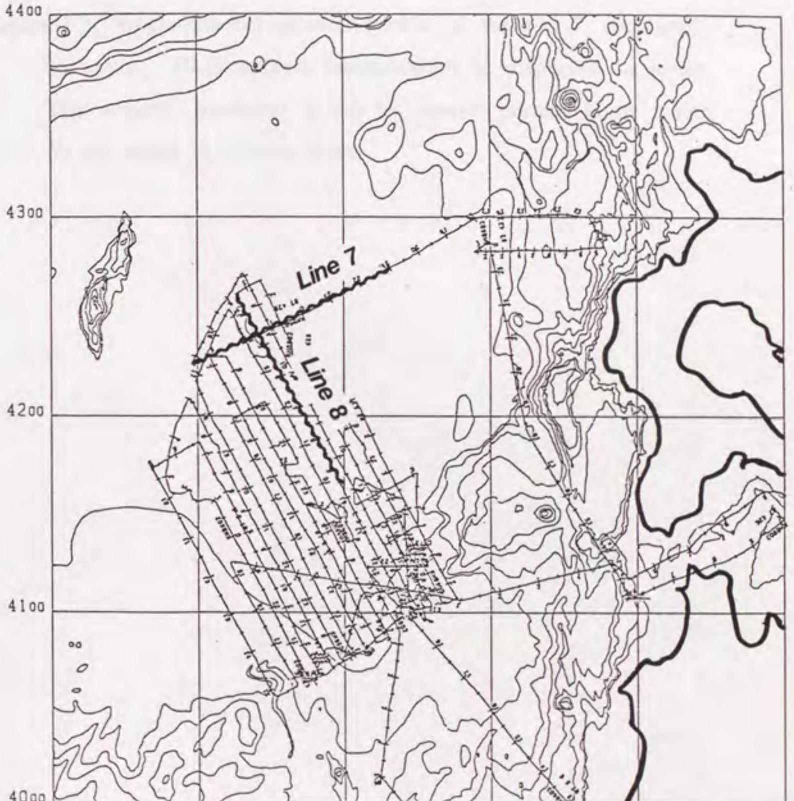
Figure I-1: Index map of the Japan Sea. Bathymetric contour interval is 500 m.

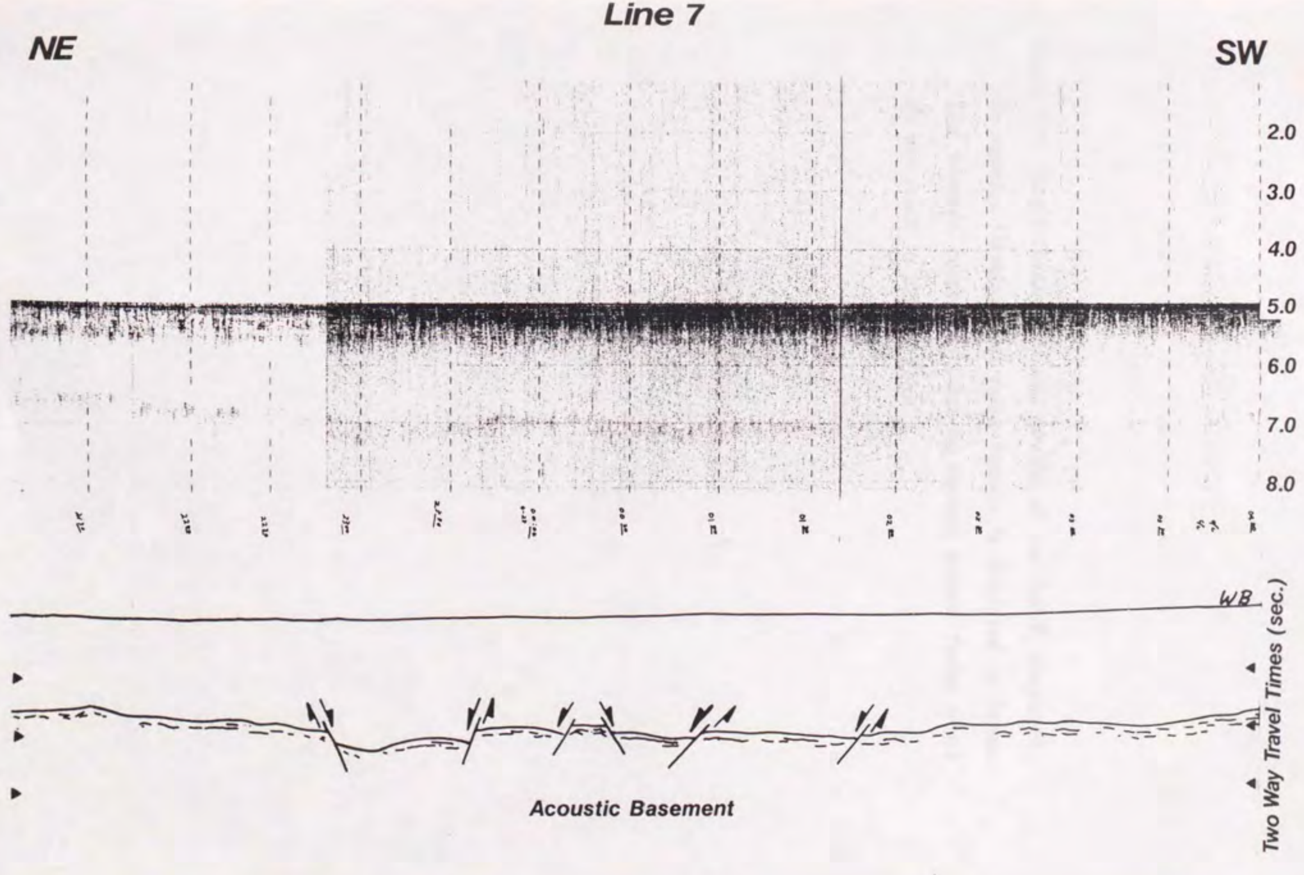

SIKHOTE-ALIN
TARTARY TROUGH
SAKHALIN
Soya Strait
Rebun Is.
Rishiri Is.
MUSASHI BANK
Vityaz smt.
OKUSHIRI RIDGE
ST
HOKKAIDO
Bogorov smt.
JAPAN BASIN
Okushiri Is.
OSHIMA PLATEAU
OT
Tsugaru Strait
NT
Siberia smt.
YAMATO RIDGE
Gabass smt.
GENZAN TROUGH
KOREA PLATEAU
KITA-YAMATO BANK
Kita-Yamato Trough
TAKUYO BANK
YAMATO BANK
Oga P.
Yamato smt. chain
YAMATO BASIN
SADO RIDGE
MOGAMI TROUGH
ULLUNG PLATEAU
KITA-OKI BANK
Sado Is.
Ullung Is.
Takeshima Is.
OKI BANK
TSUSHIMA BASIN
OKI RIDGE
OKI TROUGH
Noto P.
KOREA
HONSHU
Oki Is.
Tsushima Strait
Tsushima Is.
KYUSHU
200 km
130
135
140
144

Figure I-2: Track chart of the single-channel seismic profiling line-7 and line-8 of KH-86-2 cruise (wavy lines), Ocean Research Institute, University of Tokyo.



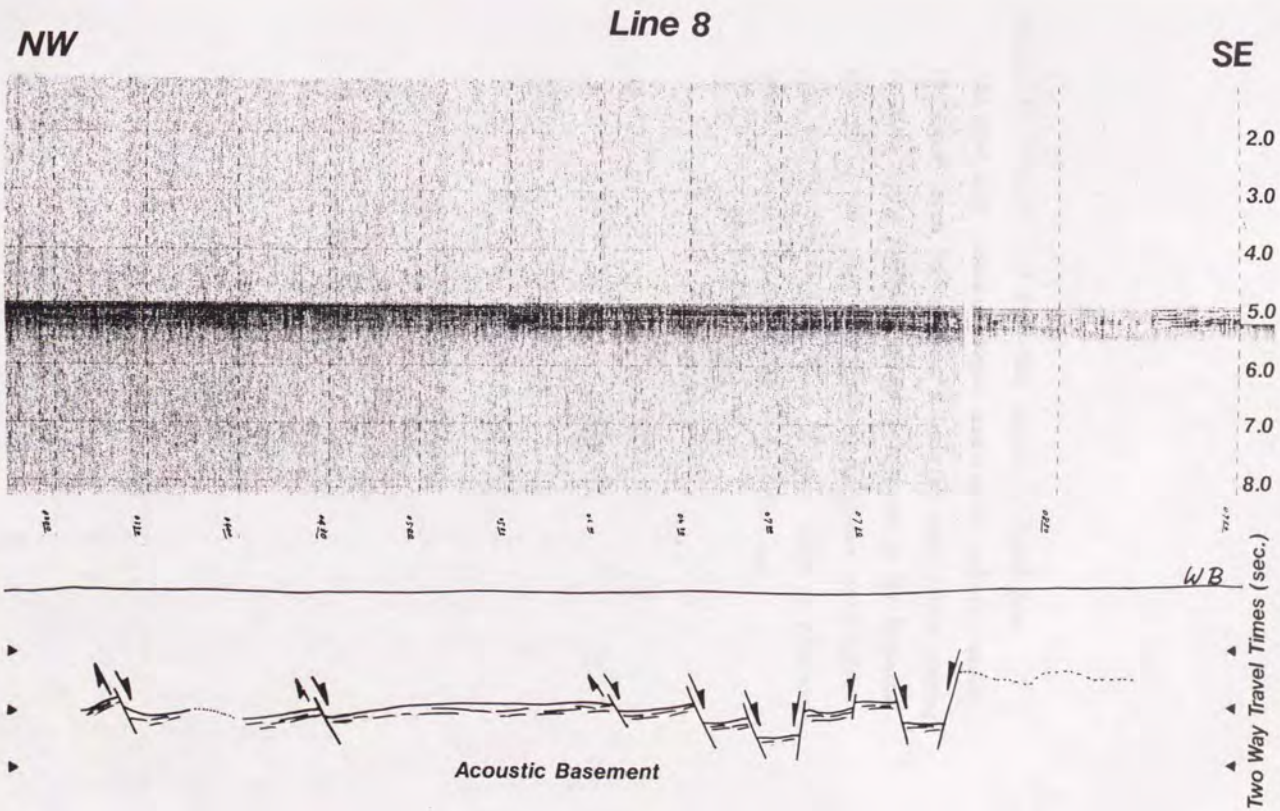
4400
4300
4200
4100
4000
136
137
138
139
140
141
Line 7
Line 8

Figure I-3: Single-channel seismic profile of the line-7, displayed in upper. Geostructural interpretation is displayed in lower. The acoustic basement is cut by several normal faults which do not reach to the sea floor.



Line 7
NE
SW
2.0
3.0
4.0
5.0
6.0
7.0
8.0
WB
Two Way Travel Times (sec.)
Acoustic Basement

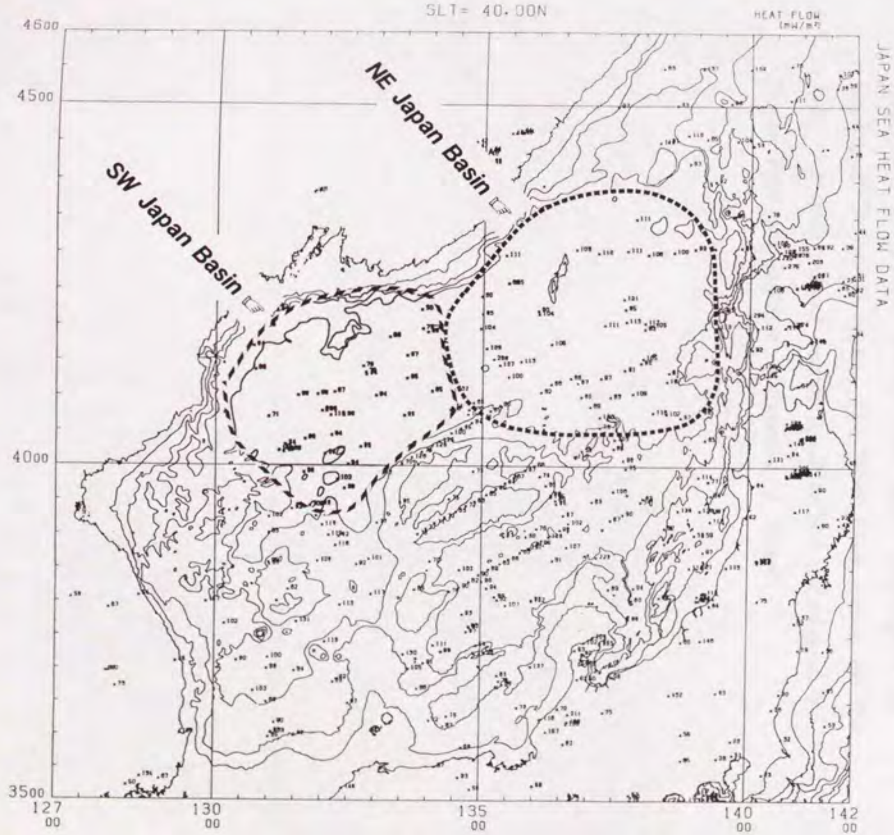
Figure I-4: Single-channel seismic profile of the line-8, displayed in upper. Geostructural interpretation is displayed in lower. The acoustic basement is cut by several normal faults which do not reach to the sea floor.



Line 8
NW
SE
2.0
3.0
4.0
5.0
6.0
7.0
8.0
Two Way Travel Times (sec.)
WB
Acoustic Basement

Figure I-5: Compiled heat flow data around the Japan Sea.

The heat flow values of Japan Basin show regional variety. Northeast Japan Basin shows a little bit high values, average value is 114.4 mW/m^2, which can convert to the formation age, 18-20 Ma. Southeast Japan Basin shows much colder than the Northeast Japan Basin, average value is $85mW/m^2$, which estimated as 31-35 Ma of formation age.



NE Japan Basin (mW/m^2)

80	85	104	109	268	107	100	119
95	105	85	112	119	111	90	104
105	90	91	109	97	109	116	106
111	99	100	108	111	110	109	121
192							

Average: 114.4
= 2.67 (HFU) >>>>> **18 - 20 Ma**

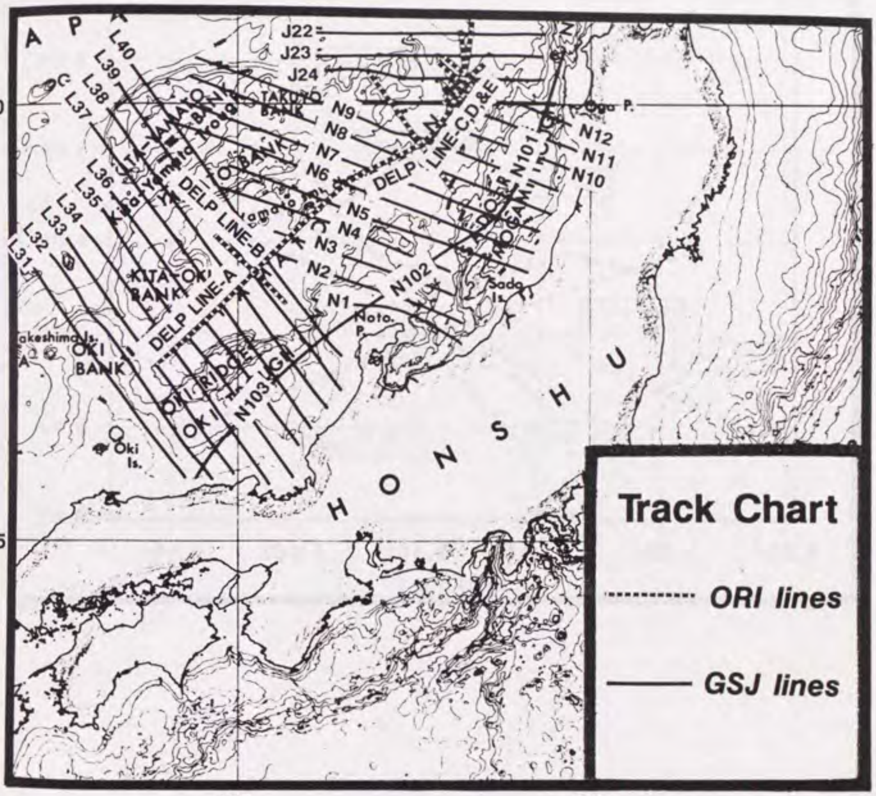
SW Japan Basin (mW/m^2)

50	73	89	88	87	78	79	94
54	86	84	95	94	88	141	59
85	85	84	95	54	98	120	102
89	89	59	89	87	71	119	90
102	33						

Average: 85.0
= 2.03 (HFU) >>>>> **31 - 35 Ma**

Figure I-6-(1): Whole track chart in the Yamato Basin. Dashed line shows the multichannel seismic survey lines taken by Ocean Research Institute, University of Tokyo. Solid line shows the single-channel seismic survey lines which investigated by Geological Survey of Japan. (2): Track chart around the Site 794. All multichannel seismic profiles are investigated by Ocean Research Institute, University of Tokyo.

(1)



Track Chart
ORI lines
GSJ lines
J22
J23
J24
TAKUYO BANK
N9
N8
N7
N6
N5
N4
N3
N2
N1
N12
N11
N10
N101
N102
N103
DELP LINE-A
DELP LINE-B
DELP LINE-C,D,&E
L31
L32
L33
L34
L35
L36
L37
L38
L39
L40
KITA-OKI BANK
OKI BANK
OKI RIDGE
Oki Is.
Sado Is.
Noto P.
Oga P.
H O N S H U
40
35
135
140

(2)

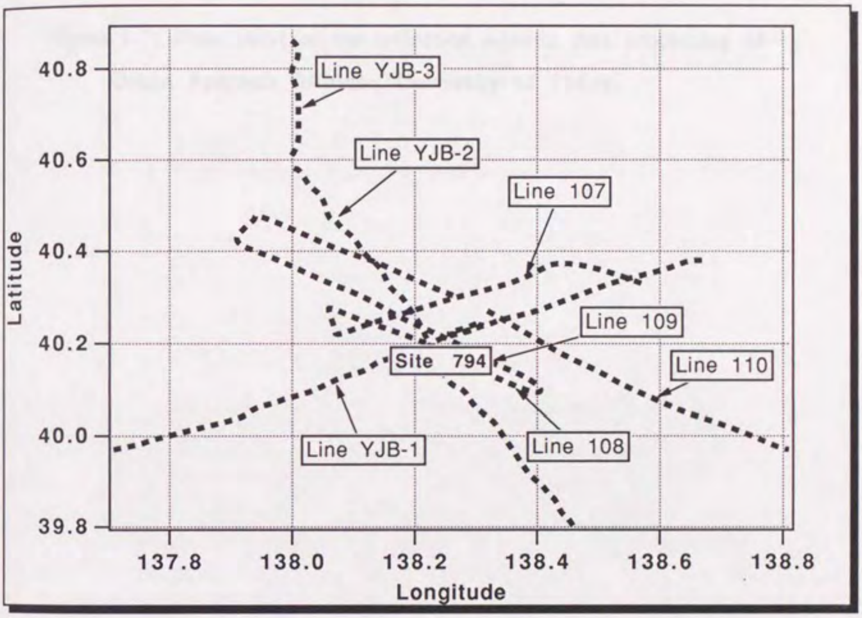

Line YJB-3
Line YJB-2
Line 107
Line 109
Site 794
Line 110
Line YJB-1
Line 108
Latitude
Longitude
40.8
40.6
40.4
40.2
40.0
39.8
137.8
138.0
138.2
138.4
138.6
138.8

Figure I-7: Flow chart of the reflection seismic data processing of Ocean Research Institute, University of Tokyo.

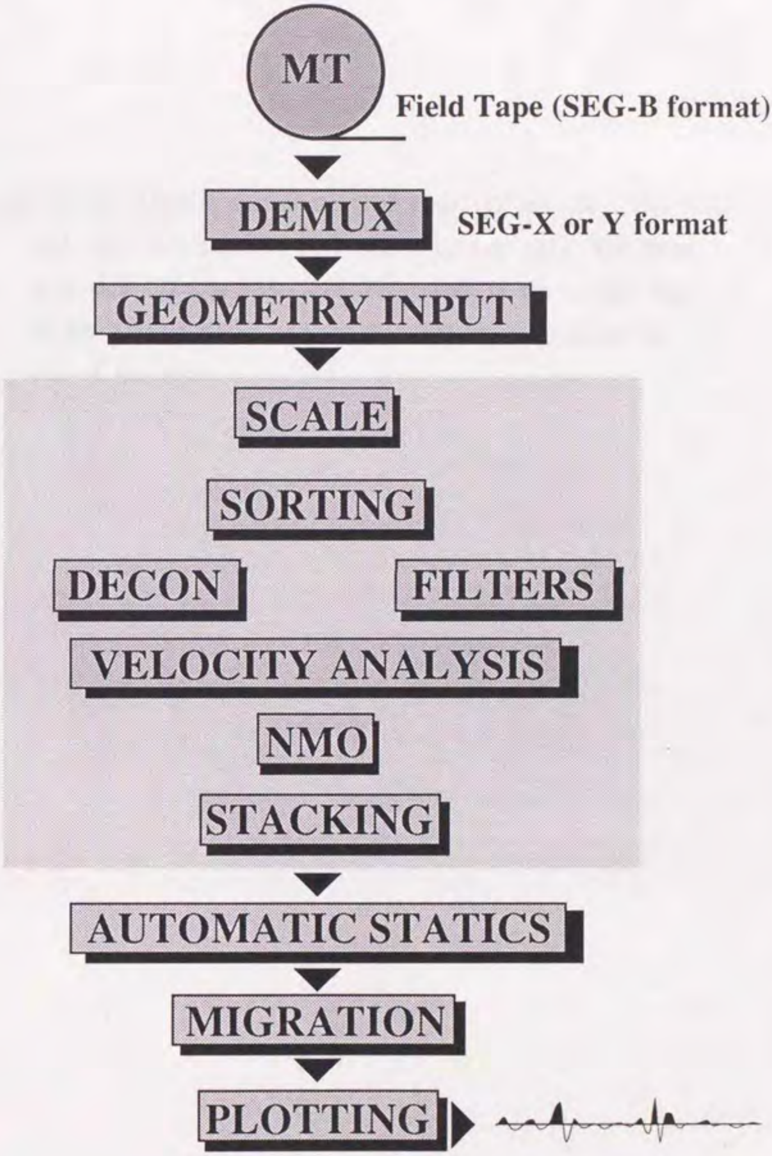

MT
Field Tape (SEG-B format)
DEMUX
SEG-X or Y format
GEOMETRY INPUT
SCALE
SORTING
DECON
FILTERS
VELOCITY ANALYSIS
NMO
STACKING
AUTOMATIC STATICS
MIGRATION
PLOTTING

Figure I-8: Site location map of the ODP Legs 127 and 128. Site 794, 795, 796, and 797 were drilled by Leg 127. The other were done by Leg 128. Site 794 situate in the norther edge of the Yamato Basin, and the Site 797 locate southwestern end of the basin.

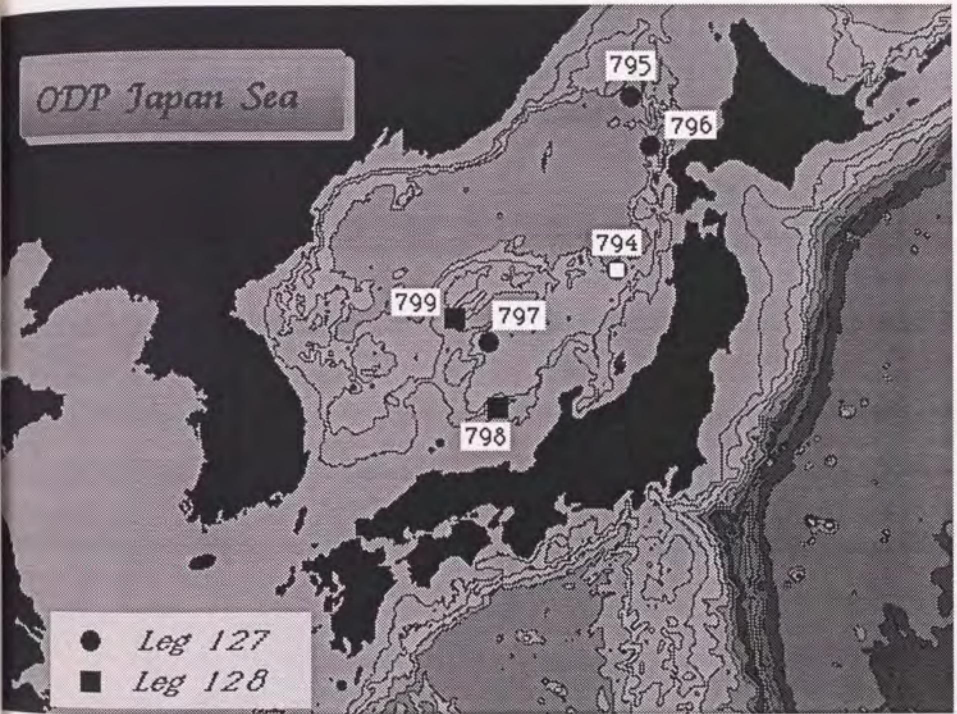

ODP Japan Sea
795
796
794
799
797
798
Leg 127
Leg 128

Figure I-9: Illustration shows sampling and measurement procedure for physical properties during the Leg 127.

