July 2000
Seismic Reflection and Subbottom Profiler Images
from the NEMO-3 Cruise

Volume 2
Seismic Reflection Images

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BSU CGISS Technical Report 2000-05
1 July 2000
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1. Introduction

The data presented here were collected on the NEMO-3 cruise of the R/V Melville, from 16 May to 8 June 2000. Volume 1 of this technical report contains all the Chirp Subbottom profiler data digitally recorded and archived on NEMO-3, while Volume 2 contains all the seismic reflection data. Each data set is presented in order of Julian Day (May 16 is JD137, etc.) and includes 6 hour incremental swathmaps made on the cruise.

Seismic Reflection Parameters

The seismic reflection data were collected using a dual 150 c.i. GI gun seismic source and using the Scripps 4-channel hydrophone streamer. The data were digitally recorded in SEG-Y format, 0.5 msec/sample, using 2 byte integers. We collected 7 seconds of data with no delay.

We merged the data with 1-second P-code GPS navigation (position is for bridge of the R/V Melville, 60 meters forward of the GI gun source or 40 m forward of the fantail). The geometry of the experiment is as follows: GI guns are towed 20 m aft of the fantail. The midpoint of channel 1 is 125 m aft of the fantail; channel 2 midpoint is 175 m aft, channel 3 midpoint is 225 m aft, and channel 4 midpoint is 275 m aft of the fantail.

The data have been stacked, and the SEG-Y file on CD is of the stacked data. Raw 4-channel data have been archived separately on DAT tapes, or for the latter part of the cruise on CD disks. The data are written without a band-pass filter. However, the plot images are shown with a 30-500 Hz bandpass filter. The processing flow is as follows: Read in the 4-channel data; add header values, as described below; define geometry of channels and source; NMO correction using a constant 1500 m/sec sound velocity; sort CDPs using CDP=ffil - channel number; diversity stack (to remove electrical crosstalk between chirp and seismic recording system).

The seismic data have been merged with 1 second P-code GPS data and centerbeam depth from the R/V Melville Seabeam 2000 swathmapping system. Gravity information, in unknown units from standard Scripps underway files have been written into header bytes 181-184. The merged data are in the following locations in the binary header:

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Alternate var name</th>
<th>Byte position</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>center beam depth</td>
<td></td>
<td>61-64</td>
<td>uncorrected m</td>
</tr>
<tr>
<td>Longitude</td>
<td>Source-X</td>
<td>73-76</td>
<td>decimal degrees x 10**6</td>
</tr>
<tr>
<td>Latitude</td>
<td>Source-Y</td>
<td>77-80</td>
<td>decimal degrees x 10**6</td>
</tr>
<tr>
<td>time delay</td>
<td>(delay recording time)</td>
<td>109-110</td>
<td>milliseconds</td>
</tr>
<tr>
<td>Year</td>
<td></td>
<td>157-158</td>
<td></td>
</tr>
<tr>
<td>Day</td>
<td></td>
<td>159-160</td>
<td>Julian days</td>
</tr>
<tr>
<td>hour</td>
<td></td>
<td>161-162</td>
<td></td>
</tr>
<tr>
<td>minute</td>
<td></td>
<td>163-164</td>
<td></td>
</tr>
<tr>
<td>second</td>
<td></td>
<td>165-166</td>
<td></td>
</tr>
<tr>
<td>gravity</td>
<td></td>
<td>181-184</td>
<td></td>
</tr>
</tbody>
</table>

Seismic reflection data were collected along much of but not all of the NEMO-3 cruise track. The majority of the data were collected on the Cocos and Carnegie Ridges and within the Panama Basin. Each specific survey was given a site name, or was named as the transit leg between sites.
Sites that were given priority for drilling are described in more detail in Lyle et al. (2000) and in Mix et al. (2000)

Chirp Subbottom Profiling

We archived the correlated signal from a Knudsen 320B/R digital echo sounder after adding 1-second P-code GPS navigation and center beam depth from the R/V Melville Seabeam 2000 system. The chirp system is a swept 2-7 kHz high resolution seismic system. The data are in SEG-Y format, 0.067 sec/sample, in 2 byte fixed format.

