鳥状に配置するとよい。
3 取り付け後、金輪には保護のためにビニルテープを数回巻く。
4 温度計取り付け後に各センサー間の距離を測定する。

測定方法

通常のピストンコアラーのオペレーションと異なるのは以下の点である。

1 本測定ではワイヤーの保護のため，ピストンコアラーとワイヤーの間に約 20m のロープを取り付けて計測を行う

2 海底面から約 50m 上でキャリブレーションのための水温の測定を 10 分程度行う。

3 着底後、約 10 分間温度計測を行う。
計測中，テンションをモニターしテンションが掛かるようであればウインチを繰り出す。但し過度に繰り出すと弛んだロープが装置に巻きつく恐れがあるので注意する

Figure 4-9. Heat Flow thermometer system (in Japanese).

5. Preliminary Results

5-1. Preliminary results of seafloor electromagnetic survey using OBEMs

Kiyoshi Baba & Masahiro Ichiki

5-1-1. Objectives

Magnetotelluric (MT) soundings provide us an image of electrical feature of Earth's interior. Because electrical conductivity of the mantle materials is strongly dependent of temperature, partial melt, and volatiles such as water, electrical conductivity structure models estimated through seafloor MT surveys are definitely useful to discuss where the source of the “Petit Spot” volcanic activity is and its relation to the mantle dynamics. For these objectives, we planed a seafloor MT experiment using six ocean bottom electromagnetometers (OBEMs) and deployed them during the cruise “R/V Yokosuka YK05-06”. The experiment contains two targets: 1) Semi-regional structure of the lithosphere and asthenosphere beneath the “Petit Spot” area based on 10-weeks observation. 2) Regional upper mantle structure in the northwestern Pacific Ocean based on one-year observation.

The first target is focused on the source area of the “Petit Spot” magma. Five OBEMs are deployed on cross-shape array centering on Yukawa knoll with ~100 km intervals (Figure 5-1-1-1). We investigate the electrical conductivity of the lithosphere and asthenosphere down to 200 km depth where the peterological studies suggest that the melt generated. One of the most basic questions, whether the asthenosphere is partially molten everywhere and hence “Petit Spot” is just an indication of pathway to the surface or the asthenosphere beneath the “Petit Spot” area is anomalous with high temperature or high contents of volatiles resulting in partial melt, can be answered through the electrical conductivity structure.

The cross-shape observation array is also designed for dealing easily with the anisotropic electrical conductivity, setting the OBEM sites on the lines parallel to and perpendicular to the current motion of the Pacific plate. Recent seafloor MT study has revealed that the electrical conductivity of the asthenosphere in the East Pacific Rise is mainly controlled by water (hydrogen dissolved in minerals) and anisotropic, suggesting the lattice preferred orientation of mantle minerals (Baba et al., 2005). However, it is still unknown whether the electrical conductivity of old oceanic asthenosphere is anisotropic or not. This study is also the first attempt in the world about this point. Further, structural change associated with Nosappu fracture zone is also taken into account. The lines connecting the sites NWP0504 and NWP0505, and NWP0503 and NWP0502 are orthogonallized to the fracture zone. Observation during ~10 weeks would be enough for the exploration of the asthenospheric depth. A task of this cruise is to recover the OBEMs deployed at the four sites (NWP0503 – NWP0506). The other site is common to the long-term site (NWP0502), which locates on the southern east point of the array.

The second target is motivated from a study of global seismic tomography. The P-wave velocity structure model shows a remarkable low velocity region at depths of 300 – 600 km beneath the outer rise (Figure. 5-1-1-2). The low velocity region seems to extend to the "Petit Spot" area, although its eastern margin is not well resolved by the land-based tomography. Low velocity anomalies are frequently interpreted as high temperature anomalies and hence the low velocity region beneath the outer rise may suggest an upwelling of high temperature materials. However, the upwelling adjacent to the downwelling of the Pacific plate is implausible under realistic mantle viscosity (Yanagisawa, personal communication). For elucidating the physical state of the mantle more accurately, analyzing both the seismic velocity and electrical conductivity is critical. Ichiki et al. (2005) developed a method to distinguish the thermal and compositional (hydrogen) effects on electrical conductivity by referring seismic P-wave velocity. Applying Ichiki et al's method to the northwestern Pacific region enables us to discuss the physical states and dynamics, which may be related to "Petit Spot".

We have carried out a long-term seafloor MT survey in the northwestern Pacific Ocean since 2003 to reveal the regional structure of the upper mantle down to ~400 km depth. We have already collected one-year-long MT data at sites NWP0301 and NWP0302. Two sites were newly deployed during the cruise "R/V Yokosuka YK05-06", NWP0501 and NWP0502, respectively locate ~350 km south of the sites NWP0301 and NWP0302 (Fig. 1-3-6-3). These sites are designed for one-year observation. In the deploying cruise, we didn't have enough time to wait for the settlements of the OBEMs and determination of their positions on the seafloor. Thus, we planed the positioning of the two OBEMs in this cruise.

Further, we plan additional long-term surveys in the coming years, which fill the region in the circle centering on the "Petit Spot" area with a diameter of ~1000 km. We ultimately aim to obtain a three-dimensional (3-D) electrical conductivity structure model of the upper mantle in the region by analyzing these data jointly.

5-1-2. Positioning and recovery of the OBEMs

The positioning of the OBEMs was carried out by measuring slant ranges between vessel and OBEM. We succeeded it for four OBEMs for 10-weeks observation. The deployed and estimated settled positions of the OBEMs are listed in Table 5-1-1-1. For all the recovered OBEMs, the radio beacon was worked successfully. Flashing lights were not necessary to work because of the recoveries were done in daytime.

We failed the positioning of the other two OBEMs at sites NWP0501 and NWP0502, which were deployed for one-year observation. For site NWP0502, OBEM-JM5 never responded to the calls from vessel although the attempts were done near the deployment point and at eight locations where two nautical miles apart from the deployment points. Possible causes of the failure are: 1) Failure of any part of the acoustic communication system equipped on the OBEM, such as transducer, transponder, cable, and battery, and 2) The OBEM was not there. It might drift far away by strong ocean current when it was deployed or by the anchor was released because of unknown reason.

For site NWP0501, we acquired the responses from the OBEM-JM6 but couldn't measure the slant range because the responses are too weak. Water depth of the area is shallower than those for the other sites. Seastate was good. Thus, we doubt that the acoustic system of the OBEM was something wrong and decided to recover the OBEM.

The SSBL system started catching the response from the OBEM when it was ascending around 1600 m depth. The OBEM was successfully recovered. We did not find any critical reason of the weak response from tests and checks of the acoustic system on board. Further investigations with the maker should be required.

The estimated settled positions of the OBEMs at sites NWP0501, NWP0503, and NWP0505 are more than 1 km away from the deployment positions because of fast ocean current in the area. For example, in the area of site NWP0505, the current was more than 2 knots per hour during the recovery task. Because the OBEM-JM1 at site NWP0505 equips the acoustic communication system by Nichiyu Giken, which the SSBL system is not available, it took about one hour to find the OBEM since it surfaced. Checking ocean current and positioning during deployment cruise should be done for easy recovery of OBEM although we didn't have enough time for it in the previous cruise.

5-1-3. Acquired data, magnetotelluric analyses and the preliminary results.

The basic information of acquired data is shown in Table 5-1-3-1. The built-in clocks had gained about few to a few tens seconds in 3 months, which were drastically improved the precision than the previous results. Figure 5-1-3-1 shows electromagnetic and tilt field variations at each site. Although unidentified step, rectangular and outlier noises are superimposed on electric field, generally good data have been acquired except those at NWP0505. Obvious three geomagnetic pulsations are recorded well in the first month and electric field variations are also clearly collected corresponding to the activities. The magnetic field variations are almost acquired well. The tilt field data at all sites except NWP0504 are also fine. The tilt field data of NWP0504 have a drift, which was detected by that the geomagnetic field with the tile correction was implausible. The tilt field data at all sites except NWP0504 were fine.

For the magnetotelluric analyses, the electromagnetic fields acquired on the observation coordinates were converted into those on the geographic coordinate; After tilt field corrections, the horizontal coordinates were rotated so that the declinations during a quiet day are consistent with those of the 10^{th}-generation of IGRF. The quiet day was set to 13:00-15:00 on 26^{th} May, 2005, UTC. Figure 5-1-3-2 shows magnetotelluric (MT) apparent resistivity and phase responses. The MT impedance tensors were calculated by using the robust estimation code (Chave et al., 1987). MT impedance tensor, apparent resisitivity (ρ ij) and phase (ϕ ij) responses are defined as follows,

$$\begin{bmatrix} E_x \\ E_y \end{bmatrix} = \begin{bmatrix} Z_{xx} & Z_{xy} \\ Z_{yx} & Z_{yy} \end{bmatrix} \begin{bmatrix} H_x \\ H_y \end{bmatrix}, \ \rho_{ij} = 0.2T\left|Z_{ij}\right|^2, \ \phi_{ij} = Arg(Z_{ij})$$

,where i, j = x or y, T is period. Index x and y means north-south and east-west directions, respectively. E, H denotes the Fourier demodulations of electric and magnetic fields. Impedance elements, Zij are complex values. Fine MT responses were obtained between 1000 and 10^5 seconds in period. Getting guidelines of the modeling electrical conductivity distribution, a dimensionality analysis was carried out by using MT phase tensor (Caldwell et al., 2004). Figure 5-1-3-3 shows the arc tangents of the principal phase tensor elements ($\tan^{-1}(\Phi min)$, $\tan^{-1}(\Phi max)$) and angle β. If we write MT impedance tensor as Z = X+iY, phase tensor $\mathbf{\Phi}$, angle β and principal phase tensor elements are defined as follows.

$$\mathbf{\Phi} = \begin{bmatrix} \Phi_{11} & \Phi_{12} \\ \Phi_{21} & \Phi_{22} \end{bmatrix} = \mathrm{X}^{-1}\mathrm{Y}, \ \beta = 0.5\tan^{-1}\left(\frac{\Phi_{12} - \Phi_{21}}{\Phi_{11} + \Phi_{22}}\right)$$

$$\Phi_{\min} = \sqrt{\Phi_1^2 + \Phi_3^2} - \sqrt{\Phi_1^2 + \Phi_3^2 - \Phi_2^2}, \Phi_{\max} = \sqrt{\Phi_1^2 + \Phi_3^2} + \sqrt{\Phi_1^2 + \Phi_3^2 - \Phi_2^2}$$
$$\Phi_1 = tr(\mathbf{\ddot{O}}), \Phi_2 = \sqrt{\det \mathbf{\ddot{O}}}$$

If the angle β almost zero, regional conductivity distribution is 1-D or 2-D. Otherwise, the distribution is 3-D. In the former case, Φmin and Φmax are equivalent if the distribution is 1-D. Unfortunately, calculated 95 % confidence limits of principal phase elements are very large. However, the dimensionality analysis by the phase tensor indicates that the regional 1-D or 2-D modeling is valid for these MT response data between 1000 and 10000 seconds in period. Hence, we treated the MT response in this frequency range and modeled a 1-D conductivity structure.

For 1-D modeling, we used the Occam (Constable et al., 1987) and ρ + (Parker and Booker, 1996) inversion techniques. The Berdichevsky's average apparent resistivity and phase responses were inverted. The Berdichevsky's average impedance is

$$Z_{av} = \frac{Z_{xy} - Z_{yx}}{2}$$

The error floor was set to 5 % of apparent resistivity.

The smoothness constraint of 1st or 2nd derivative of conductivity structure along depth is imposed in the Occam inversion. Figure 5-1-3-4 represents the RMS misfit attitudes under the Occam inversion process. The criteria of finishing the inversion process were RMS<=1.0. The inversions for the data at NWP0501 and 0505 did not converge.

The ρ + inversion diagnoses whether 1-D model exist so as to explain MT data. In other words, the ρ + inversion tests the necessary condition of one-dimensionality of MT data. The ρ + inversion revealed that the data except those at NWP0505 fulfilled the necessary condition of one-dimensionality. Here, the boundary condition of the earth's surface was set to the conductor.

We show the obtained 1-D models and the fitness of the data at NWP0501, 0503, 0504 and 0506 in Figure5-1-3-5 and 5-1-3-6. The Occam models indicate that conductivity value starts to increase at 50 km in depth and the depth where the conductivity achieves the maximum value is about 120-130 km. On the other hand, the conductance delta functions, which mean the existence of the boundary where the conductive layer underlies the resistive one, locate in 100-130 km. The conductivity of
the layer is about 0.1 S/m (resistivity is 10 Ωm) and its conductance is about

10000 S. Consequently, the obtained 1-D conductivity models indicate that the lithosphere/asthenosphere boundary exists 100-130 km in depth and the conductivity of the asthenosphere is about 0.1 S/m.

References

Caldwell, T. G., H. M. Bibby and C. Brown, The magnetotelluric phase tensor, Geophys. J. Int., 158, 457-469, 2004.

Chave, A. D., D. J. Thomson and M. E. Ander, On the robust estimation of power spectra, coherencies and transfer functions, J. Geophys. Res., 92, 633-648, 1987.

Constable, S. C., R. L. Parker and C. G. Constable, Occams inversion: A practical algorithm for generating smooth models from electromagnetic sounding data, Geophysics, 52, 289-300, 1987.

Parker, R. L. and J. R. Booker, Optimal one-dimensional inversion and bounding of magnetotelluric apparent resistivity and phase measurements, Phys. Earth Planet. Inter., 98, 269-282. 1996.

Table 5-1-1-1. Deployed and estimated settled position of OBEMs. The positions of OBEM JM5 and JM6 were not determined because of failure of acoustic communication. The position of OBEM-JM6 listed in the table is obtained by SSBL when the OBEM was ascending at around 1600 m depth, which is thought to be close to the settled position.

Site (OBEM ID)	Deployed position (WGS-84)			Estimated settled position (WGS-84)		
	Latitude	Londitude	Depth	Latitude	Londitude	Depth
NWP0501 (JM6)	N 36° 59.91'	E 145° 59.89'	5590 m	~ N 37° 00.56'	~ E 145° 59.15'	****
NWP0502 (JM5)	N 37° 07.7894'	E 150° 46.7174'	5993 m	****	****	****
NWP0503 (JM2)	N 36° 50.3875'	E 149° 23.3335'	6006 m	N 36° 51.0091'	E 149° 23.7309'	5969 m
NWP0504 (JM4)	N 37° 51.3508'	E 148° 42.9327'	5848 m	N 37° 51.3418'	E 148° 42.7679'	5662 m
NWP0505 (JM1)	N 38° 31.7691'	E 150° 19.7083'	5575 m	N 38° 31.0976'	E 150° 19.1280'	5542 m
NWP0506 (TT8)	N 37° 29.8059'	E 149° 45.2235'	5971 m	N 37° 29.9836'	E 149° 45.4472'	5947 m

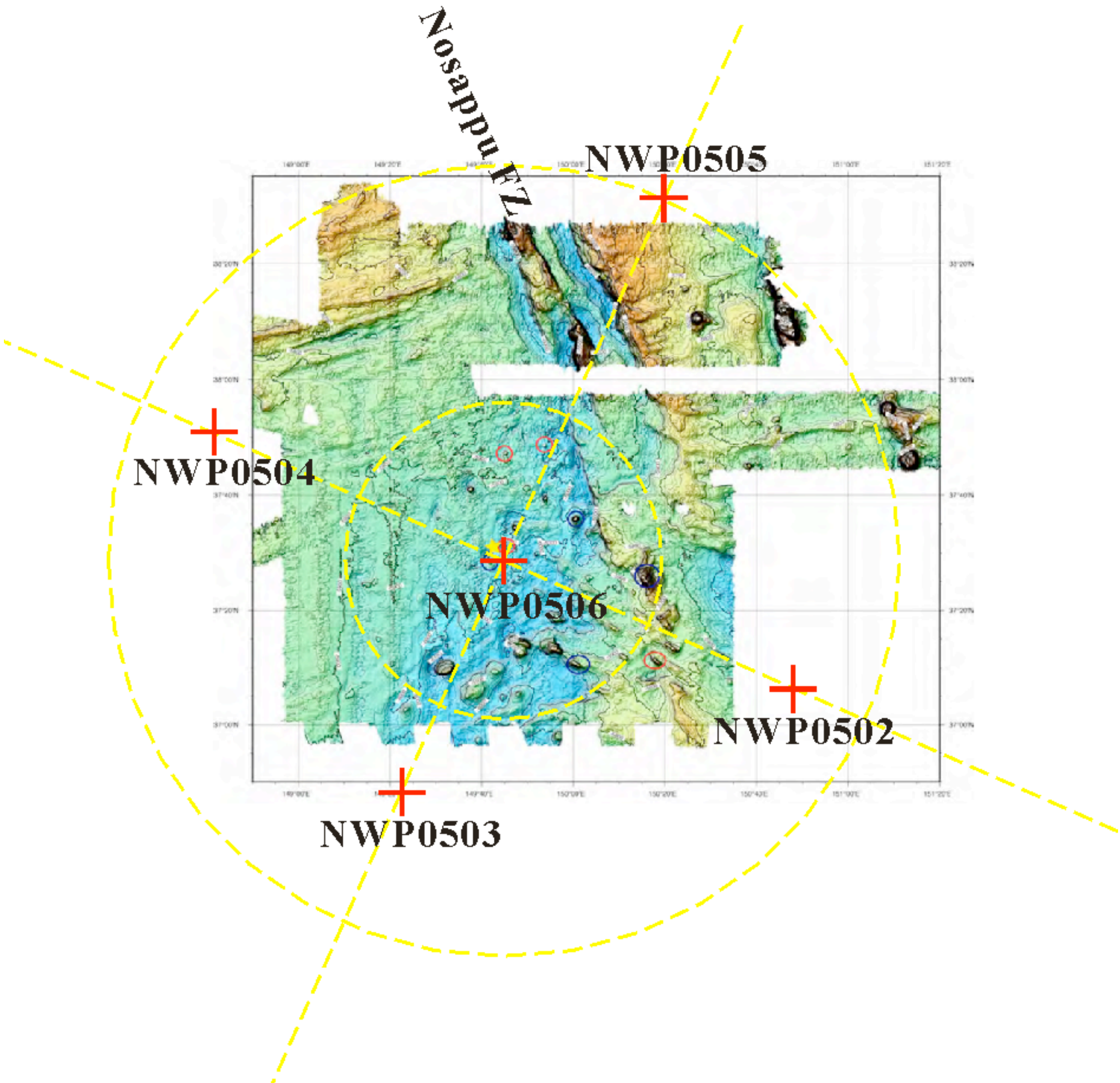


Figure 5-1-1-1. Site locations of OBEMs for 10-weeks seafloor MT observation, superimposed on bathymetric map. Red crosses are the locations where OBEMs were deployed during the cruise “R/V Yokosuka YK05-06”. Dashed lines are the directions parallel to and perpendicular to the Pacific plated motion and the circles centering on Yukawa knoll with diameters of 100 km and 250 km, respectively.

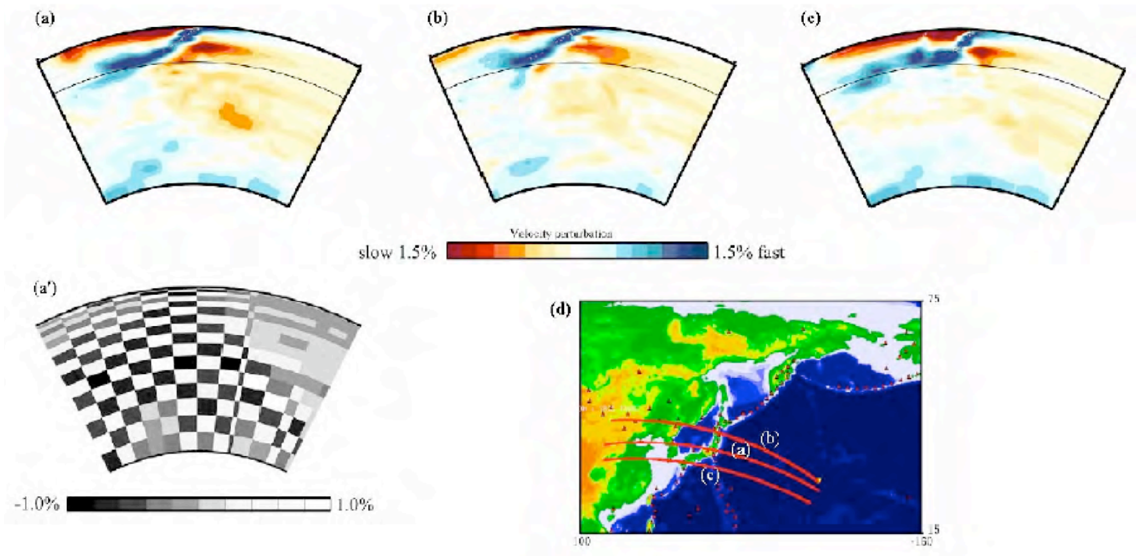


Figure 5-1-1-2. Seismic P-wave tomography model by Obayashi and Fukao (2001). Three sections (a, b, and c) are taken from the global model. The result of resolution test for the section (a) is shown in (a'). The locations of the sections are indicated in the map (d).