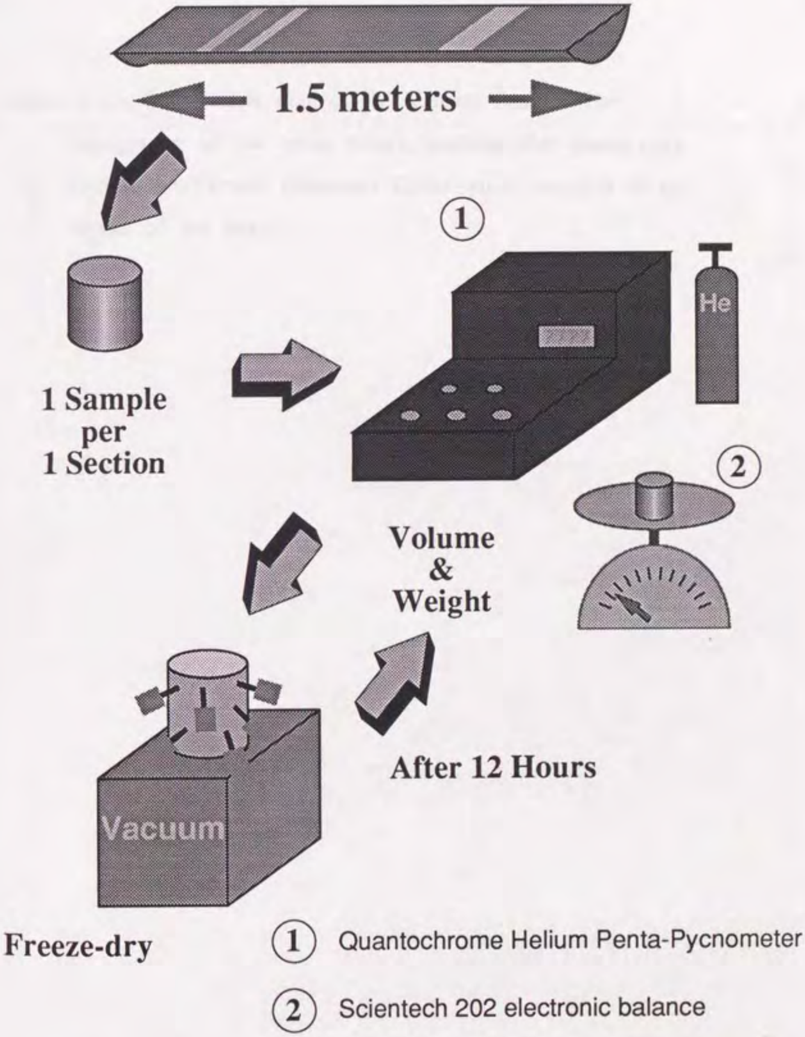
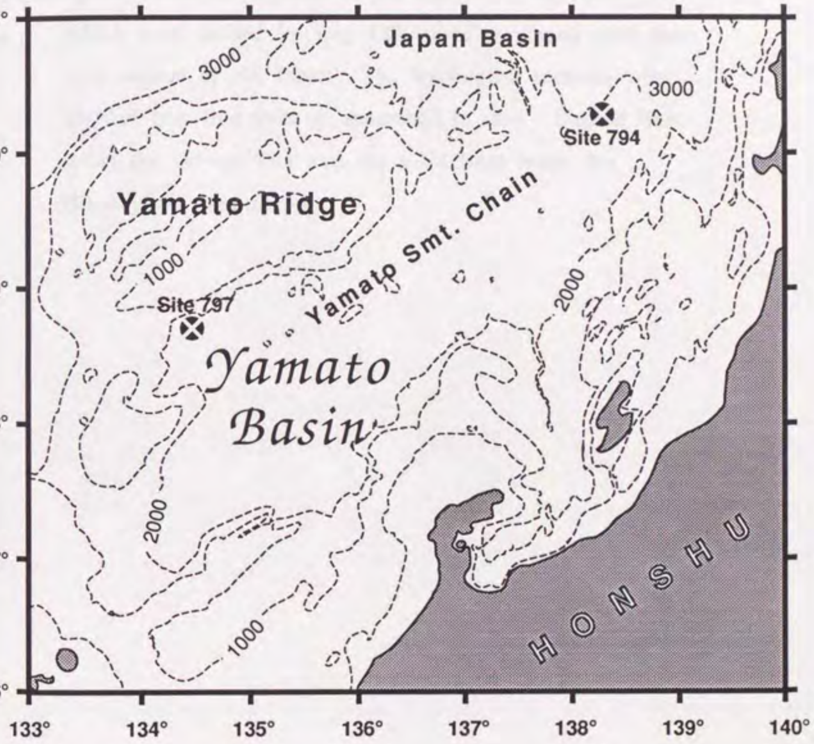
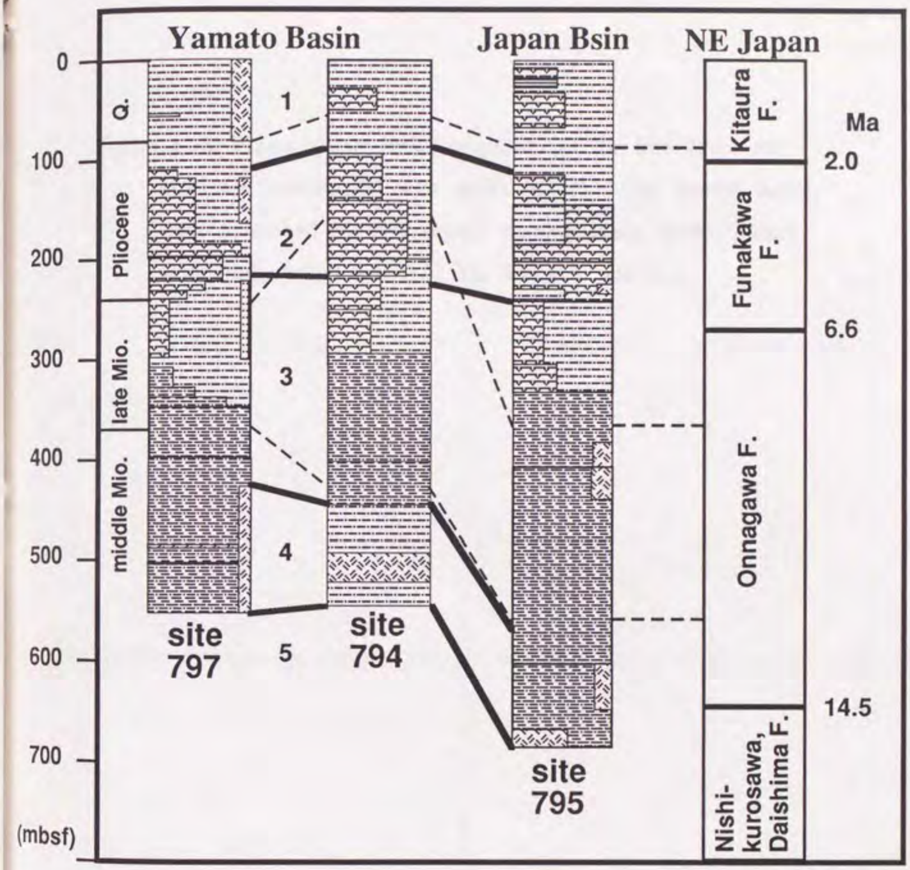

1.5 meters
1 Sample
per
1 Section
1
He
2
Volume
&
Weight
Vacuum
After 12 Hours
Freeze-dry
1 Quantochrome Helium Penta-Pycnometer
2 Scientech 202 electronic balance

Figure I-10: Bathymetric map of the Yamato Basin. The topography of the basin shows fearfully flat topography except the Yamato Seamount Chain which locating in the center of the basin.



Japan Basin
Yamato Ridge
Yamato Smt. Chain
Yamato Basin
Site 794
Site 797
HONSHU
3000
3000
2000
2000
1000
1000
41°
40°
39°
38°
37°
36°
133°
134°
135°
136°
137°
138°
139°
140°

Figure I-11: Columnar sections of the Sites 794, 795, and 797 which were drilled by Leg 127, were displayed with the type section of NE Japan. The lithological sections were divided into five units as described in text. Dashed lines mean the iso-age line and the solid lines mean the lithological boundaries.



Yamato Basin
Japan Bsin
NE Japan
0
100
200
300
400
500
600
700
(mbsf)
Q.
Pliocene
late Mio.
middle Mio.
1
2
3
4
5
site 797
site 794
site 795
Kitaura F.
Funakawa F.
Onnagawa F.
Nishi-kurosawa, Daishima F.
Ma
2.0
6.6
14.5

Figure I-12: Figure shows index properties of the Site 794. All plots are coordinated with depth (mbsf). The plotted data were smoothed by five points running mean method, each smoothing weight was 0.5, 0.8, 1.0, 0.8, and 0.5.

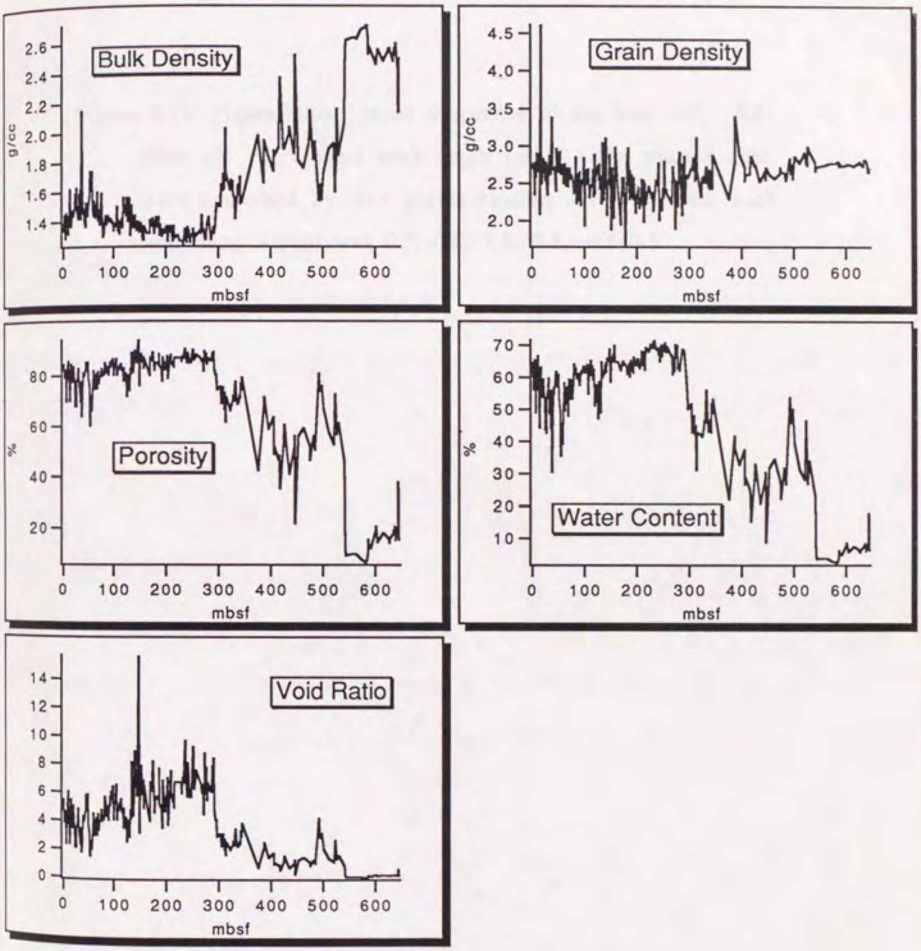

Bulk Density
g/cc
2.6
2.4
2.2
2.0
1.8
1.6
1.4
0
100
200
300
400
500
600
mbsf
Grain Density
g/cc
4.5
4.0
3.5
3.0
2.5
2.0
0
100
200
300
400
500
600
mbsf
Porosity
%
80
60
40
20
0
100
200
300
400
500
600
mbsf
Water Content
%
70
60
50
40
30
20
10
0
100
200
300
400
500
600
mbsf
Void Ratio
14
12
10
8
6
4
2
0
0
100
200
300
400
500
600
mbsf

Figure I-13: Figure shows index properties of the Site 797. All plots are coordinated with depth (mbsf). The plotted data were smoothed by five points running mean method, each smoothing weight was 0.5, 0.8, 1.0, 0.8, and 0.5.

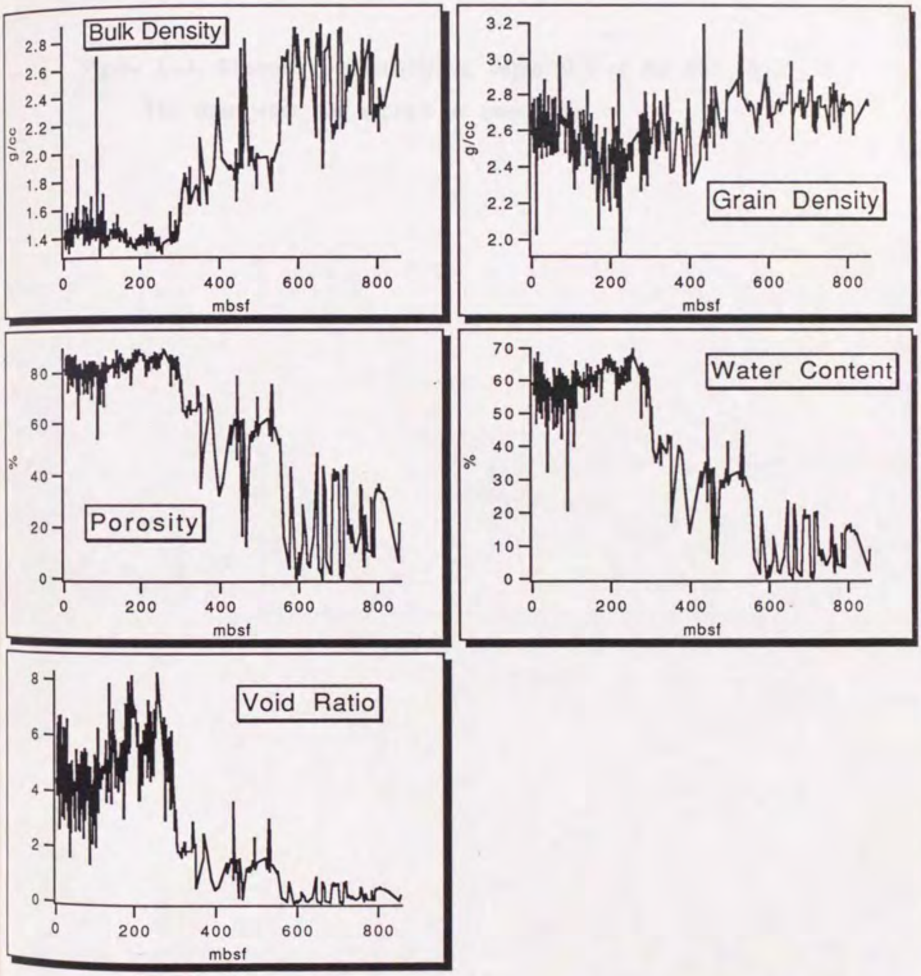

Bulk Density
g/cc
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
0
200
400
600
800
mbsf
Grain Density
g/cc
3.2
3.0
2.8
2.6
2.4
2.2
2.0
0
200
400
600
800
mbsf
Porosity
%
80
60
40
20
0
0
200
400
600
800
mbsf
Water Content
%
70
60
50
40
30
20
10
0
0
200
400
600
800
mbsf
Void Ratio
8
6
4
2
0
0
200
400
600
800
mbsf

Figure I-14: Thermal conductivity vs. depth plot of the Site 794. The data were not applied to smoothing.

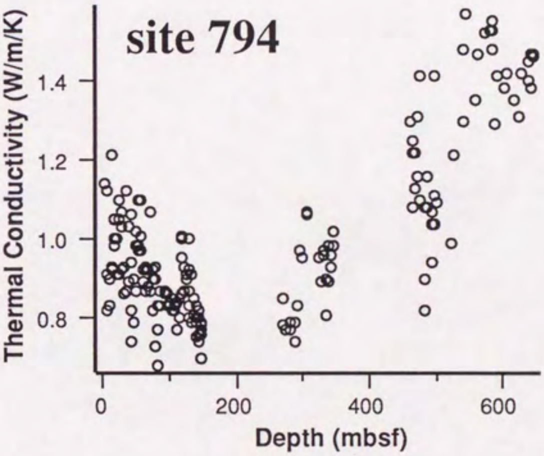

site 794
Thermal Conductivity (W/m/K)
1.4
1.2
1.0
0.8
0
200
400
600
Depth (mbsf)

Figure I-15: Thermal conductivity vs. depth plot of the Site 797. The data were not applied to smooth.

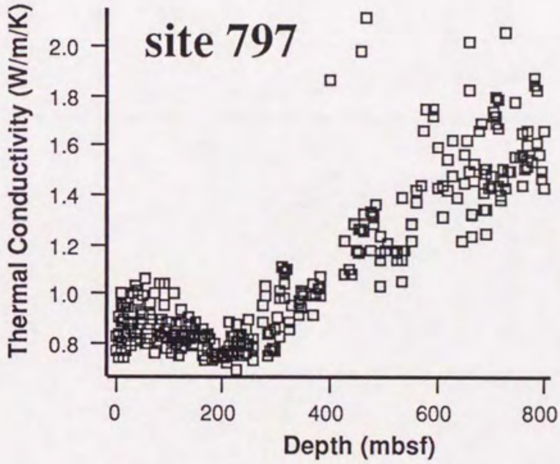
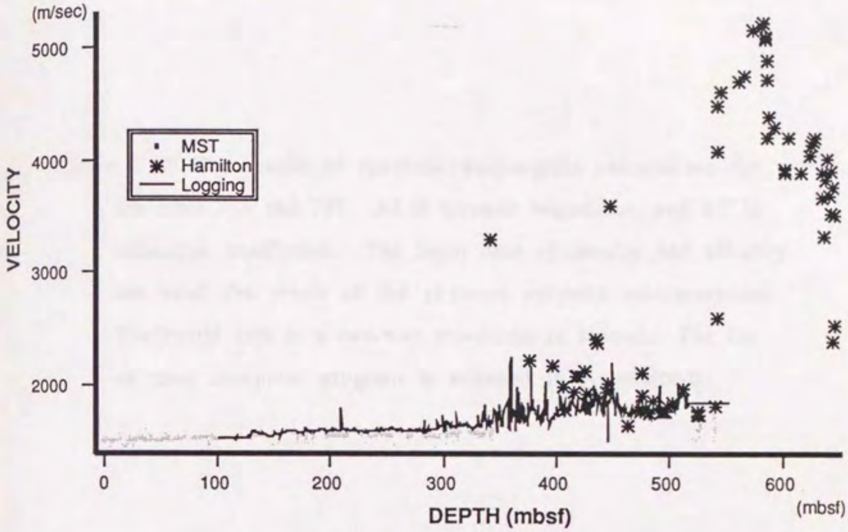

site 797
Thermal Conductivity (W/m/K)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0
200
400
600
800
Depth (mbsf)

Figure I-16: Upper plot display the each velocity profile vs. depth taken by the MST logger, Hamilton Frame, and Logging respectively. Lower plot is a result of the mixing among the velocities as displayed in the upper plot.


(m/sec)
5000
4000
3000
2000
VELOCITY
MST
Hamilton
Logging
0
100
200
300
400
500
600
(mbsf)
DEPTH (mbsf)

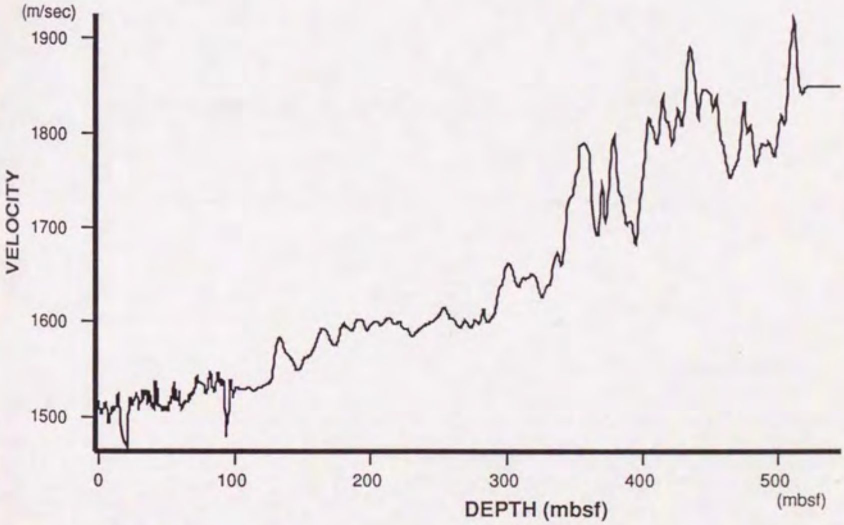
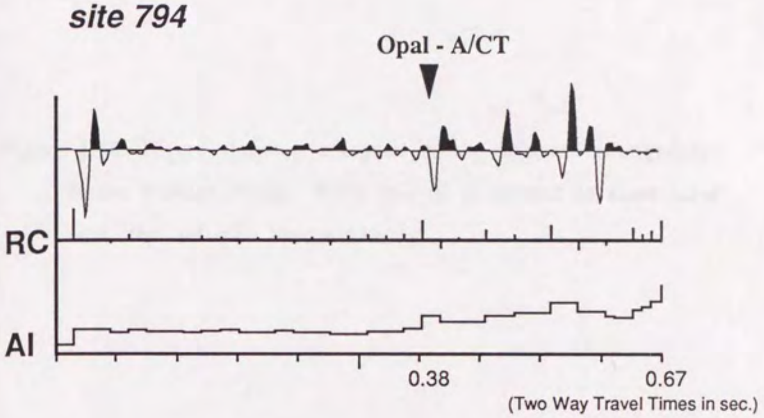
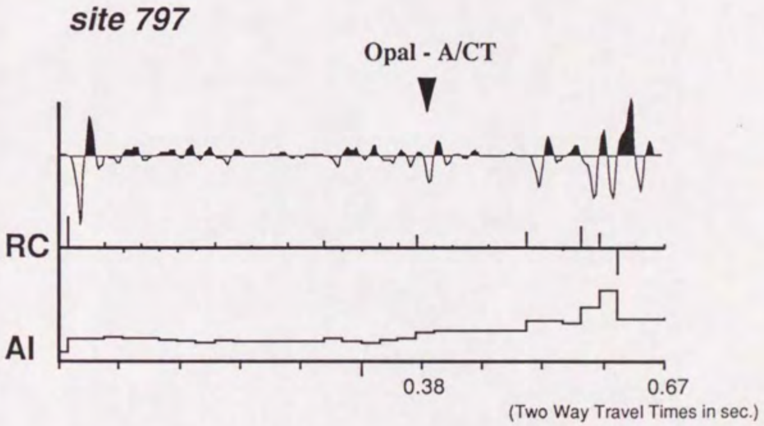

(m/sec)
1900
1800
1700
1600
1500
VELOCITY
0
100
200
300
400
500
(mbsf)
DEPTH (mbsf)

Figure I-17: The results of synthetic seismogram calculations for the Sites 794 and 797. AI is acoustic impedance, and RC is reflection coefficient. The input data of density and velocity are used the result of the physical property measurements. Horizontal axis is a two-way traveltime in second. The list of used computer program is attached in Appendix-B.





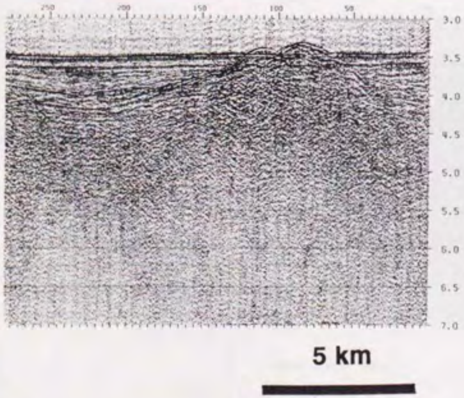
RC: Reflection Coefficient
AI: Acoustic Impedace

Figure I-18: Figure showing a legend of the acoustic stratigraphy in the Yamato Basin. Each interval is painted as same color with the seismic interpretations.

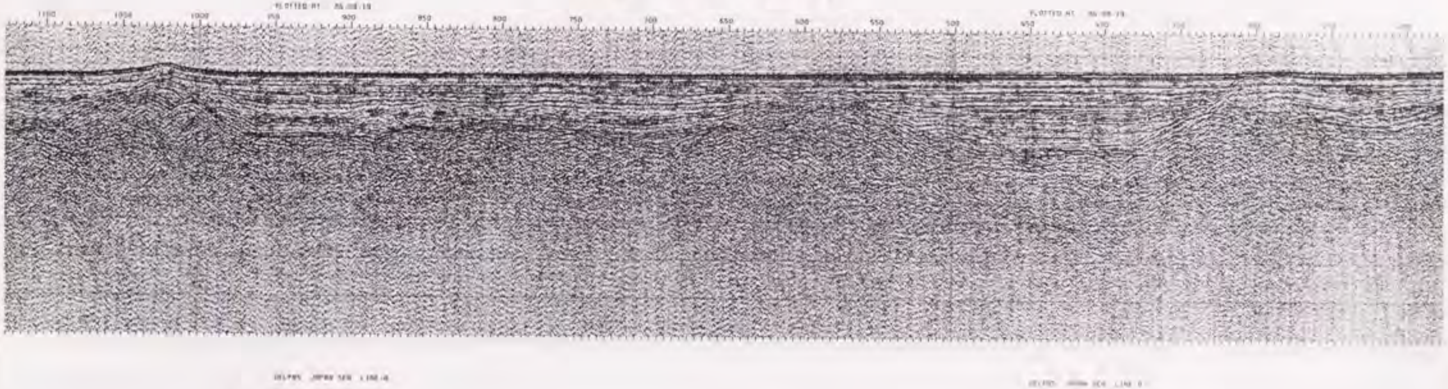
Seismic Interval	Acoustic Character	Lithologic Section
I	weak and flat stratification	alternation of clay & silty clay w/ frequent ash layers Toyama Deep Sea Fan deposits in the northern part
II	weak or transparent stratification include Opal-A/CT BSR	diatomaceous silty clay or diatom ooze
III	well stratified reflector include reverse porality reflector	alternation of chert & siliceous clay calcareous & phosphatic clay
IV	weak or transparent stratification	sand & silt (?)
V	steep inclined stratification	apron sediments of seamounts
VI	acoustic basement include low frequency reflector	alternation of sill & sediments

Figure I-19: Multichannel seismic profile of the DELP Line-A. The line runs from northeast to southwest.