The merged data are in the following locations in the binary header:

<table>
<thead>
<tr>
<th>Variable name</th>
<th>alt var name</th>
<th>byte position</th>
<th>units</th>
</tr>
</thead>
<tbody>
<tr>
<td>center beam depth</td>
<td>(water depth at source)</td>
<td>61-64</td>
<td>uncorrected m</td>
</tr>
<tr>
<td>Longitude</td>
<td>(Source-X)</td>
<td>73-76</td>
<td>decimal degrees x 10**6</td>
</tr>
<tr>
<td>Latitude</td>
<td>(Source-Y)</td>
<td>77-80</td>
<td>decimal degrees x 10**6</td>
</tr>
<tr>
<td>time delay</td>
<td>(delay recording time)</td>
<td>109-110</td>
<td>milliseconds</td>
</tr>
<tr>
<td>Year</td>
<td></td>
<td>157-158</td>
<td></td>
</tr>
<tr>
<td>Day</td>
<td></td>
<td>159-160</td>
<td>Julian days</td>
</tr>
<tr>
<td>hour</td>
<td></td>
<td>161-162</td>
<td></td>
</tr>
<tr>
<td>minute</td>
<td></td>
<td>163-164</td>
<td></td>
</tr>
<tr>
<td>second</td>
<td></td>
<td>165-166</td>
<td></td>
</tr>
</tbody>
</table>

The chirp images are shown without the delay. They have been processed by correlation with the outgoing pulse (internal to the Knudsen) and are displayed as reflection strength (instantaneous amplitude).

References


Figure 2: Seth Mogk and one of the 150 c.i. GI guns used for seismic sources on NEMO-3.

Figure 3: Towing the two GI guns beneath the high-speed “seismic surfboards”, off Costa Rica, 7 June 2000.
JD 139 (18 May 2000)--Begin TEH-1 Survey, Gulf of Tehuantepec

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
Data File SBfixavg.2000may18.0000-0600
TEH-1A-Line 1-2a
Bandpass
Tehuantepec Survey
JD139

Line 1
Line 2

3 km
TEH-1A-Line 2-3a
Bandpass
Tehuantepec Survey
JD139

NW

Line 2

3 km

Line 3

SE

Two-way Travel Time (ms)
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TEH-1A-Line 4C
Bandpass
Tehuantepec Survey
JD 139

Two-way Travel Time (ms)

Line 4

Way pt TEH-3

3 km
NW  Line 5

TEH-1A-Line 5a
Bandpass
Tehuantepec Survey
JD 139

Two-way Travel Time (ms)

3 km
NEMO-3 Site Surveys CGISS Technical Report 2000-05
Volume 2: Seismic Reflection Images from NEMO-3 (R/V Melville May-June 2000)
Data File SBfixavg.2000may18.1800-2400
TEH-1A-Line 6
Bandpass
Tehuantepec Survey
JD 139

Warning: Heading on this line is not constant
JD 141 (20 May 2000)--TEH-1 Survey, Last Day

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
TEH-1 Survey B:
Tehuantepec Margin
Two-way Travel Time (ms)

- TEH-1B survey-Line 1
- Bandpass Tehuantepec Survey
- JD141

Proposed Drillsite
TEH-1A

3 km

speed 8 knots
NW

Line 3

SE

TEH-1B survey-Line 3
Bandpass
Tehuantepec Survey
JD141

3 km

Two-way Travel Time (ms)
Two-way Travel Time (ms)
TEH-1B survey-Line 5  
Bandpass  
Tehuantepec Survey  
JD141
Two-way Travel Time (ms)

TEH-1B survey-Line 6
Bandpass
Tehuantepec Survey
JD141

3 km
Line 9

TEH-1B survey-Line 9
Bandpass
Tehuantepec Survey
JD141

3 km

Two-way Travel Time (ms)
TEH-1B survey-Line 10
Bandpass
Tehuantepec Survey
JD141
Two-way Travel Time (ms)