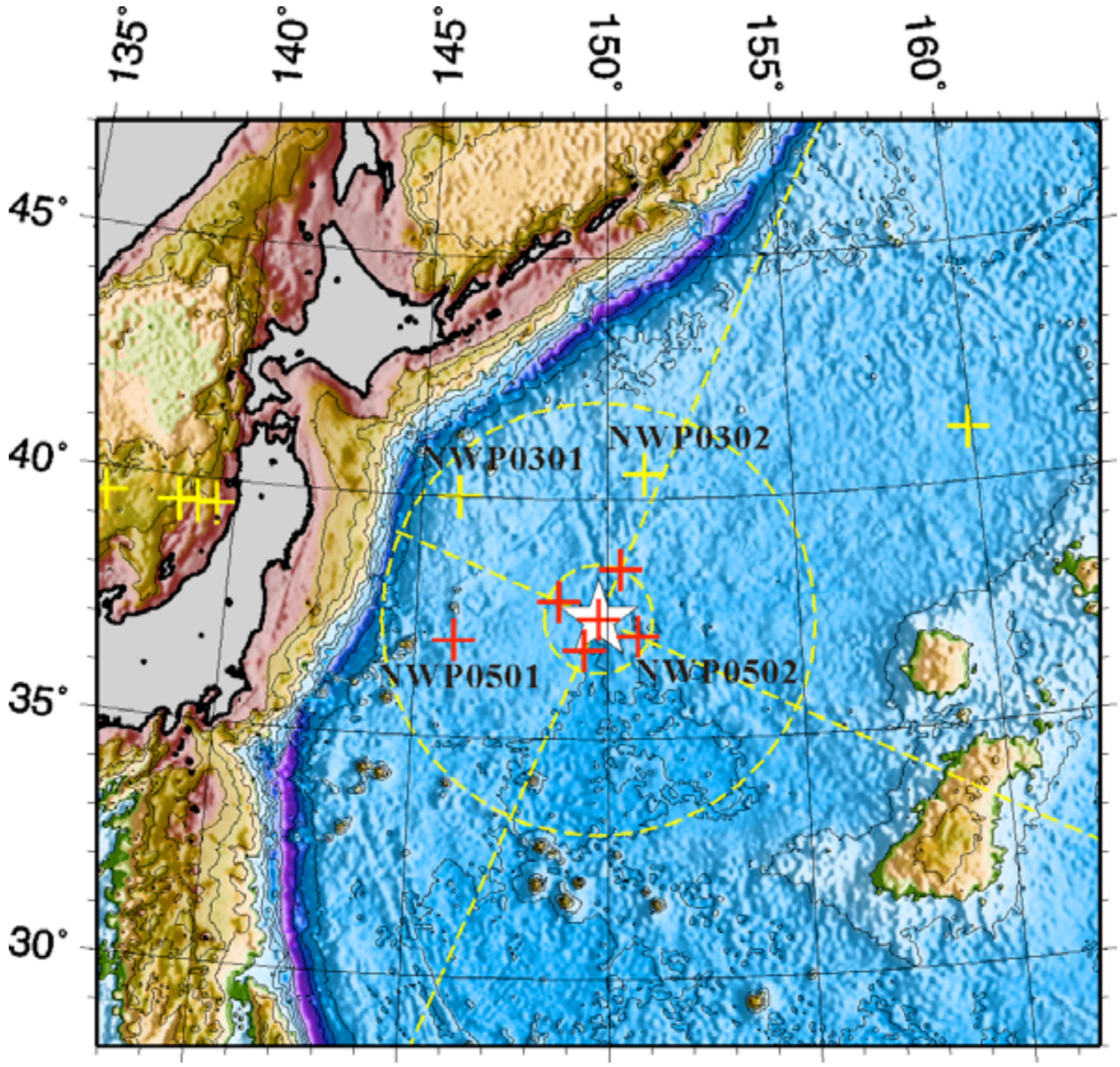


Figure 5-1-1-3. Regional bathymetry map and MT site locations in northwestern Pacific Ocean. The contour interval is 1000 m. Red crosses are the OBEM sites deployed during the cruise “R/V Yokosuka YK05-06”. Yellow crosses are the sites where MT data were collected in previous experiments. Star indicates the location of Yukawa knoll, where the fresh alkali basalts were discovered. Dashed lines indicate the directions parallel to and perpendicular to the current motion of the Pacific plate and circles centering on Yukawa knoll with diameters of 1000 km and 250 km, respectively.

Table 5-1-1-1. Basic information of the obtained OBEM data.

Site No.	Sampling Interval	First Sampling (UTC)	Last Sampling (OBEM clock in UTC)	Time mark comparing	
				GPS Clock (UTC)	OBEM Clock (UTC)
NWP0501	60 sec	00:01, 22 May, 2005	5:04, 11 Aug, 2005	5:06:00, 11 Aug, 2005	5:06:10, 11 Aug, 2005
NWP0503		00:01, 22 May, 2005	3:06, 5 Aug, 2005	3:08:00, 5 Aug, 2005	3:08:02, 5 Aug, 2005
NWP0504		00:01, 22 May, 2005	22:20, 2 Aug, 2005	22:23:00, 2 Aug, 2005	22:23:20, 2 Aug, 2005
NWP0505		00:01, 22 May, 2005	3:16, 7 Aug, 2005	3:18:05, 7 Aug, 2005	3:18:11, 7 Aug, 2005
NWP0506		00:01, 22 May, 2005	6:09, 3 Aug, 2005	6:13:00, 3 Aug, 2005	6:13:02, 3 Aug, 2005

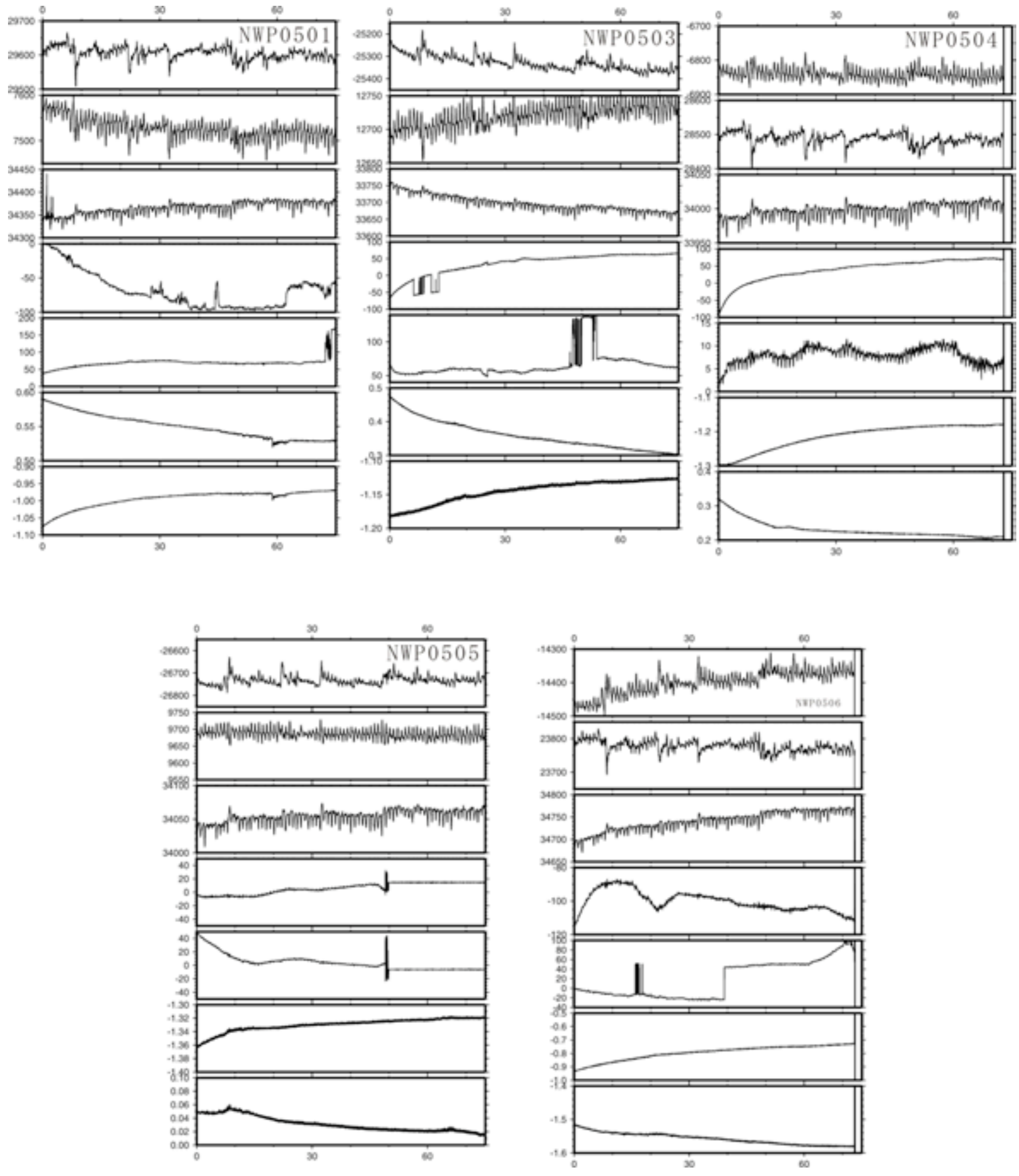
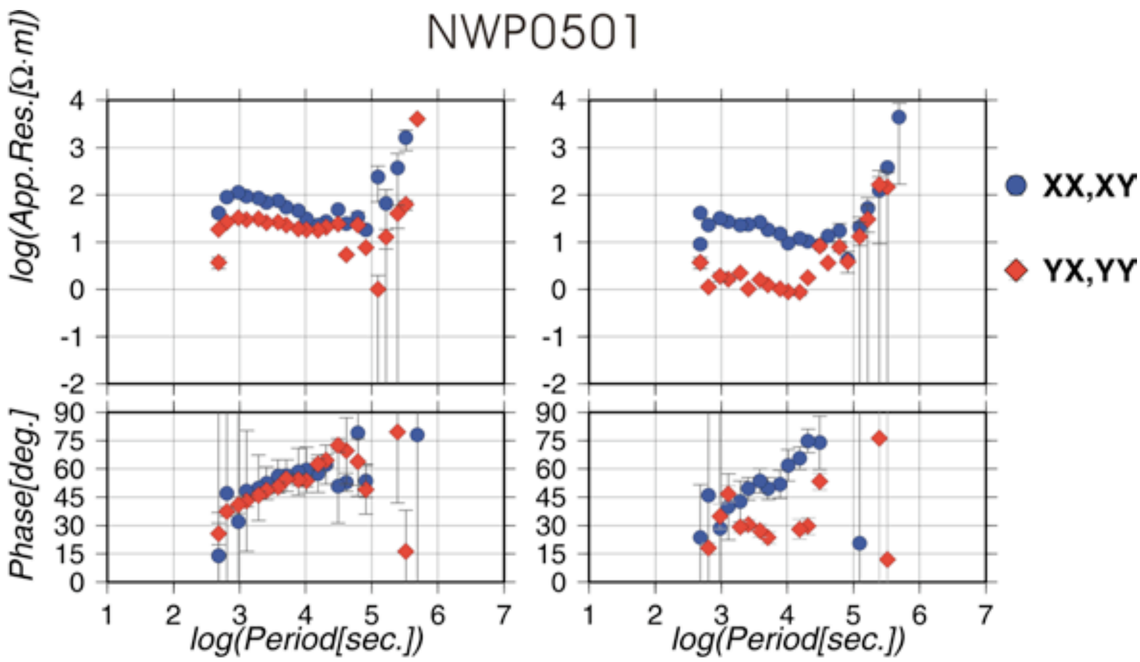
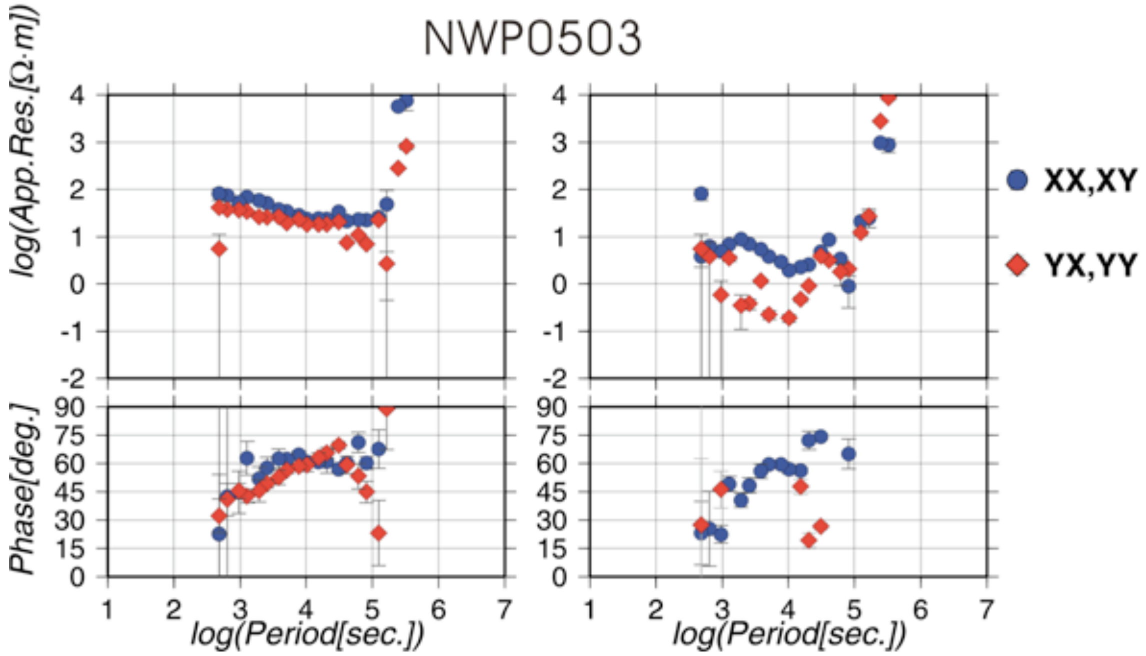
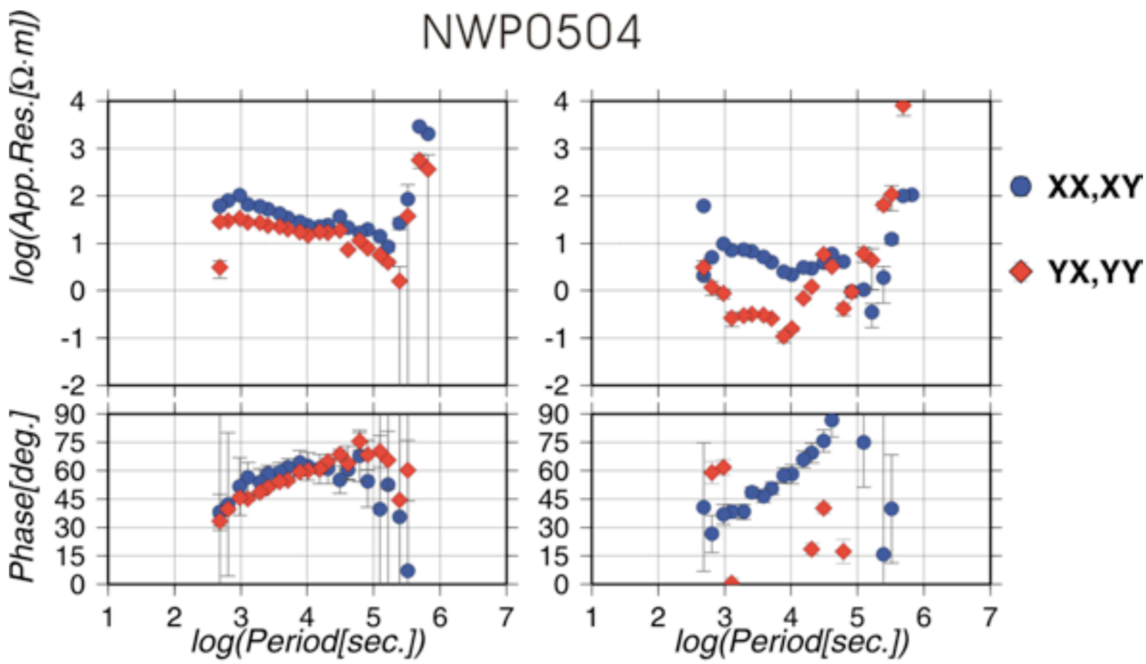


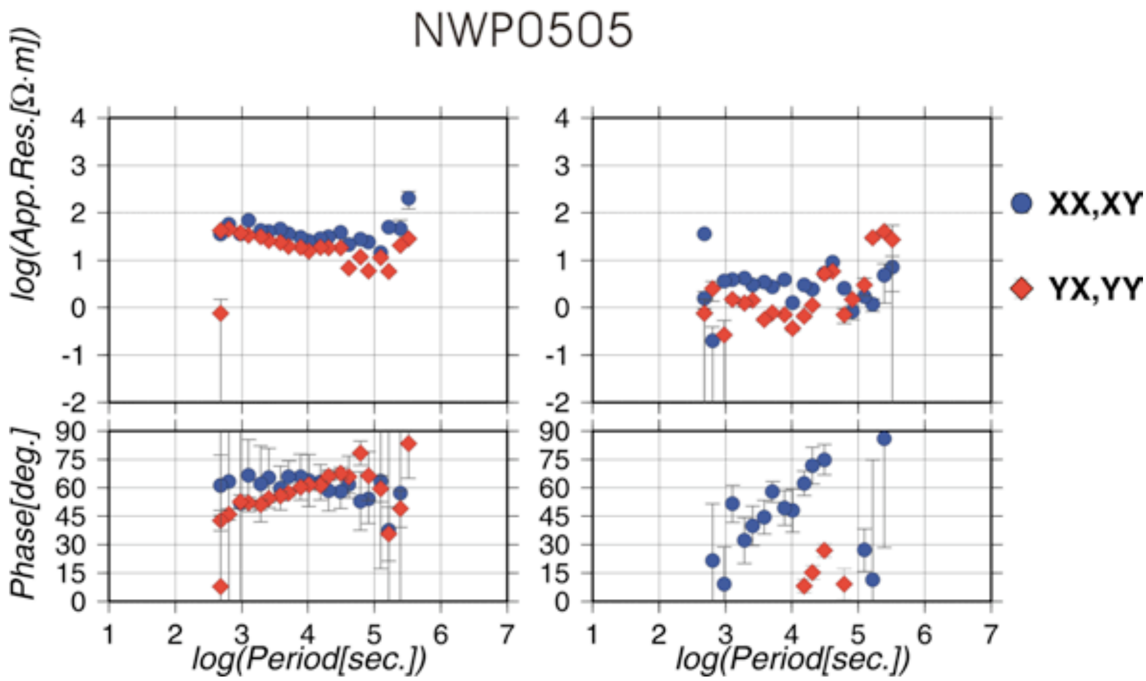
Figure5-1-3-1 Electromagnetic field and tilt field data on the observed coordinates. The unit of lateral axis is days and the start point is 22nd May, 2005. The sequence of the figures is 2 components of horizontal magnetic field (unit in nano-Tesla), vertical magnetic field (nano-Tesla), 2 components of horizontal electric field (mV/km) and 2 components of horizontal tilt field (degree) from top to bottom.







NWP0504
log(App.Res.[Ω·m])
Phase[deg.]
log(Period[sec.])
XX,XY
YX,YY



NWP0505
log(App.Res.[Ω·m])
Phase[deg.]
log(Period[sec.])
XX,XY
YX,YY

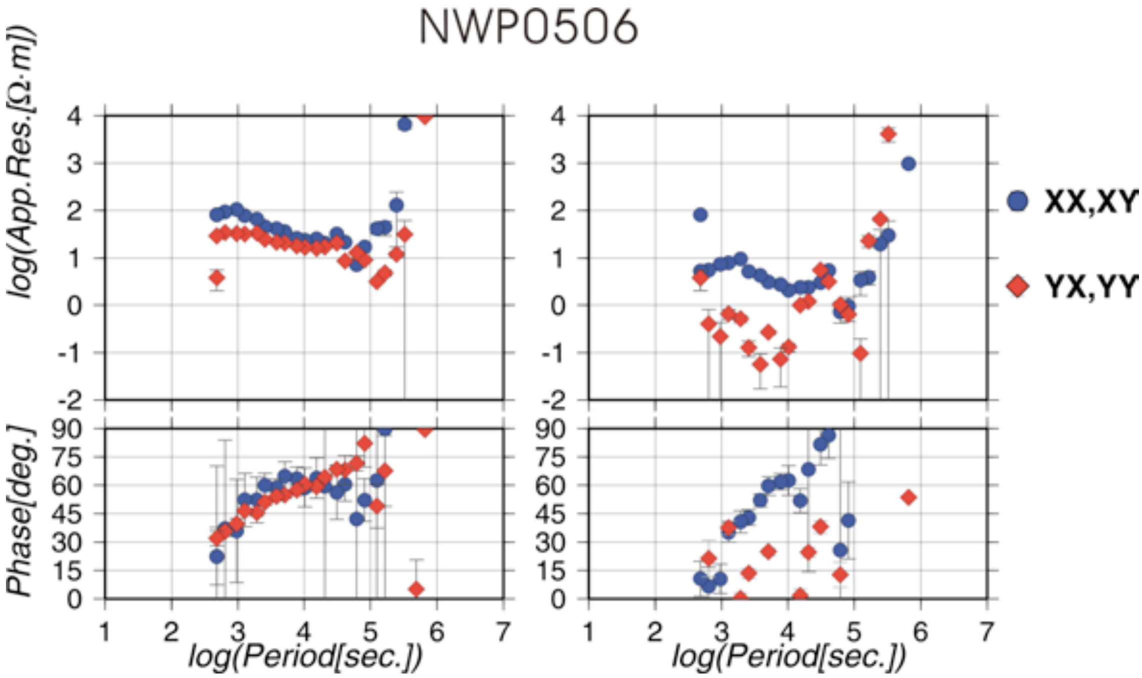


Figure5-1-3-2 MT apparent resistivity and phase responses at each site. The left hand side figures shows the MT responses calculated from the non-diagonal impedance tensor component. The X-axis is North-South direction (North positive) and Y is East-West direction (East positive).