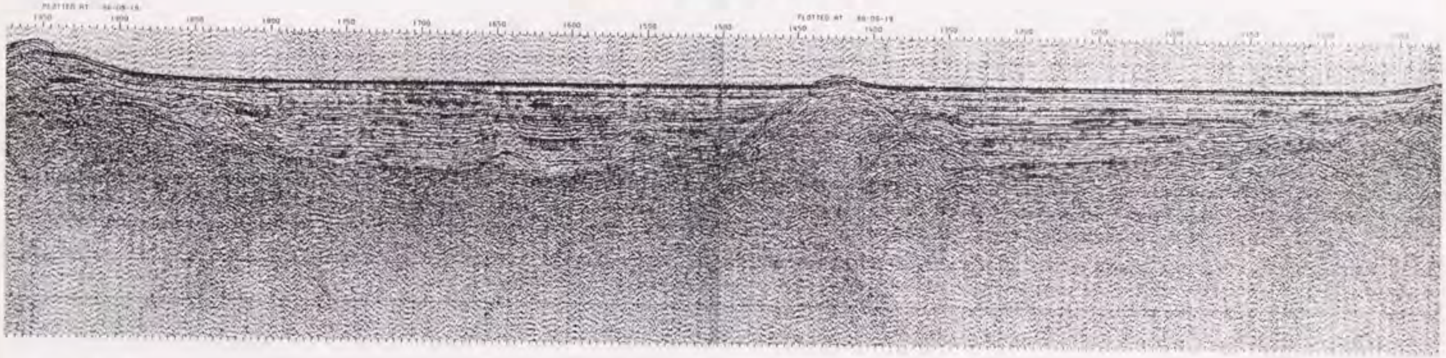
DELP Line-A (1/6)



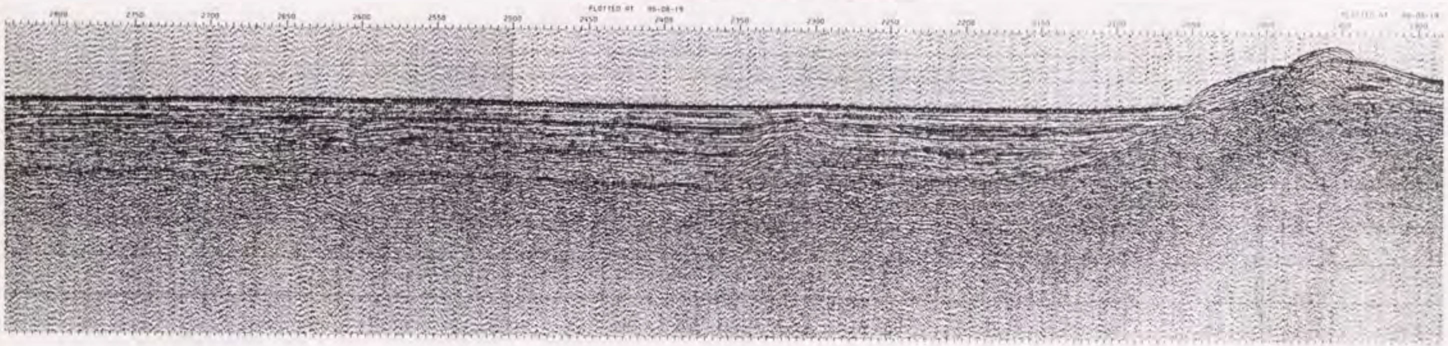
DELP Line-A (2/6)



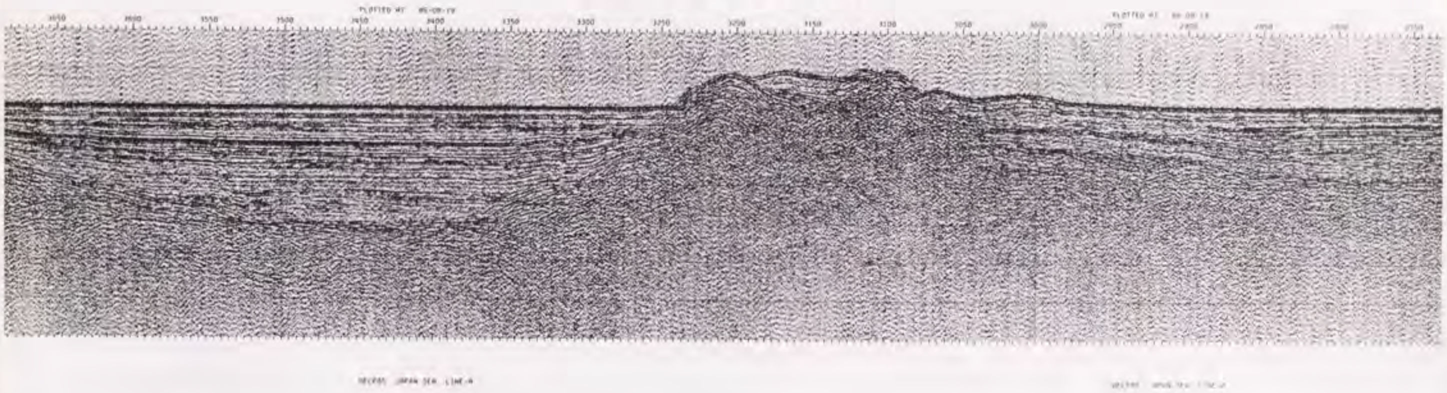
DELP Line-A (3/6)



DELP Line-A (4/6)



DELP Line-A (5/6)



SW

DELP Line-A (6/6)

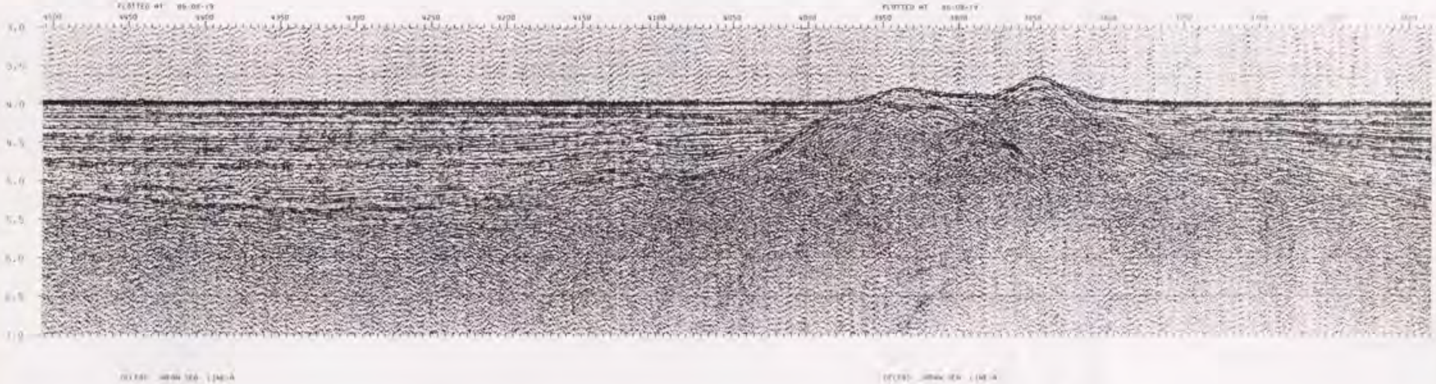


Figure I-20: Seismic interpretation of the DELP Line-A. The painted color is same as in Fig. I-18. Dotted line represents the opal-A/opal-CT boundary BSR. The profiles are continuous from the top to the bottom.

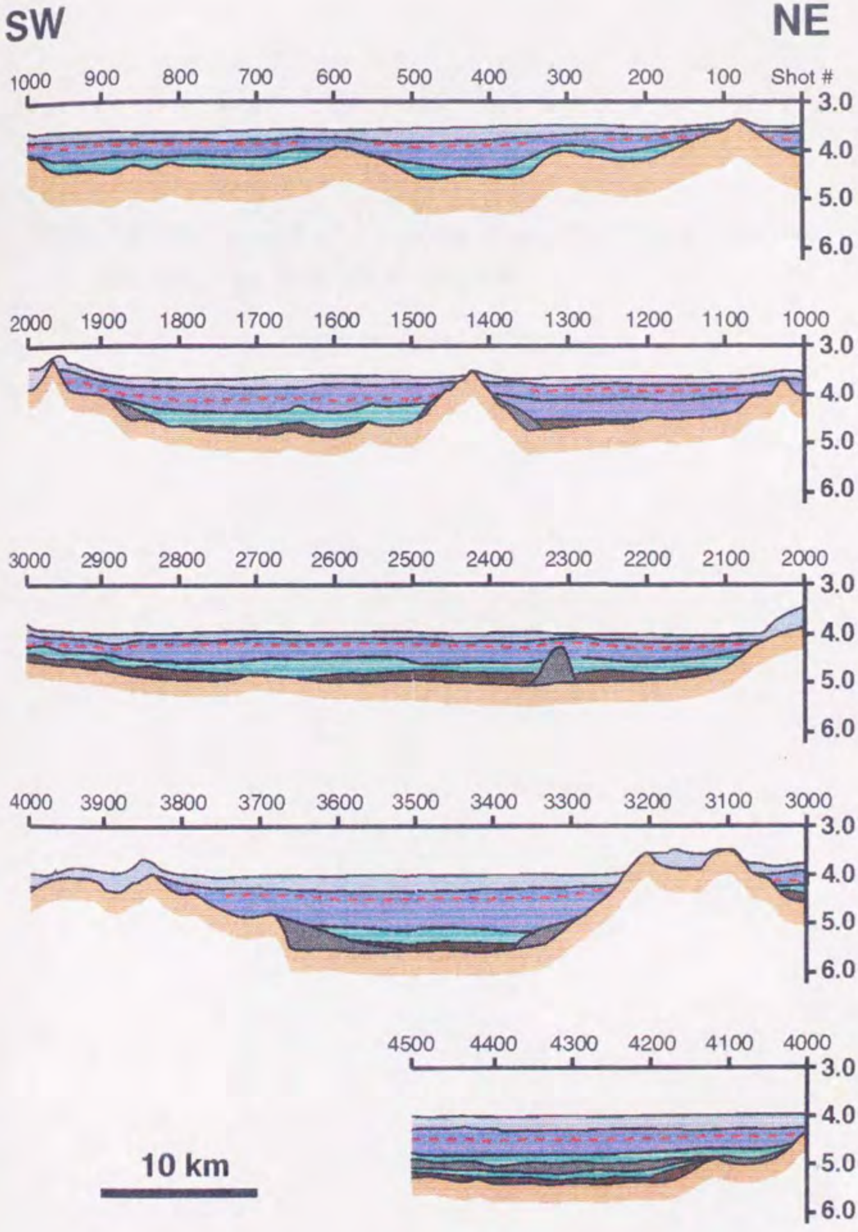
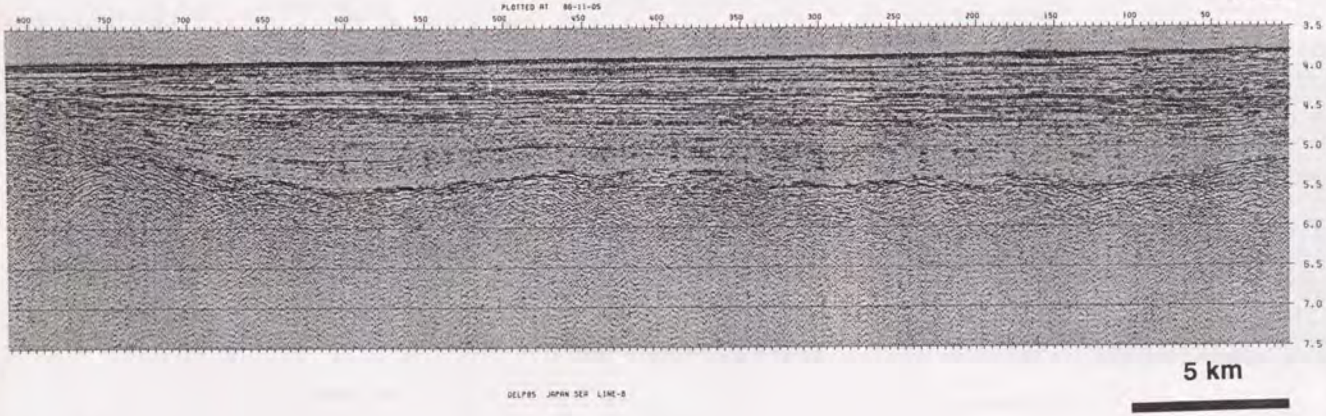
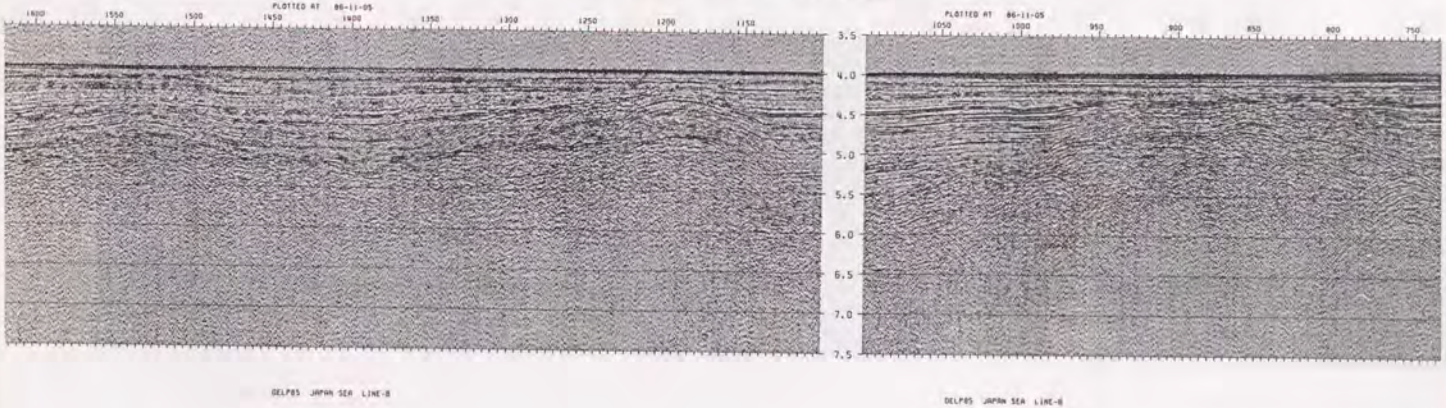

SW
NE
Shot #
1000 900 800 700 600 500 400 300 200 100
2000 1900 1800 1700 1600 1500 1400 1300 1200 1100 1000
3000 2900 2800 2700 2600 2500 2400 2300 2200 2100 2000
4000 3900 3800 3700 3600 3500 3400 3300 3200 3100 3000
4500 4400 4300 4200 4100 4000
3.0
4.0
5.0
6.0
10 km

Figure I-21: Multichannel seismic profile of the DELP Line-B. The line runs from southeast to northwest.

DELP Line-B (1/3)

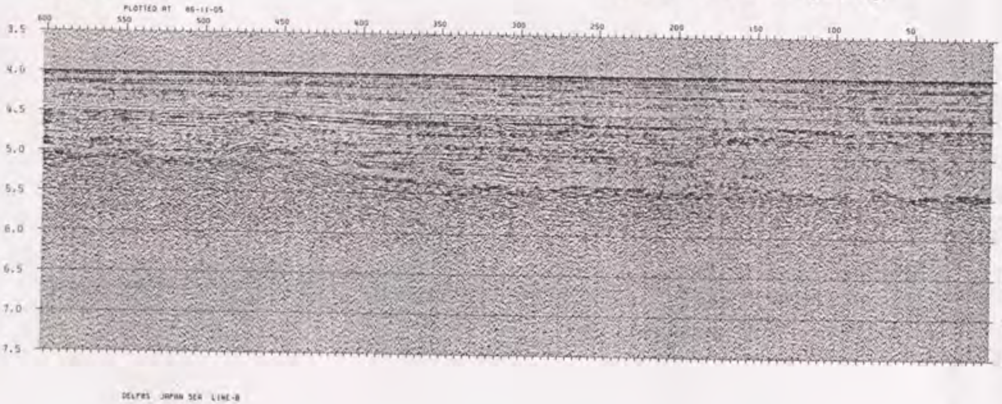


DELP Line-B (2/3)



NW

DELP Line-B (3/3)



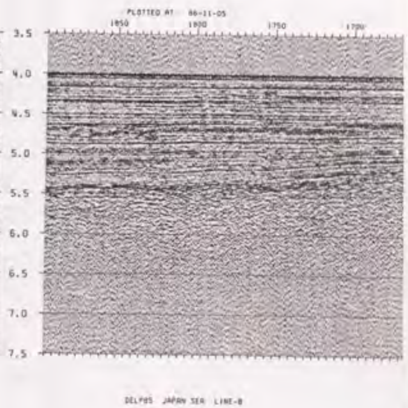
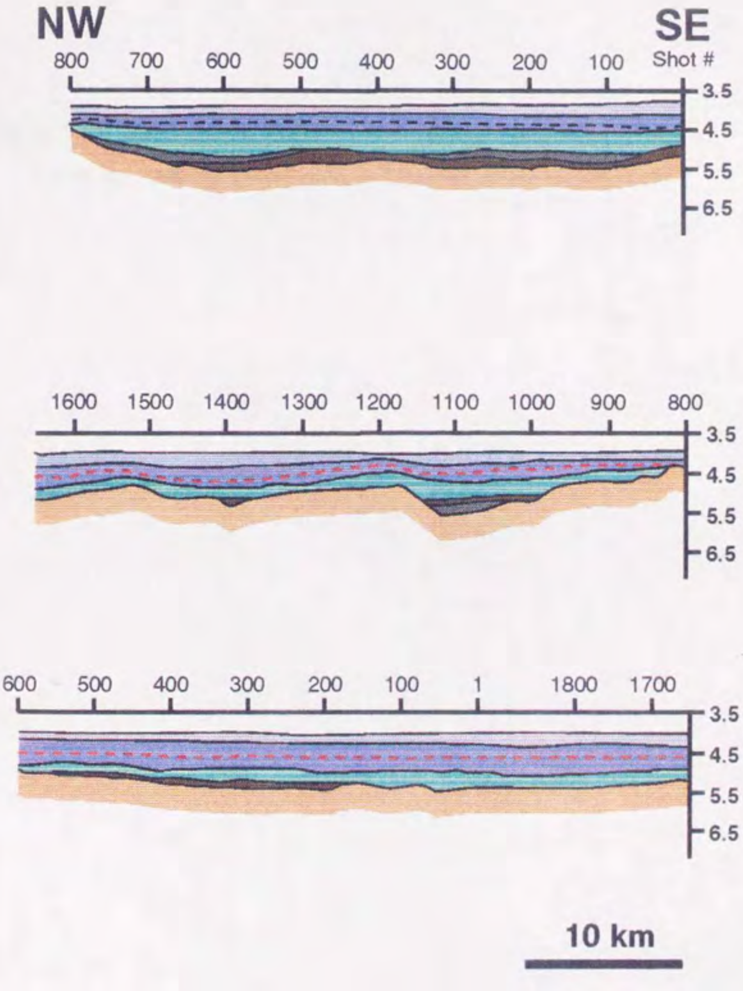


Figure I-22: Seismic interpretation of the DELP Line-B. The painted color is same as in Fig. I-18. Dotted line represents the opal-A/opal-CT boundary BSR. The profiles are continuous from the top to the bottom.

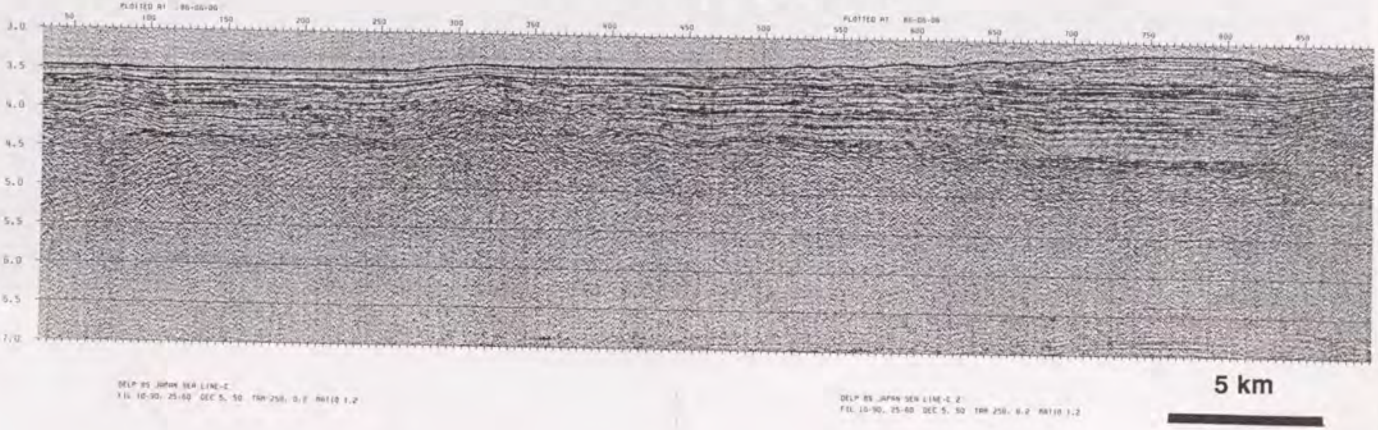


NW
SE
800 700 600 500 400 300 200 100
Shot #
3.5
4.5
5.5
6.5
1600 1500 1400 1300 1200 1100 1000 900 800
3.5
4.5
5.5
6.5
600 500 400 300 200 100 1 1800 1700
3.5
4.5
5.5
6.5
10 km

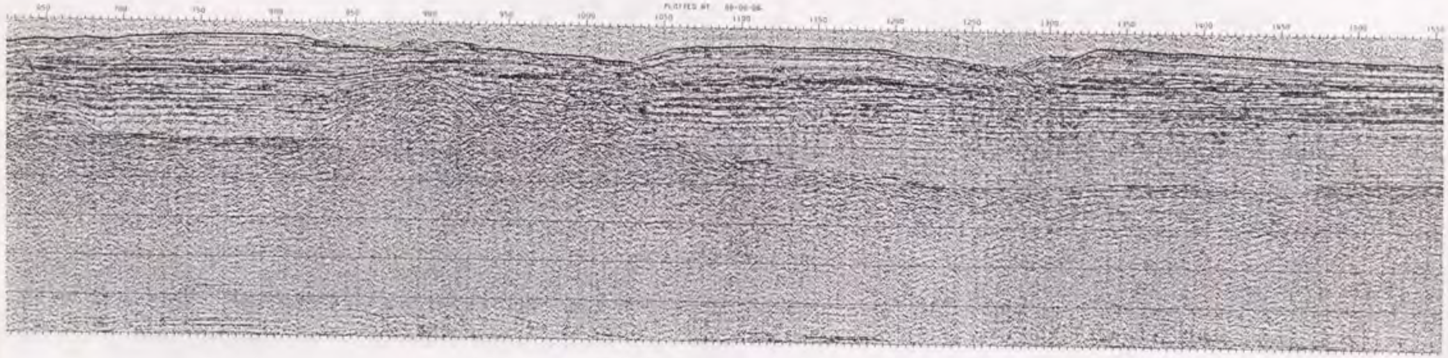
Figure I-23: Multichannel seismic profile of the DELP Line-C, D, and E. The line runs from southwest to northeast.

SW

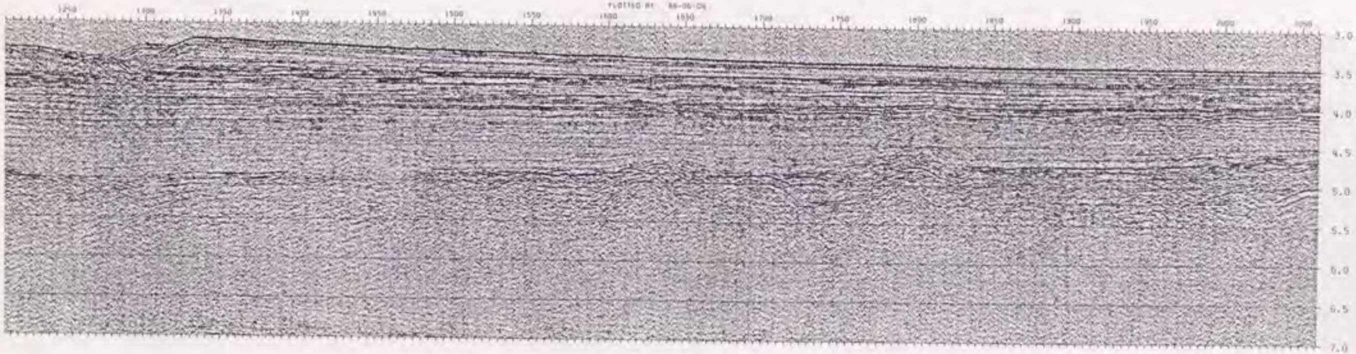
DELP Line-C, D, & E (1/6)



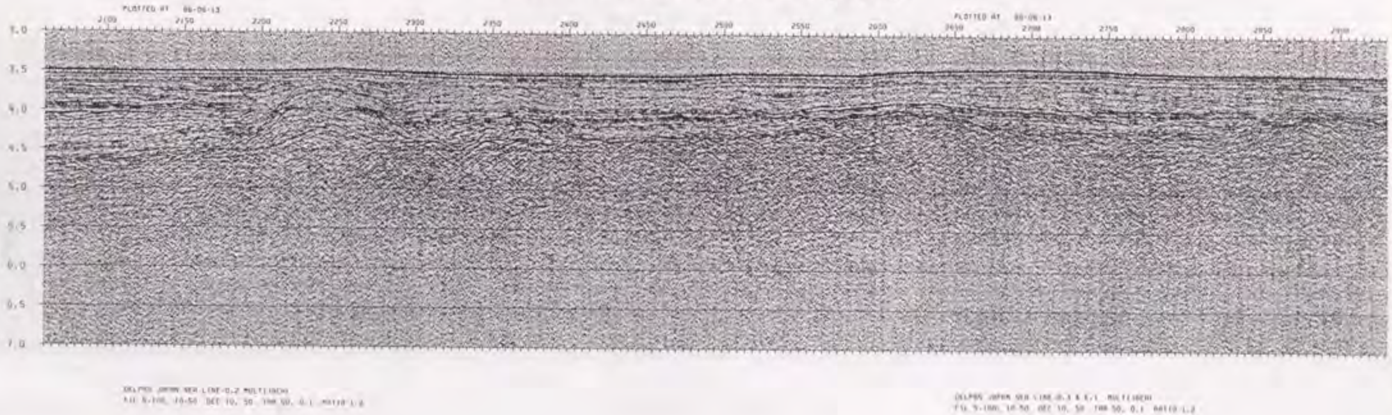
DELP Line-C, D, & E (2/6)



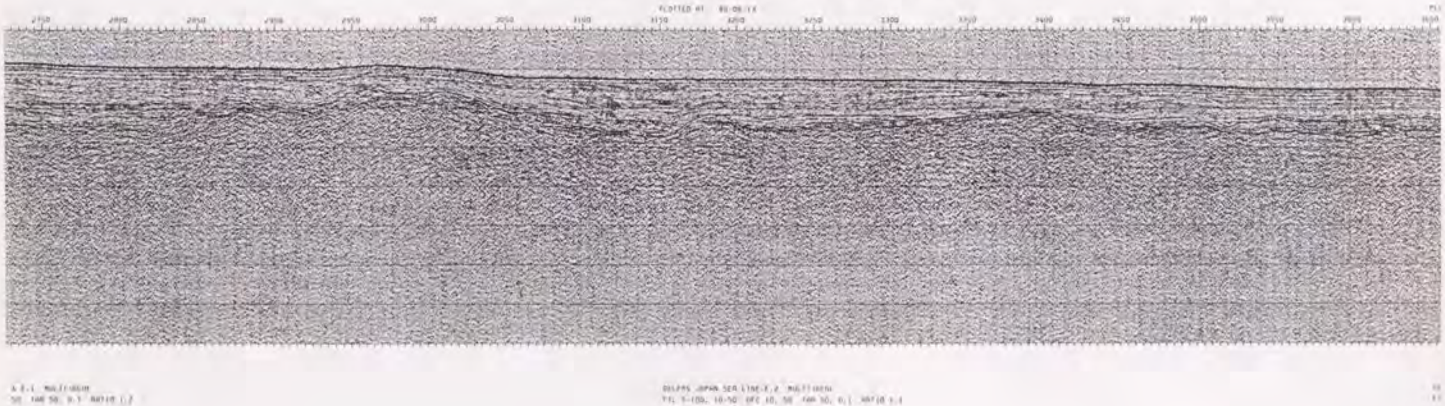
DELP Line-C, D, & E (3/6)



DELP Line-C, D, & E (4/6)



DELP Line-C, D, & E (5/6)



DELP Line-C, D, & E (6/6)

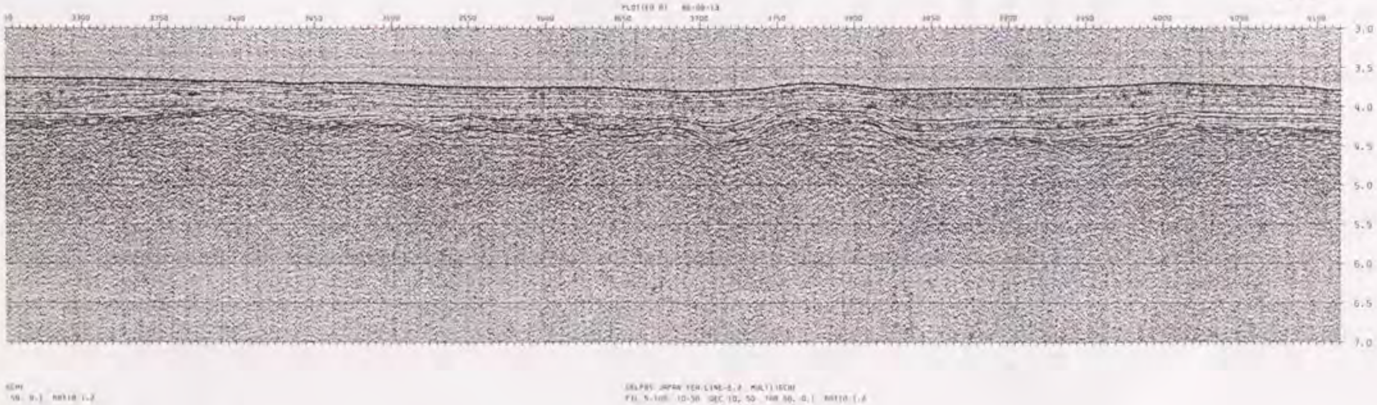
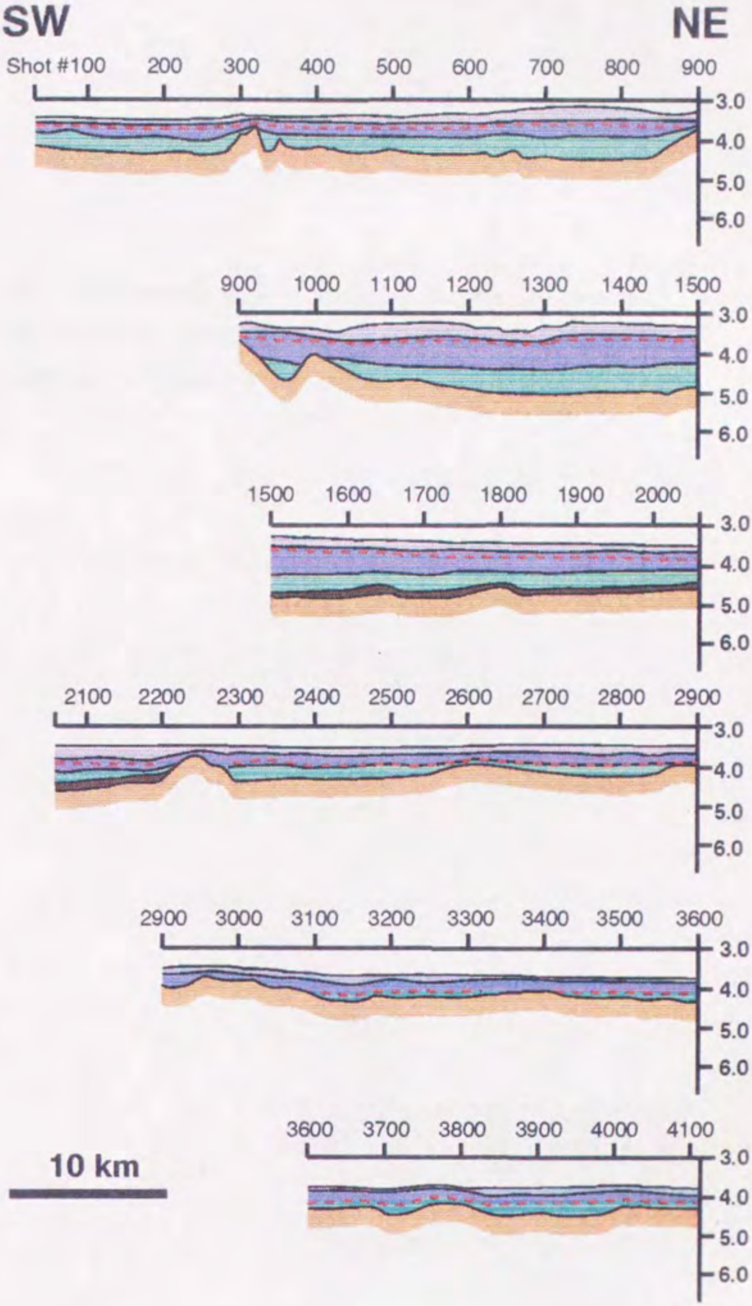


Figure I-24: Seismic interpretation of the DELP Line-C, D, and E. The painted color is same as in Fig. I-18. Dotted line represents the opal-A/opal-CT boundary BSR. The profiles are continuous from the top to the bottom.