TEH-1B survey-Line 11
Bandpass
Tehuantepec Survey
JD141

3 km
TEH-1B survey-Line 13 Bandpass Tehuantepec Survey JD141

3 km
Data File SBfixavg.2000may20.1800-2400
Two-way Travel Time (ms)

TEH-1B survey-Line 14
Bandpass
Tehuantepec Survey
JD141

change of speed at 19.13 from 8 to 10 knots
TEH-1B survey-Line 15
Bandpass
Tehuantepec Survey
JD141

change of speed from 10 to 12 knots
change of speed at 20.44 from 12 to 8 knots
JD 144 (23 May 2000)--COC-2 Survey, Cocos Ridge

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
Two-way Travel Time (ms)
Data File SBfixavg.2000may24.0600-1200
Two-way Travel Time (ms)

Line 2

COC-2A-Line 2
Bandpass
Cocos Ridge-2
Survey
JD145

3 km
Line 3

COC-2A-Line 3
Bandpass
Cocos Ridge-2
Survey
JD145

3 km

Two-way Travel Time (ms)
JD 145-146 (24-25 May 2000)--COC-3 Survey, Cocos Ridge

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
Data File SBfixavg.2000may24.1800-2400

START of COC-3 Survey

COC3 Line 4

5° 50'N 5° 50'N 5° 50'N
5° 40'N 5° 40'N 5° 40'N
5° 30'N 5° 30'N 5° 30'N
5° 20'N 5° 20'N 5° 20'N
5° 10'N 5° 10'N 5° 10'N
5° 00'N 5° 00'N 5° 00'N
4° 50'N 4° 50'N 4° 50'N
6° 00'N 6° 00'N 6° 00'N
6° 10'N 6° 10'N 6° 10'N
6° 20'N 6° 20'N 6° 20'N
6° 30'N 6° 30'N 6° 30'N
6° 40'N 6° 40'N 6° 40'N
6° 50'N 6° 50'N 6° 50'N
86° 20'W 86° 30'W 86° 40'W
86° 20'W 86° 30'W 86° 40'W
86° 20'W 86° 30'W 86° 40'W
86° 20'W 86° 30'W 86° 40'W
86° 20'W 86° 30'W 86° 40'W
Two-way Travel Time (ms)

COC-3-Line 4
Bandpass
Cocos Ridge -3
Survey
JD145

3 km

NE SW
Two-way Travel Time (ms)

Line 4
COC-3 Drillsite
MC16/PC17 cores
X COC-3 line 7

COC-3-Line 4
Bandpass
Cocos Ridge-3
Survey
JD146

3 km
Two-way Travel Time (ms)
Data File SBfixavg.2000may25.0600-1200
Two-way Travel Time (ms)

COC-3-Line 7
Bandpass
Cocos Ridge-3
Survey
JD146

change of speed at 06.51
from 10 to 8 knots

X COC-3 line 5  X COC-3 line 4

3 km
JD 146-147 (25-26 May 2000)--PAN-1 Survey, Panama Basin

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
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Two-way Travel Time (ms)

Line 1

PAN-1-Line 1
Bandpass
Panama Basin 1 Survey
JD146

speed 10 knots
Line 1

PAN-1-Line 1
Bandpass
Panama Basin 1
Survey
JD146

Two-way Travel Time (ms)

NW

SE

3 km
Core Sites JC 19, MC 20

PAN-1-Line 2 Bandpass
Panama Basin 1 Survey
JD147

Two-way Travel Time (ms)

3 km
Two-way Travel Time (ms)

change of speed at 08.17 from 10 to 9 knots

3 km
Line 6
Projected Core Sites JC 19, MC 20

PAN-1-Line 6
Bandpass
Panama Basin 1
Survey
JD147

3 km

Two-way Travel Time (ms)
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PAN-1-Line 7
Bandpass
Panama Basin 1
Survey
JD147

Two-way Travel Time (ms)