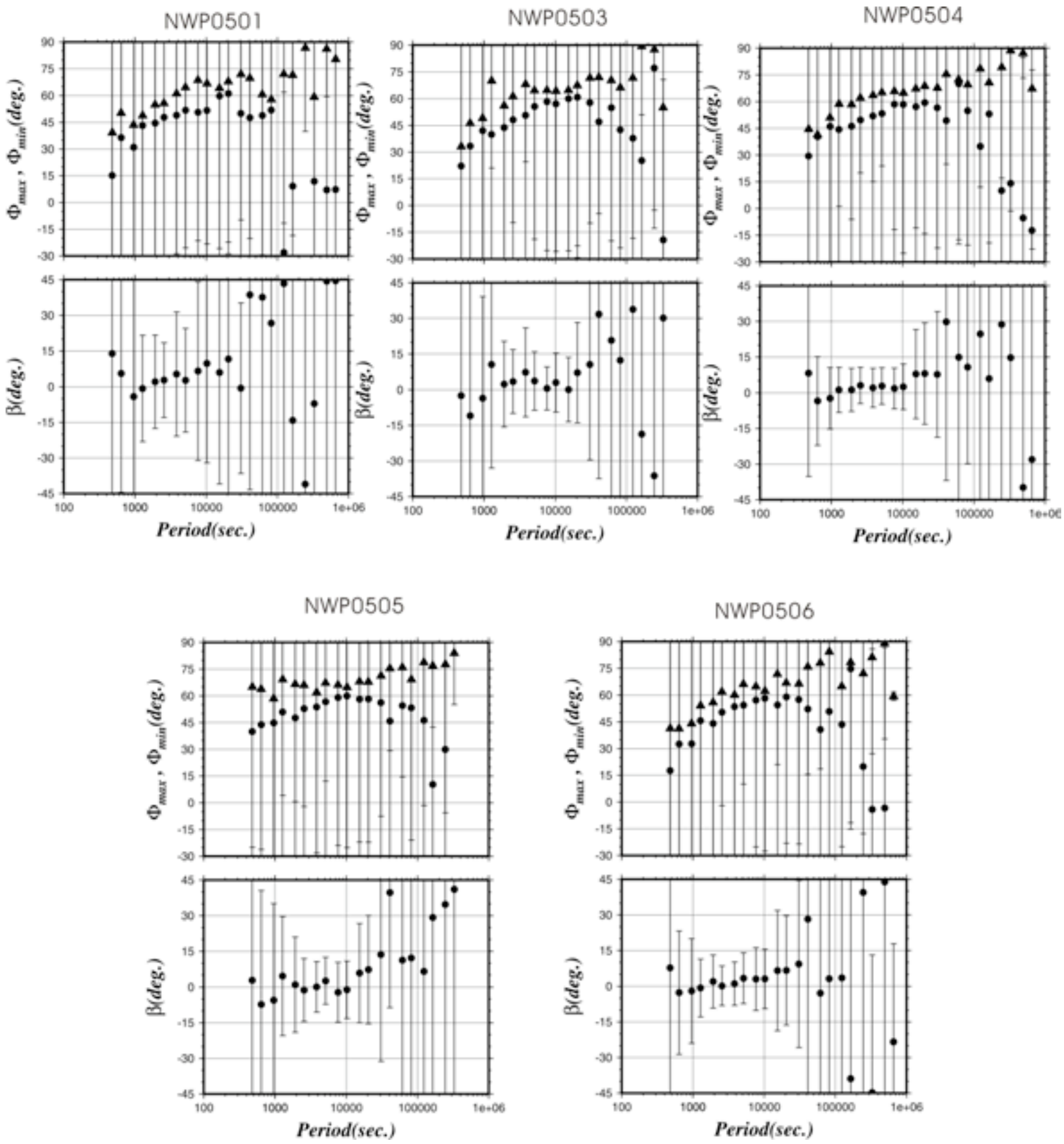
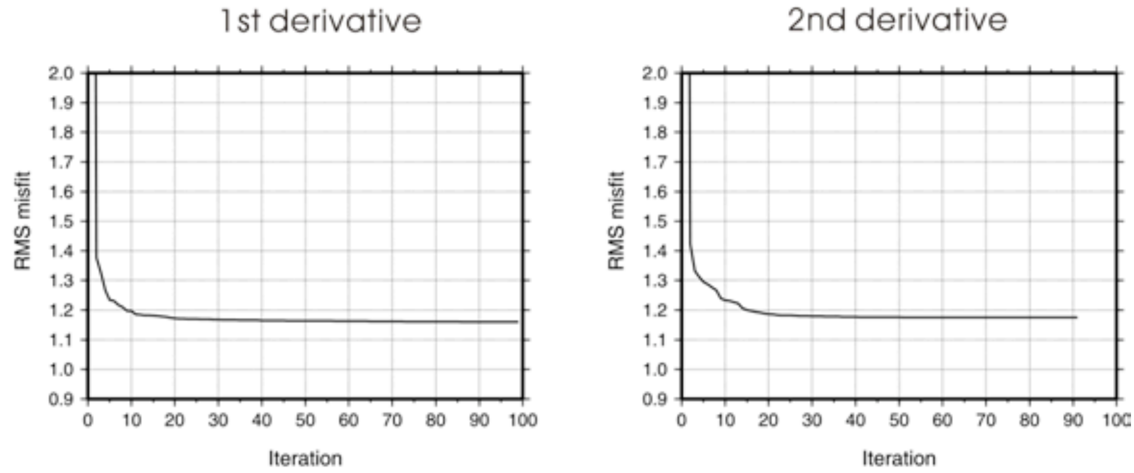
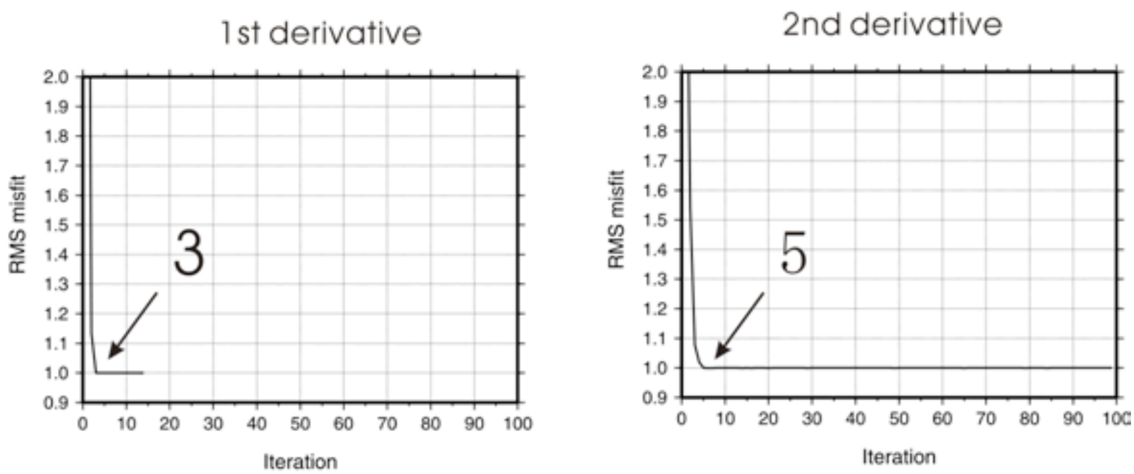


Figure5-1-3-3 Arc tangents of the principal elements and the angle β of the MT phase tensors. See text for details.

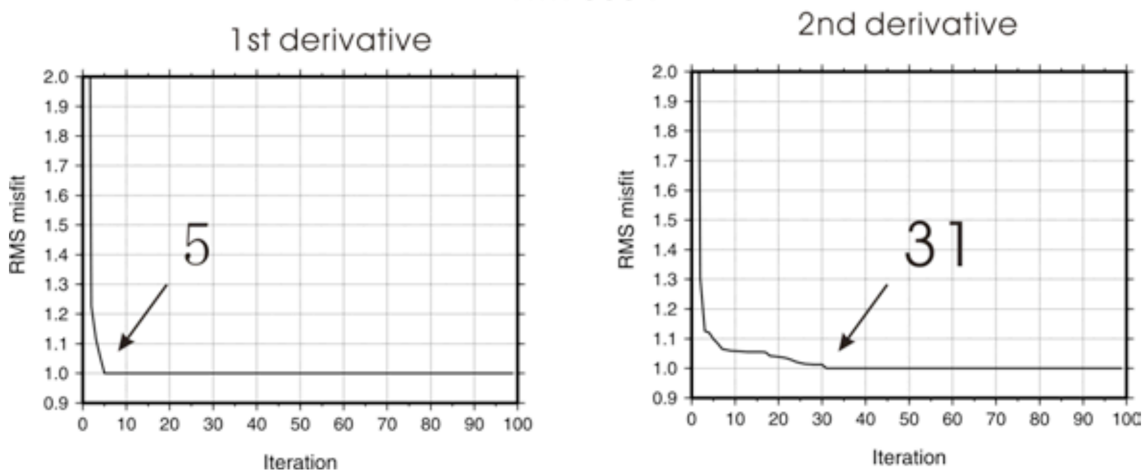
NWP0501



NWP0503



NWP0504



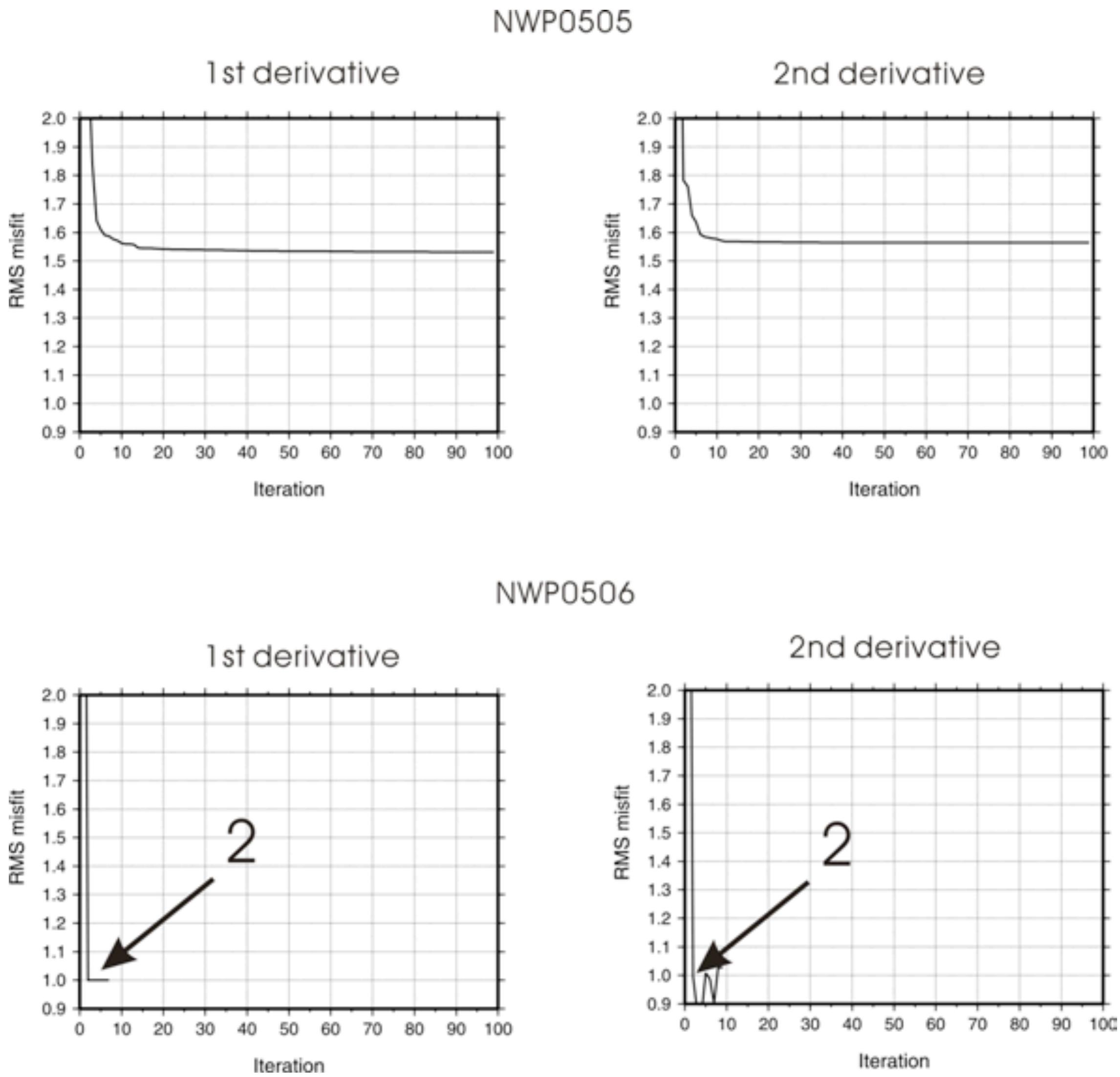


Figure5-1-3-4 Fitness changes along the Occam inversion processes. The arrows and accompanied numbers represent the iteration number where the final models were obtained.

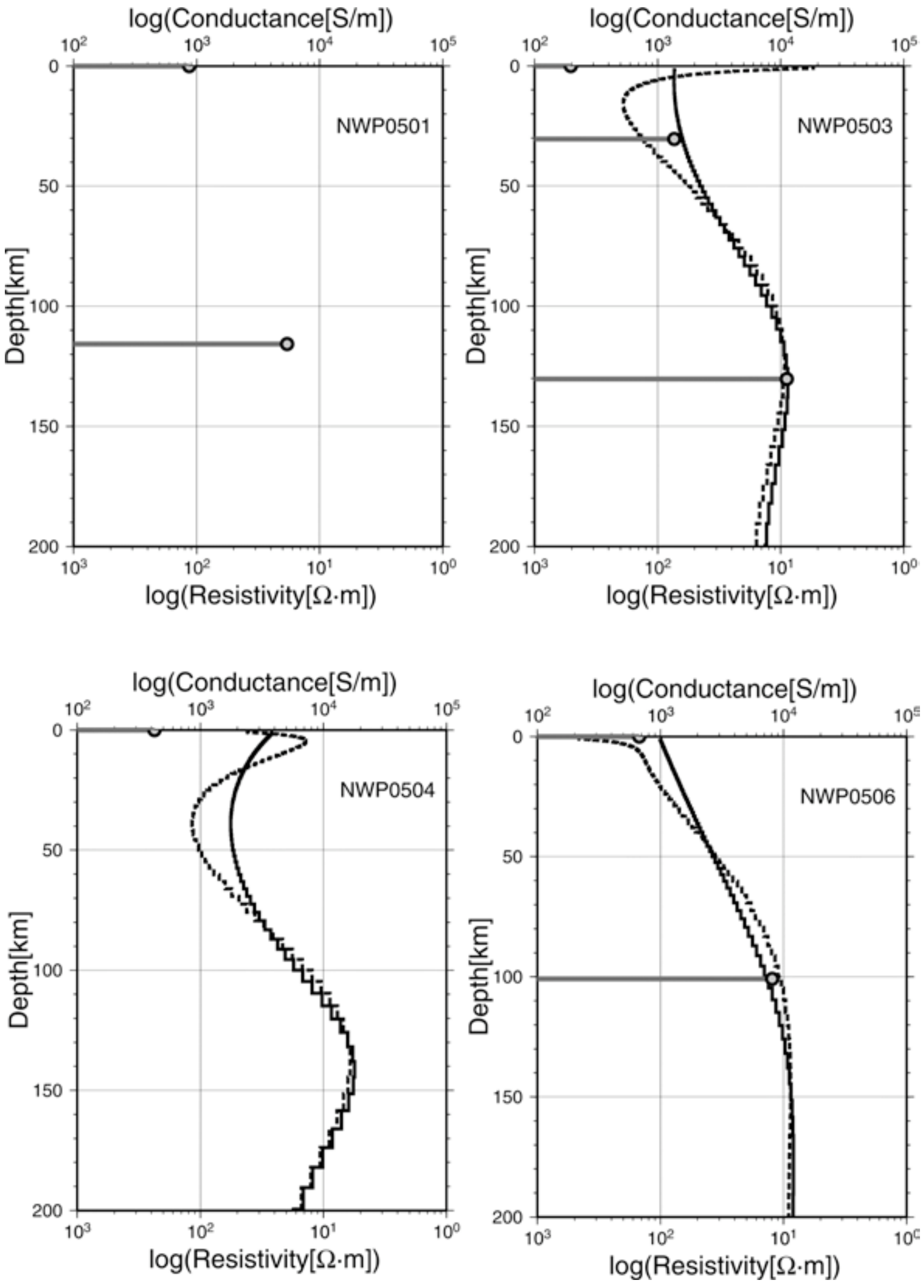
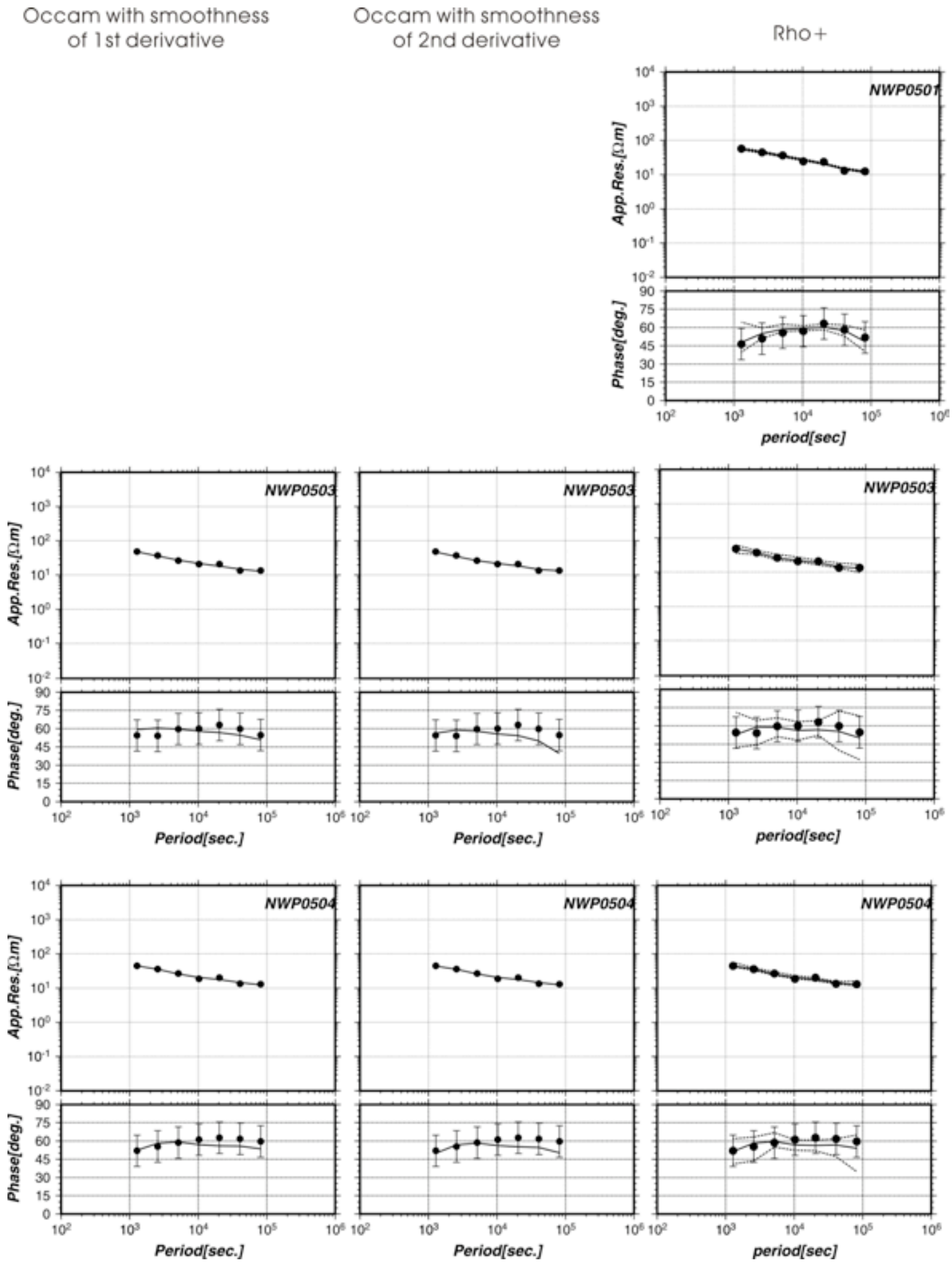


Figure5-1-3-5 1-D resistivity (reciprocal of conductivity) models obtained by the Occam inversion and 1-D conductance models obtained by the $\rho+$ inversion. Solid and dotted lines show the 1-D resistivity models obtained with the smoothness constraint of 1st and 2nd derivatives, respectively. The conductance delta functions at NWP0504 exist deeper than 300 km in depth.



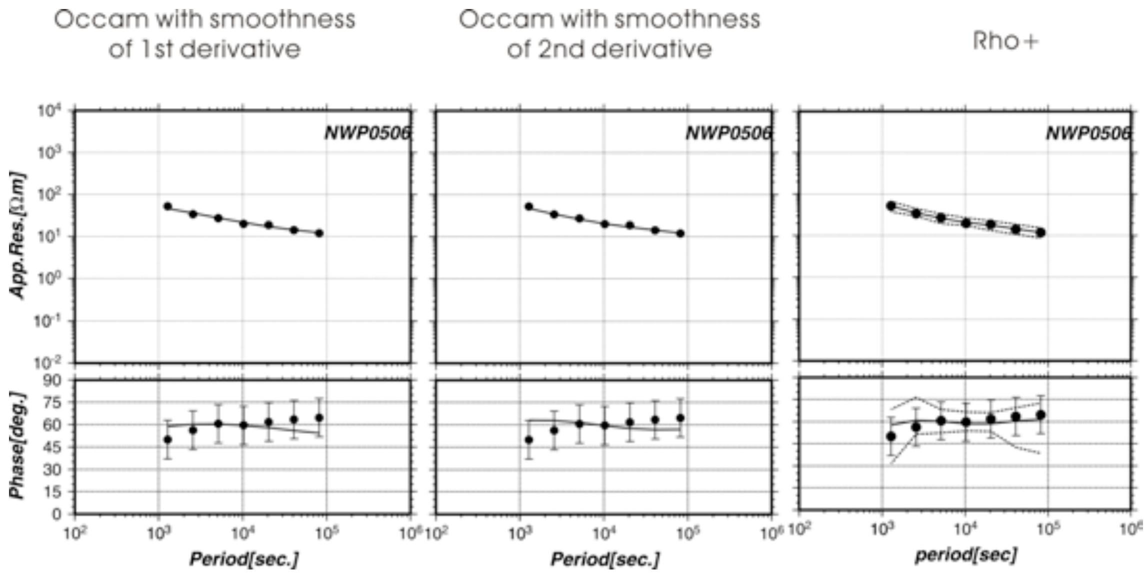


Figure5-1-3-6 Fit of the MT responses calculated from the 1-D models to the observed ones. Solid lines show the synthetic responses and close circles are observed ones. The 95 % confidence limits of the responses calculated from the 1-D conductance model are also shown in the figures of the ρ + inversion (thick dotted lines).