SW
NE
Shot #100
200
300
400
500
600
700
800
900
900
1000
1100
1200
1300
1400
1500
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
2900
3000
3100
3200
3300
3400
3500
3600
3600
3700
3800
3900
4000
4100
3.0
4.0
5.0
6.0
10 km

Figure I-25: Multichannel seismic profile of the line 107, which was taken during the KT-88-9 cruise. The line runs from northeast to southwest.

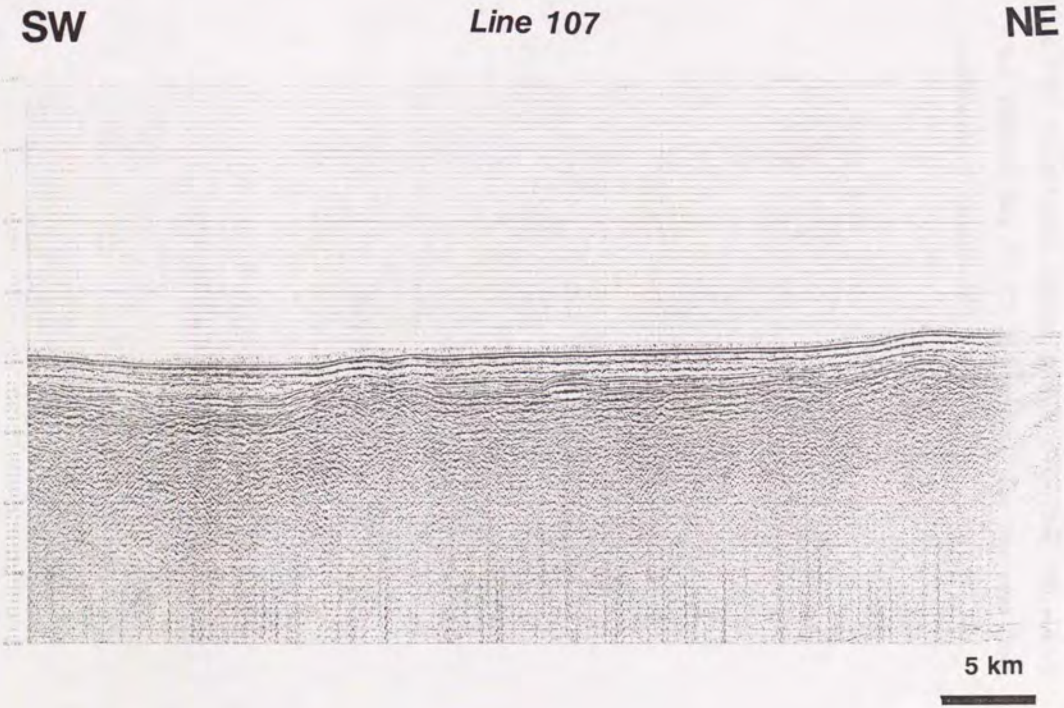

SW
Line 107
NE
5 km

Figure I-26: Multichannel seismic profile of the line 108, which was taken during the KT-88-9 cruise. The line runs from northwest to southeast.

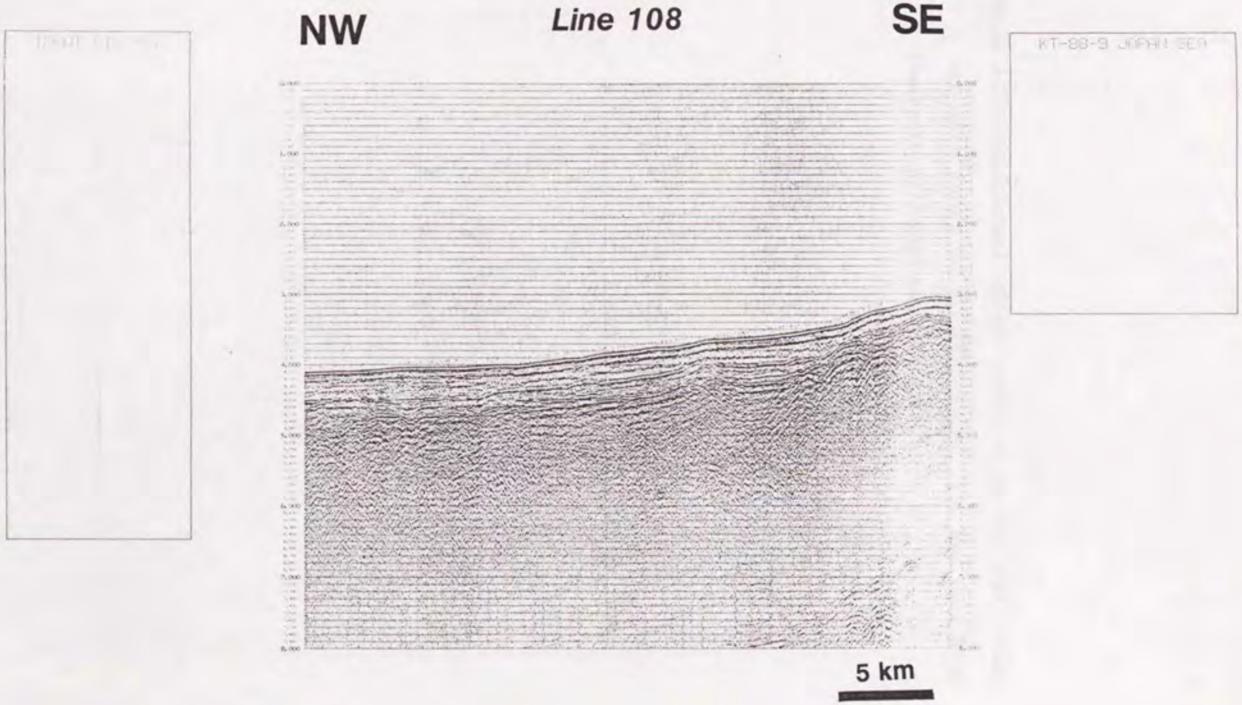
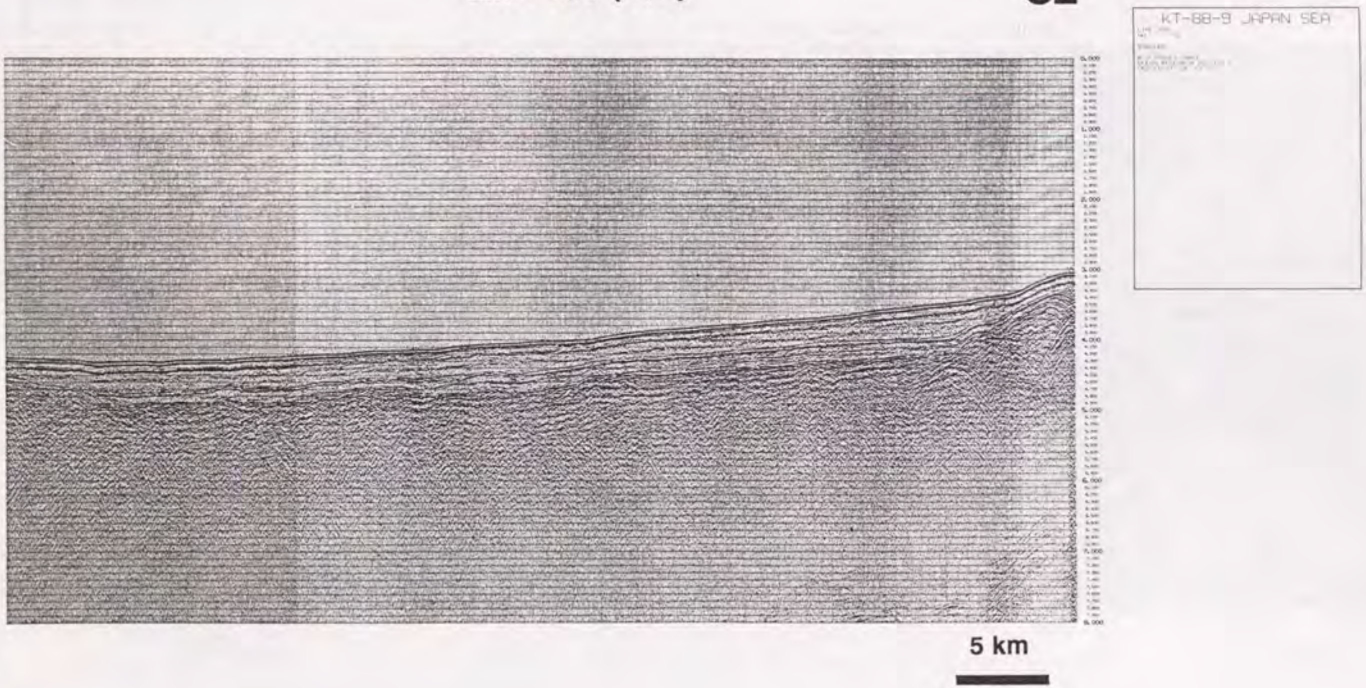

NW
Line 108
SE
KT-88-9 JAPAN SEA
5 km

Figure I-27: Multichannel seismic profile of the line 109, which was taken during the KT-88-9 cruise. The line runs from southeast to northwest.

Line 109 (1/2)

SE



NW

Line 109 (2/2)

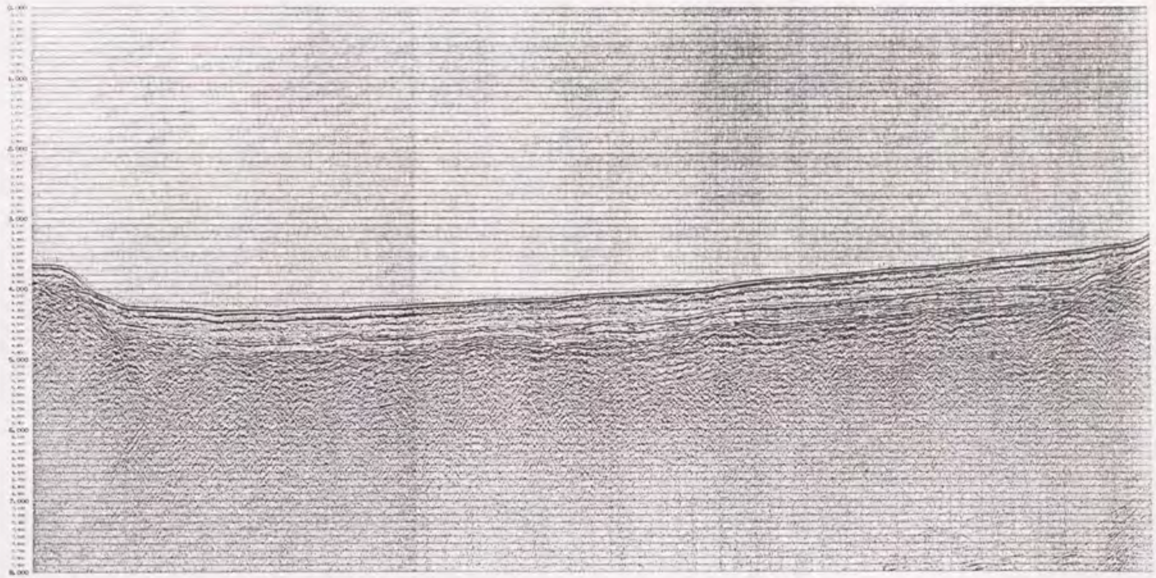
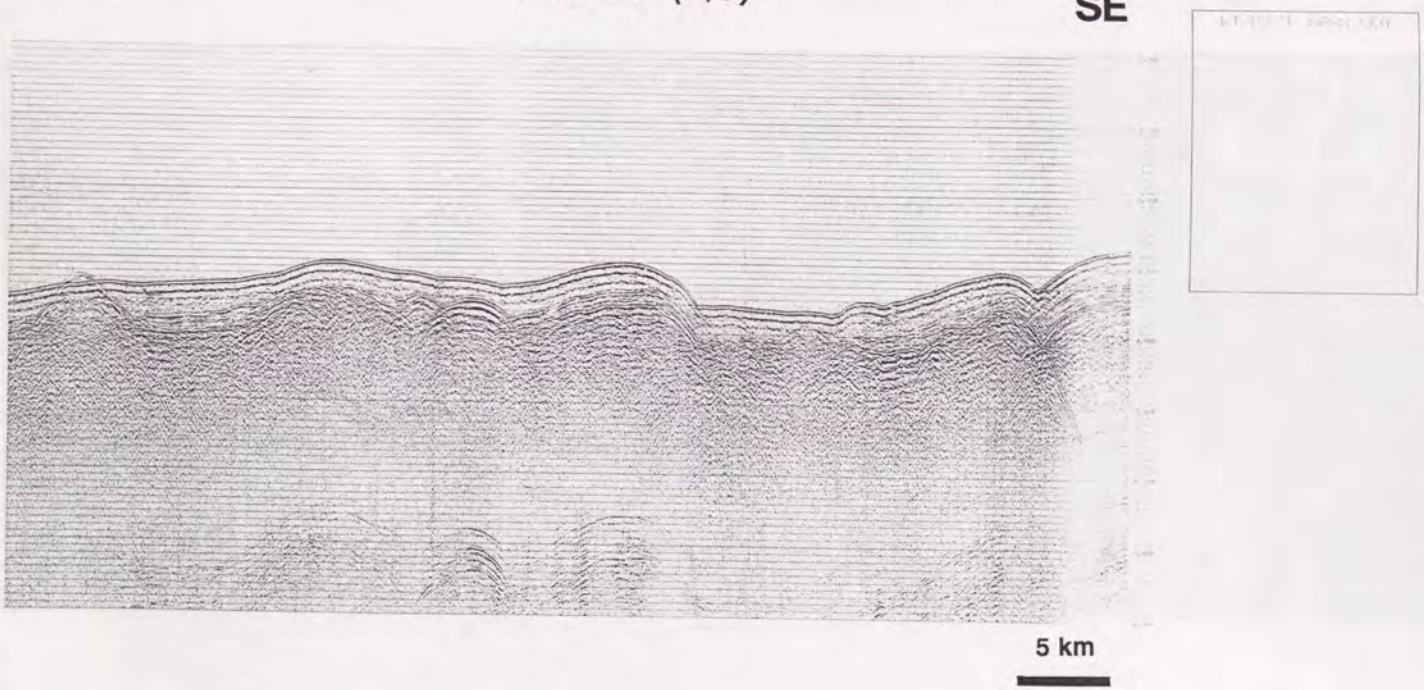
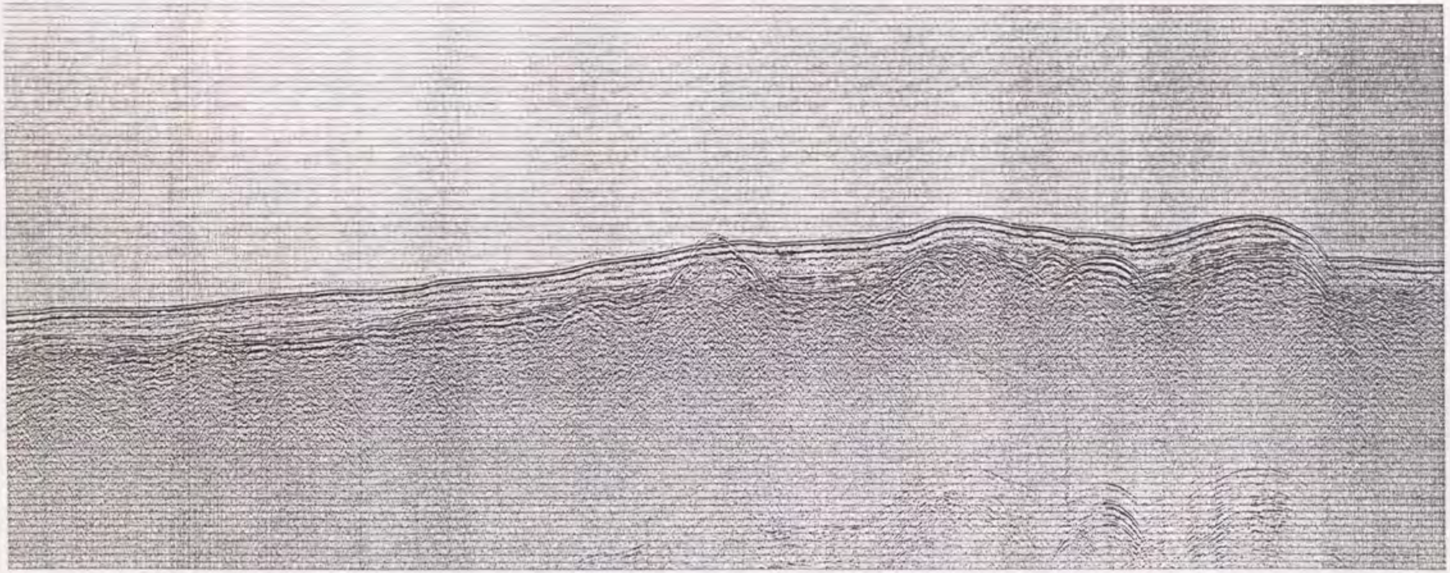


Figure I-28: Multichannel seismic profile of the line 110, which was taken during the KT-88-9 cruise. The line runs from northwest to southeast.

Line 110 (1/3)



Line 110 (2/3)



NW

Line 110 (3/3)

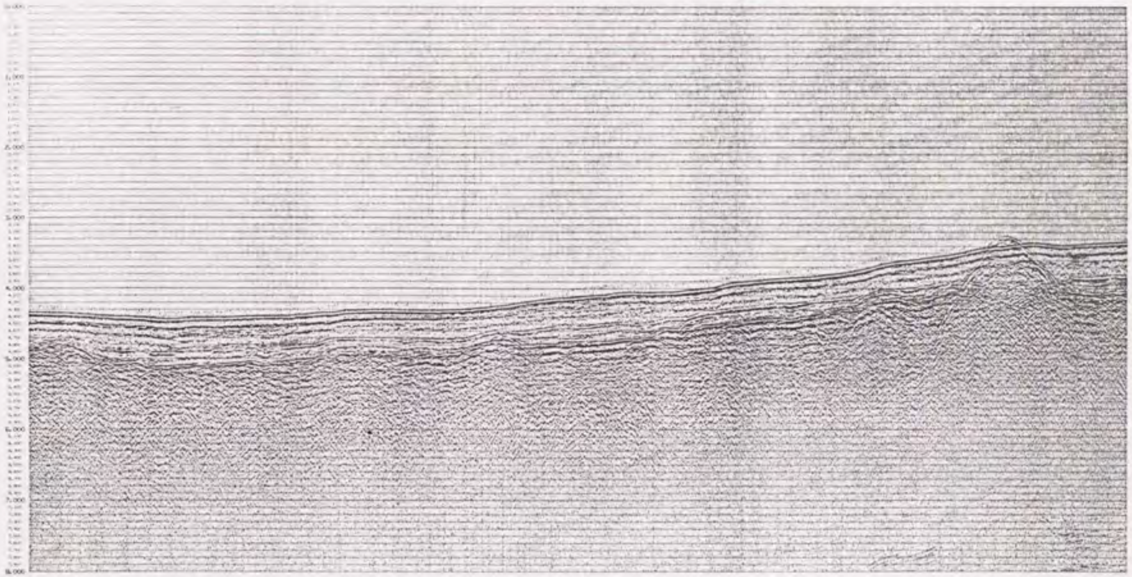
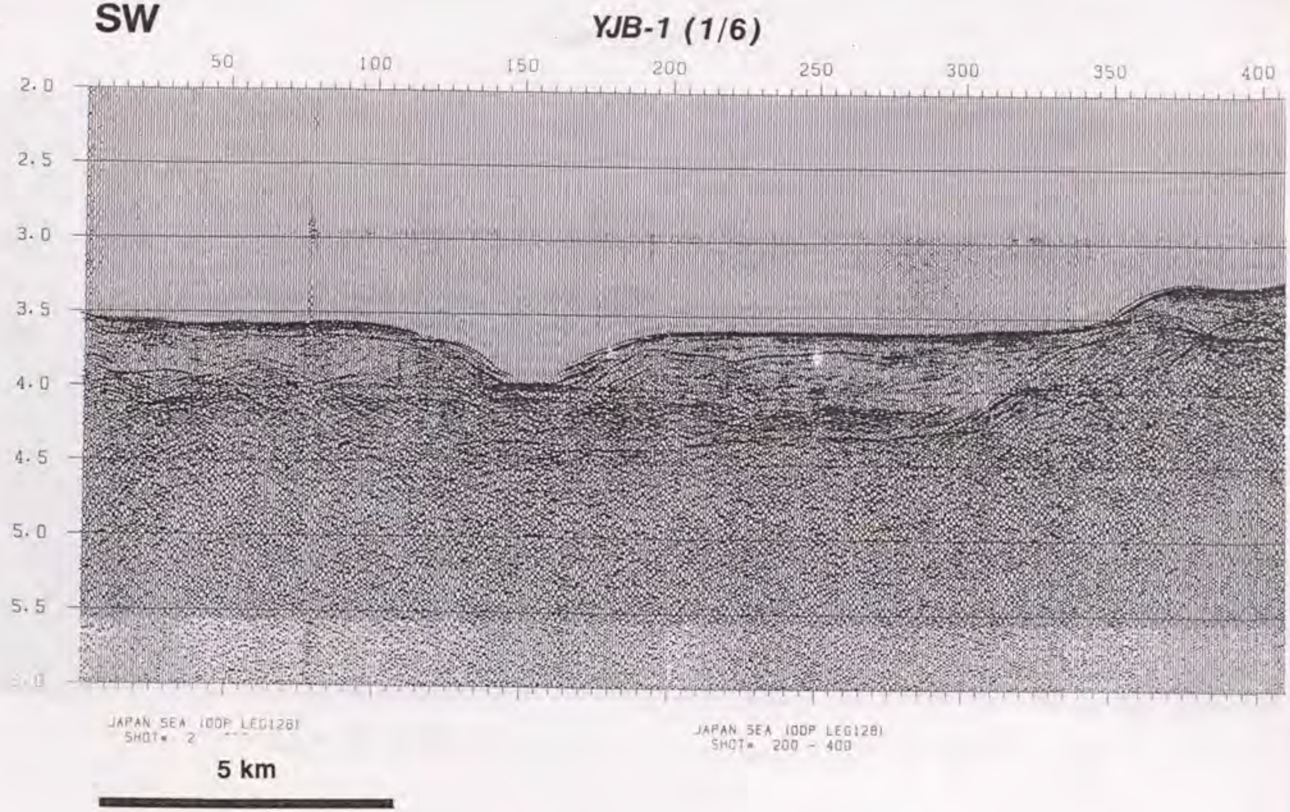
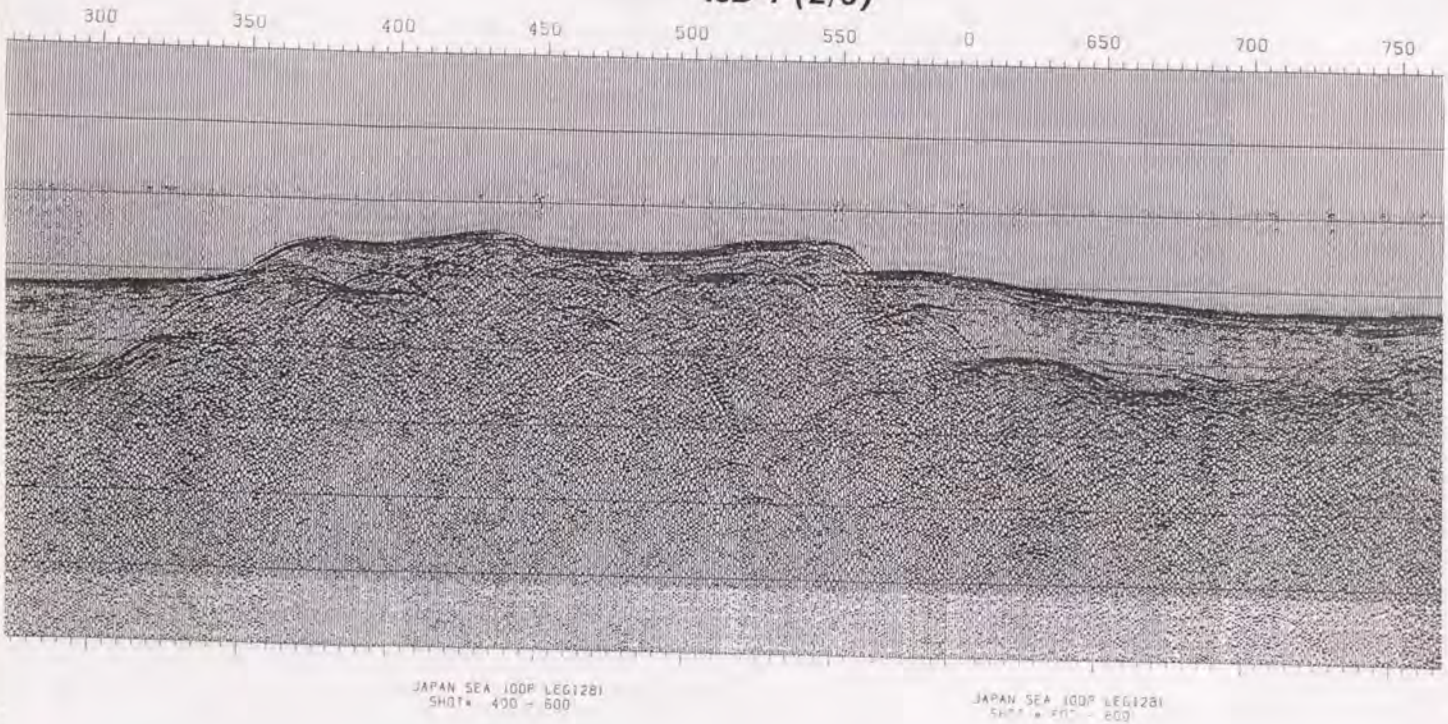


Figure I-29: Multichannel seismic profile of the line YJB-1, which was taken during the KT-89-15 cruise. The line runs from southwest to northeast.