3 km

speed 10 knots

X PAN-1 line 2
X PAN-1 turn btw. line 1 and 2

Line 7
JD 148 (27 May 2000)--Transit from PAN-1 and PAN-2, Panama Basin

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
Data File SBfixavg.2000may26.1800-2400
PAN-1 transit Line 1
Bandpass
Panama Basin 1
Transit
JD147, JD148

3 km

Two-way Travel Time (ms)

speed 10 knots
Data File SBfixavg.2000may27.0000-0600
PAN-1 transit Line 1
Bandpass
Panama Basin 1
Transit
JD148

3 km
Line 1

PAN-1 transit Line 1
Bandpass Panama Basin 1 Transit JD148

Two-way Travel Time (ms)

3 km
PAN-1 transit Line 1
Bandpass Panama Basin 1
Transit JD148
JD 148 (27 May 2000)--PAN-2 Survey, equator in Panama Basin

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
PAN-2 - Line 1
Bandpass
Panama Basin 2
Survey
JD148

speed 10 knots
Two-way Travel Time (ms)
Two-way Travel Time (ms)  

PAN-2 Drill site  
Cores 23JC, 24JC  
X PAN-2 line 1  

X PAN-2 line 4  
40 min. of data lost  

change of speed from  
10 to 8 knots  

PAN-2 - Line 5  
Bandpass  
Panama Basin 2  
Survey  
JD148  

3 km
JD 150 (29 May 2000)--CAR-2 Survey, Carnegie Ridge, South Flank

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
NW

11 min. of data lost

Line 1

3 km

Two-way Travel Time (ms)

speed 10 knots

CAR-2 - Line 1 Bandpass Carnegie Ridge 2 Survey JD150
NW   Line 1   SE

CAR-2 - Line 1
Bandpass
Carnegie Ridge 2
Survey
JD150

3 km

Two-way Travel Time (ms)
NW  \[\text{Line 2}\] SE

X CAR-2 turn btw. line 3 and 4

change of speed at 18.00 from 10 to 8 knots

Two-way Travel Time (ms)
NW  CAR-2A Drillsite  Line 3  SE
Cores 25MC, 27JC, 26HC
X CAR-2 line 6
3 km

SE Line 3 NW
Start Line 3  Turn  End Line 2
X CAR-2 line 5

CAR-2 - Line 3
Bandpass
Carnegie Ridge 2
Survey
JD150
Data File SBfixavg.2000may30.0000-0600

start Line 4

CAR2
Line 3
CAR-2 - Line 3
Bandpass
Carnegie Ridge 2
Survey
JD150, 151

X CAR-2 line 2

Turn
End Line 3

Line 3

NW

SE

3 km
NW  -->  Line 4  -->  SE

End Line 4  |  Turn

3 km

CAR-2 - Line 4
Bandpass
Carnegie Ridge 2
Survey
JD151

Two-way Travel Time (ms)

change of speed at 05.52 from 8 to 10 knots
CAR-2 - Line 5
Bandpass
Carnegie Ridge 2
Survey
JD151

NW
SE

X CAR-2 line 2

3 km

Two-way Travel Time (ms)
CAR-2 - Line 6
Bandpass Carnegie Ridge 2 Survey JD151

Two-way Travel Time (ms)

change of speed at 10.06 from 10 to 8 knots

X CAR-2 line 2

3 km

X CAR-2 line 3

End Line 5
Start Line 6

Line 6

CAR-2A Drillsite

NE

SW
JD 152 (31 May 2000)--end CAR-2 Survey

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
CAR-2 - Line 10
Bandpass
Carnegie Ridge 2
Survey
JD152

3 km
CAR-2 - Line 10
Bandpass Carnegie Ridge 2 Survey JD152

Two-way Travel Time (ms)

3 km
JD 152 (31 May 2000)--Begin CAR-1 Survey, Carnegie Ridge Crest

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
CAR-1 - Line 1
Bandpass
Carnegie Ridge 1
Survey
JD152

speed 11 knots

3 km
Two-way Travel Time (ms)