5-2. Piston Core

by Suzuki & Mori

5-2-1. Purpose of Piston Core study

Sedimentary process of the surface sediments, petit Spot Knolls, off Northern Japan Trench

Our study purpose using piston cores is to understand 1) sedimentary processes and 2) compaction processes of the sediments near the knolls and flat sea-floor surface of the Pacific plate. Those factors might reflect the subjacent mysteriously young volcanisms on the Pacific plate.
1) We expect to recover volcanic fragment layers, which are supplied by volcanic activities from the knoll. This records growth history of the knoll. To read the detailed history, we will study event sediment description, mineral composition and age determination of sediments. Furthermore, we will study sedimentation rate of the core samples using biostratigraphy and paleomagnetism. It plays an important role in interpretation of the side scan data, which shows rigid surface (e.g. lava) being probably consistent with young volcanisms. The lavas are buried progressively by long-term pelagic sedimentation. We would like to understand relationship between the side scan intensity and the sediment cover degree.
2) We would like to study compaction processes of the pelagic sediments using physical properties measurements and microfabric analyses. The physical properties and microfabrics in the pelagic sediments change progressively during burial compaction. We consider that the pelagic environment is one of the best fields for the compaction study because of steady state conditions without any significant tectonic events.

5-2-2. Site PC#01

Date: 18 July: time 10:00-13:47
Location: flat plane on the Pacific Plate apart from the Yukawa Knoll
Position: 150°18.50’, 37°16.84’
Water depth: 5731 m
Total length recovered, ma in, 250 cm: pilot, 73 cm
Major Lithology: hemipelagic mud

The coring site for PC-01 is carried out on the flat plane of the NW Pacific sea floor. This site sediment is thought to deposit slowly and steadily. The dominant lithology of sediments of PC-01 is characterized four parts from the top: dull brown clay, yellowish brown clay, dull yellow orange clay and grayish brown clay, respectively.

The dull brown clay is composed of faintly laminated brownish black clay layer. The grayish brown clay contains black burrow, clasts and many layer structures in visual inspection. Black colored mud layers are observed at 135-136 cm and 138 cm.10 cm core from the top has soupy. 10 cm core from the bottom is disturbed by flowing.

Description:

Siliceous biogenic slightly tuffaceous pelagic clay with several mud layers.
Most of the muddy or clayey sediments during this cruise are almost the same, with some variety of the degree of contents of siliceous fossils, their state of dissolution.

Operation

We started operation at 9:35, and lowering the system at 10:00. After 5670 m wire out, the winch was stopped to lock the heaving damper to measure water temperature at 11:53 for 10 min, 5732 m in water depth, and then started out again at slow speed (20 m/min). We observed a sudden decrease of wire tension at 12:04, indicating that the system hit the sea-floor. The winch was stopped to measure sediment temperature for 15 min. Winding in the wire to recover the piston core system, the maximum tension including weight of the piston core system reached 55 kN including pull out. Wire angle was almost vertical throughout the operation. At 13:47 the system surfaced and was recovered.

Smear slide examination

By smear slide examination we calculated the proportions of minerals and fossils of the piston core sediments and then graphed (Fig.). The proportion of sedimentary components was estimated by visible calculation by using microscope based on comparative percentage diagrams proposed by（Tucker, M.E., 2003, Sedimentary Rocks in the Field, The geological field guide series Third edition, John Wiley & Sons Ltd., West Sussex, 234p.）
(R, G, ROTHWELL 1989) introduced about smear slide in detail. Such a similar diagram of the smear slide examination is also used by IODP cruse to judge the

sediment component easily and rapidly on board.

5-2-2. Site PC#02

Date: 8 August: time 9:30-13:52
Location: root of the seamount south side the Yukawa Knoll
Position: 149°44.77’, 39°23.43’
Water depth: 5945 m
Total length recovered, main, 336 cm: pilot, 97 cm
Major Lithology: hemipelagic mud

The coring site for PC-02 was carried out under Yukawa Knoll on the Pacific Plate (Figure 5-11). This site sediment is thought to deposit offshore slowly and steadily. The dominant lithology of sediments of PC-02 is characterized four parts from the top: yellowish gray clay, dark grayish yellow clay, yellow brown clay and grayish olive clay, respectively (Figure 5-12). The yellowish gray clay is contains a light olive ash layer (some cm) and calcite burrows. The dark grayish yellow clay contains a hard black layer. The yellowish brown clay contains a dark greenish gray mud layer and black ash burrows. The volcanic ash is observed at 41-43 cm and 208 cm.

We took four pick up photos of each sections (Figure 5-13 to 5-16).

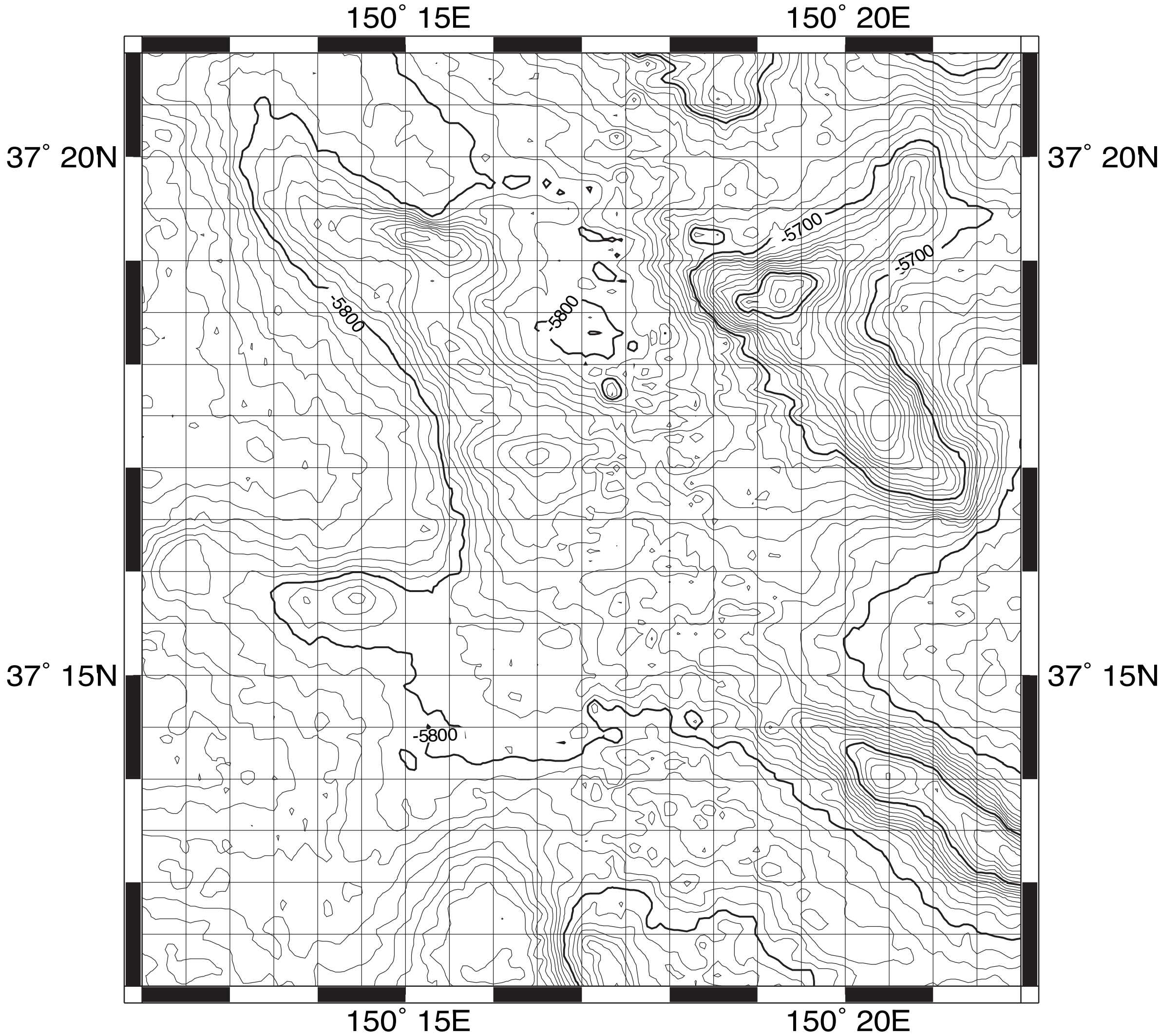
Description:

Siliceous biogenic slightly tuffaceous pelagic clay with several mud layers and an ash layer.

Most of the muddy or clayey sediments are almost the same, with some variety of the degree of contents of siliceous fossils, their state of dissolution. An ash layer at 41-43 cm is mainly composed of ash clasts (approximately 1 mm). These are almost transparent and colorless.

Operation

We started operation at 9:06, and lowering the system at 9:30. After 5860 m wire out, the winch was stopped to lock the heaving damper to measure water temperature at 11:28 for 10 min, 5947 m in water depth, and then started out again at slow speed (20 m/min). We observed a sudden decrease of wire tension at 11:42, indicating that the system hit the sea-floor. The winch was stopped to measure sediment temperature for 15 min. Winding in the wire to recover the piston core system, the maximum tension including weight of the piston core system reached 56 kN including pull out. Wire angle was almost vertical throughout the operation. At 13:30 the system surfaced and was recovered.



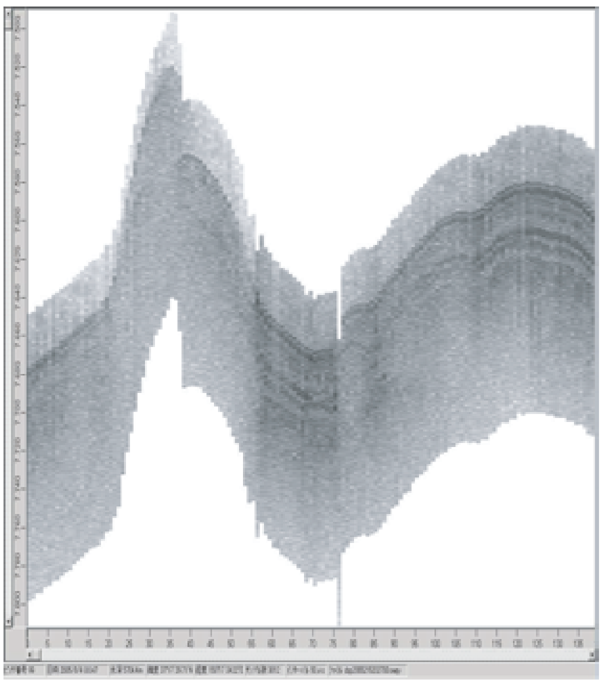


Figure. Coning site of PC-01

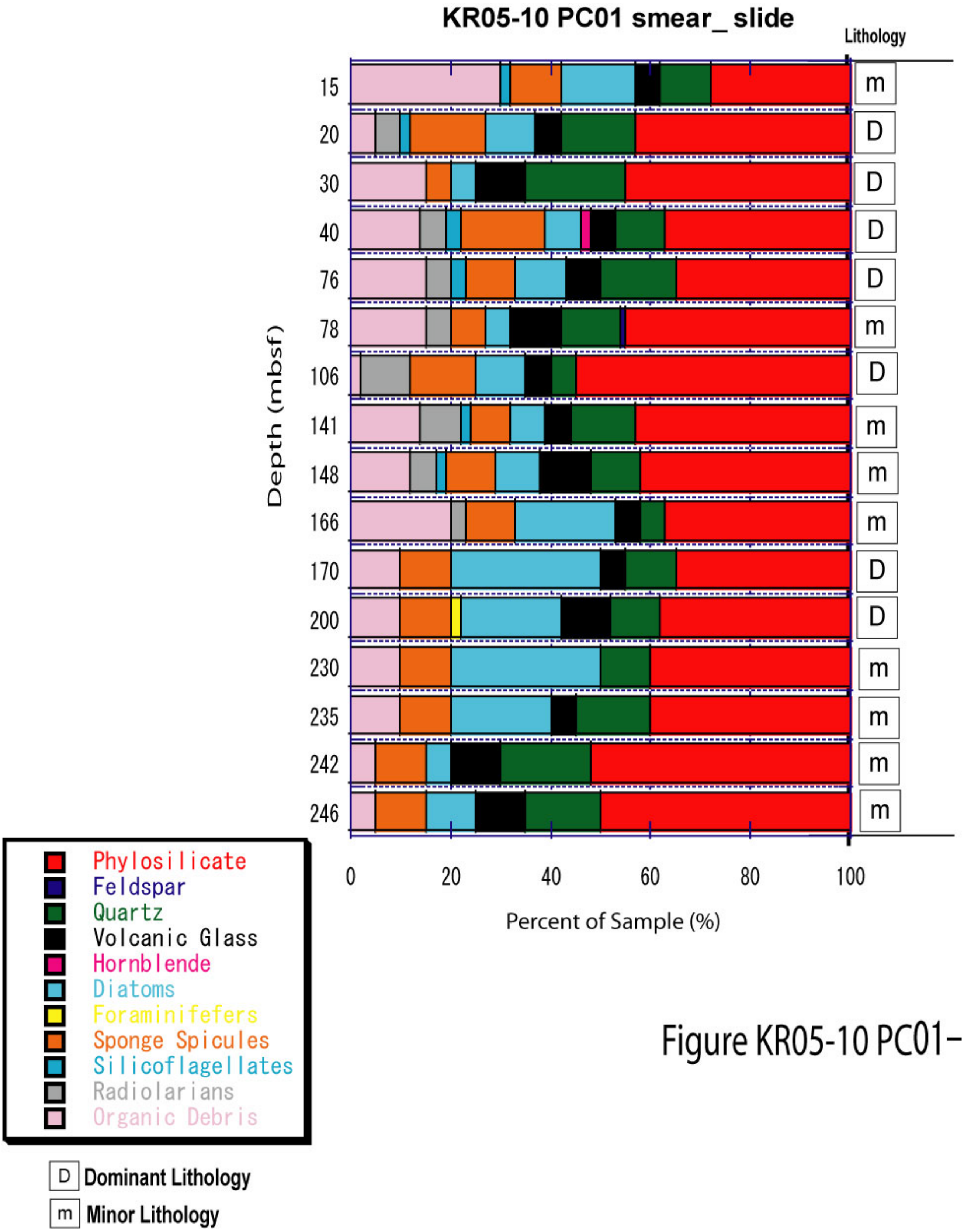
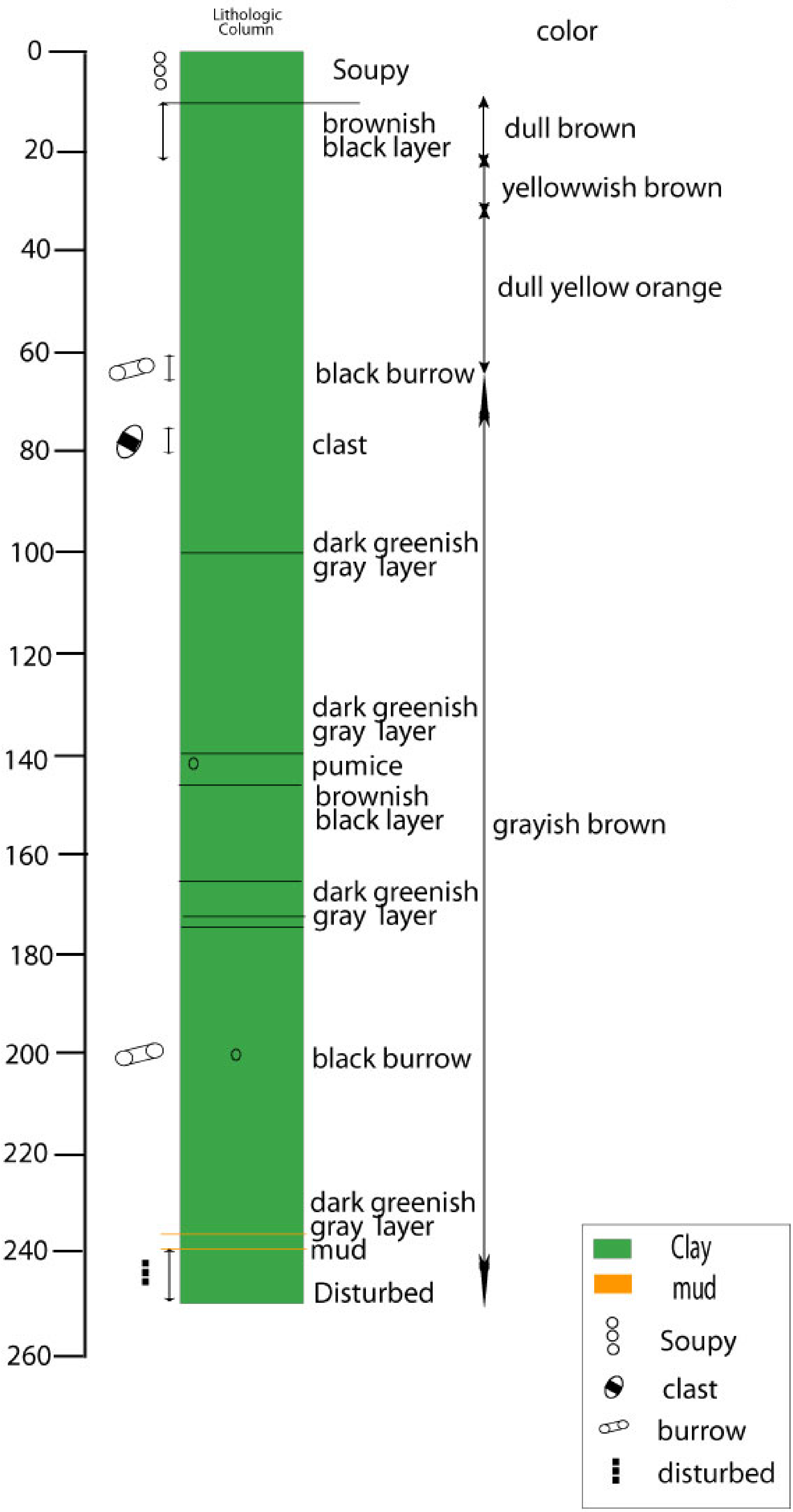


Figure KR05-10 PC01-


Lithologic Column
color
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Soupy
brownish black layer
black burrow
clast
dark greenish gray layer
dark greenish gray layer
pumice
brownish black layer
dark greenish gray layer
black burrow
dark greenish gray layer
mud
Disturbed
dull brown
yellowwish brown
dull yellow orange
grayish brown
Clay
mud
Soupy
clast
burrow
disturbed