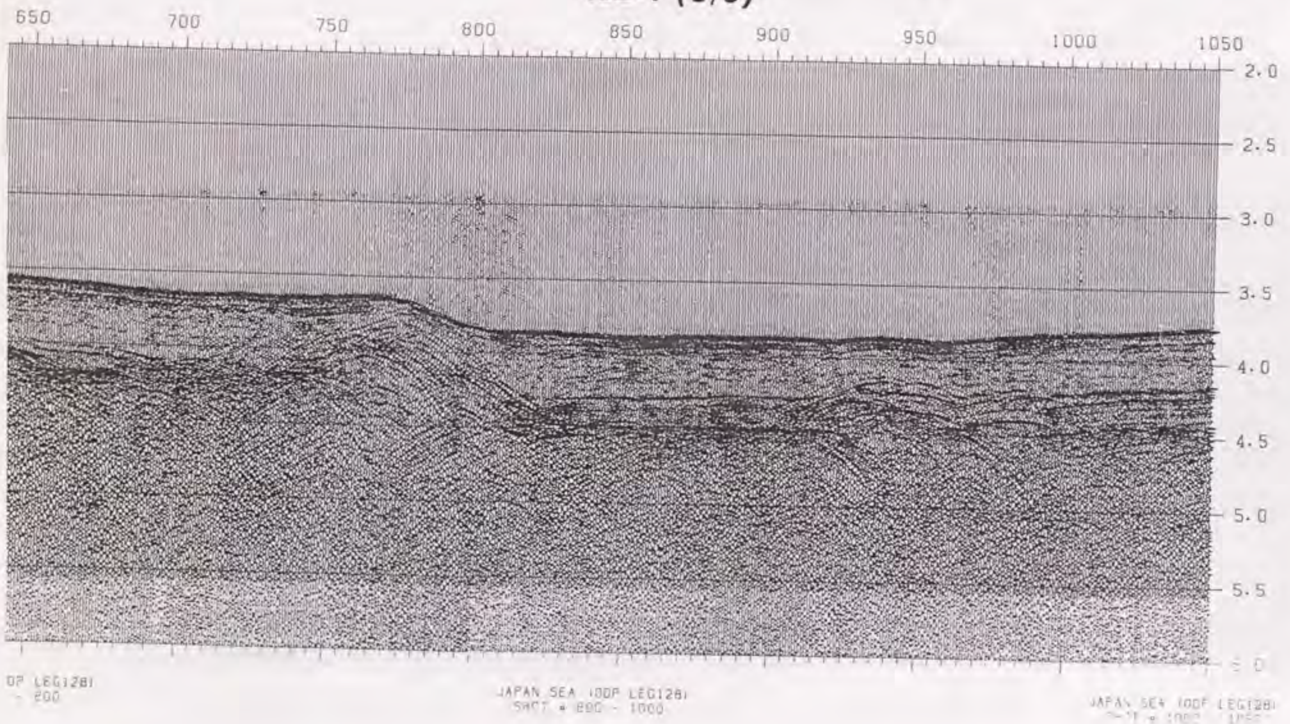

SW
YJB-1 (1/6)
50
100
150
200
250
300
350
400
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
JAPAN SEA (ODP LEG128)
SHOT# 2
JAPAN SEA (ODP LEG128)
SHOT# 200 - 400
5 km

YJB-1 (2/6)



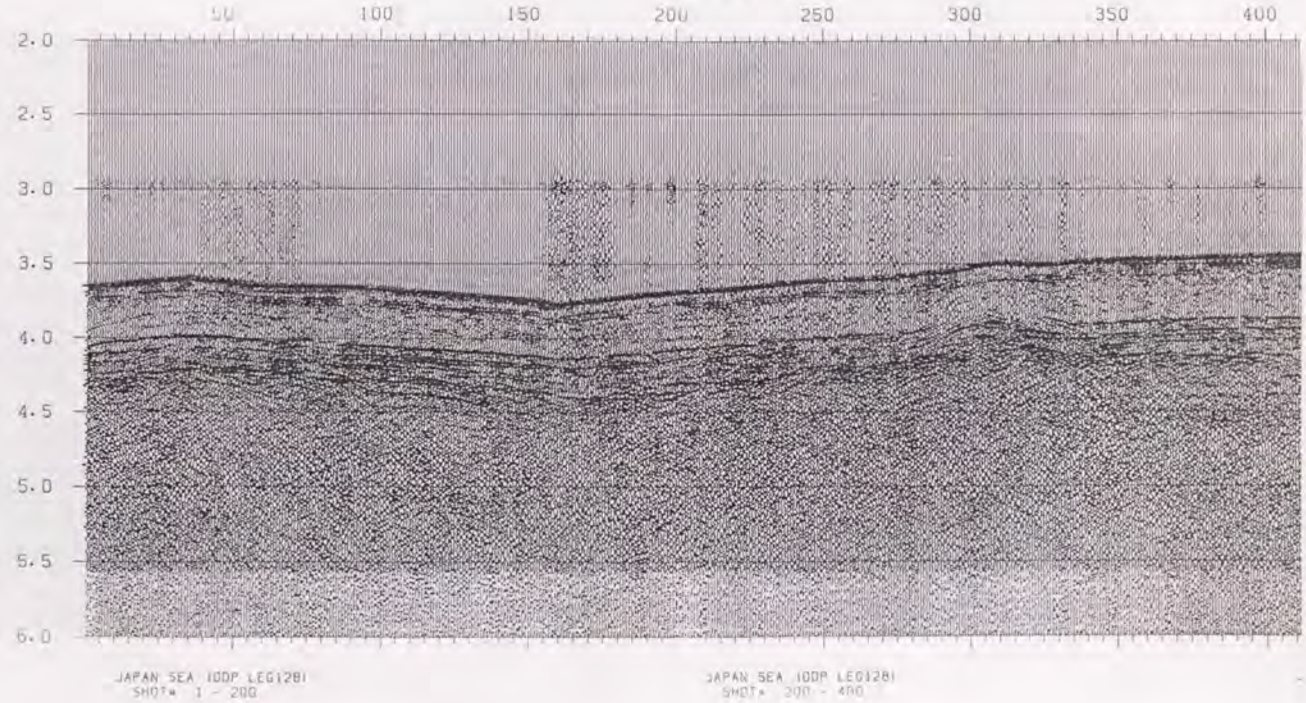
300
350
400
450
500
550
0
650
700
750
JAPAN SEA (ODP LEG128)
SHOT# 400 - 600
JAPAN SEA (ODP LEG128)

YJB-1 (3/6)



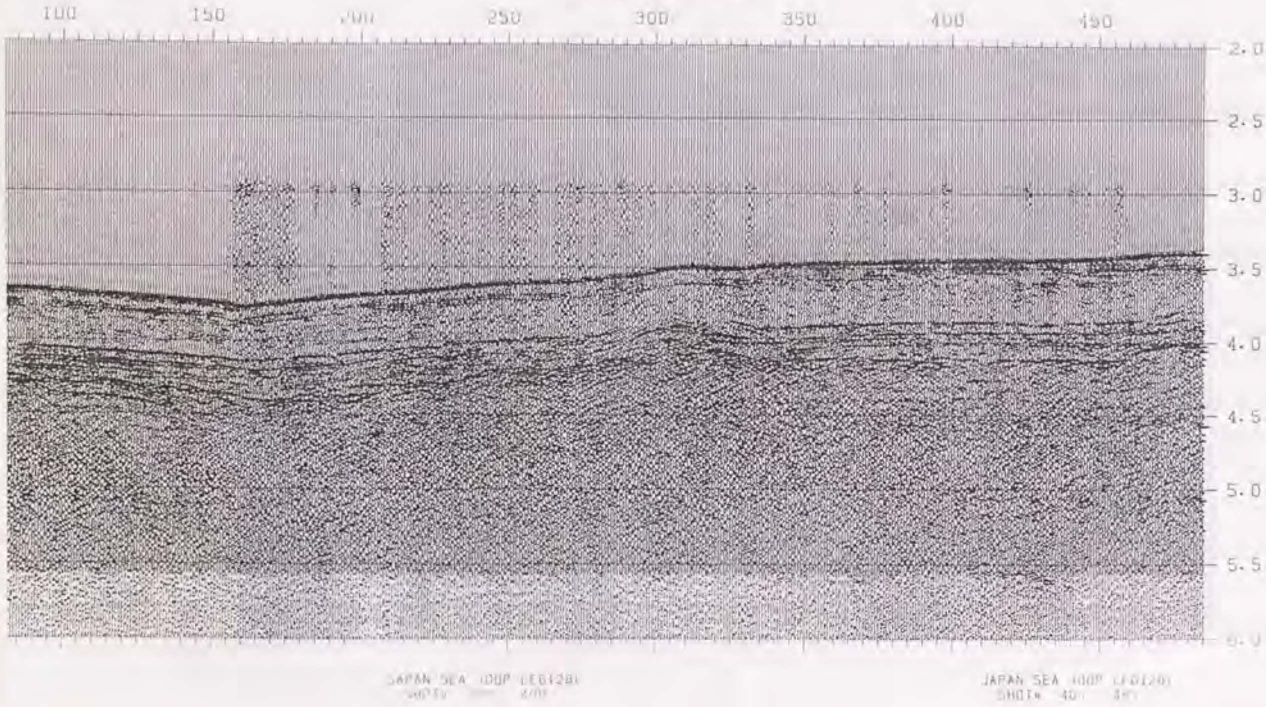
650
700
750
800
850
900
950
1000
1050
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
DP LEG128)
JAPAN SEA (ODP LEG128)
SHOT # 800 - 1000
JAPAN SEA (ODP LEG128)

YJB-1 (4/6)



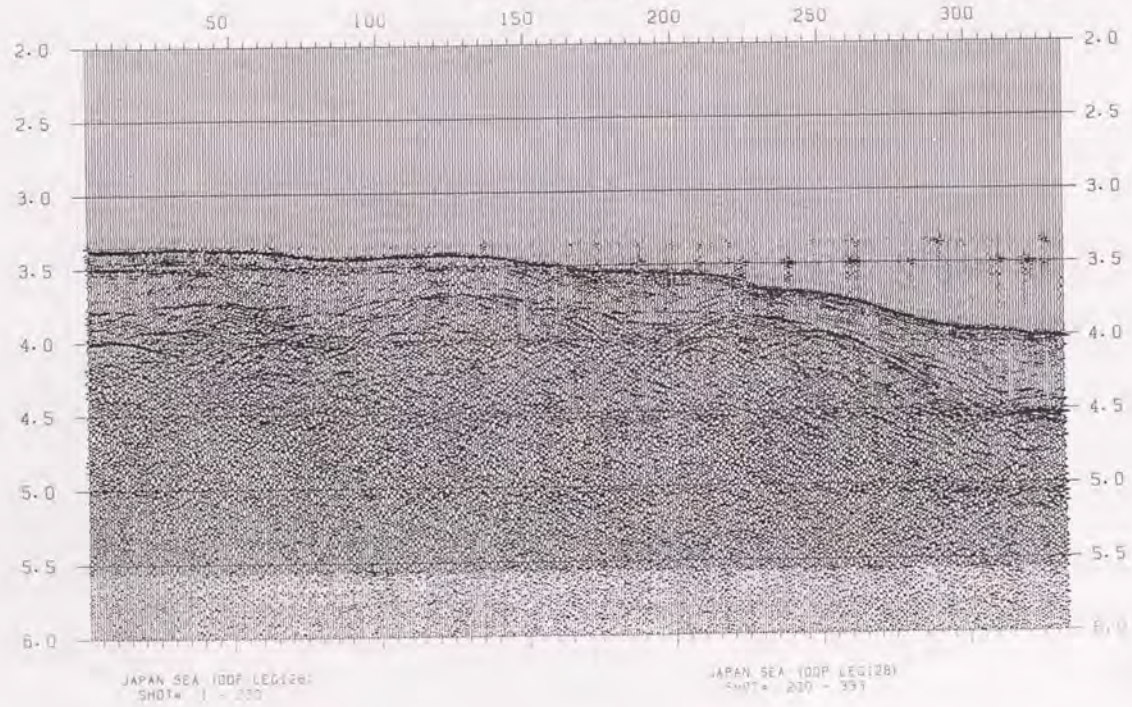
50
100
150
200
250
300
350
400
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
JAPAN SEA (ODP LEG128)
SHOT# 1 - 200
JAPAN SEA (ODP LEG128)
SHOT# 200 - 400

YJB-1 (5/6)



100
150
200
250
300
350
400
450
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
JAPAN SEA (ODP LEG128)
JAPAN SEA (ODP LEG128)

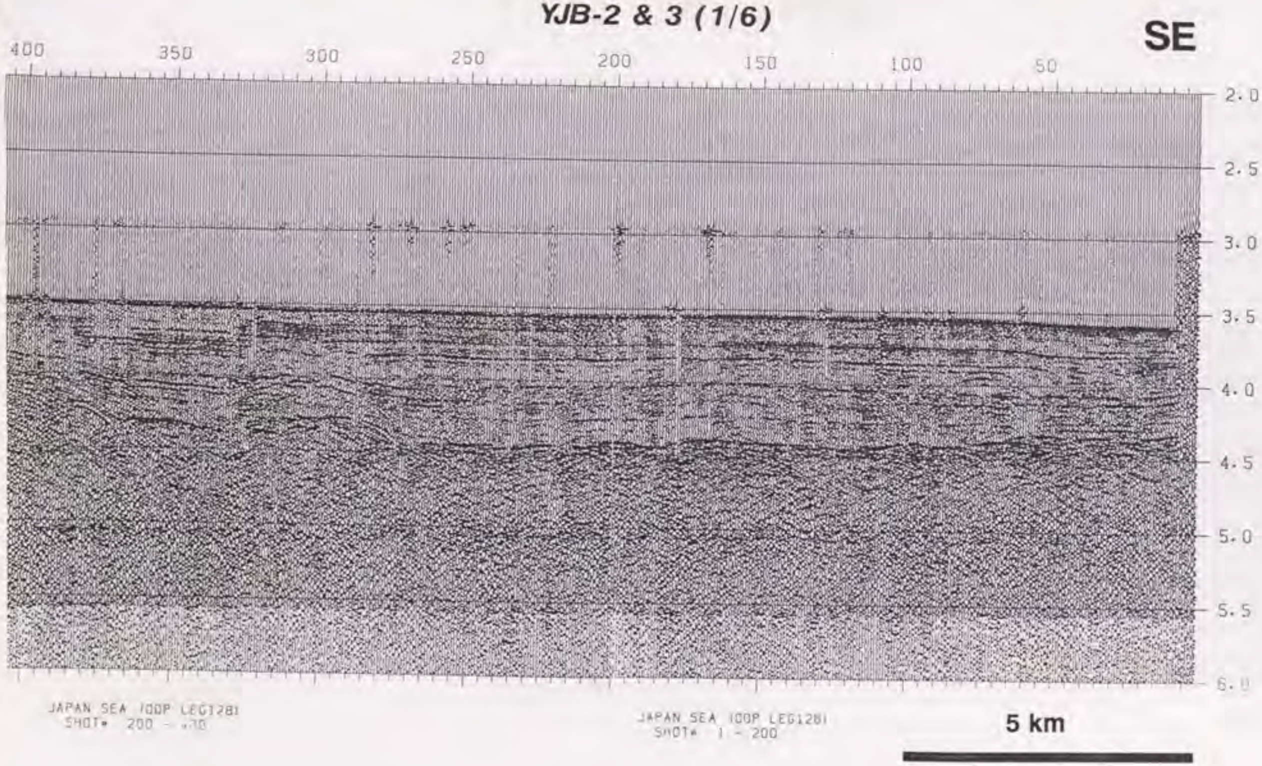
YJB-1 (6/6) **NE**



50
100
150
200
250
300
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
JAPAN SEA (ODP LEG128)
SHOT# 1 - 230
JAPAN SEA (ODP LEG128)
SHOT# 230 - 331

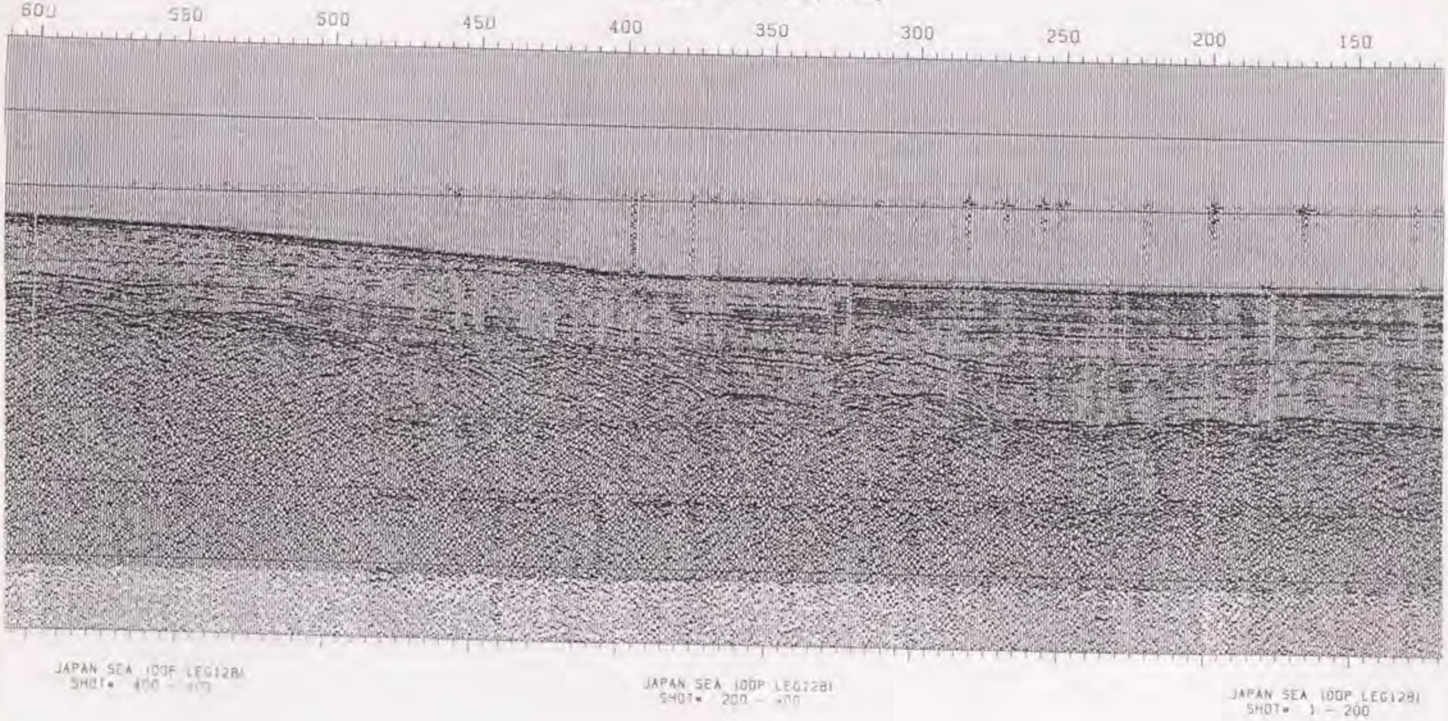
Figure I-30: Multichannel seismic profile of the line YJB-2 and 3, which was taken during the KT-89-15 cruise. The line runs from southeast to northwest.

YJB-2 & 3 (1/6)

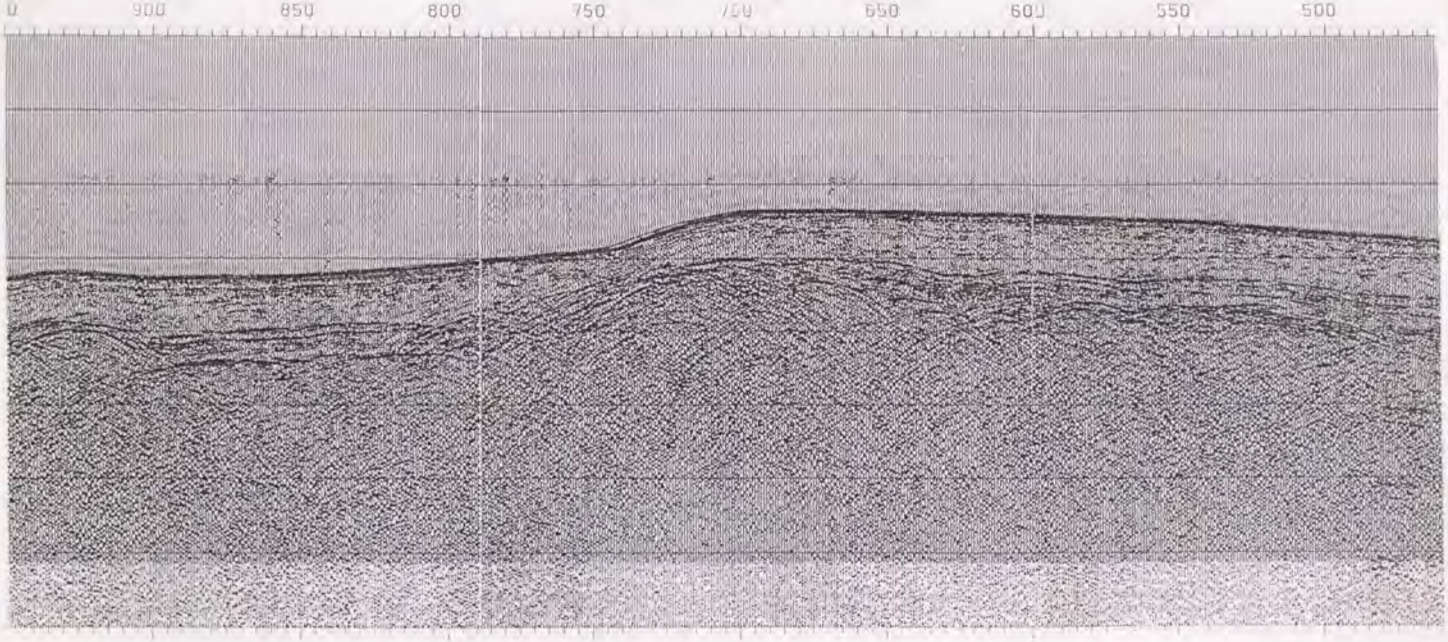


SE
400
350
300
250
200
150
100
50
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
JAPAN SEA IODP LEG128I
SHOT# 200 - 410
JAPAN SEA IODP LEG128I
SHOT# 1 - 200
5 km

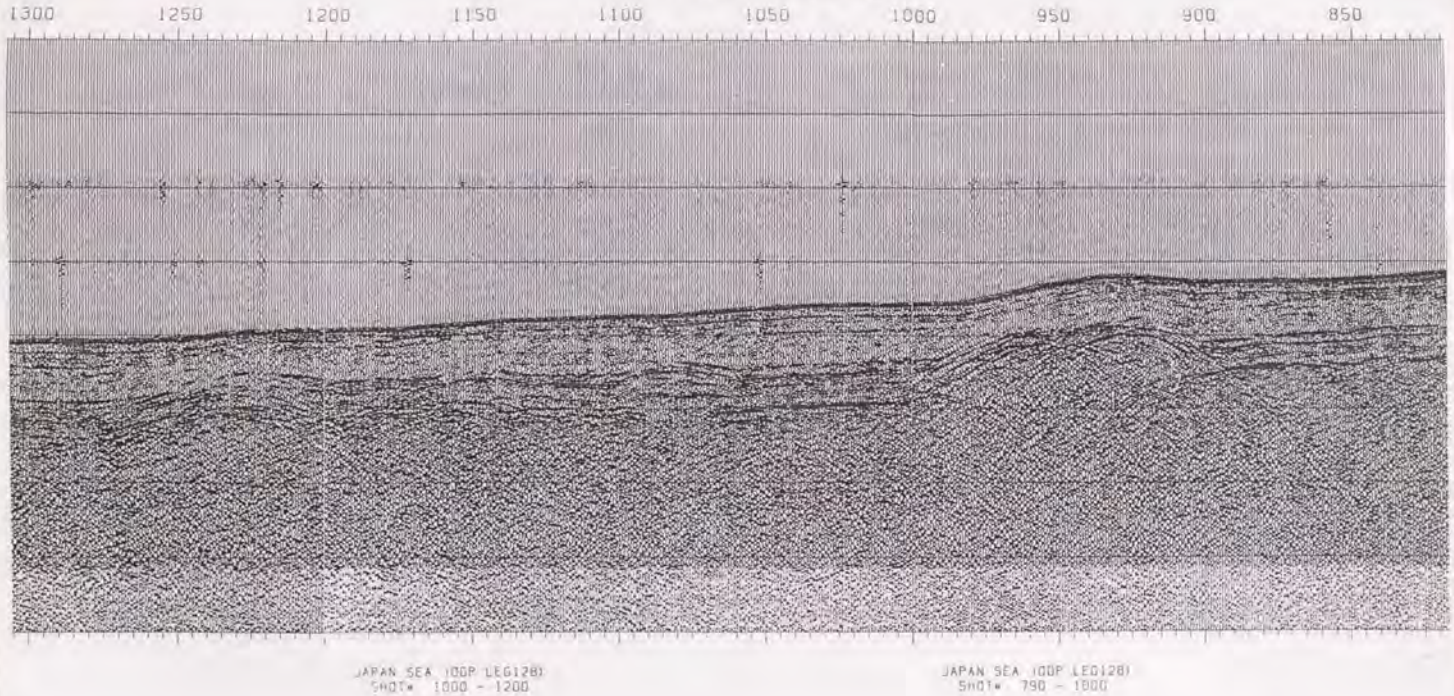
YJB-2 & 3 (2/6)