CAR-1 - Line 1
Bandpass
Carnegie Ridge 1
Survey
JD152

3 km
Projected location of Cores 29MC, 31JC, 30NB
X CAR-1 line 5

CAR-1 - Line 2
Bandpass
Carnegie Ridge 1
Survey
JD152

3 km
CAR-1 - Line 3
Bandpass
Carnegie Ridge 1 Survey
JD153

Two-way Travel Time (ms)
CAR-1 - Line 4
Bandpass
Carnegie Ridge 1
Survey
JD153

NW
Line 4
SE

Start Line 4
End Line 4

Two-way Travel Time (ms)

3 km
Cores 29MC, 31JC, 30NB
X CAR-1 line 13
X CAR-1 line 2
X CAR-1 line 3
CARNegie Ridge 1 Survey
JD153

Two-way Travel Time (ms)
CAR-1 - Line 7
Bandpass
Carnegie Ridge 1 Survey
JD153

3 km
Data File SBfixavg.2000jun01.1200-1800
CAR-1 - Line 9
Bandpass
Carnegie Ridge 1 Survey
JD153
3 km
CAR-1 - Line 11
Bandpass
Carnegie Ridge 1 Survey
JD153

Two-way Travel Time (ms)

3 km

X CAR-1 line 8

End Line 11
Turn

Line 11
NW

End Line 12

Line 12

X CAR-1 line 5
X CAR-1 line 6
X CAR-1 line 7

SE

Start Line 12

Turn

3 km

CAR-1 - Line 12
Bandpass
Carnegie Ridge 1
Survey
JD153

Two-way Travel Time (ms)
CAR-1 - Line 13
Bandpass
Carnegie Ridge 1
Survey
JD153

Cores 29MC, 31JC, 30NB
X CAR-1 line 5

X CAR-1 line 2

X CAR-1 line 6

Start Line 13

Two-way Travel Time (ms)

End Line 13

3 km
JD 154 (2 June 2000)--CAR-1 to PAN-3 transit, Panama Basin

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
PAN-3 transit - Line 1
Bandpass
Panama Basin 3 Transit
JD154

Two-way Travel Time (ms)

speed 11 knots
NW

Line 1

SE

PAN-3 transit - Line 1
Bandpass
Panama Basin 3 Transit
JD154

Two-way Travel Time (ms)

3 km
NW

Line 1

SE

3 km

PAN-3 transit - Line 1
Bandpass
Panama Basin 3 Transit
JD154

Two-way Travel Time (ms)
NW

Line 1

SE

PAN-3 transit - Line 1
Bandpass
Panama Basin 3 Transit
JD154

3 km

Two-way Travel Time (ms)
NW       Line 1       SE

PAN-3 transit - Line 1
Bandpass
Panama Basin 3 Transit
JD154, JD155

JD155  JD154
NW

---

Line 1

---

SE

Two-way Travel Time (ms)

PAN-3 transit - Line 1
Bandpass
Panama Basin 3 Transit
JD155
Data File SBfixavg.2000jun03.0600-1200
PAN-3 transit - Line 1
Bandpass
Panama Basin 3 Transit
JD155

Two-way Travel Time (ms)
Line 1

PAN-3 transit - Line 1
Bandpass
Panama Basin 3 Transit
JD155

Two-way Travel Time (ms)
PAN-3 transit - Line 1
Bandpass
Panama Basin 3 Transit
JD155

Two-way Travel Time (ms)
PAN-3 transit - Line 1
Bandpass
Panama Basin 3 Transit
JD155
JD 155 (3 June 2000)--PAN-3 Survey, Deep Panama Basin

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
NW

Turn Start Line 2

Line 2

SE

PAN-3 - Line 2
Bandpass
Panama Basin 3 Survey
JD155

Two-way Travel Time (ms)

3 km
JD 157 (5 June 2000)--Transit from PAN-3 to COC-1

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
COC-1 transit - Line 1
Bandpass
Cocos Ridge 1 Transit
JD156, 157

Two-way Travel Time (ms)

3 km

speed 9 knots
JD 157 (5 June 2000)--COC-1 Survey, Shallow Cocos Ridge

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
Data File SBfixavg.2000jun05.0000-0600