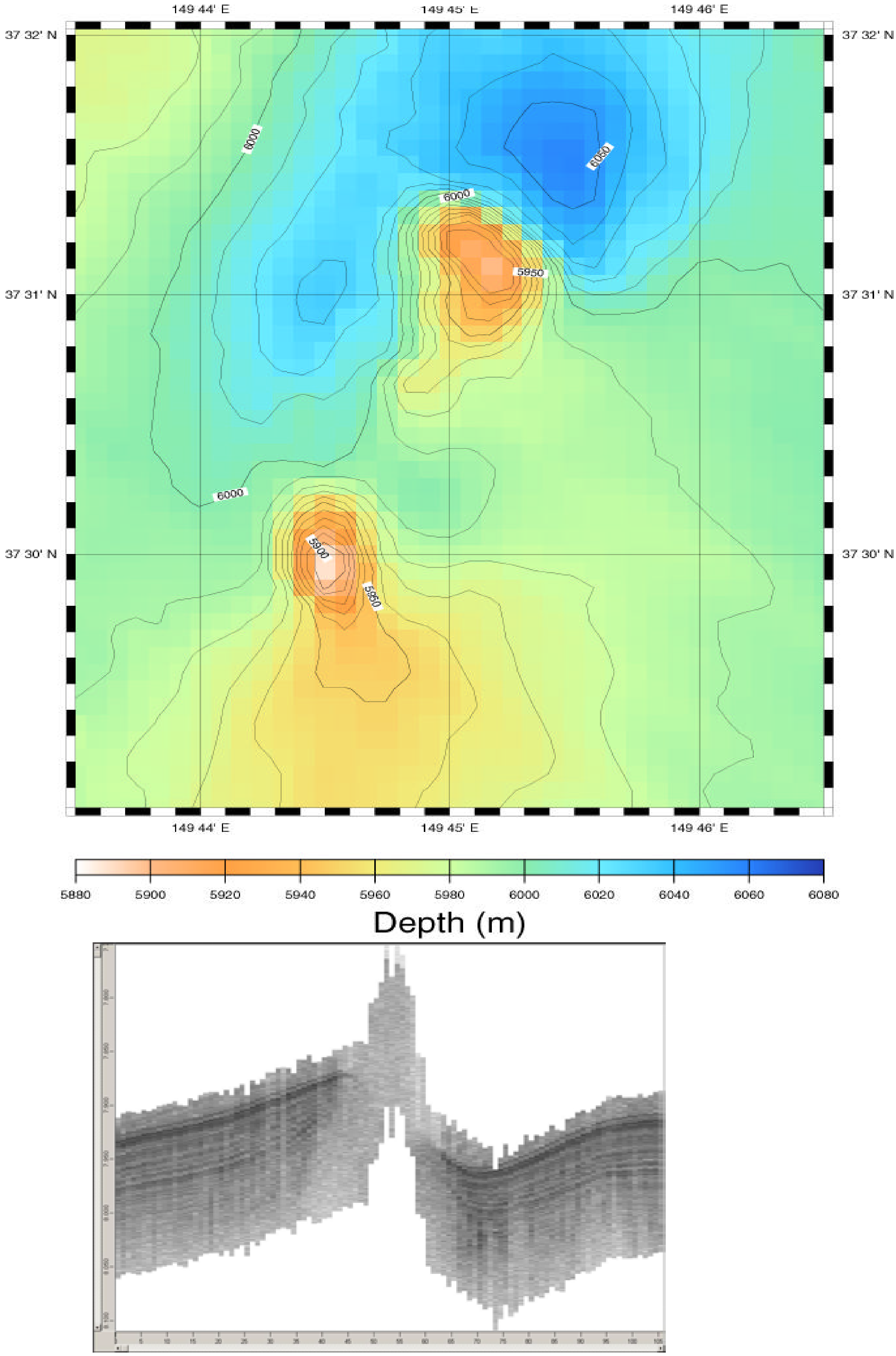


Figure Coning site of PC-02

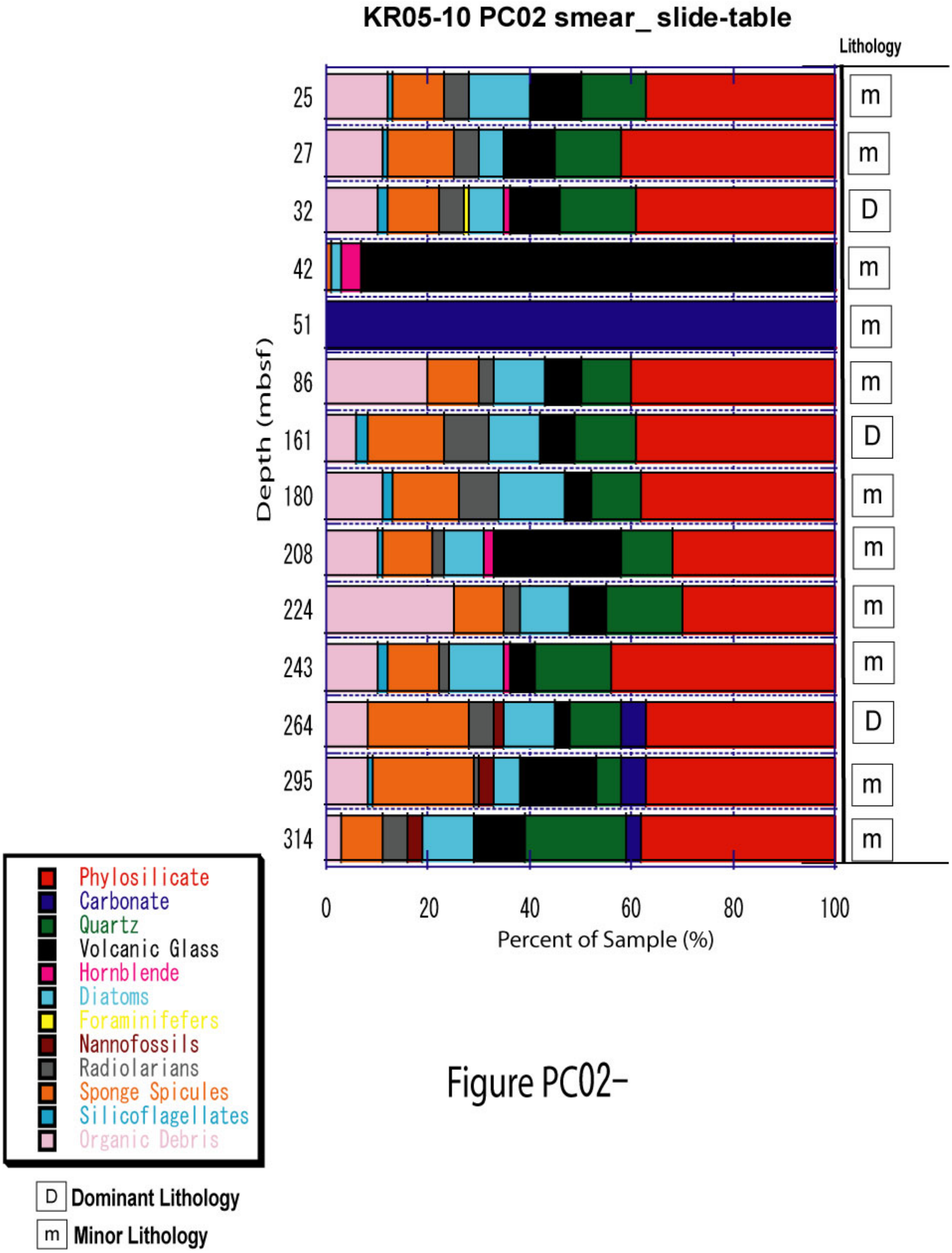
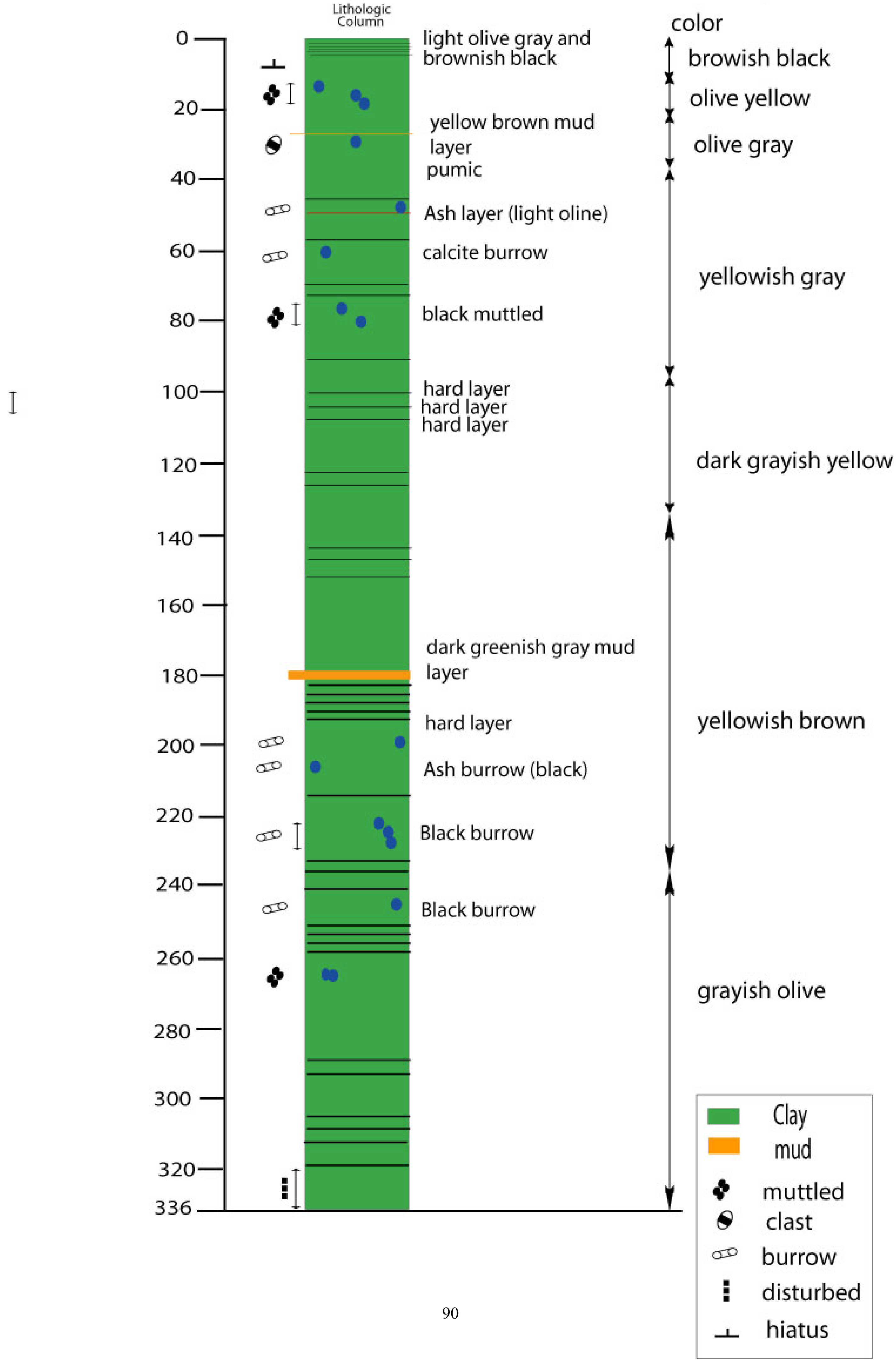

KR05-10 PC02 smear_ slide-table
Lithology
Depth (mbsf)
25
27
32
42
51
86
161
180
208
224
243
264
295
314
m
m
D
m
m
m
D
m
m
m
m
D
m
m
0
20
40
60
80
100
Percent of Sample (%)
Phylosilicate
Carbonate
Quartz
Volcanic Glass
Hornblende
Diatoms
Foraminifefers
Nannofossils
Radiolarians
Sponge Spicules
Silicoflagellates
Organic Debris
D Dominant Lithology
m Minor Lithology

Figure PC02-


Lithologic Column
color
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
336
light olive gray and brownish black
yellow brown mud layer
pumic
Ash layer (light oline)
calcite burrow
black muttled
hard layer
hard layer
hard layer
dark greenish gray mud layer
hard layer
Ash burrow (black)
Black burrow
Black burrow
browish black
olive yellow
olive gray
yellowish gray
dark grayish yellow
yellowish brown
grayish olive
Clay
mud
muttled
clast
burrow
disturbed
hiatus

5-3. Heat Flow

by Ayu Takahashi

5-3-1. System

Temperature gradients in sediments were measured using heat flow system of ANTARES Temperature Data loggers (ANTARES Data system GmbH) mounted on the piston corer barrel. Five ANTARES loggers of Channel 1-5 were set helically on the outside of the barrel between the base of the weight stand and the core catcher bit by approximately 80cm intervals. Channel 5 was at the top of the barrel, and Channel 1 was at the bottom, located about 75 cm (PC01), and 50 cm (PC02) from the tip of core catcher bit.

The piston core was stopped at a depth about 50 m above the sea floor for 10 minutes to calibrate the thermistors, and then descended to bottom. Because the system must be kept in the sediment for 15 minutes to obtain stable temperature, 20 m nylon rope was placed between the balance and main wire for avoiding additional wire out that may cause pulling the barrel out of the sea floor by either heaving or drifting of the ship during the measurement.

5-3-2. Result

After simple correction for bias of each thermistor, temperature gradients as shown in Figure 5-3-1 are obtained.

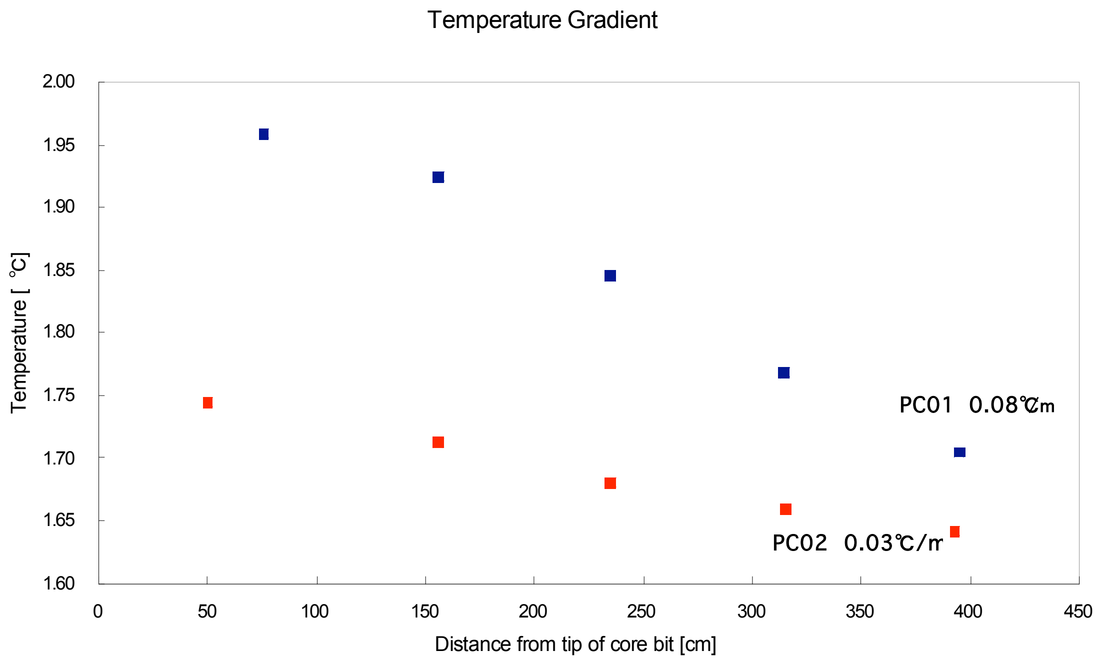
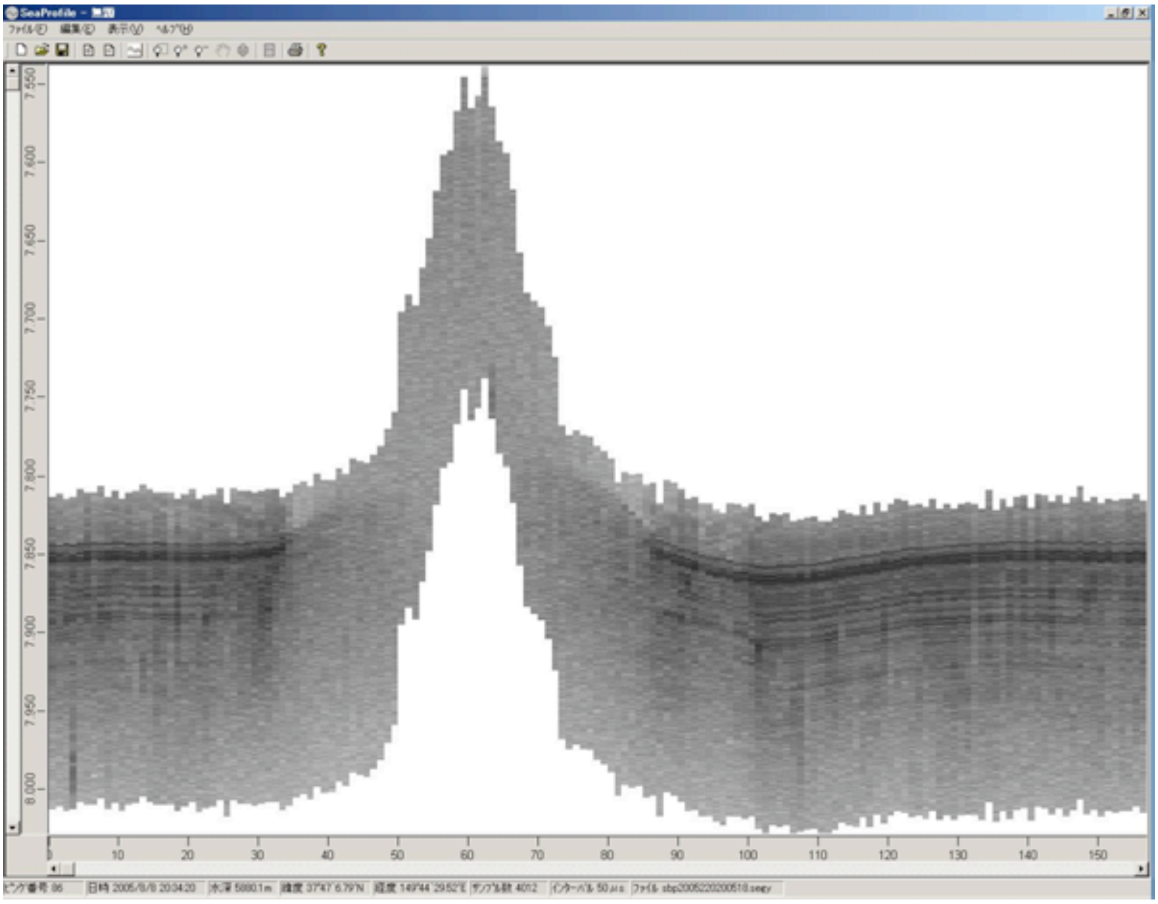


Figure 5-3-1. Temperature gradient of PC01 and PC02 sites

PC01 site is located near the ridge, and PC02 site is SE foot of Yukawa Knoll (for details, see Figure 5-2-?). Contrary to previous expectation, temperature gradient near Yukawa knoll is 0.03 deg/m, less than half of the value near the ridge (0.08 deg/m), nor around Fukahori knoll (0.06 and 0.07 deg/m, data obtained during KR04-08 cruise). It could be considered that heat flow was high during the knoll was active, once the volcanism ended, the heat flow dropped to normal value.

5-4. Dredge **by Machida**

We got just one chance to dredging during this cruse. Dredge site (Station KR05-10 D01) were selected to investigate the origin and distribution of “Petit-spot” volcanism in the northwestern Pacific on the basis of the detailed bathymetric map newly obtained by multi narrow beam echo sonar (SeaBeam) system. We assumed that outcrops exist at the summit of this knoll, based on previous sub bottom profile and single channel seismic observations. However, we could not get any rocks from the site. The survey line selected for that the dredge system reach to the summit of this knoll. The operation of dredge was successful. We have no problem during operation. But, very “silent” movement of dredge system was assumed from tension meter observation. Then, we could not obtain any hard-rock samples on this site. Some soft sediment (mud) with several small rounded pumices were corrected from pipe-dredge. The result suggests that rock escarpment distribute in a few limited region in this small knoll. We need dredging again and/or observation and sampling using *SHINKAI* or *KAIKO* submersibles.



D#01:Unnamed Knoll

Date: 9th August, 2005

Site: 37° 47.20'N, 149° 44.96'E (-5850 m) to 37° 47.25'N, 149° 45.25'E (-5740 m)

5-5. Single Channel Seismic Reflection

by Toshiya Fujiwara and NME SCS operational team

5-5-1. Data Collection

During the KR05-10 cruise, single channel seismic (SCS) reflection surveys were conducted on August 3rd, 4th and 8th. The survey was intended to reveal the subsurface structure of the "Petit Spot" area and the Nossappu Fracture Zone. The survey lines are shown in Figures 5-5-1 and 5-5-2 and Table 5-5-1. Line-1 passed the south of the Yukawa and the North Yukawa knolls, and crossed the western boader of the Nossappu Fracture Zone. Line-2 also crossed the fracture zone and went through echelon knolls. Line-3~9 passed small knolls or depressions associated with knolls. Line-5 followed the same route of Line AB in the YK05-06 SCS experiment for the comparison.

Survey ship speed was ~4 knots against water. A GI gun (G: 250 cu in., I: 105 cu in.) with air-pressure of 140 bar was used for a seismic source (See Section 4-2 for detail description of the observation). Shots were fired at a time spacing of 15 seconds (~30 m spacing) for Line-1, 12 seconds (~23 m spacing) for Line-2, and 10 seconds for Line3~9 (~20 m spacing).

5-5-2. Results

5-5-2-1. Sediment Layer

Resultant seismic profiles of Line-1~9 are shown in Figure 5-5-3 to Figure 5-5-11. As common features of "undisturbed" seafloor structure apart from small knolls or the fracture zone, since the water depth is ~5900 m, the reflectors around 7900 msec two-way travel time (TWT) are refections from the seafloor (Figures 5-5-3~5-5-11). These reflectors are weak in amplitude. The sediment layer, which is lying beneath the seafloor, is found to be transparent in the study area. Some reflectors lying horizontally are identified within the sediment layer. The sediment covers ~300 msec TWT, indicating sediment thickness of ~300 m. Around 8200 msec TWT, reflectors with the strongest amplitude are commonly indentified. These reflectors are presumed to be reflections from top of oceanic igneous crust of the Pacific Plate (Figures 5-5-3~5-5-11).

5-5-2-2. Small Knolls

Seismic profiles show common features at small knolls (Figures 5-5-5~5-5-11). There are found to be no broad base around the small knolls because there are no reflectors extending from the foot of small knolls. Instead, around 100 msec TWT above the oceanic crust, strong reflectors are identified within the sediment layer (ex. Figure 5-5-7: trace 720-780). These are probably reflections from sheet-like volcanic edifices related to the Yukawa Knoll. These reflectors lie horizontally in the vicinity of small knolls.

In the portion between bottom of the depression and crest of the small knolls, reflectors from the seafloor are too unclear to distinguish likely due to topographic steep gradient (ex. Figure 5-5-7: trace 540-600). The sediment layer beneath this portion is opaque. Such the portion is limited to ~500-1200 m in width, typically. Possible explanation that this portion is opaque because of inhomogeneous in the sediment layer. Or, there is 3D-like reflective structure with steep scarps (ex. diapir, conduit, pipe, etc), thus the seismic waves scatter. The reflectors from oceanic igneous crust dip downward toward the knolls. The diffraction waves are visible at the boundary between this portion and "undisturbed" sediment layers, indicating horizontal inhomogeneous structure.

5-5-2-3. Circum-Area and Fracture Zone

In the long cross sections shown in Figures 5-5-3 and 5-5-4. There is difference in feature of reflection from the oceanic igneous crust. For example, flat lying reflection is identified between traces 100-600 in Figure 5-5-3. While disorganized reflective patterns are identified between traces 600-1900 in Figure 5-5-3. It may suggest that the oceanic crust was deformed by "Petit Spot" volcanism. Between traces 1300-1600 in Figure 5-5-3, the seismic profile is passing the south of the Yukawa knolls (Figure 5-5-1). Around trace 1800, topography does not show knoll structure, but elevation of the reflector is found. The edifice could be a hidden volcano. The zone where reflective patterns disorganized may be a "Petit Spot" zone.

The sediment layer is found to be thin at topographic highs in the fracture zone (Figure 5-5-3: trace 2600-2900, Figure 5-5-4: trace 400-800). Beneath the portion, reflectors of oceanic igneous crust are elevated. This result may suggest intrusion. Intrusion of deeper crustal or upper mantle rocks is discussed from results of magnetic anomaly (see Section 5-5 in detail).