600
550
500
450
400
350
300
250
200
150
JAPAN SEA (ODP LEG128)
JAPAN SEA (ODP LEG128)
SHOT# 200 -
JAPAN SEA (ODP LEG128)
SHOT# 1 - 200

YJB-2 & 3 (3/6)

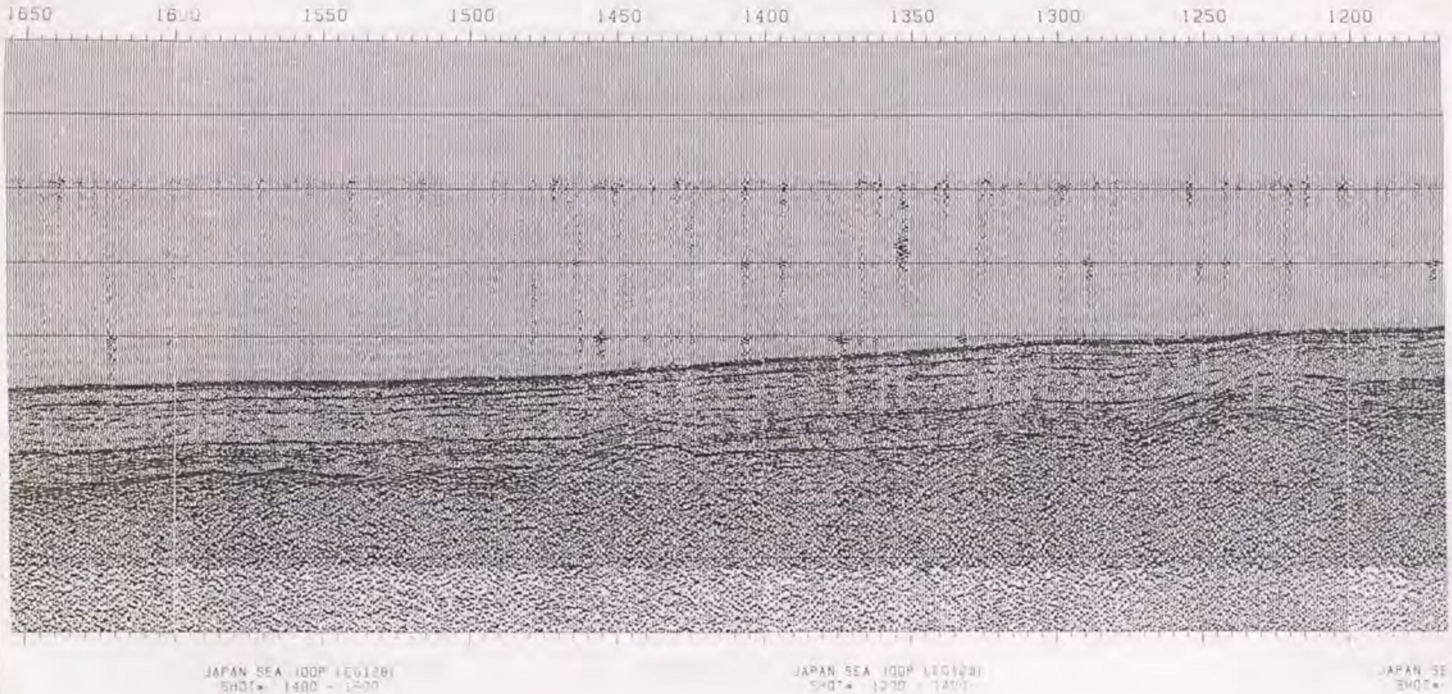

900
850
800
750
650
550
500
LEG128)
1000
JAPAN SEA (ODP LEG128)
JAPAN SEA

YJB-2 & 3 (4/6)



1300
1250
1200
1150
1100
1050
1000
950
900
850
JAPAN SEA (ODP LEG128)
SHOT# 1000 - 1200
JAPAN SEA (ODP LEG128)
SHOT# 790 - 1000

YJB-2 & 3 (5/6)



1650
1600
1550
1500
1450
1400
1350
1300
1250
1200
JAPAN SEA
JAPAN SEA
JAPAN SE

YJB-2 & 3 (6/6)

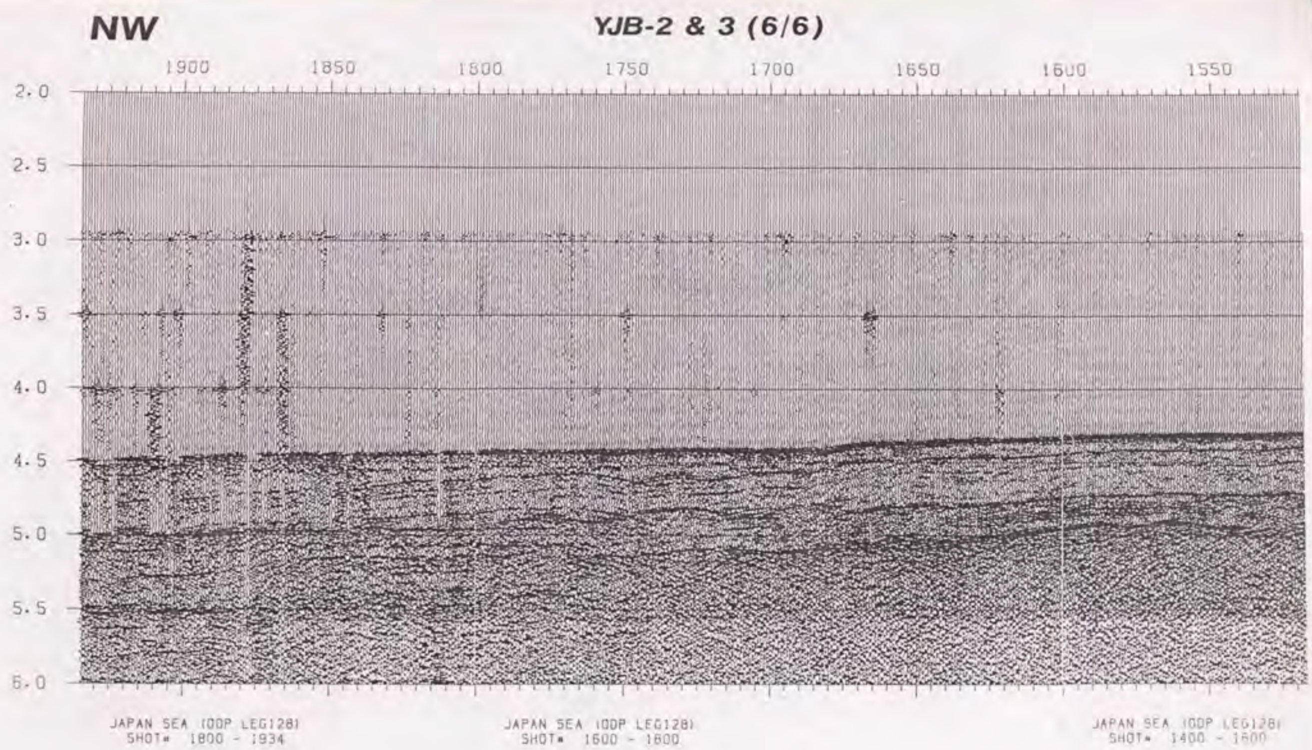

NW
1900
1850
1800
1750
1700
1650
1600
1550
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
JAPAN SEA (ODP LEG128)
SHOT# 1800 - 1934
JAPAN SEA (ODP LEG128)
SHOT# 1600 - 1800
JAPAN SEA (ODP LEG128)
SHOT# 1400 - 1600

Figure I-31: All seismic interpretations of GSJ profiles are displayed from the north to the south, from J-22 to L36. The painted color is same as in Fig. I-18.

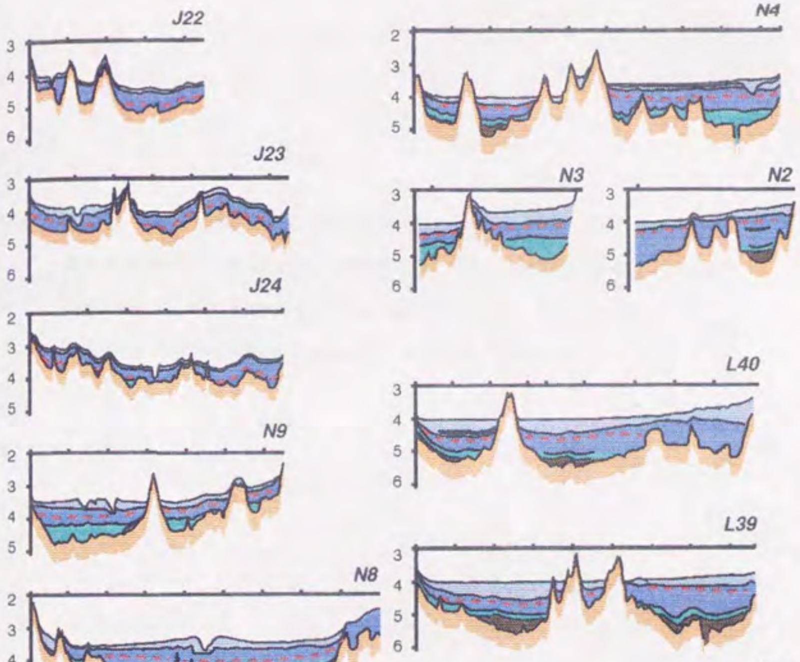

J22
J23
J24
N9
N8
N7
N6
N5
N4
N3
N2
L40
L39
L38
L37
L36
Vertical Exagg. = 21
20 km

Figure I-32: An example of the acoustic character of Toyama Deep Sea Channel and the fan deposits. The central arrow shows the axis of the Toyama Deep Sea Channel. Overbank deposits show some irregular surface topography.

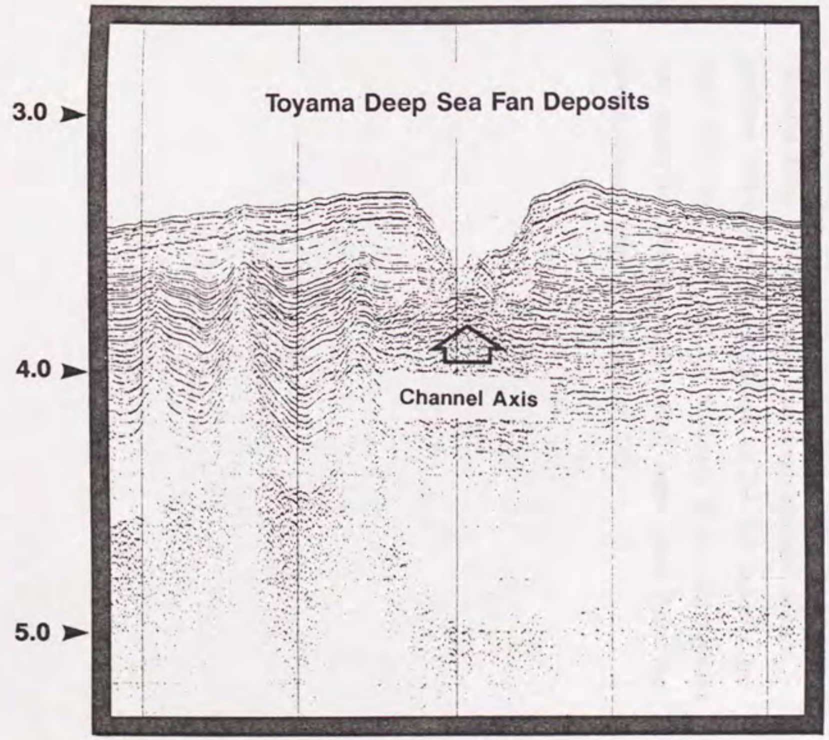
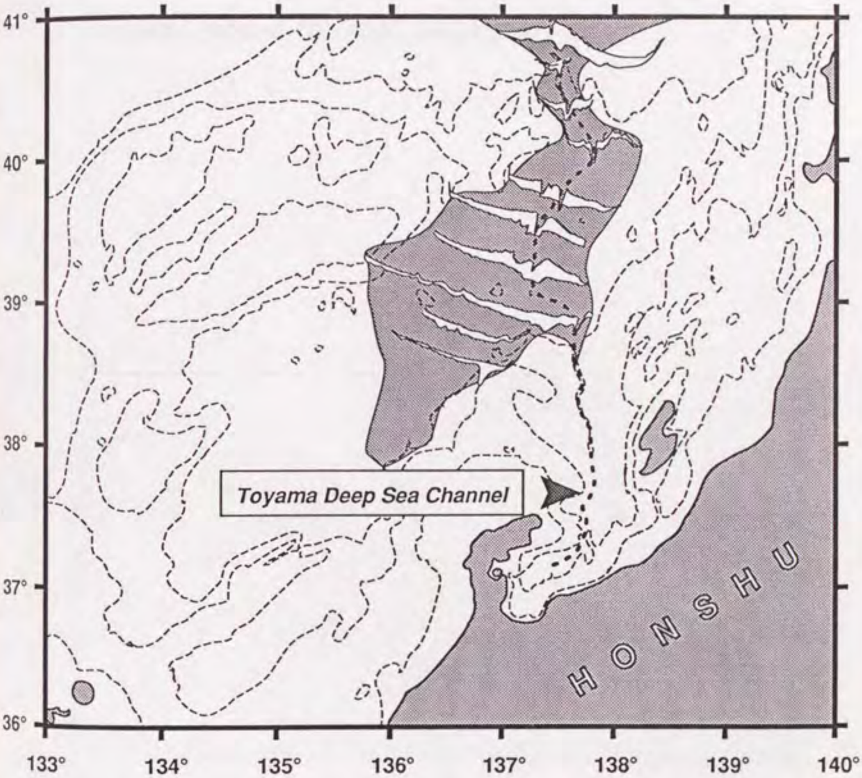
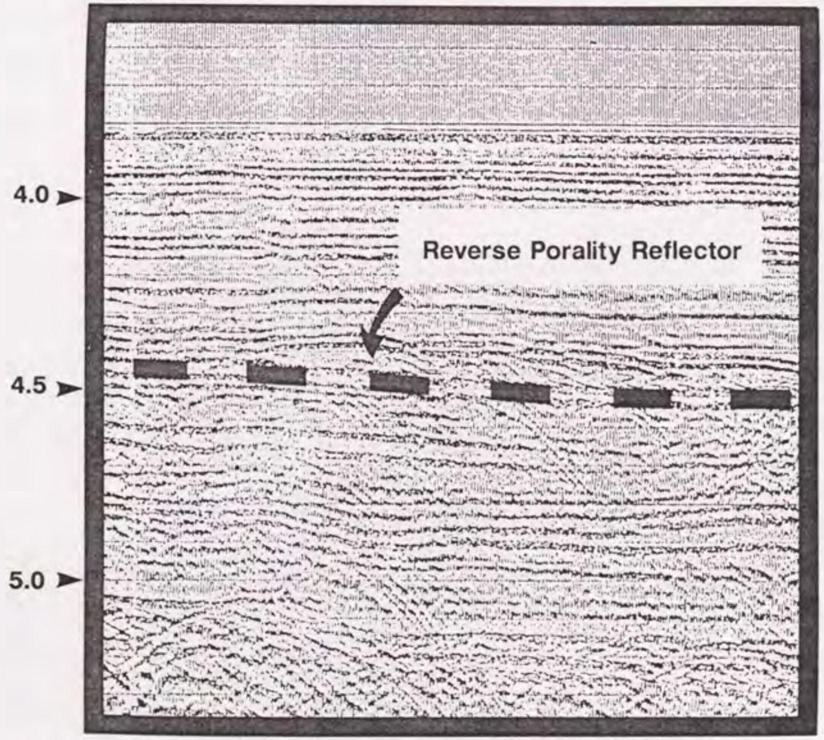

3.0
4.0
5.0
Toyama Deep Sea Fan Deposits
Channel Axis

Figure I-33: The distribution of the Toyama Deep Sea Fan deposits (hatched area). The thick dashed line shows the axis of the Toyama Deep Sea Channel. Ten single-channel seismic profiles which show the thickness of the fan deposits are also illustrated. The variable thickness of the fan deposits are displayed simultaneously which were taken from the single-channel seismic profiles of GSJ.



41°
40°
39°
38°
37°
36°
133°
134°
135°
136°
137°
138°
139°
140°
Toyama Deep Sea Channel
HONSHU

Figure I-34: An example of the reverse polarity reflector in the seismic interval III (thick dashed line).



4.0
4.5
5.0
Reverse Porality Reflector

Figure I-35: An example of the acoustic basement features. Note the low frequency reflectors and the some horizontal reflectors that are sills based on the drilling results of ODP Leg 127.

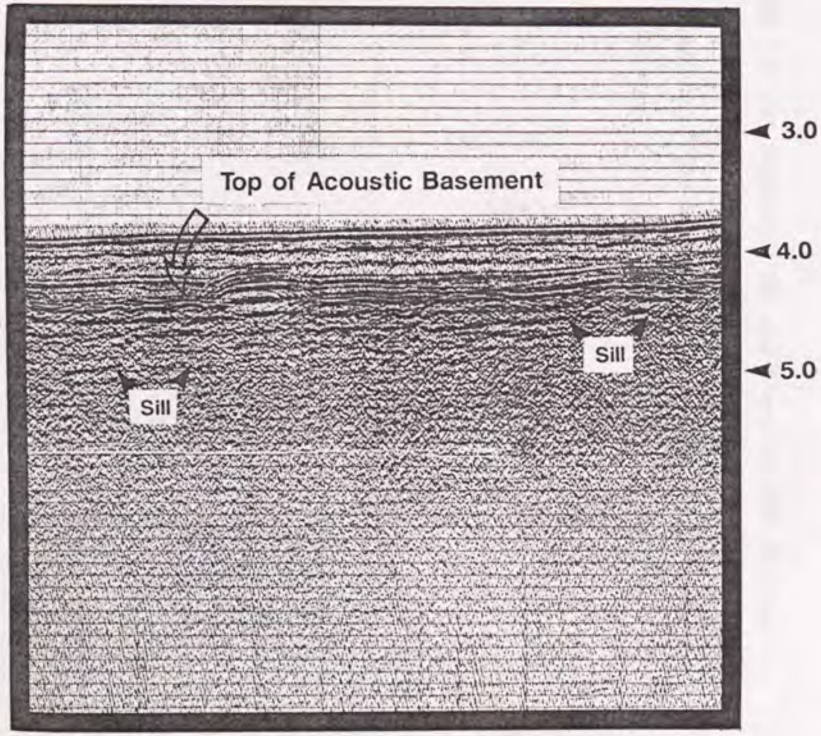
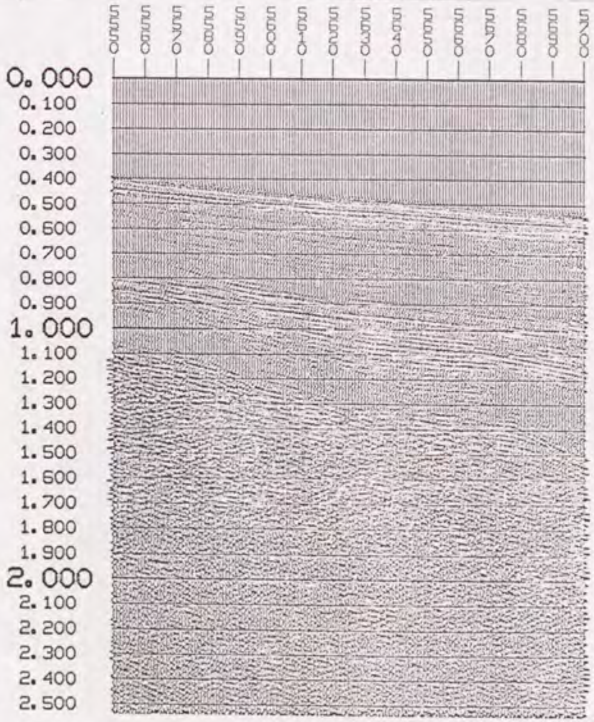

Top of Acoustic Basement
Sill
Sill
3.0
4.0
5.0

Figure I-36: An example of the opal-A/opal-CT BSR (Bottom Simulating Reflector), which clearly cuts the sedimentary reflectors. The left figure is an original seismic profile and the right is an interpretation of it.


0.000
0.100
0.200
0.300
0.400
0.500
0.600
0.700
0.800
0.900
1.000
1.100
1.200
1.300
1.400
1.500
1.600
1.700
1.800
1.900
2.000
2.100
2.200
2.300
2.400
2.500

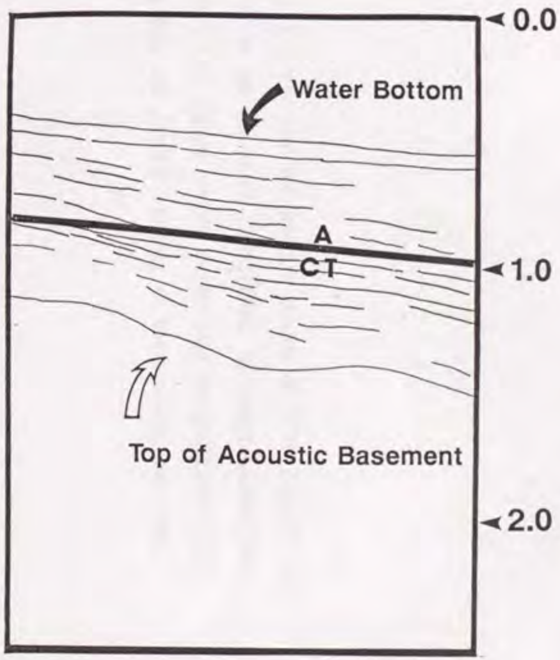
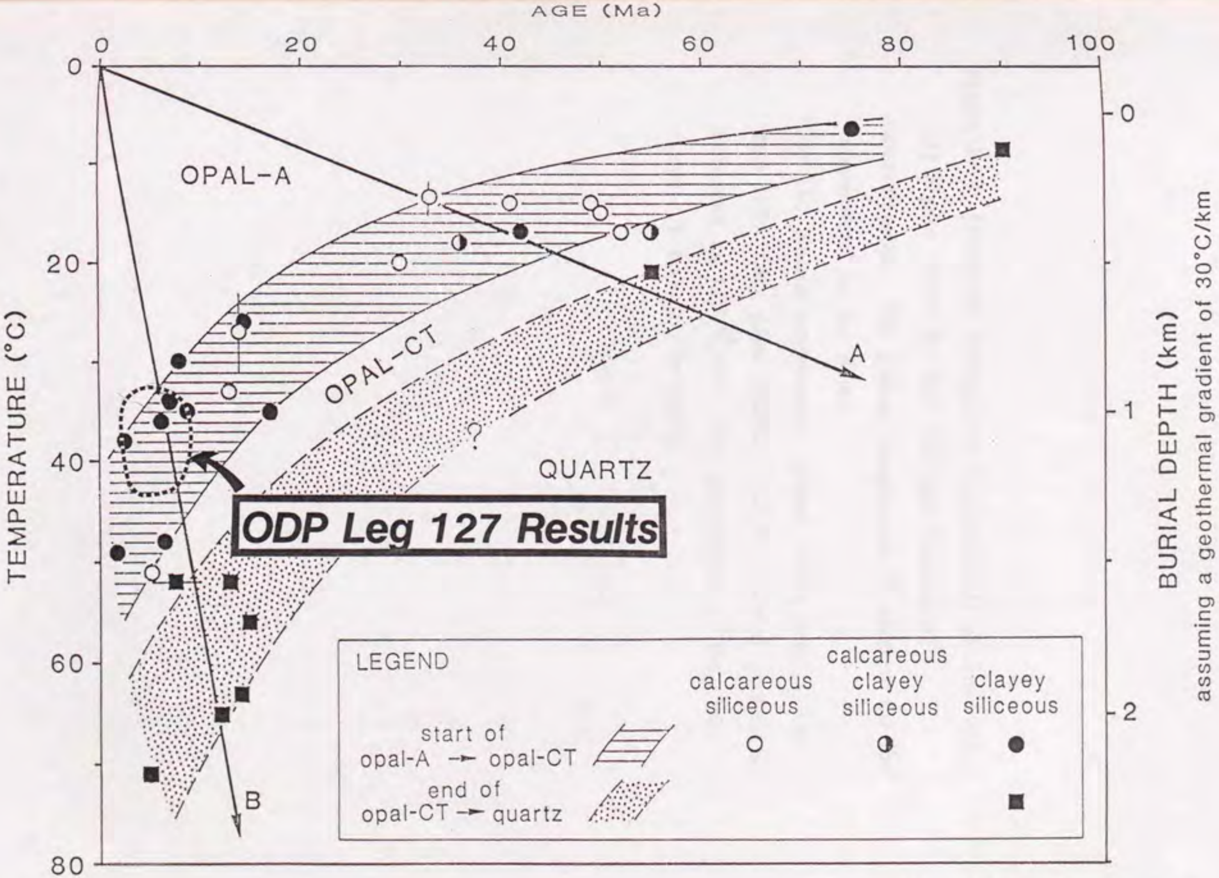

0.0
Water Bottom
A
CT
1.0
Top of Acoustic Basement
2.0

Figure I-37: The age and temperature results of ODP Leg 127 are plotted on the figure of Tada (1990, in press) (dashed line circle). This figure clearly shows that the sediments of Japan Sea are closely relating to temperature, not time.



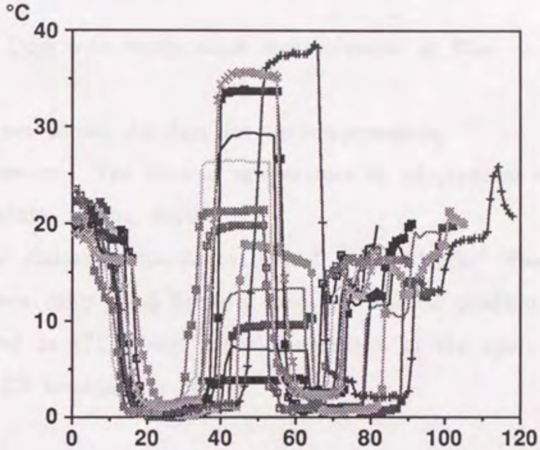
Tada, 1990 (in press)

Figure I-38: Downhole temperature measurements at Site 794.

(1) Figure shows the data for each temperature measurement. The plateau temperature is adopted for the temperature at the depth.

(2) The plateau temperatures plotted versus depth. The data show fairy good linearity, and the thermal gradient is estimated as 125 °C/km. The temperature of the opal-A/opal-CT boundary is 38 °C.

(1)


°C
40
30
20
10
0
0
20
40
60
80
100
120

(2)

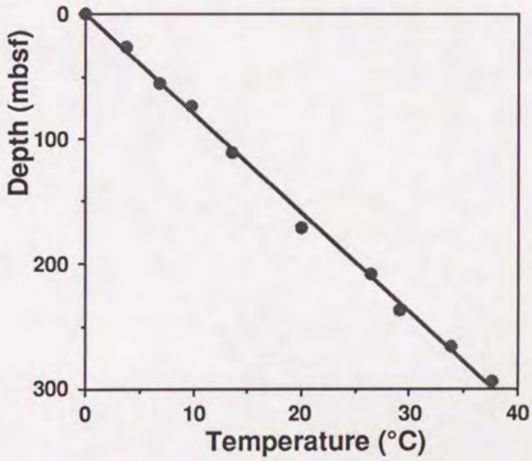
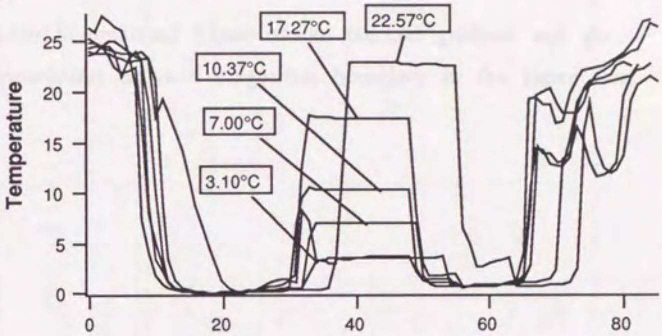

Depth (mbsf)
0
100
200
300
0
10
20
30
40
Temperature (°C)

Figure I-39: Downhole temperature measurements at Site 797.