Line 1

[Map showing seismic reflection images with coordinates and data file information]
COC-1 survey - Line 1
Bandpass
Cocos Ridge 1 Survey
JD157

3 km

speed 8 knots

Two-way Travel Time (ms)
Data File SBfixavg.2000jun05.0600-1200
COC-1 survey - Line 1
Cocos Ridge 1 Survey
JD157

Two-way Travel Time (ms)

3 km
COC-1 survey - Line 3
Bandpass
Cocos Ridge 1 Survey
JD157

3 km
COC-1 survey - Line 4
Bandpass
Cocos Ridge 1 Survey
JD157

3 km
Data File SBfixavg.2000jun05.1200-1800
COC-1 survey - Line 6
Bandpass
Cocos Ridge 1 Survey
JD157

3 km

Two-way Travel Time (ms)
W  Line 7  E

Cores 38MC, 40JC, 39NB

X COC-1 line 5  X COC-1 line 4  X COC-1 line 1

COC-1 survey - Line 7
Bandpass
Cocos Ridge 1 Survey
JD157

3 km
JD 158 (6 June 2000)--COC-4 Survey, Cocos Ridge

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
COC-4 - Line 1
Bandpass
Cocos Ridge Survey 4
JD157, JD158

SW

Line 1

NE

speed 10 knots

3 km
COC-4 - Line 1
Bandpass
Cocos Ridge Survey 4
JD158

Two-way Travel Time (ms)
COC-4 - Line 3
Bandpass
Cocos Ridge Survey 4
JD158

Two-way Travel Time (ms)

change of the speed at 6.48 from 10 to 8 knots
COC-4 - Line 4
Bandpass
Cocos Ridge Survey 4
JD158

3 km
COC-4 - Line 6
Bandpass
Cocos Ridge Survey 4
JD158

Two-way Travel Time (ms)
Two-way Travel Time (ms)

COC-4 - Line 7
Bandpass
Cocos Ridge Survey 4
JD158

COC-4 Drillsite

Cores 41MC, 43JC
X COC-4 line 5
X COC-4 line 2

3 km
Data File SBfixavg.2000jun06.1800-2400

Line 8

Line 9
COC-4 - Line 8  
Bandpass  
Cocos Ridge Survey 4  
JD158  

Two-way Travel Time (ms)  

change of the speed at 21.04  
from 8 to 10 knots  

3 km
JD 159 (7 June 2000)--COC-5 Survey, Costa Rica Margin

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
Data File SBfixavg.2000jun07.0000-0600
COC-5 - Line 1
Bandpass
Cocos Ridge 5 Survey
JD159

3 km

speed 10 knots
COC-5 - Line 2
Bandpass
Cocos Ridge 5 Survey
JD159

Two-way Travel Time (ms)

3 km
Data File SBfixavg.2000jun07.0600-1200
COC-5 - Line 5
Bandpass
Cocos Ridge 5 Survey
JD159

X COC-5 turn btw. lines 1 and 2
X COC-5 turn btw. lines 3 and 4
X COC-5 line 4

Two-way Travel Time (ms)

3 km
JD 159 (7 June 2000)--MAT-1 Surveys, Mid-America Trench

High Resolution Seismic Reflection Records

NEMO Leg 3

R/V Melville
NW  Line 1  SE

MAT-1 - Line 1
Bandpass
Middle American Trench
Survey
JD159

speed 10 knots

3 km

Two-way Travel Time (ms)
Two-way Travel Time (ms)

MAT-1 - Line 2
Bandpass
Middle American Trench Survey
JD159

3 km
NW

Line 3

SE

MAT-1 - Line 3
Bandpass
Middle American Trench Survey
JD159

3 km

Two-way Travel Time (ms)
Two-way Travel Time (ms)

MAT-1 - Line 4
Bandpass
Middle American Trench
Survey
JD159

3 km

MAT1 Survey

SWNE
NW  Line 5  SE

MAT-1 - Line 5
Bandpass
Middle American Trench Survey
JD159

Two-way Travel Time (ms)

3 km