Table 5-5-1. SCS survey lines. (LT=UT+10 hrs)

Line 1		
Start:	37° 22.93' N	149° 22.73' E: 8/3 18:44 LT
End:	37° 35.43' N	150° 14.24' E: 8/4 08:00 LT (3158 shots)
Line 2		
Start:	37° 23.82' N	149° 28.03' E: 8/4 16:55 LT
End:	36° 49.13' N	149° 41.36' E: 8/5 6:30 LT (4076 shots)
Line 3		
Start:	37° 30.80' N	149° 41.20' E: 8/8 14:58 LT
End:	37° 26.10' N	149° 42.20' E: 8/8 16:05 LT
Line 4		
Start:	37° 28.00' N	149° 40.50' E: 8/8 17:05 LT
End:	37° 31.00' N	149° 46.00' E: 8/8 18:33 LT
Line 5		
Start:	37° 27.97' N	149° 45.51' E: 8/8 19:41 LT
End:	37° 32.00' N	149° 43.30' E: 8/8 20:50 LT
Line 6		
Start:	37° 32.50' N	149° 44.00' E: 8/8 21:17 LT
End:	37° 30.00' N	149° 47.50' E: 8/8 22:16 LT
Line 7		

Start:	37° 31.60' N	149° 48.00' E: 8/8 22:56 LT
End:	37° 48.50' N	149° 44.70' E: 8/9 03:33 LT

Line 8

Start:	37° 46.90' N	149° 43.00' E: 8/9 04:34 LT
End:	37° 47.20' N	149° 46.50' E: 8/9 05:34 LT

Line 9

Start:	37° 47.40' N	149° 46.50' E: 8/9 06:12 LT
Start:	37° 46.90' N	149° 43.00' E: 8/9 07:30 LT

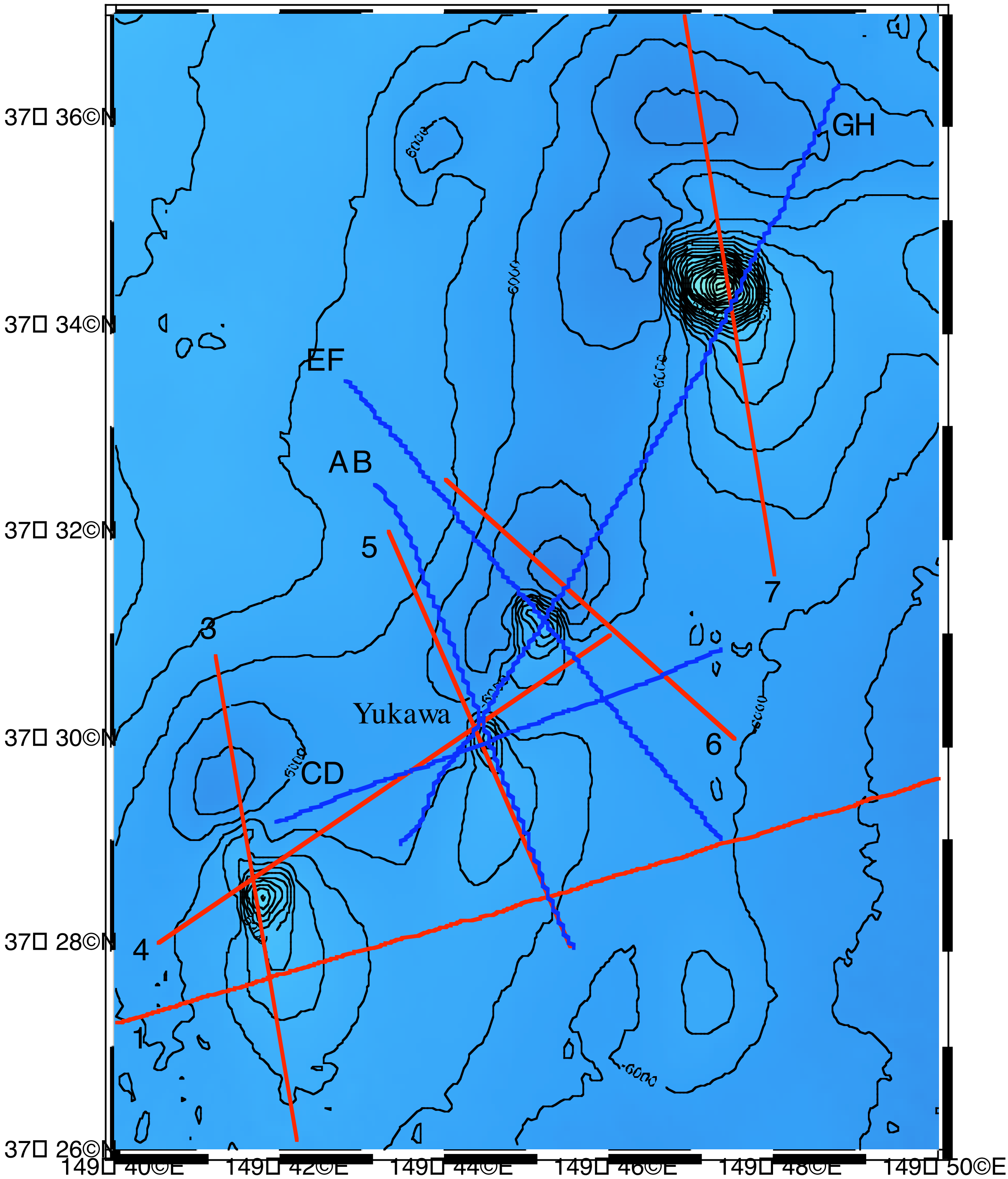


Figure 5-5-1. Ship tracks of the SCS survey in the Yukawa Knoll area. Red lines show SCS lines in KR05-10, and blue lines show ship tracks in YK05-06.

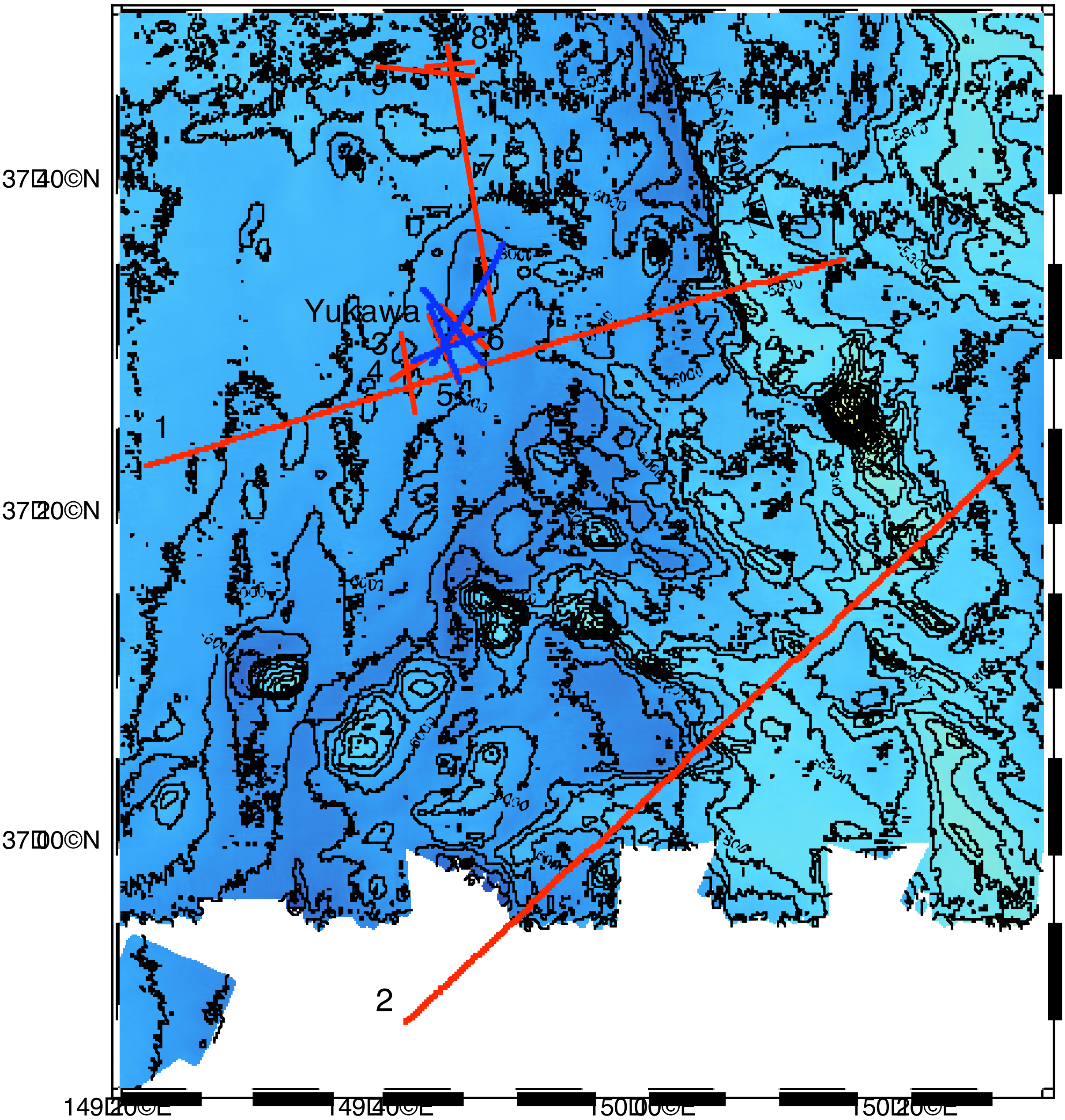


Figure 5-5-2. Ship tracks of the SCS survey in the survey area. Red lines show SCS lines in KR05-10, and blue lines show ship tracks in YK05-06.

Figure 5-5-3. Seismic profile Line-1. Horizontal axis shows trace of shot numbers and vertical axis shows two-way travel time (msec). The seismic data were bandpass filtered for wavelengths between 10-15 Hz and between 200-250 Hz, and Auto Gain Controll (AGC) was applied with a 3000 msec window.

Figure 5-5-4. Seismic profile Line-2.

Figure 5-5-5. Seismic profile Line-3.

Figure 5-5-6. Seismic profile Line-4

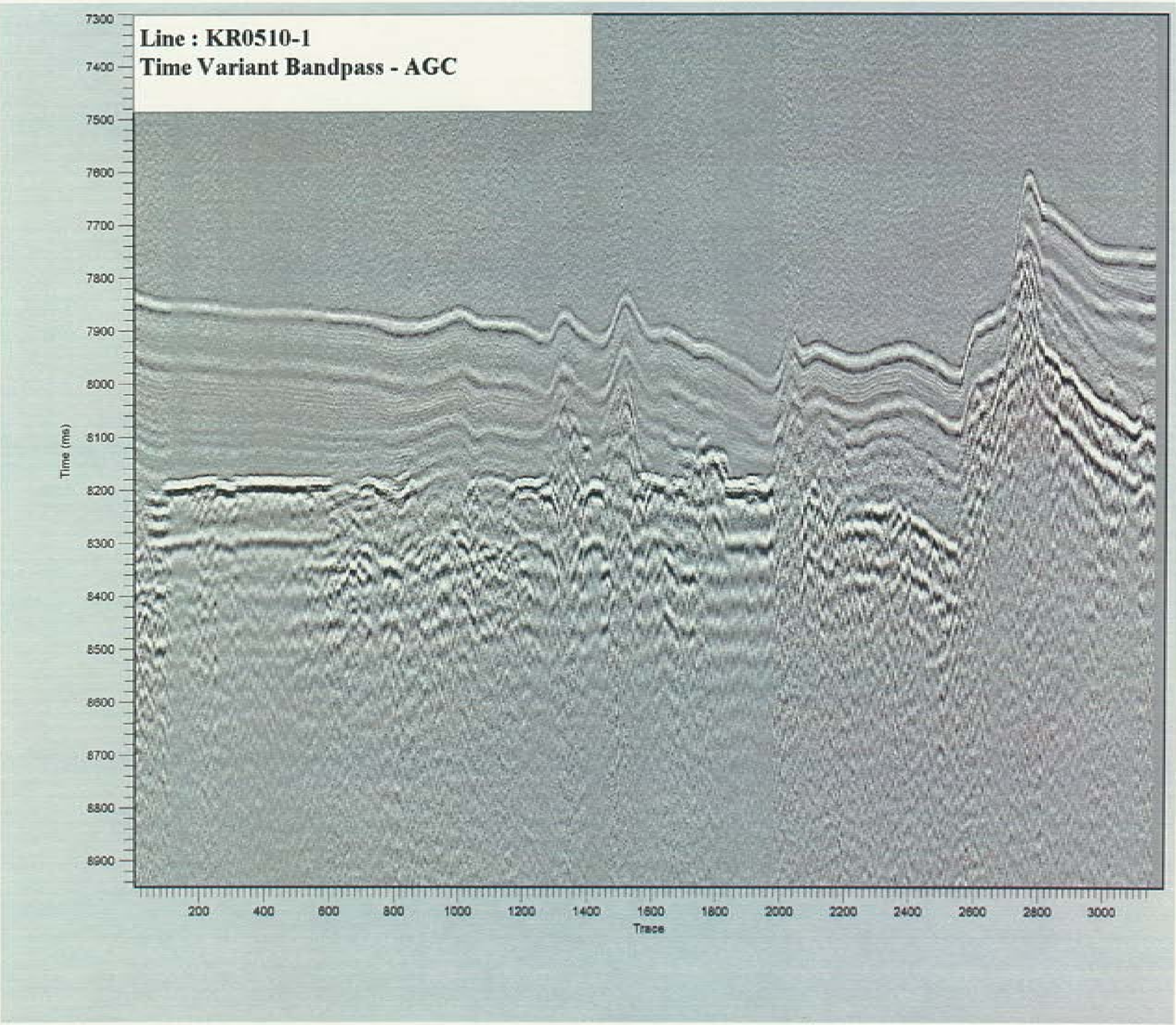
Figure 5-5-7. Seismic profile Line-5.

Figure 5-5-8. Seismic profile Line-6.

Figure 5-5-9. Seismic profile Line-7.

Figure 5-5-10. Seismic profile Line-8.

Figure 5-5-11. Seismic profile Line-9.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Time (ms)
7300
7400
7500
7600
7700
7800
7900
8000
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8200
8300
8400
8500
8600
8700
8800
8900
200
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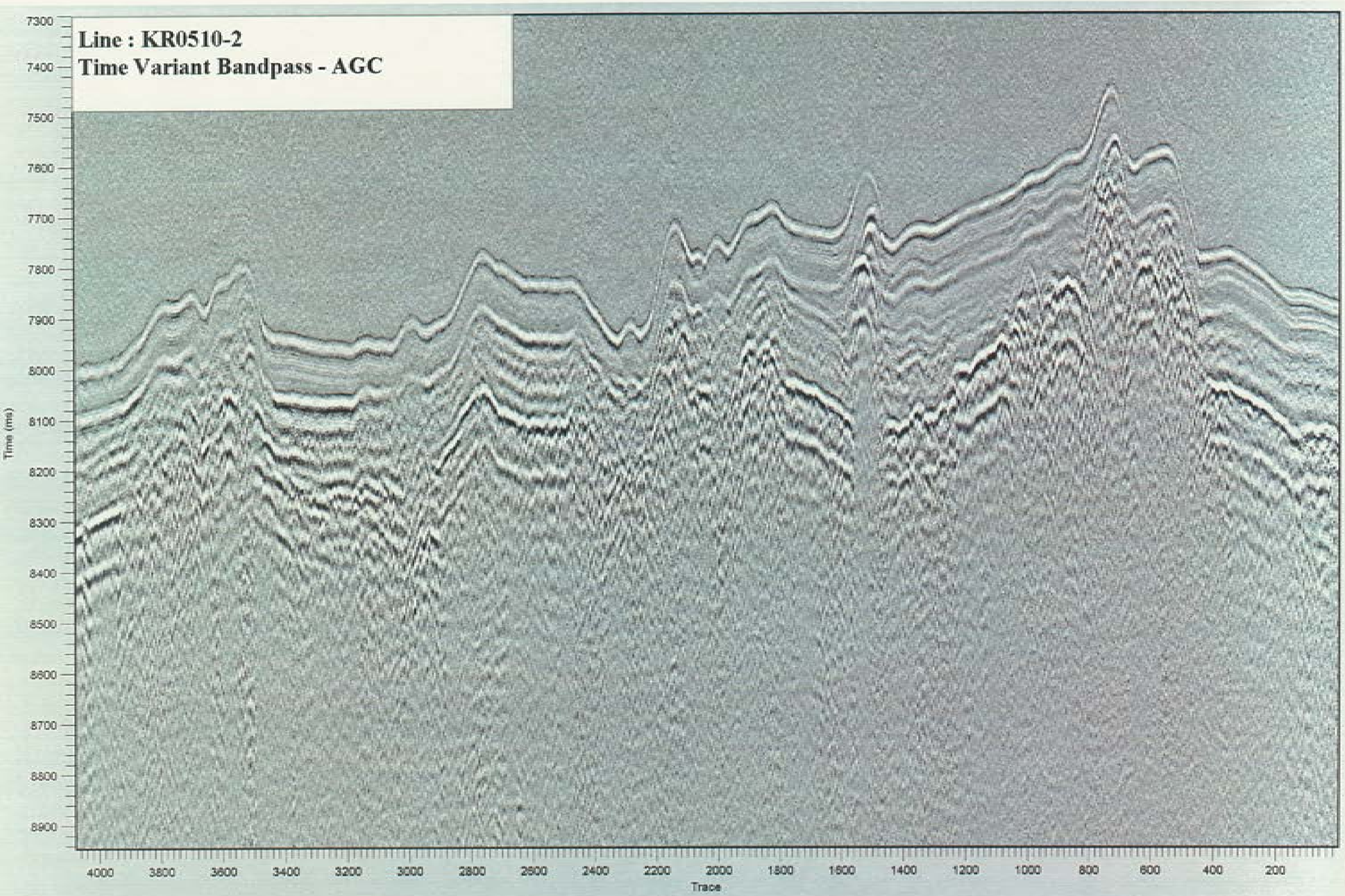
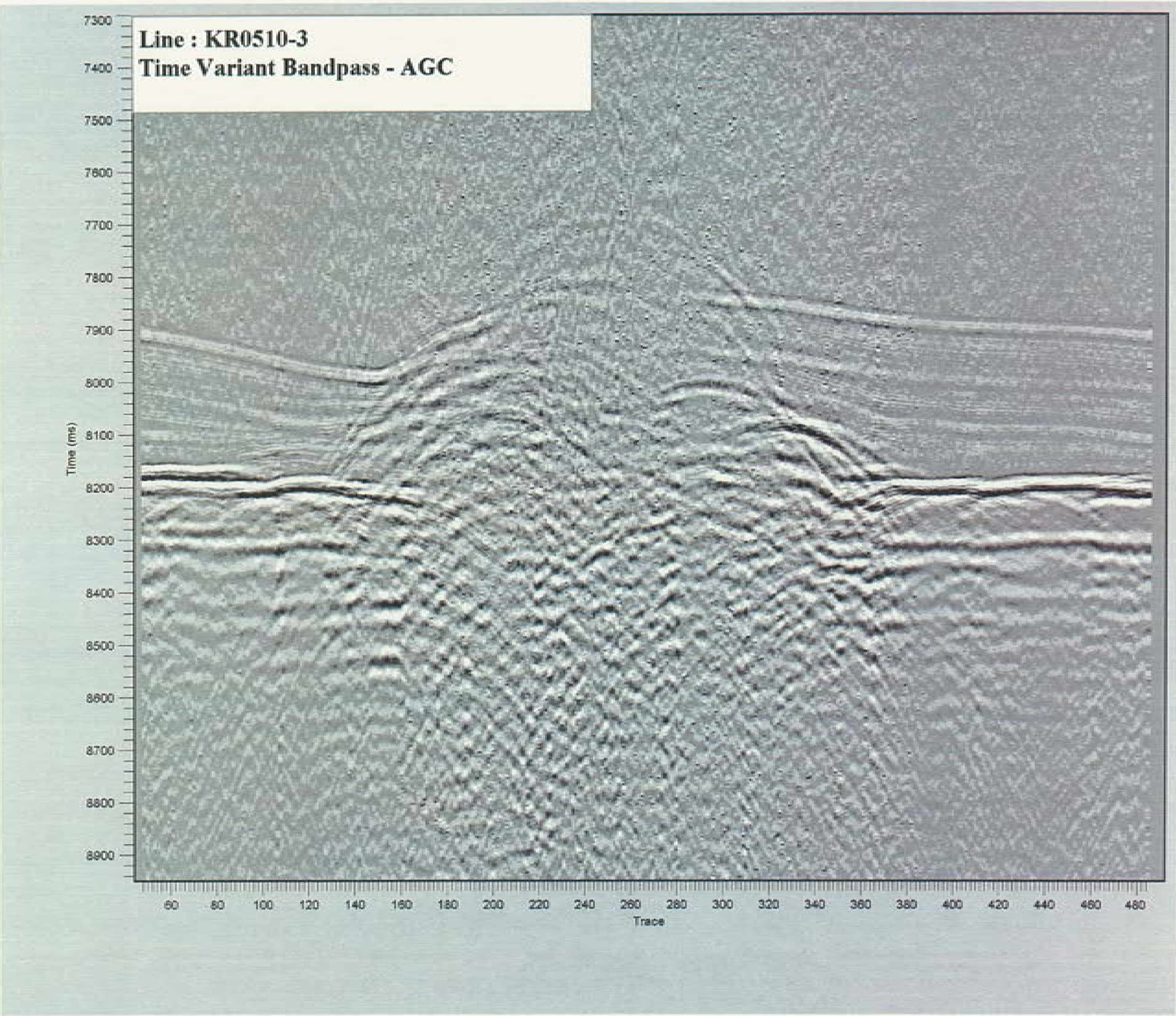
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
Trace