(1) Figure shows the data for each temperature measurement. The plateau temperature is adopted for the temperature at the depth.

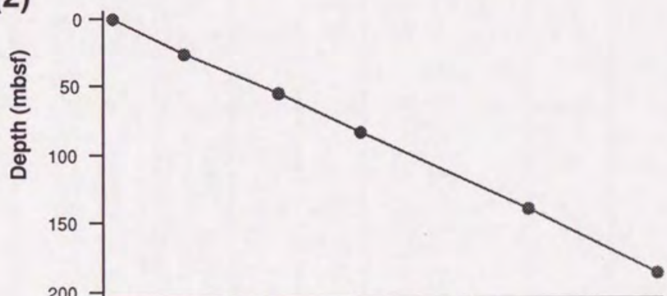
(2) The plateau temperatures plotted versus depth. The data show fairy good linearity, and the thermal gradient is estimated as 121 °C/km. The temperature of the opal-A/opal-CT boundary is 36 °C.

(1)



17.27°C
22.57°C
10.37°C
7.00°C
3.10°C
Temperature
25
20
15
10
5
0
0
20
40
60
80

(2)



Depth (mbsf)
0
50
100
150
200
5
10
15
20
Temperature (°C)

Figure I-40: Summarized figure of the thermal gradient and the temperatures at each diagenetic boundary in the Japan Sea.

site	Temperature (°C)		Thermal Gradient	
	A/CT	CT/Qz		
794	38 °C	49 °C	125 °C/km	*Yamato Basin*
795	43	57	132	*Japan Basin*
796	40	53	178	*Okushiri Ridge*
797	36	48	121	*Yamato Basin*
798	40		111 - 83	*Oki Ridge*
799	46		98	*Kita-Yamato Trough*

Figure I-41: Study area in the Yamato Basin (hatched).

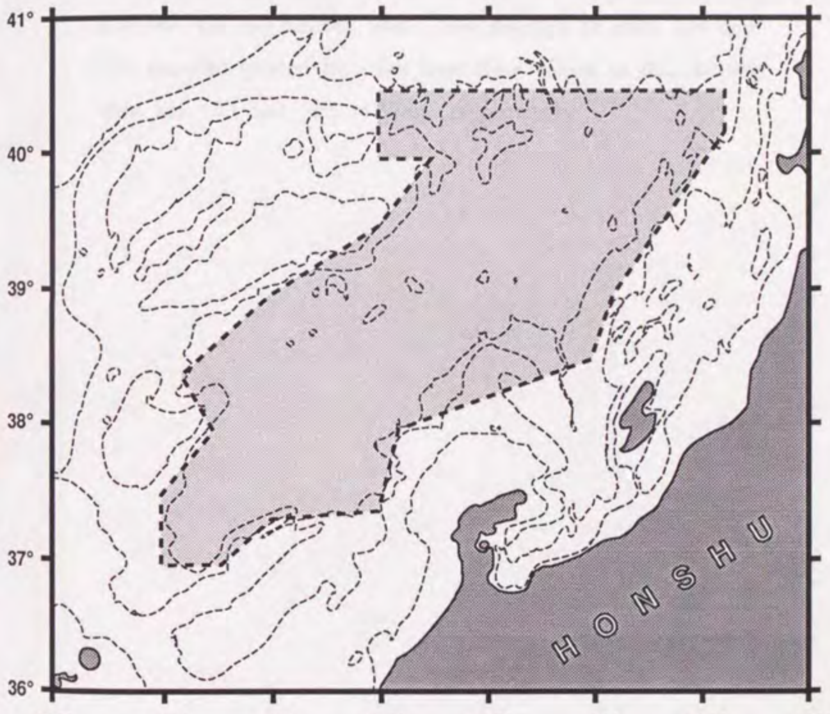
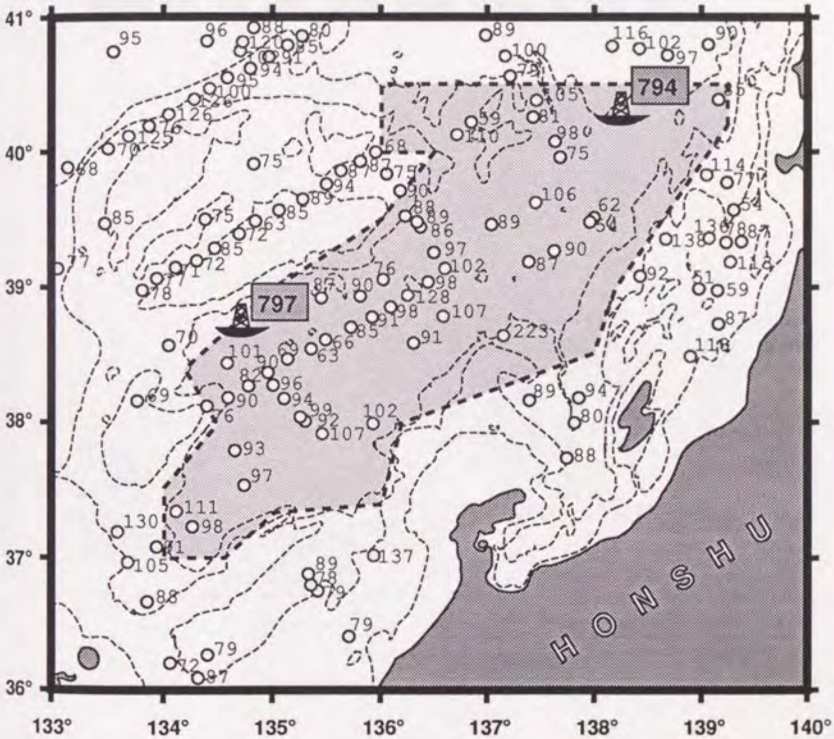

41°
40°
39°
38°
37°
36°
133°
134°
135°
136°
137°
138°
139°
140°
HONSHU

Figure I-42: Compiled heat flow data from Yasui *et al.* (1966) and Yamano *et al.* (1987). The average heat flow value is 96 mW/m^2 for the hatched area. The location of sites 794 and 797 are also plotted in. The heat flow values at that drilling sites are 103 and 101 mW/m^2 respectively.



41°
40°
39°
38°
37°
36°
133°
134°
135°
136°
137°
138°
139°
140°
794
797
HONSHU

Figure I-43: Combined thermal conductivity data. Open circle means the Site 794. Open squire means the Site 797.

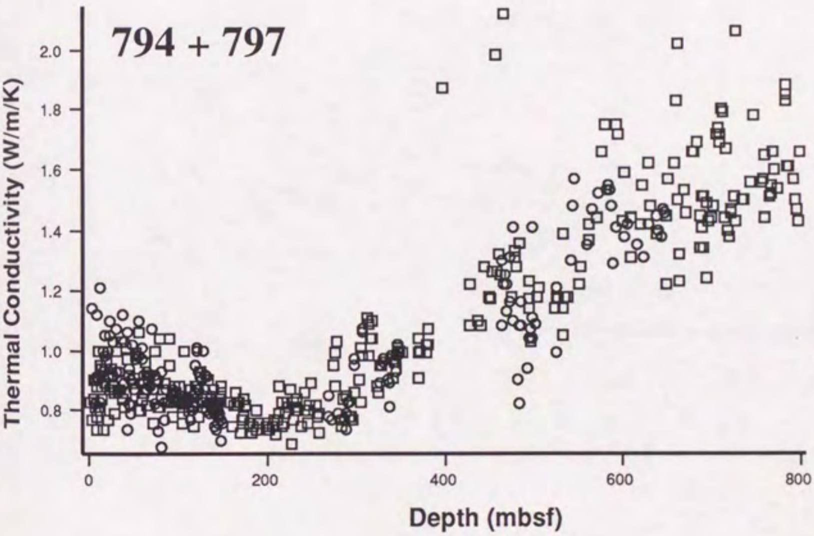
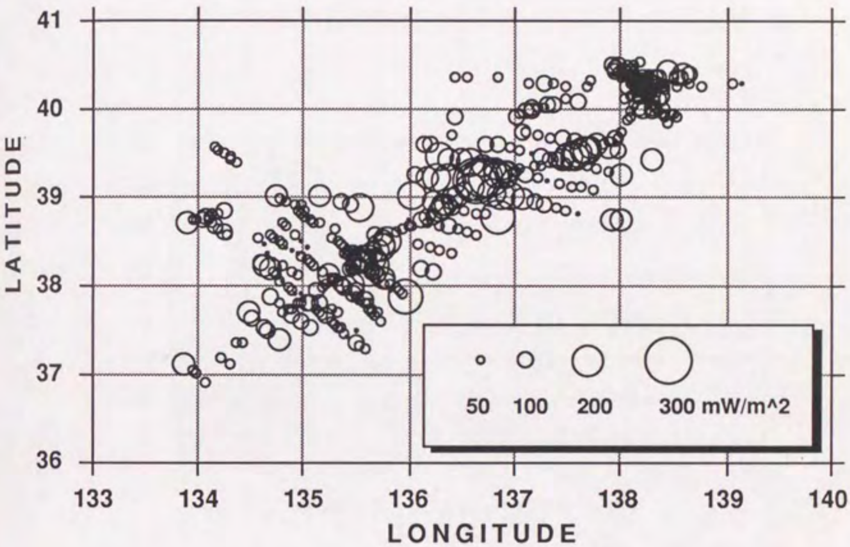

794 + 797
Thermal Conductivity (W/m/K)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0
200
400
600
800
Depth (mbsf)

Figure I-44: Calculated heat flow data are plotted as bubbles.



LATITUDE
41
40
39
38
37
36
133
134
135
136
137
138
139
140
LONGITUDE
50
100
200
300 mW/m^2

Figure I-45: Histogram of the calculate heat flow values.

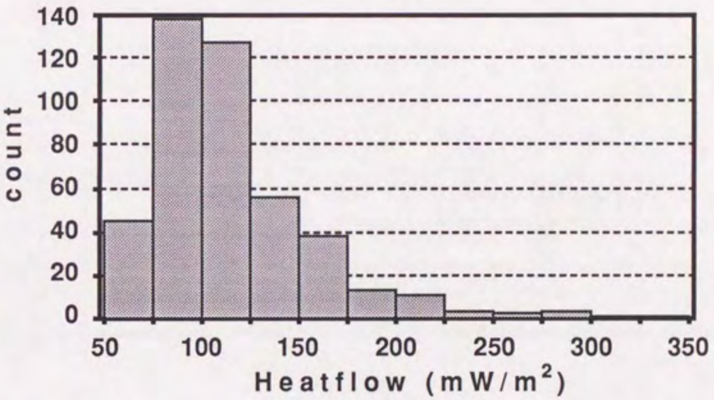
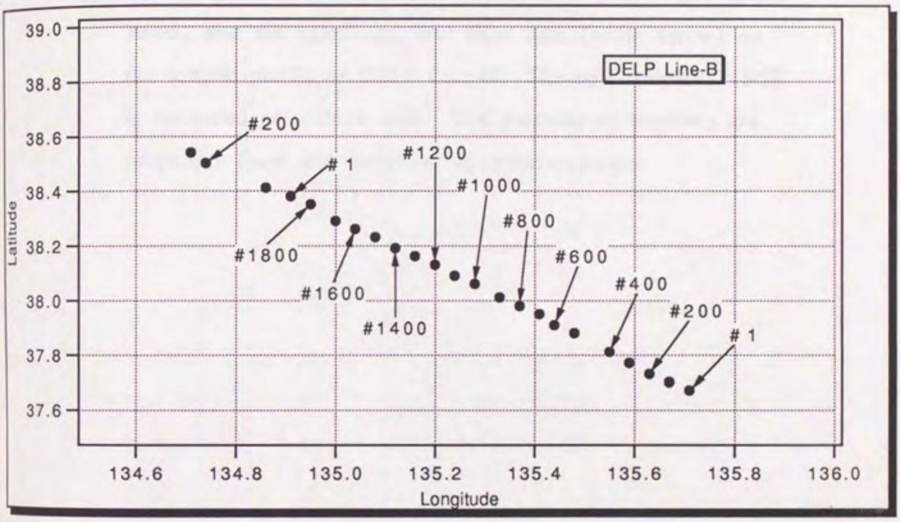
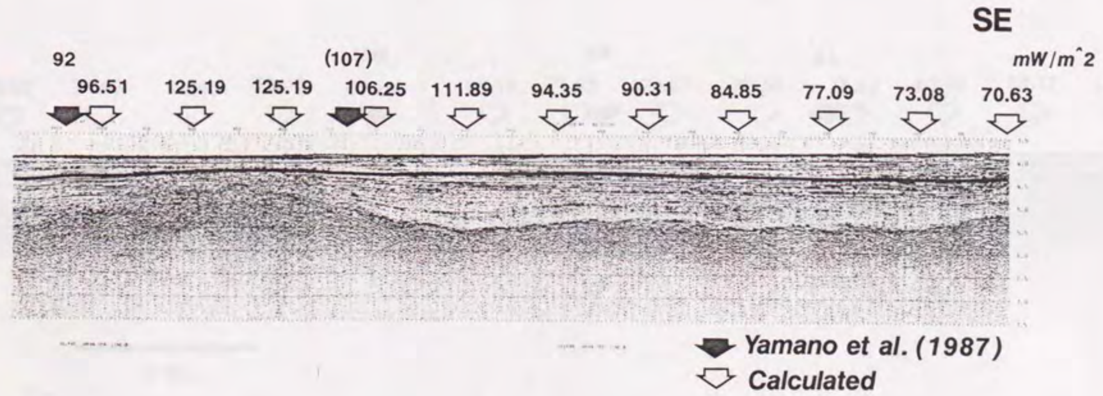

count
140
120
100
80
60
40
20
0
50
100
150
200
250
300
350
Heatflow (mW/m²)

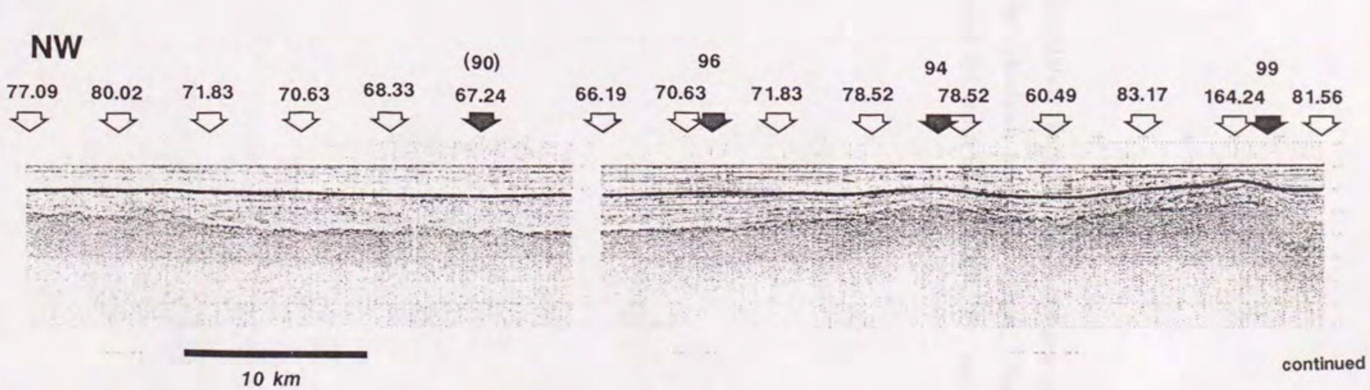
Figure I-46: Track chart of the DELP Line-B. Numbers include the shot number for each location.



DELP Line-B
39.0
38.8
38.6
38.4
38.2
38.0
37.8
37.6
Latitude
#200
1
#1200
#1000
#800
#1800
#600
#1600
#400
#1400
#200
1
134.6
134.8
135.0
135.2
135.4
135.6
135.8
136.0
Longitude

Figure I-47: Correlation between the thermistor prove data (black arrow) and the calculated heat flow data (white arrow) on the seismic profile of DELP Line-B. The opal-A/opal-CT BSR is enhanced as a thick line. The parentheses numbers are projected from the neighboring measurements.


SE
mW/m^2
92
(107)
96.51
125.19
125.19
106.25
111.89
94.35
90.31
84.85
77.09
73.08
70.63
Yamano et al. (1987)
Calculated


NW
77.09
80.02
71.83
70.63
68.33
(90)
67.24
66.19
96
70.63
71.83
78.52
94
78.52
60.49
83.17
99
164.24
81.56
10 km

continued

Figure I-48: Correlation between the thermistor probe data and the nearby calculated heat flow values. The each correlation was changed the mesh size, 5', 10', 20', and 30' meshes.

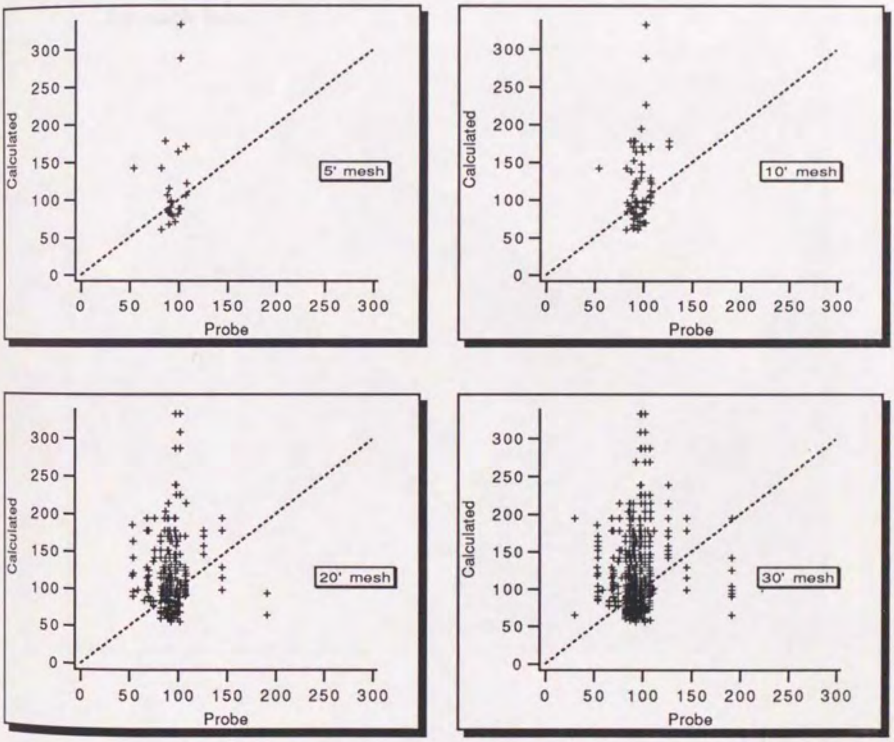
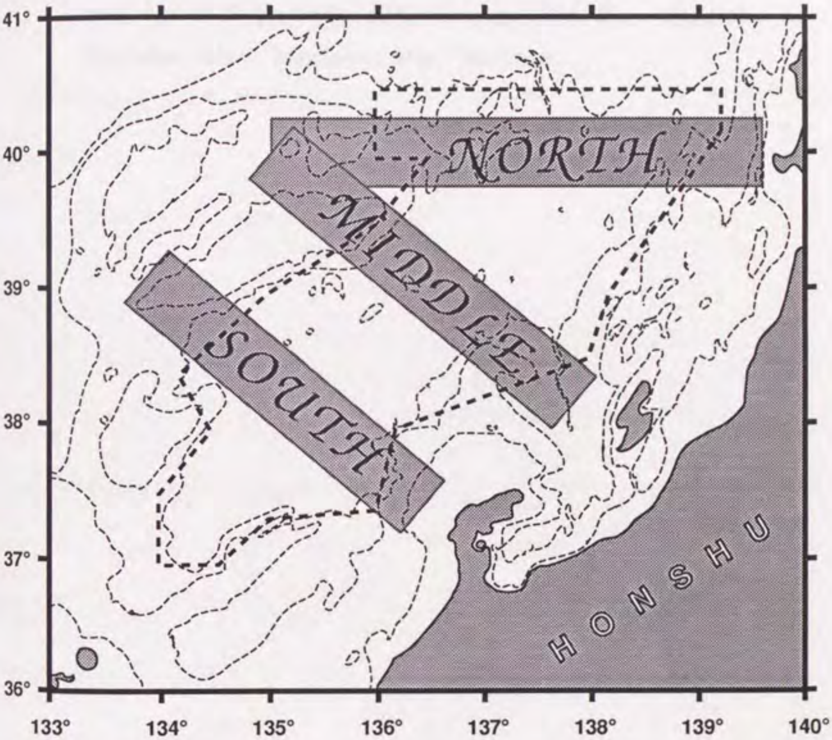
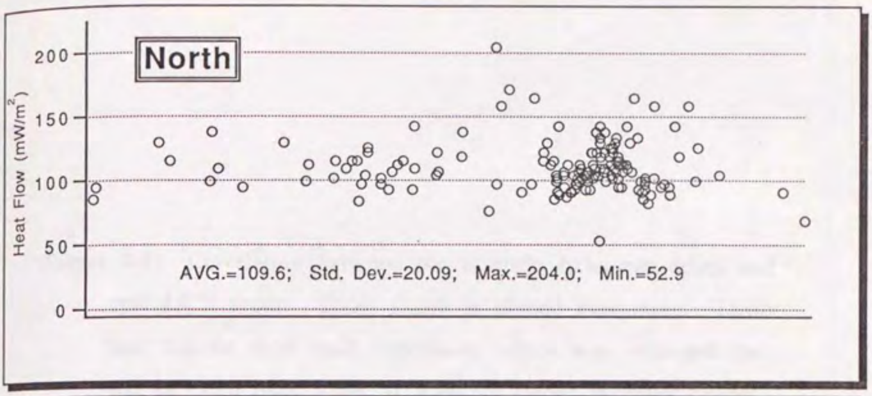

Calculated
Probe
5' mesh
10' mesh
20' mesh
30' mesh
0
50
100
150
200
250
300

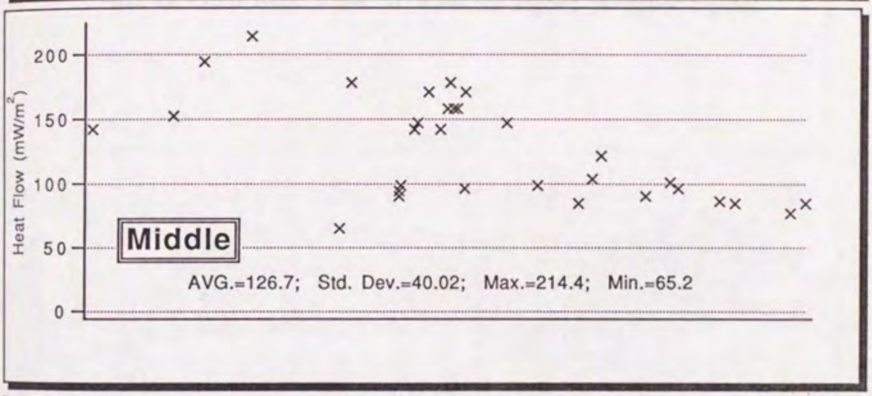
Figure I-49: Figure shows the selected area for the calculation of average values. It was named as North, Middle, and South for each box.



41°
40°
39°
38°
37°
36°
133°
134°
135°
136°
137°
138°
139°
140°
NORTH
MIDDLE
SOUTH
HONSHU

Figure I-50: Calculated heat flow values are projected into the each box of Figure I-49. AVG: Average , Std. Dev.: Standard Deviation, Max.: Maximum, Min.: Minimum.


North
Heat Flow (mW/m²)
200
150
100
50
0
AVG.=109.6; Std. Dev.=20.09; Max.=204.0; Min.=52.9


Middle
Heat Flow (mW/m²)
200
150
100
50
0
AVG.=126.7; Std. Dev.=40.02; Max.=214.4; Min.=65.2

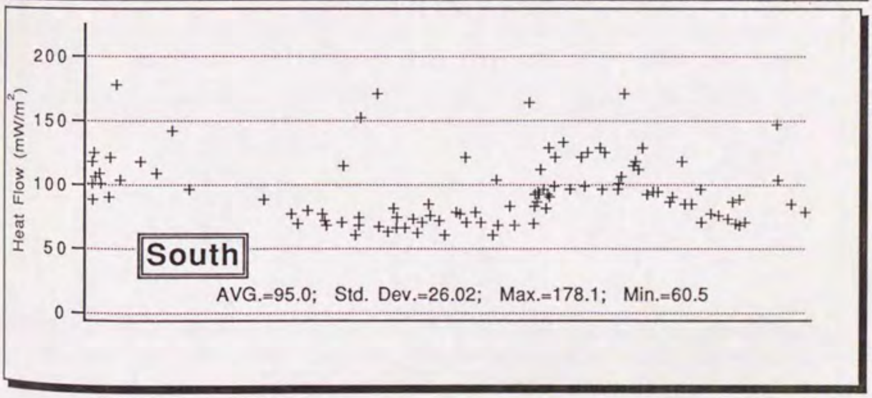

South
Heat Flow (mW/m²)
200
150
100
50
0
AVG.=95.0; Std. Dev.=26.02; Max.=178.1; Min.=60.5

Figure I-51: Correlation between the acoustic basement depth and opal-A/CT depth. Upper figure is plotted everything. Lower four figures show each correlation which were changed the size of mesh from 5' to 20' (see the legend in upper figure).