Line : KR0510-2
Time Variant Bandpass - AGC
Time (ms)
7300 7400 7500 7600 7700 7800 7900 8000 8100 8200 8300 8400 8500 8600 8700 8800 8900
4000 3800 3600 3400 3200 3000 2800 2600 2400 2200 2000 1800 1600 1400 1200 1000 800 600 400 200
Trace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Time Variant Bandpass - AGC
Time (ms)
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7400
7500
7600
7700
7800
7900
8000
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8200
8300
8400
8500
8600
8700
8800
8900
Trace
60
80
100
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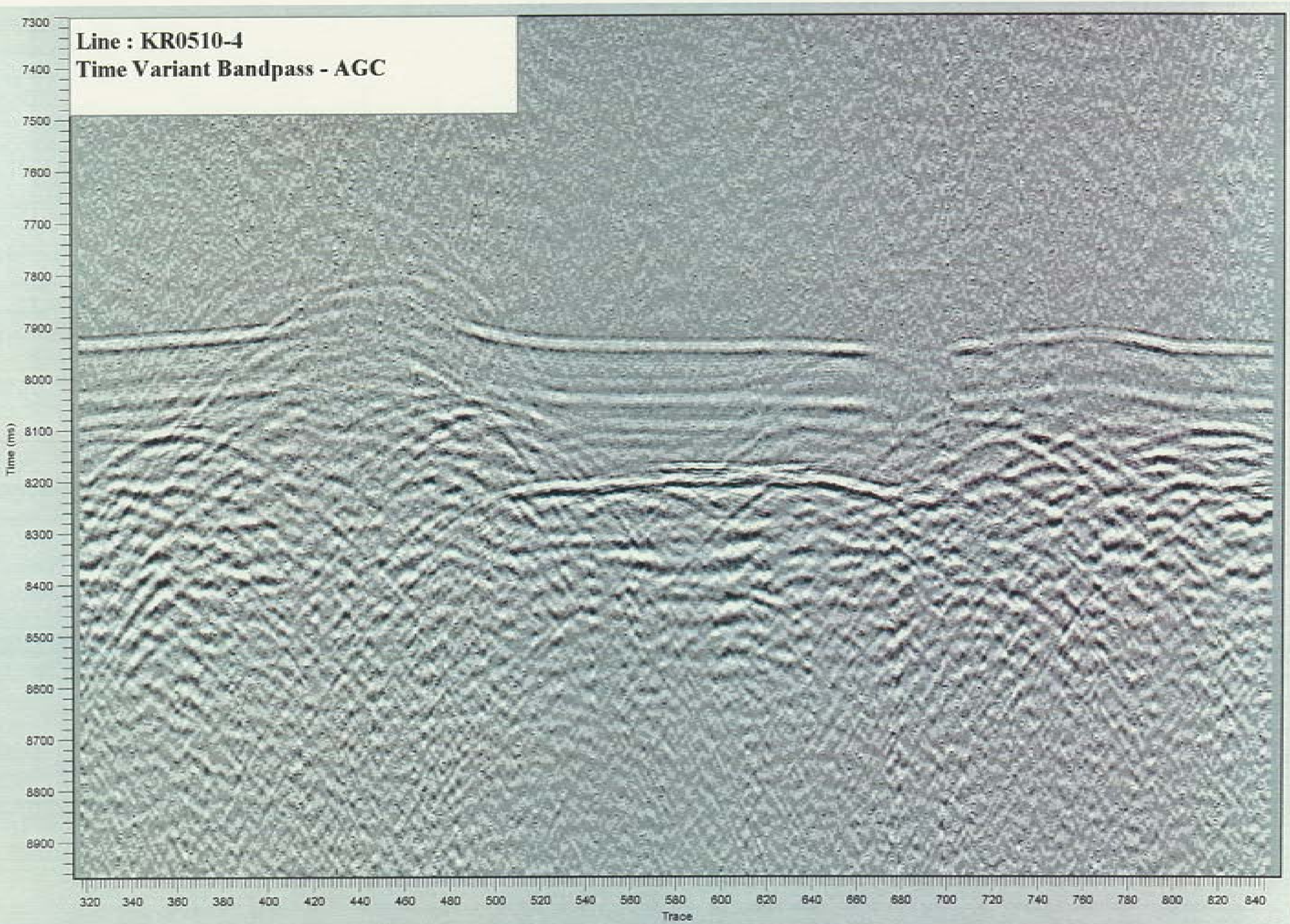
400
420
440
460
480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Time Variant Bandpass - AGC
Time (ms)
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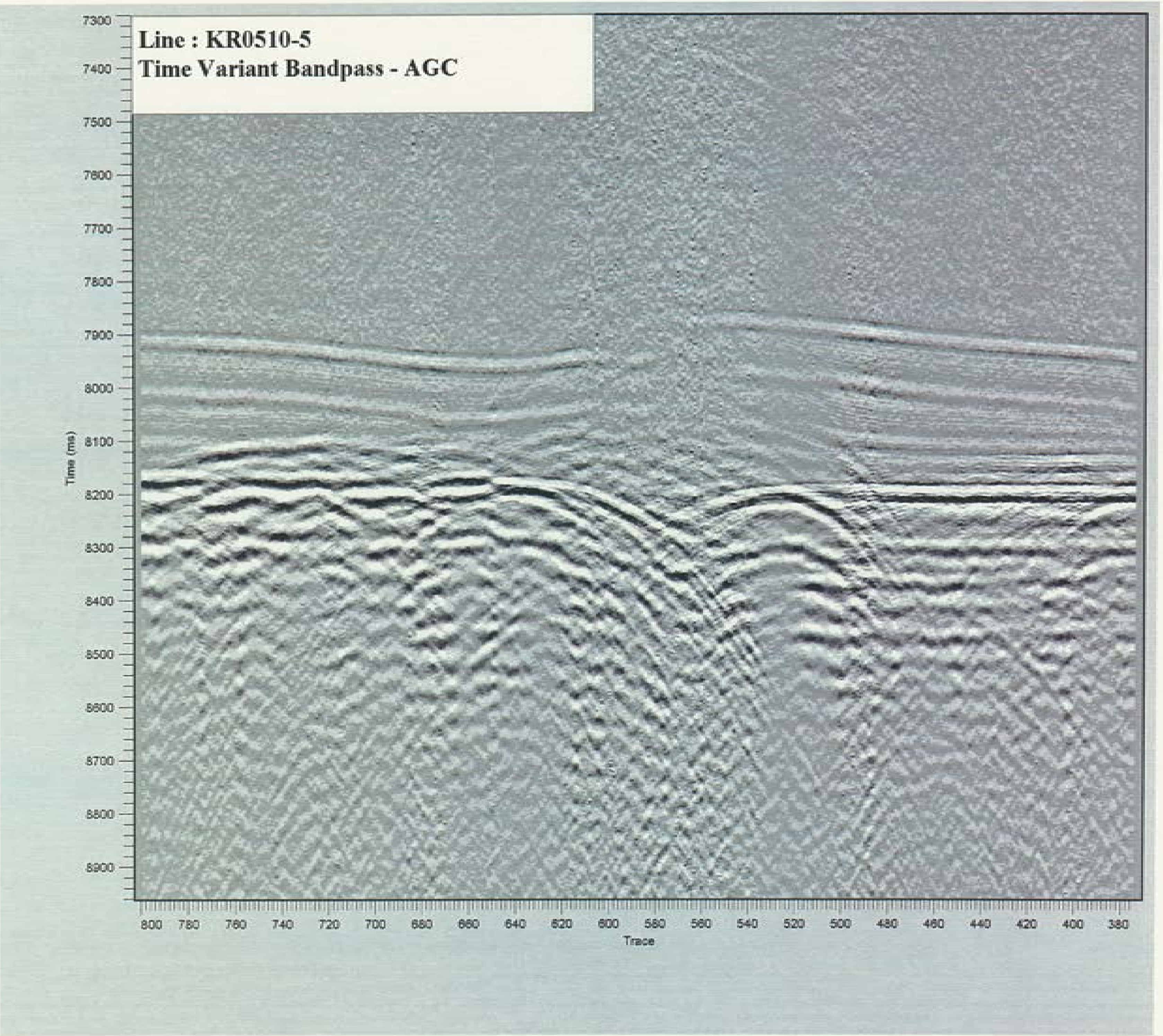
7400
7500
7600
7700
7800
7900
8000
8100
8200
8300
8400
8500
8600
8700
8800
8900
Trace
320 340 360 380 400 420 440 460 480 500 520 540 560 580 600 620 640 660 680 700 720 740 760 780 800 820 840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Time Variant Bandpass - AGC
Time (ms)
7300 7400 7500 7600 7700 7800 7900 8000 8100 8200 8300 8400 8500 8600 8700 8800 8900
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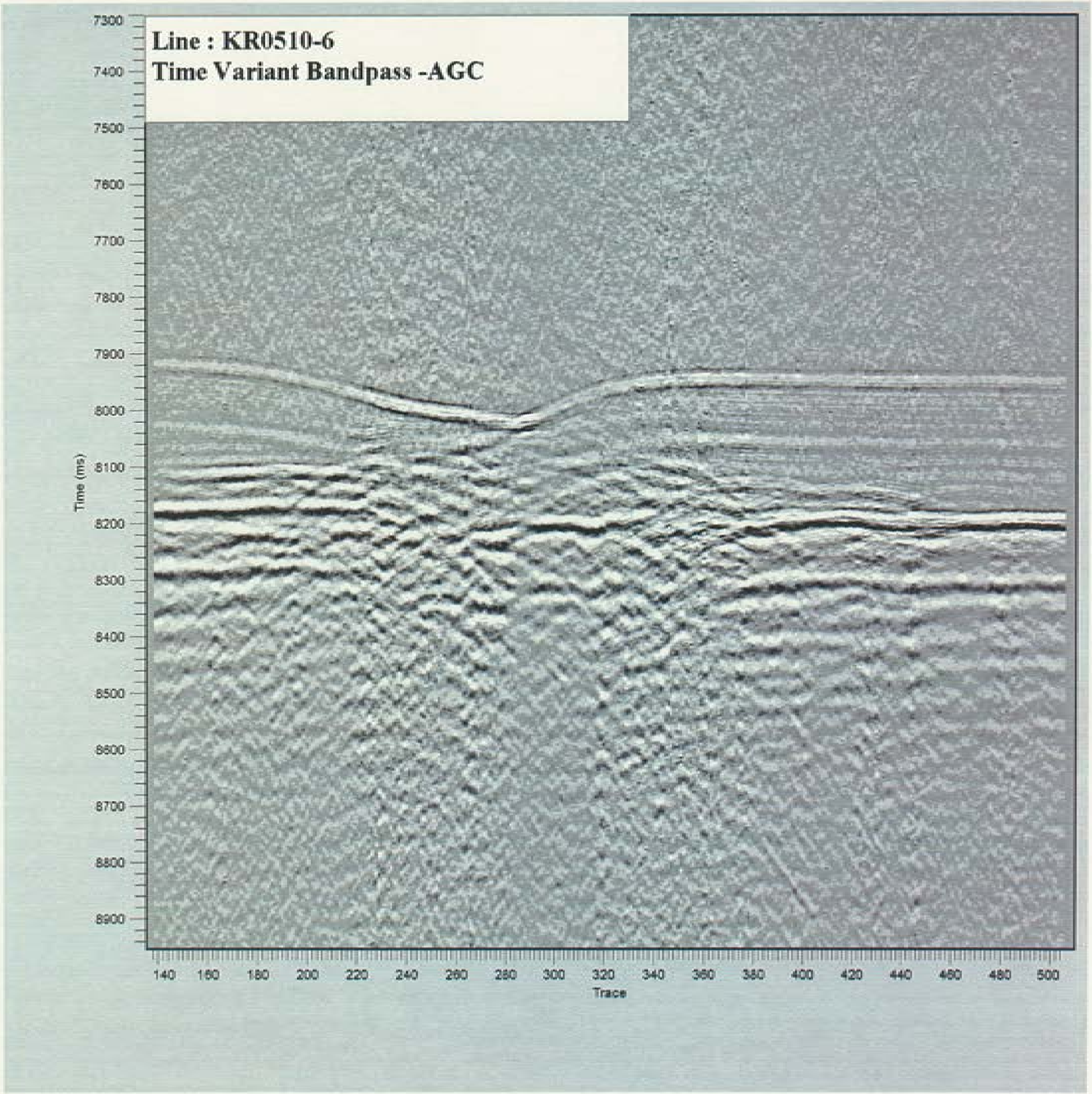
Trace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Time Variant Bandpass -AGC
Time (ms)
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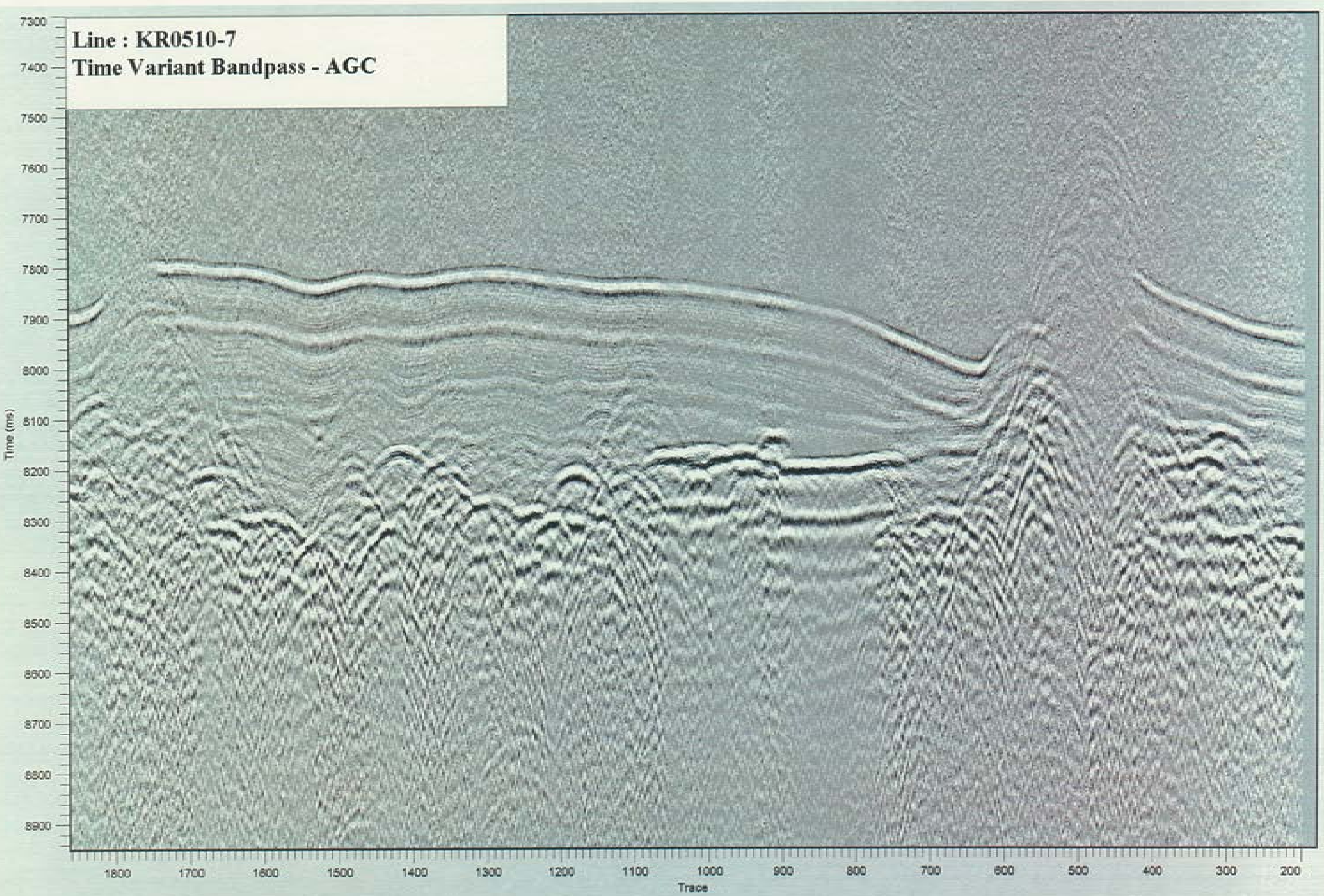
7400
7500
7600
7700
7800
7900
8000
8100
8200
8300
8400
8500
8600
8700
8800
8900
140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500
Trace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Time Variant Bandpass - AGC
Time (ms)
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7900
8000
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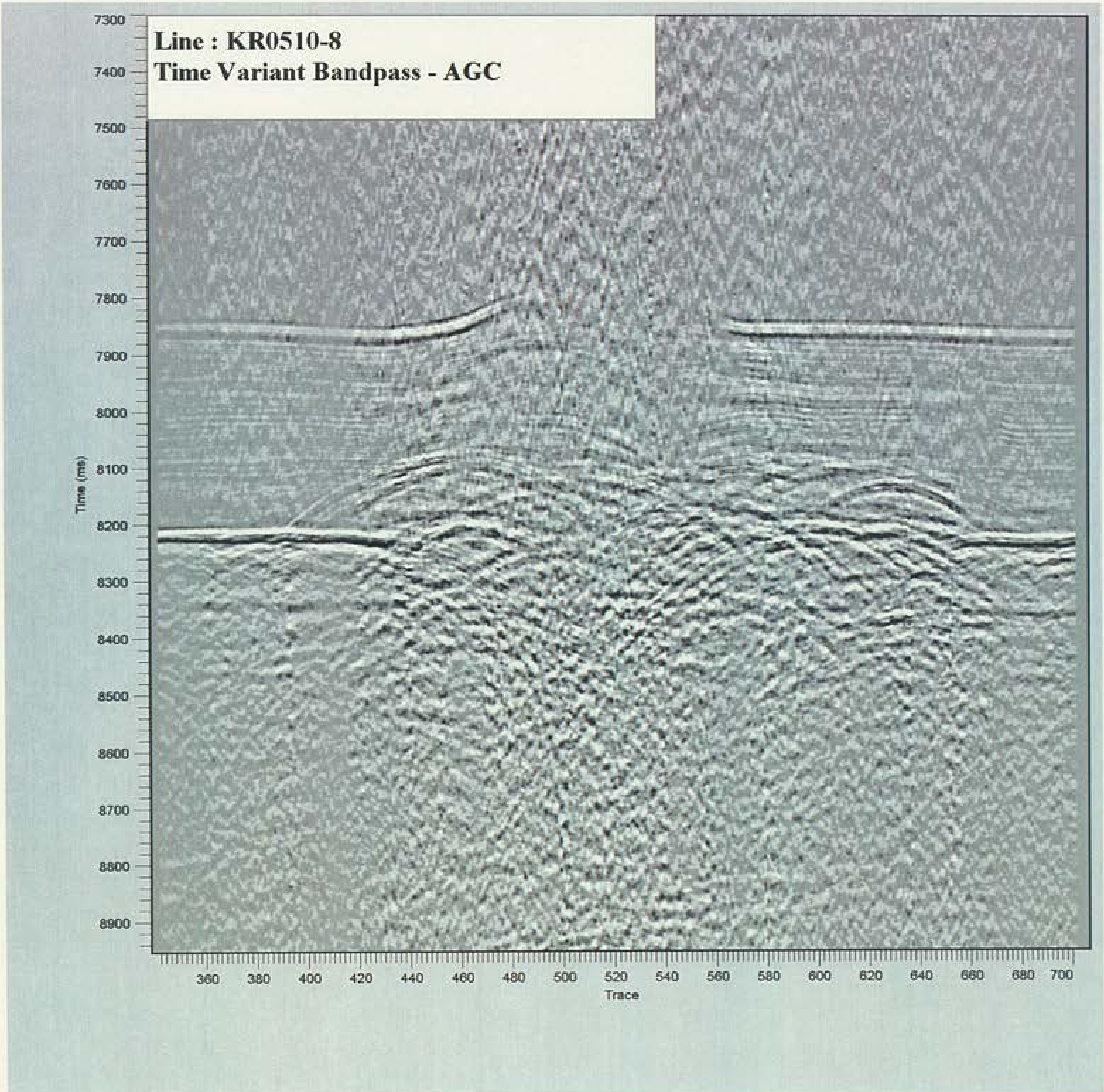
8500
8600
8700
8800
8900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
Trace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Time Variant Bandpass - AGC
Time (ms)
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7600
7700
7800
7900
8000
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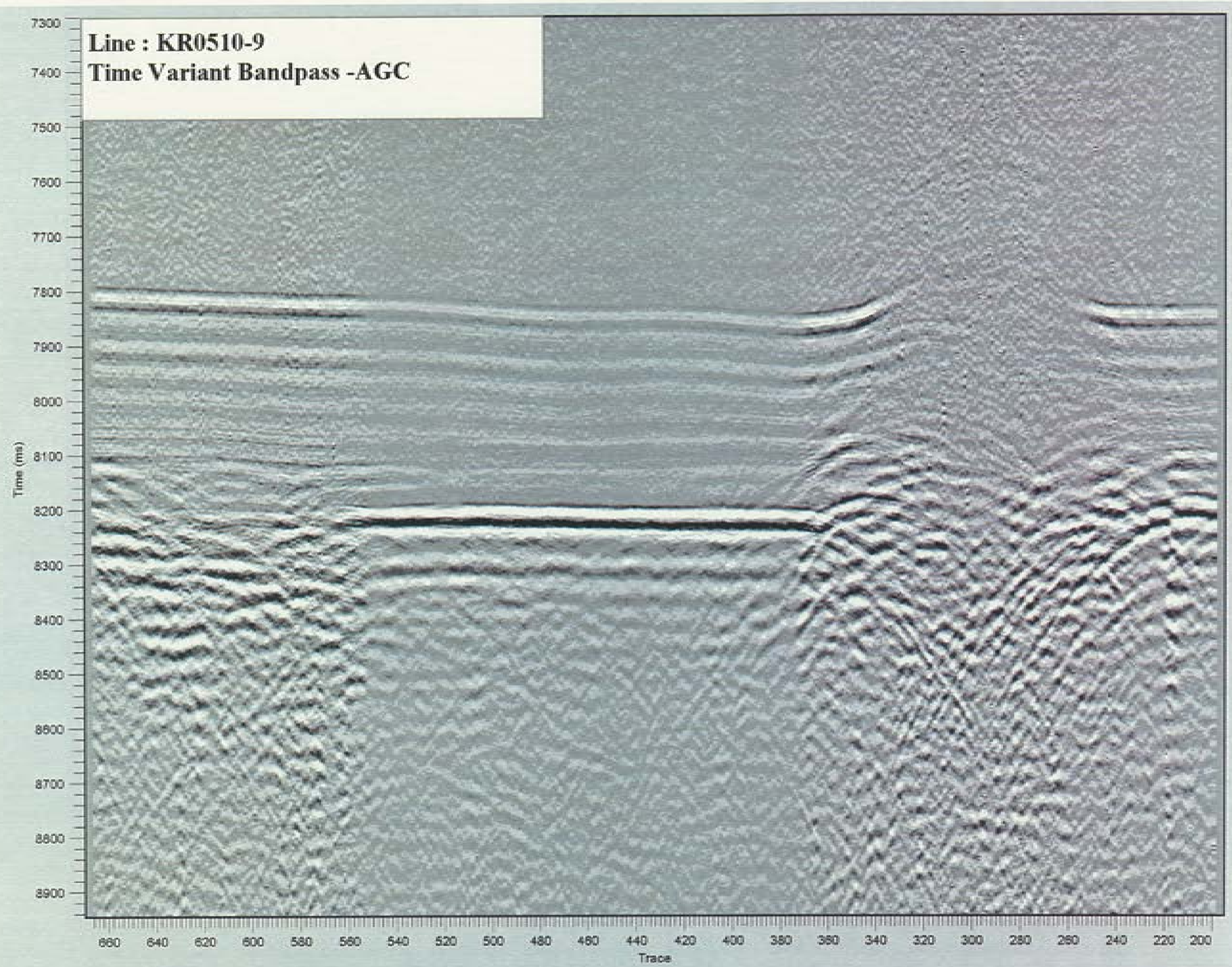
8300
8400
8500
8600
8700
8800
8900
360
380
400
420
440
460
480
500
520
540
560
580
600
620
640
660
680
700
Trace


Line : KR0510-9
Time Variant Bandpass -AGC
Time (ms)
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7400
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7600
7700
7800
7900
8000
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8400
8500
8600
8700
8800
8900
660
640
620
600
580
560
540
520
500
480
460
440
420
400
380
360
340
320
300
280
260
240
220
200
Trace

5-6. Magnetic Anomalies

by Toshiya Fujiwara

5-6-1. Data Collection

During the KR05-10 cruise, geophysical surveys, whose items included were gravity and geomagnetics, were conducted aboard the R/V Kairei. The aim of the geophysical surveys was to provide a detailed geophysical characterization of the lithosphere in the northwestern Pacific on and off-axis ridge flanks, which will be used to unravel tectonic evolution and crustal structure.

Geomagnetic total force data were obtained by using a surface-towed proton precession magnetometer PROTO10 (Kawasaki Geol. Eng. Co.). The sensor was towed 300 m behind the ship. The data were collected every 20 seconds in transit and at nighttime SeaBeam surveys. In the beginning of the cruise, the magnetometer was out of order. The magnetometer was towed only a few days. Survey ship tracks were designed to fill gaps and to extend to the east and to the south of the previous magnetic measurement in the KR03-07, KR04-08, and YK05-06 (Figure 5-6-1). After positioning correction taking into account the sensor cable length, the geomagnetic total force anomaly was calculated by subtracting the International Geomagnetic Reference Field (IGRF) 9th generation [IAGA, 2003] as the reference field.

Vector magnetic field data were collected using a shipboard three-component magnetometer, Tierra Tecnica SFG-1214. The data were collected with a sampling rate of 8 Hz throughout the cruise. "Figure-8 turn"s (a ship runs along an 8-shaped track consisting of two circles) were made for calibration of the ship's magnetic effect [Isezaki, 1986]. The turns were made at ? locations (Table 5-6-1). The IGRF 9th model was also employed as the reference magnetic field for calculation of vector geomagnetic anomaly and "Figure-8" calibration (Table 5-6-2).

5-6-2. Total Force Magnetic Anomaly

Figure 5-6-1 shows a magnetic total force anomaly in the survey area. The magnetic data used in this map were from KR05-10, YK05-06, KR04-08, and KR03-07 merged with data from the National Geophysical Data Center (NGDC). In this map, Japanese Lineations trending ENE-WSW is clearly identified. The Nosappu Fracture Zone offsets the oceanic lithosphere right-laterally by ~250 km. Crustal ages of the west side are estimated to be M15 (142 Ma)~ M13 (139 Ma). Crustal ages of the east side are estimated to be M12 (137 Ma)~ M11 (133 Ma). The age difference between the both sides is ~5 m.y.

Amplitude of the magnetic anomaly lineation in the east side of the fracture zone (> 500 nT peak-to-trough) is higher than in the west side (< 300 nT) (Figure 5-6-1). In consideration of paleo-ridge-transform geometry, the oceanic crust in the east side was created at outside corner, whereas the crust in the west side was created at inside corner of the mid-ocean ridge in the vicinity of the fracture zone. Thus, the magnetic anomaly amplitudal difference may be caused by preferential emplacement of extrusive basaltic layer to the outside corner. Extrusive basalts are known to be highly magnetized, and they contribute to a large part of the magnetic signal.

Petit-Spot rocks sampled in KR03-07 and KR04-08 were found that to have very high magnetization

(~60 A/m) [Obi et al., 2004]. Petit-Spot may produce particular magnetic anomaly, if significant volume exists. However apparently, original magnetic lineation seems to be not disorganized by such newly erupted volcanism (around the yellow circles in Figure 5-6-1), indicating total volume of erupted volcanoes is small.

In the Nossapu Fracture Zone, the amplitude of magnetic anomaly is much smaller than the other flanks. The result is consistent with a common feature of thin coverage of extrusive basalt in fracture zones in the world. The magnetic anomaly in the fracture zone is rather biased to positive anomaly. This result may suggest intrusion of deeper crustal or upper mantle rocks because these rocks have strong induced magnetization. Possibility of intrusion is also suggested from results of single-channel seismic reflection survey (see Section 5-3 in detail).

5-6-3. Vector Magnetic Anomalies

Magnetic vector anomalies will be utilized to map the strike directions of lineated magnetic boundaries, which are commonly representing lithological boundaries, geomagnetic reversals, or topographic offsets of magnetized layers due to faults, and estimation of the direction of crustal magnetization.

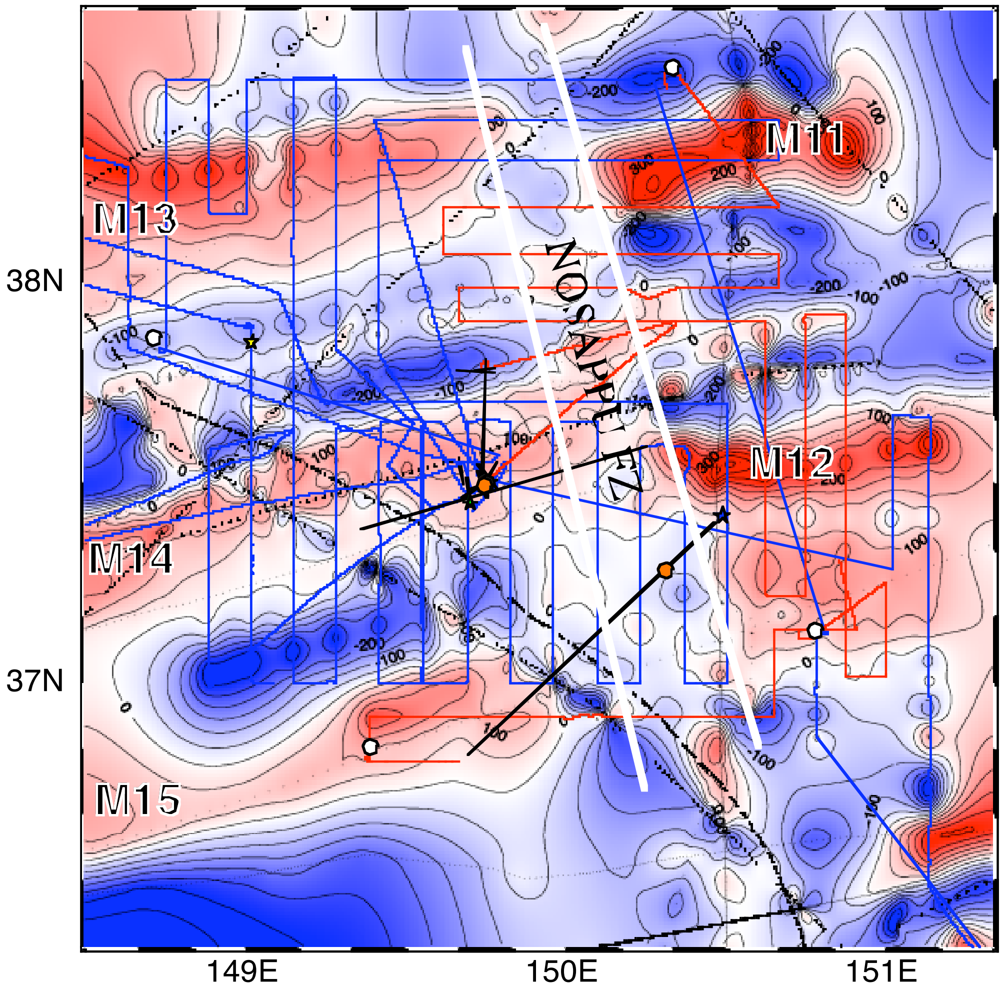

Figure 5-6-1. Magnetic anomaly of the study area. Contour lines are plotted every 50 nT. Red shade indicates positive anomaly and blue shade indicates negative anomaly. Red lines show ship tracks obtained using a proton magnetometer measurement in the KR05-10 cruise. Blue lines show the KR03-07, KR04-08,

and YK05-06 ship tracks. Dotted lines correspond to ship tracks from NGDC data used in this compilation. Orange circles mark piston core sites, white circles mark dredge sites, and gray circles mark OBEM stations. Stars indicate locations of "Figure-8 turn". Solid lines show SCS lines. White heavy white lines delineate the Nosappu Fracture Zone.

Table 5-6-1. Summary of "Figure-8" (LT=UT+10 hrs).

1. 8/2 10:52-11:13 LT; 38°54'N, 146°45'E; IGRF X 28237, Y -3287, Z 36320 nT
2. 8/4 16:09-16:26 LT; 37°25'N, 150°29'E; IGRF X 28511, Y -2547, Z 33865 nT

Table 5-6-2. Coefficients of calibration **A**-matrix. Coefficients a_{11}~a_{33} are related to magnetic susceptibility of the ship, and a_{14}, a_{24}, and a_{34} indicate a permanent magnetic moment of the ship's body.

a_{11}=0.90567	a_{12}=-0.05910	a_{13}=-0.00479	a_{14}=2418.6
a_{21}=0.06004	a_{22}=0.75900	a_{23}=-0.01265	a_{24}=6985.3
a_{31}=0.03051	a_{32}=-0.00776	a_{33}=1.23409	a_{34}=6229.1

5-7. Gravity Anomalies

by Toshiya Fujiwara

5-7-1. Data Collection

Onboard gravity measurements were made using a Bodenseewerke KSS-31 marine gravity meter. The data were recorded every 1 minute, and were collected throughout the cruise. The system incorporates ship's position, speed, and heading through onboard LAN. According to "Sea State" filtering (low-pass filtering to cancel out gravity effect by ship's movement), the gravity data delays 76 seconds. "Sea State 2" was selected in this cruise. The measured gravity values (6/28: -1424.8 mGal, 8/12: ? mGal) are tied to absolute gravity values at the JAMSTEC pier in Yokosuka (979758.7 mGal) at the beginning and end of the cruise. The "gravity tie" is conducted using data before departure and after arrival at the pier to estimate sensor drift of the gravity meter. Therefore, gravity data processing (readjustment of time difference, Etovos, drift, and reference gravity corrections) should be required onshore.

Shipboard gravity anomaly will be used for analysis of the crustal structure combined with bathymetry and seismic reflection data. Analysis of lithospheric flexure and deformation using satellite derived gravity anomaly combined with the shipboard gravity anomaly may be helpful.

6. Future studies

6-1. Natsue Abe

1. The interdisciplinary survey on a new type intra-plate volcanism -"Petit-spot" in the NW Pacific-

The study of petit-spot has two aspects; 1) to understand what the petit-spot is, and 2) to understand many geological and geophysical phenomena through petit-spot survey. This interdisciplinary survey was taken as the study of the both aspects. One of main theme is to understand the substances of the oceanic lithosphere; the thickness, the physical properties, the seismicity, the geochemistry and the petrology. To understand the thermal conductivity (heat flow) and substance circulation through the oceanic lithosphere is also important topics. I will combine all data from KR05-10 (and also YK05-06) to figure the substance of the oceanic lithosphere out.

2. Study the of the oceanic lithosphere Petrology and Geochemistry of the lower crust and upper mantle xenoliths and xenocrysts from YK05-06 and KR04-08 samples.

The study of peridotites derived from the mantle is the most direct way to investigate the geochemical processes at work in the deep interior of the Earth. Samples of mantle peridotite occur as tectonically emplaced peridotite massifs and as xenoliths carried to the surface by volcanic eruptions. The origins of mantle xenolith samples from oceanic islands are generally better constrained than their more common counterparts found in continental volcanics. Petit-spot xenoliths will be given direct images of the sub-oceanic lithospheric mantle beneath the petit-spot volcanos geochemically, petrologically and rheologically. Then these xenoliths data will constraint the geophysical model on the oceanic lithosphere. The dredge taken only once during this cruise was unfortunately unsuccessful, however, we have already sampled petit-spot alkaline basalts and its inclusions from oceanic lithospheric materials. I will describe mainly mantle and lower crustal xenoliths and xenocryst in alkaline basalt, and study the structure and nature of the sub-oceanic lithosphere.

3. Integrated Ocean Drilling Program (IODP) drilling proposal.

IODP is one of the best project to understand the earth system using by ocean floor drilling. Petit-spot volcanism will be the target to conduct IODP drilling cruise. I will combine all data of this cruise and previous petit-spot cruises, and apply for IODP drilling cruise to understand both the mechanism of the petit-spot volcanism and the construction of the oceanic lithosphere.

6-2. Naoto Hirano

Detail distribution of the petit spot

Using on-board data, we will firstly report detail distribution of young lava field using the back-scan image and bathymetry by the SEABEAM 2112 during KR03-07, KR04-08, YK05-06 and this cruise. Detail distributions of the "petit spot monogenic volcano group" may be along some sub-crustal fissures due to the flexural Pacific Plate (e.g. outer-rise). Such fractures would lead the magma to the surface. The cause of eruption may be resolved by tectonophysics such as some bendings or fractures of oceanic plate. We will simulate some bendings of the flexural plate with decreasing pressure or fractures into lithosphere. The arrangements of lava field using backscatter on this cruise may also indicate the cause of eruption.

High reflection areas in the backscatter image expecting the lava field appear are shown along some irregularly topographic highs and normal faults on the subducting Pacific Plate. Results of previous cruises during 2003-2005 show that the lava field is composed of two type lavas; one is vesicular lavas forming some topographic highs (possibly pillow lavas) and another is underlying sheet flow (dense and flood-like lavas). The latter would be concealed by topographic highs and pelagic mud.

Newly surveyed the young lava field

After the first report of young lava fields on the eastern tip of the Hokkaido Rise, the petit spot, we should search another young lava fields. Multibeam survey and back scatter image during this cruise shows some new petit spot area. The next target areas for the new petit spot are confirmed on this cruise, as follows:

1. 40^{O}43'N, 152^{O}30'E: Kuril Trench to outer-rise system
2. 39^{O}35'N, 152^{O}00'E: Kuril Trench to outer-rise system
3. 36^{O}53'N, 150^{O}40'E: Echelon seamounts, the Nosappu Fracture Zone
4. 36^{O}50'N, 150^{O}45'E: Echelon seamounts, the Nosappu Fracture Zone
5. 37^{O}45'N, 150^{O}47'E: East of the Nosappu Fracture Zone

After the future search for these areas, we may solve the question: "Which are the petit spot locally accidental or common on the outer-rise?"

Source and origin of magma

This theme is the first main study during the petit-spot project. We should obtain answers of two questions about the source of magmas in the mantle and the cause of eruption.

Firstly we will solve the source mantle of this magma based on the geochemical studies of major and trace element compositions and radiometric isotopes using many samples during KR03-07, KR04-08 and YK05-06 cruises, and SHINKAI6500 dives. Each element trend along the differentiation line of magma can indicate the mineralogy of source mantle, which are a tool to consider the depth in the mantle. We think that the variation of obtained rocks such as ol-bearing basalt, cpx-bearing basalt, aphyric basalt and dolerite are useful to recognize the source mineralogy and depth. Sr, Nd, Pb and noble gas isotopes would indicate source material in the mantle (primitive or depleted mantles). Our results of petrological and geochemical studies should be collaborated with the geoelectoromagnetical studies using OBEM (by Dr. M. Ichiki & K. Baba) on this cruise.

Volcanic glass materials obtained by the PC#02

Fine volcanic glass layers are observed in PC#02 from the abyssal plain at the south of the Yukawa Knoll. Preliminary results of PC#02 show that ash layer is relatively hard compared with the normal hemi-pelagic sediments. We will analyse geochemical compositions of this volcanic glasses using the electron microprobe and the LA-ICPMS. If the origin of these ash layers are the petit spot volcanism, we will decide the detail ages of eruption of the Yukawa Knoll and other petit spot volcanoes. This work will do to collaborate with Mr. Suzuki and Mr. Mori.

6-3. Toshiya Fujiwara

We have collected intensive bathymetry, gravity, magnetics, heat-flow, and seismic reflection data in the survey area since 2003. Compilation of sort of geophysical data and analysis are helpful to understand the geological background and geo-dynamics of the "Petit-spot", and also of the northwestern Pacific.

6-4. Takahiro SUZUKI & Ryota MORI

I will measure several physical properties from the piston core samples of KR05-10 PC01 and PC02. A continuous plastic cube (7 cc) working half samples were collected at all horizons. The core of the PC01 is 2.5 m long of pelagic clayey sediments deposited near the Fracture Zone NW Pacific ocean at 5732 m depth. The core of the PC02 is m long of pelagic clayey sediments deposited near the south of the Yukawa Knoll NW Pacific ocean at 5732 m depth. The purpose of study is to know the sedimentary process using the physical properties as follows.

1.Water content

To know the porosity data for calculation of penetration through cross area of sediment. (formula)

Water content = (bulk volume - particle volume)/bulk volume ×100(%)

2.Wet Density

To measure wet density.

(formula)

Density (g/cm^3) = mass/volume

3.Anisotropy of magnetic susceptibility. (AMS)

To know the paleocurrent direction for each cube.

4.Particle distribution

To know the particle size distribution pattern, as a basic information of sediment.

5.Soft X-ray radiograph

To obtain soft X-ray radiograph image to know the sediment structure and texture for understanding sedimentary environment.

6. Thin section and SEM

To observe a microfabrics of sediments

In detail from 1,2, 4, 5 and 6, I will study compaction process of pelagic sediments during long term as geologic time scale. The long-term compaction process is thought to be proceeded slowly by creep deformation. This process plays an important role in early deformation of sediments in shallow burial. The pelagic sediment is the best samples for compaction study because of steady state deposition field with constant sedimentation rate without any significant tectonic deformations. I would like to measure and observe microfabrics in the pelagic sediments using anisotropy of magnetic susceptibility and scanning electron microscopy.

From 3 I will analyze paleocurrent direction of hemipelagic sediments related to “Contourite”. PC-01 was collected from the flat surface plane on the northwestern Pacific Plate. This are is flat on the Pacific Plate. PC-02 was collected from near the Yukawa Knoll. This knoll is surrounded by ring-shape depression. The depression is thought to be formed by bottom current erosion suggesting data of SeaBeam mapping, subbottom profiler and core samples. I analyze the bottom current direction using paleomagnetism, anisotropy of magnetic susceptibility measurement and microfabric observation. I expect that the paleocurrent direction indicating bottom current direction can be detected by grain alignments in the sediments and stratigraphic structure by subbottom profiler.

More over I will discuss each physical properties and paleocurrent, comparing KR04-08 cruse data that could get a piston core near the Fukahori Knoll (KR 04-08 PC-01) with the KR05-10 PC01 and 01

6-5. Ayu TAKAHASHI

From newly obtained age data, contrary to previous expectations, volcanism related to petit spots could be considered to occur in extensive area. The preliminary result of OBEM also doesn't show the presence of highly distinctive conductivity variation beneath Yukawa knoll. In other words, there is a possibility of generating small amount of melt wherever oceanic lithosphere under some sorts of stress is deformed. Hence, one of the directions in numerical modeling is to deal with brittle fracturing of upper part of the lithosphere and elastic or viscoelastic strain within the lower part.

The other direction of calculation concerns the modification of flow within the upper-most part of mantle. Seabeam and side scan data shows the volcanoes considered to be related to petit spot exist NW of the cretaceous volcano. To certain depth of mantle, there is flow dragged by overlying lithosphere as it moves. If crust underneath the cretaceous volcano was thickened by isostasy, there would be the change of flow within the upper-most part of the mantle. This slight upward mantle flow may cause melting on a small scale that possibly leads up to petit spot volcanism.

SCS shows that there are sills around knolls. Considerably amount of magma intrude sediments other than forming knolls. Estimating the subsurface structure, and the ratio of eruption and intrusion from Seabeam and SCS, total melt productivity of other petit spot volcanoes.

Acknowledgements

All onboard scientists express great thanks to the "KAIREI" captain Mr. Ryono and all crew member of their excellent operations. Also shore-base staff of the JAMSTEC had excellent support for our cruise, particularly for Mr. Mitsuda, Mr. Kodera NME supported our daily jobs during the cruise. We sincerely appreciate his generous support. Not at least we are grateful to Dr. M. Kinoshita of JAMSTEC and Prof. M. Yamano of ERI for their preparations of piston corer and heat flow systems, respectively.