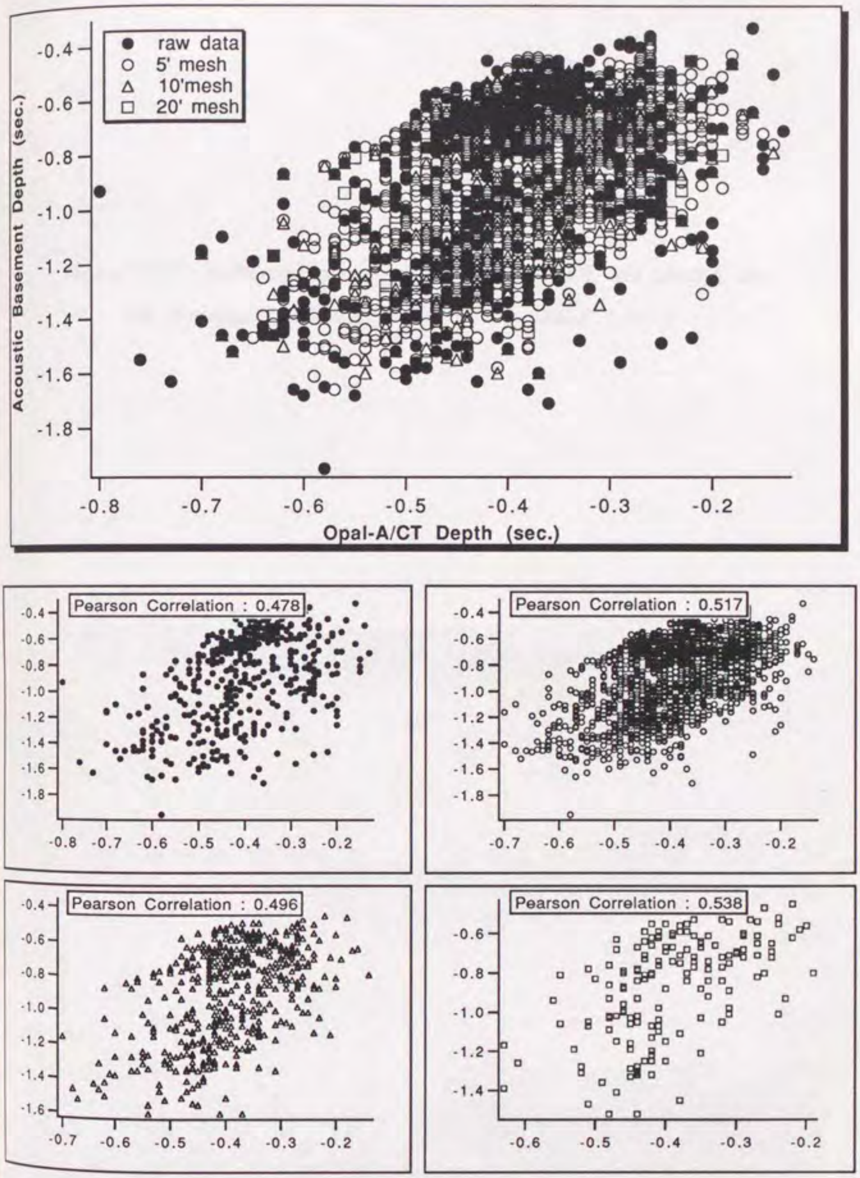
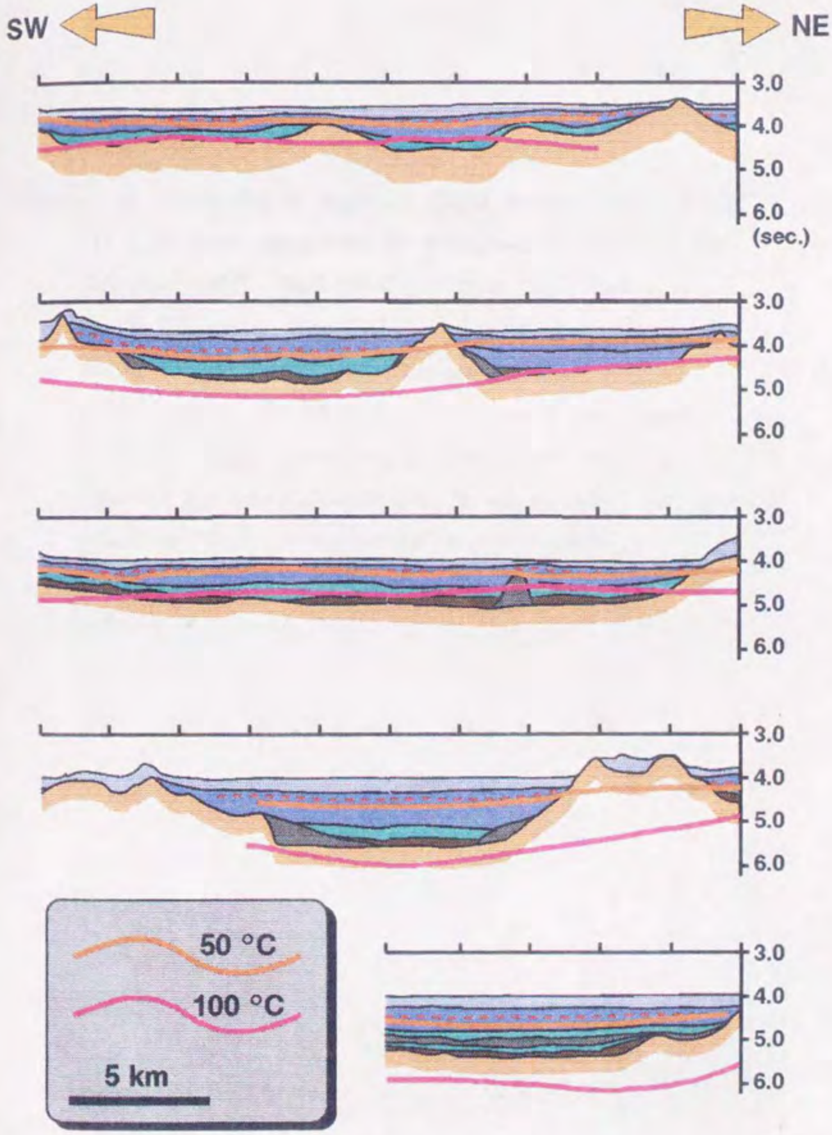
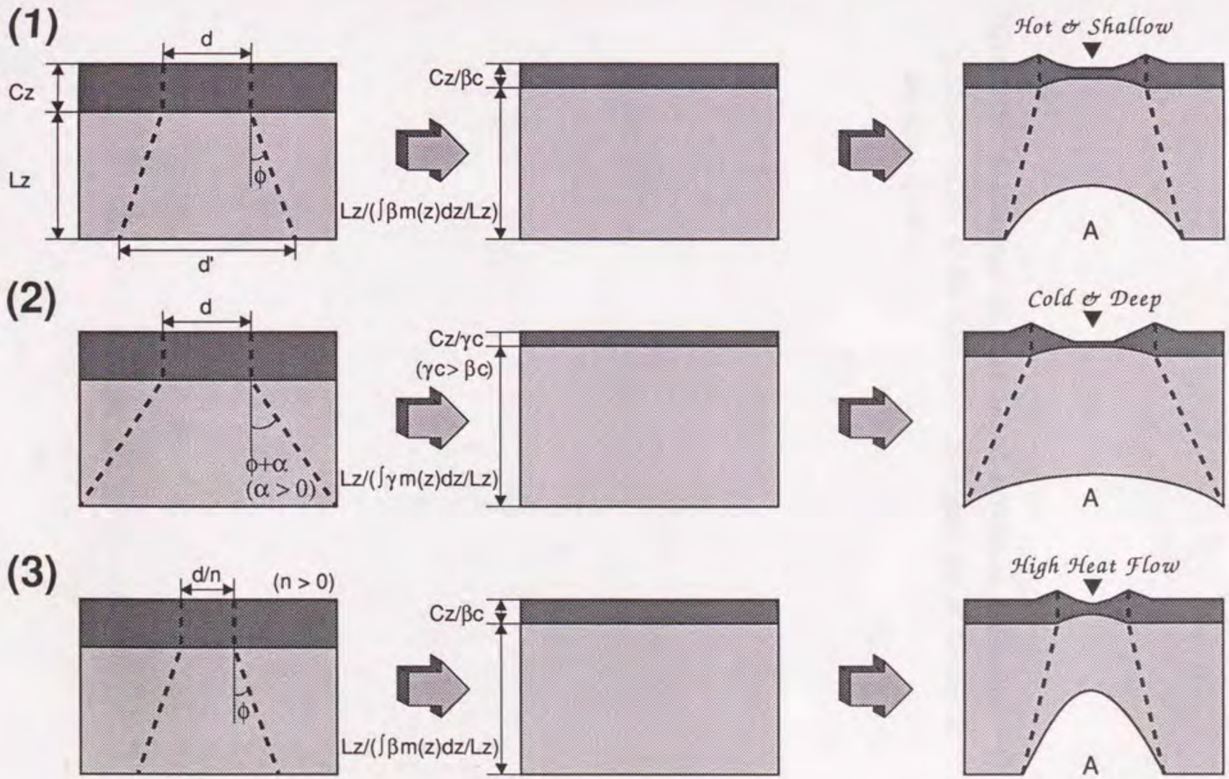

raw data
5' mesh
10'mesh
20' mesh
Acoustic Basement Depth (sec.)
Opal-A/CT Depth (sec.)
Pearson Correlation : 0.478
Pearson Correlation : 0.517
Pearson Correlation : 0.496
Pearson Correlation : 0.538

Figure I-52: Isothermal planes of 50°C and 100°C are plotted on the interpreted seismic profile of the DELP Line-A.



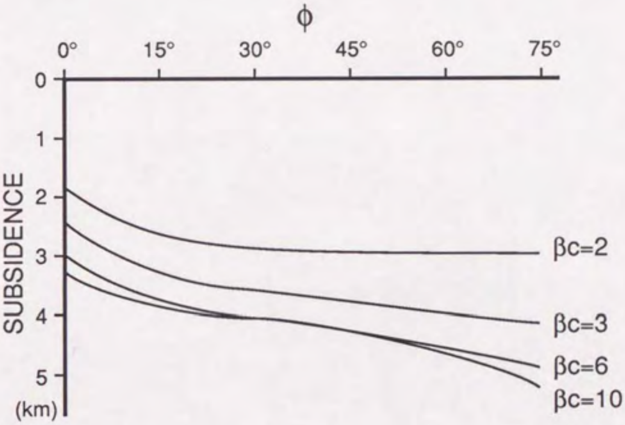
SW
NE
3.0
4.0
5.0
6.0
(sec.)
50 °C
100 °C
5 km

Figure I-53: Framework of formation model for the Yamato Basin. (1): Continuous nonuniform stretching model of Rowley & Sahagian (1986). Dark shading is crust, light shading is mantle lithosphere. Cz: thickness of crust. Lz: thickness of mantle lithosphere. d: initial horizontal width. A: asthenosphere. (2): Stretching factor and ϕ are changed from (1). Crustal subsidence is much greater than (1), however, the asthenospheric uplift is not so high. (3): Same condition with (1) except initial horizontal width. Asthenospheric uplift is restricted in narrow area and the uplift is significantly high.



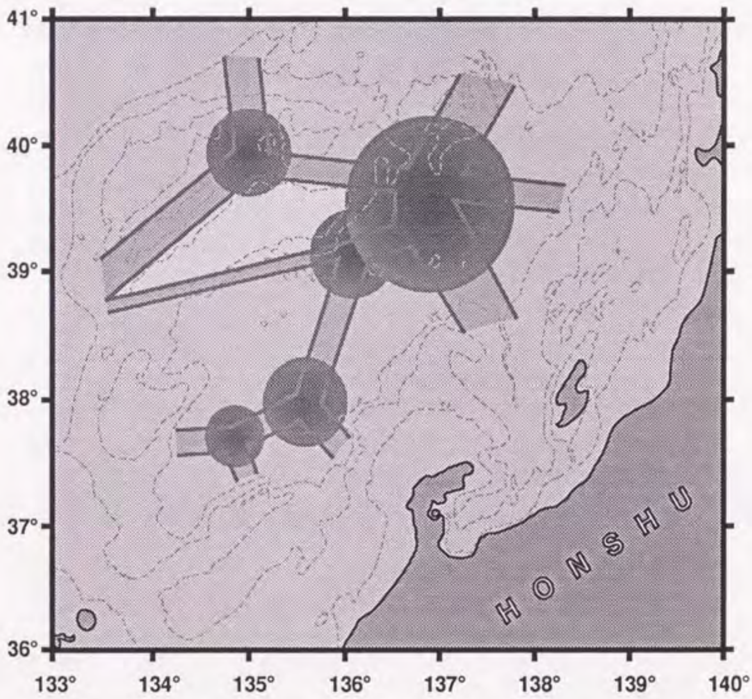
(1)
d
Cz
Lz
ϕ
d'
Cz/βc
Lz/(∫βm(z)dz/Lz)
Hot & Shallow
A
(2)
d
ϕ+α
(α > 0)
Cz/γc
(γc> βc)
Lz/(∫γm(z)dz/Lz)
Cold & Deep
A
(3)
d/n
(n > 0)
ϕ
Cz/βc
Lz/(∫βm(z)dz/Lz)
High Heat Flow
A

Figure I-54: Relationship between crustal subsidence and ϕ for various values of βc, taken from the Figure 2-a of Rowley & Sahagian (1986).



ϕ
0°
15°
30°
45°
60°
75°
0
1
2
3
4
5
(km)
SUBSIDENCE
βc=2
βc=3
βc=6
βc=10

Figure I-55: A possible model for explain the abnormal thermal structure of the Yamato Basin.



41°
40°
39°
38°
37°
36°
133°
134°
135°
136°
137°
138°
139°
140°
HONSHU

Plate I-1: The depth variation of the Opal-A / Opal-CT transformation boundary in two-way travel time.

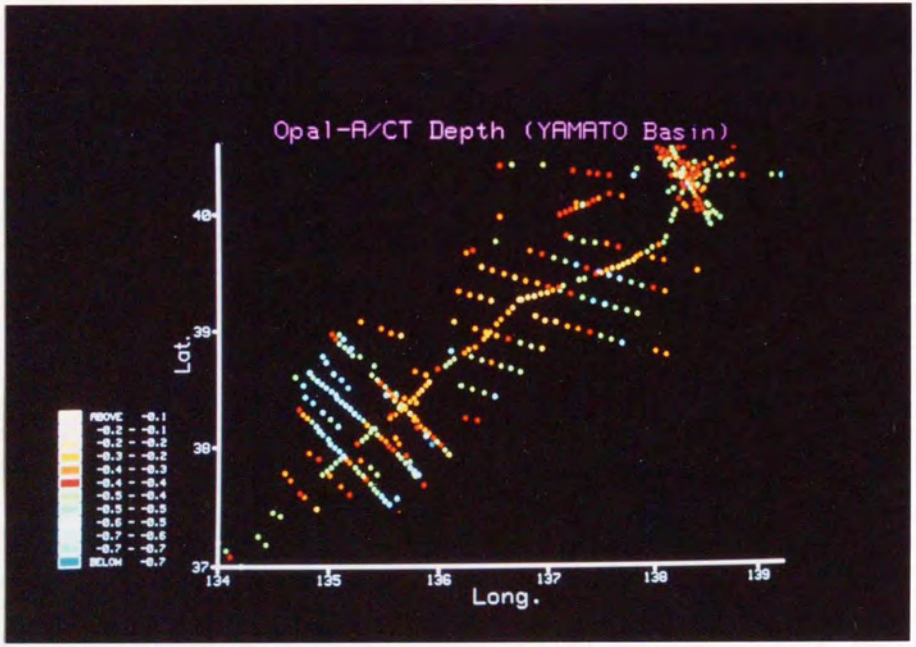

Opal-A/CT Depth (YAMATO Basin)
Lat.
40
39
38
37
Long.
134
135
136
137
138
139
ABOVE -0.1
-0.2 - -0.1
-0.2 - -0.2
-0.3 - -0.2
-0.4 - -0.3
-0.4 - -0.4
-0.5 - -0.4
-0.5 - -0.5
-0.6 - -0.5
-0.7 - -0.6
-0.7 - -0.7
BELOW -0.7

Plate I-2: Contour map of the Opal-A / Opal-CT depth anomaly.

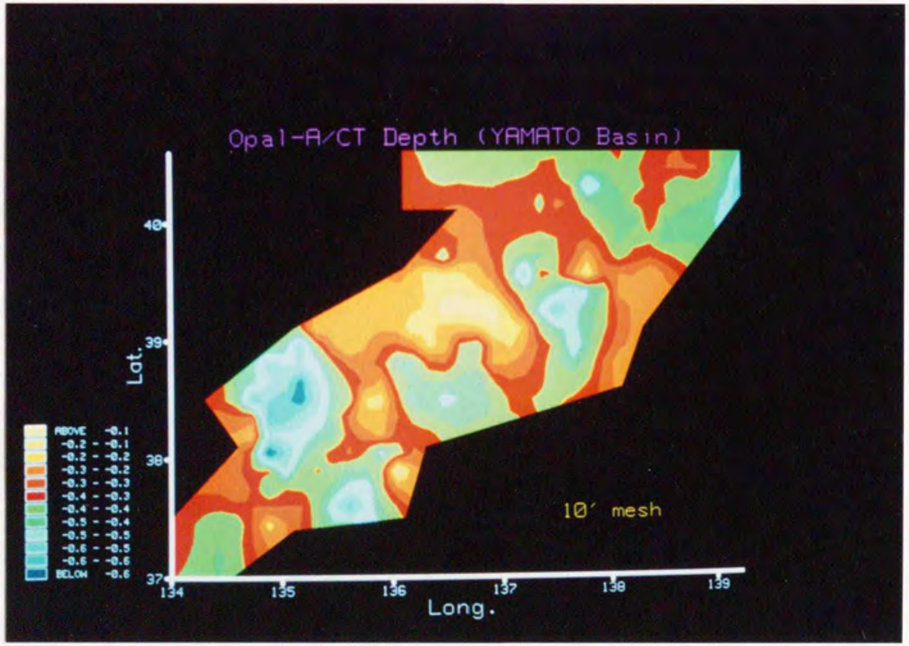

Opal-A/CT Depth (YAMATO Basin)
10′ mesh
Lat.
Long.
40
39
38
37
134
135
136
137
138
139
ABOVE -0.1
-0.2 - -0.1
-0.2 - -0.2
-0.3 - -0.2
-0.3 - -0.3
-0.4 - -0.3
-0.4 - -0.4
-0.5 - -0.4
-0.5 - -0.5
-0.6 - -0.5
-0.6 - -0.6
BELOW -0.6

Plate I-3: Calculated heat flow anomaly. The interval of contour is 25 mW/m^2.

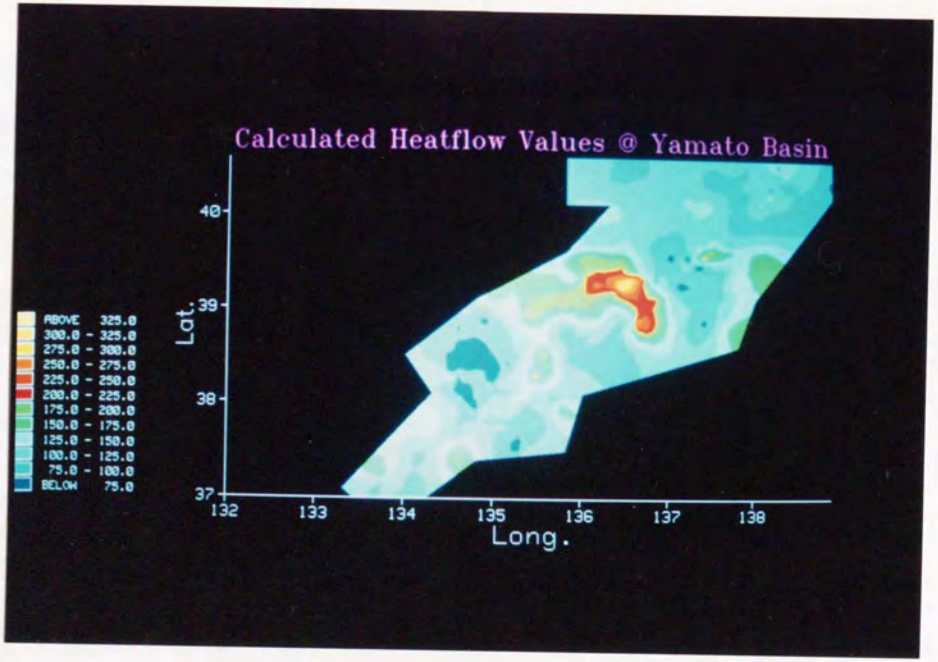

Calculated Heatflow Values @ Yamato Basin
ABOVE 325.0
300.0 - 325.0
275.0 - 300.0
250.0 - 275.0
225.0 - 250.0
200.0 - 225.0
175.0 - 200.0
150.0 - 175.0
125.0 - 150.0
100.0 - 125.0
75.0 - 100.0
BELOW 75.0
Lat.
40
39
38
37
132
133
134
135
136
137
138
Long.

Plate I-4: Estimated isothermal plane depth (50°C).

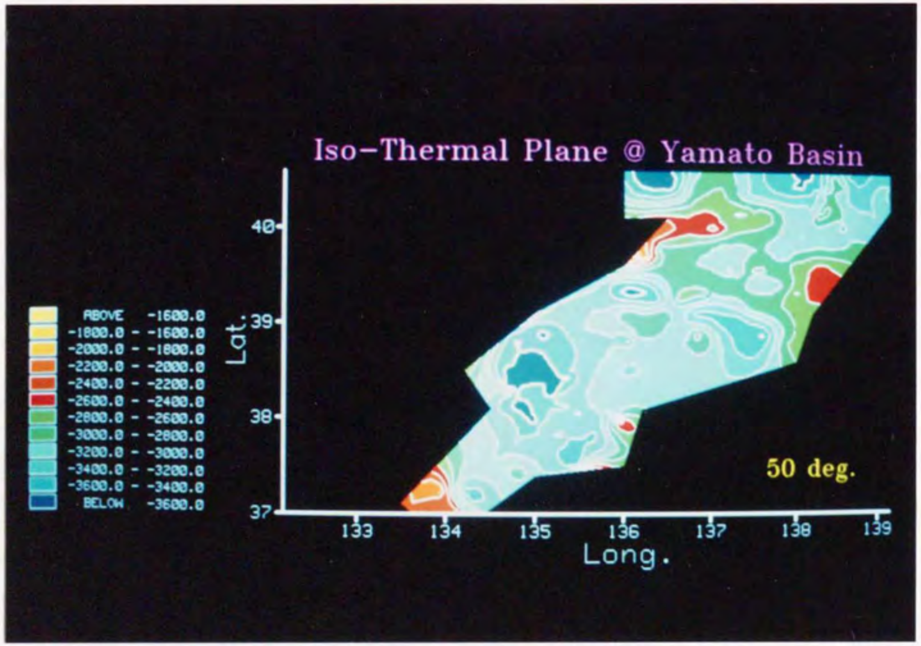

Iso-Thermal Plane @ Yamato Basin
ABOVE -1600.0
-1800.0 - -1600.0
-2000.0 - -1800.0
-2200.0 - -2000.0
-2400.0 - -2200.0
-2600.0 - -2400.0
-2800.0 - -2600.0
-3000.0 - -2800.0
-3200.0 - -3000.0
-3400.0 - -3200.0
-3600.0 - -3400.0
BELOW -3600.0
Lat.
40
39
38
37
133
134
135
136
137
138
139
Long.
50 deg.

Plate I-5: Estimated isothermal plane depth (100°C).

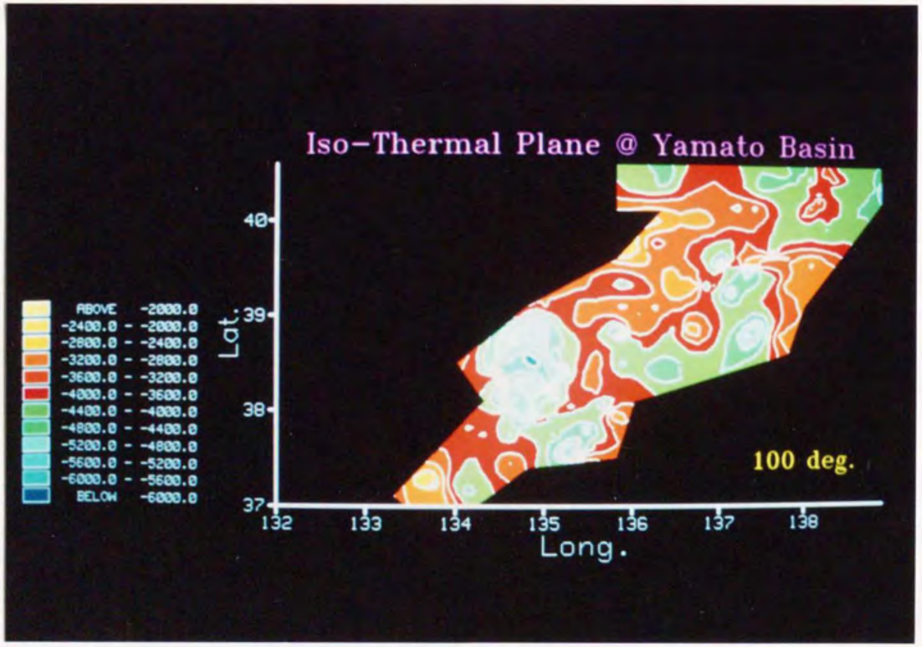
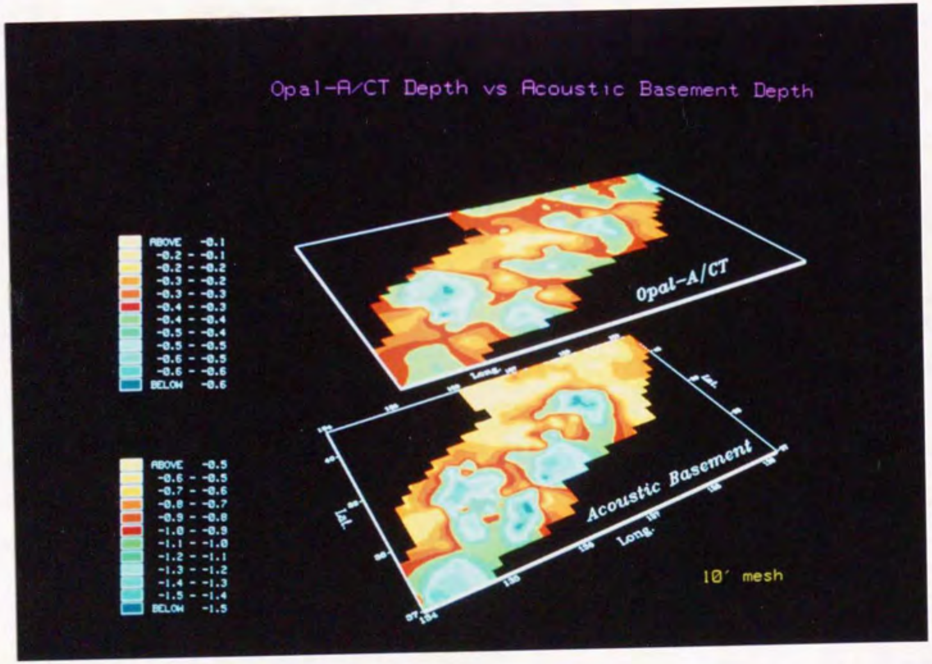

Iso-Thermal Plane @ Yamato Basin
ABOVE -2000.0
-2400.0 - -2000.0
-2800.0 - -2400.0
-3200.0 - -2800.0
-3600.0 - -3200.0
-4000.0 - -3600.0
-4400.0 - -4000.0
-4800.0 - -4400.0
-5200.0 - -4800.0
-5600.0 - -5200.0
-6000.0 - -5600.0
BELOW -6000.0
Lat.
40
39
38
37
132
133
134
135
136
137
138
Long.
100 deg.

Plate I-6: Comparison between the depth of Opal-A / Opal-CT boundary and the depth of acoustic basement.


Opal-A/CT Depth vs Acoustic Basement Depth
ABOVE -0.1
-0.2 - -0.1
-0.2 - -0.2
-0.3 - -0.2
-0.3 - -0.3
-0.4 - -0.3
-0.4 - -0.4
-0.5 - -0.4
-0.5 - -0.5
-0.6 - -0.5
-0.6 - -0.6
BELOW -0.6
ABOVE -0.5
-0.6 - -0.5
-0.7 - -0.6
-0.8 - -0.7
-0.9 - -0.8
-1.0 - -0.9
-1.1 - -1.0
-1.2 - -1.1
-1.3 - -1.2
-1.4 - -1.3
-1.5 - -1.4
BELOW -1.5
Opal-A/CT
Acoustic Basement
Long.
Lat.
10′ mesh