



Cruise Report

SE Caribbean Seismic Project Active Source Experiment R/V Maurice Ewing Cruise EW0404 18 April – 3 June 2004

Abstract

Collaborative research: Crust-mantle interactions during continental growth and high-pressure rock exhumation at an oblique arc-continent collision zone: SE Caribbean margin

The interiors of the continents are constructed of island arcs and microcontinental fragments. Theories of continental formation rely on island arc accretion to continental margins as a primary element in post-Archean continental development. The Caribbean-South American plate boundary zone is the result of Caribbean-American plate interactions starting in the Mesozoic and culminating in the Cenozoic accretion of the Leeward Antilles arc to the northern South American craton. Deformation has been diachronous with older Paleocene and Eocene collision-related features in western Venezuela and Neogene collision-related features in eastern Venezuela and Trinidad.

An important element of the collision has been the exhumation of high-pressure, low-temperature (HP/LT) metamorphic rocks of the Caribbean Mountain system and the offshore island of Margarita. The HP/LT rocks (formed up to 75 km in depth) originated in a subduction setting far to the west and are now at the surface in elongate belts showing progressively younger HP/LT metamorphism from west to east. The ascent and exhumation of metamorphic belts is the result of extension and compression which has operated in concert with poorly understood mantle processes.

A major tectonic feature found in onland areas south of the metamorphic belt is a narrow fold and thrust belt and adjacent foreland basin thought to have accommodated a significant (>50 km) amount of horizontal shortening during arc-continent transpression.

We carried out a geologic-geophysical investigation to test hypotheses related to arc-continent collision and accretion, HP/LT rock exhumation and development of folded belts. Geophysical investigations of crust-mantle structure will be combined with geologic studies of timing, deformation, and uplift. We propose to time the cessation of arc magmatism associated with arc accretion, and timing of HP/LT metamorphism and exhumation across the length of the boundary. The geometries of arc accretion, exhumation, and the hinterland of the folded belt will be investigated with active and passive seismic methods.

The proposed research undertaken at four different universities will provide an understanding of 1) the time-transgressive history and crust-mantle mechanical processes by which island arcs accrete to continents along oblique collision zones; 2) deeply buried HP/LT rocks are exhumed, 3) and fold and thrust belts form in transpressive environments. In the mantle we will examine how the subcrustal lithosphere drives the accretion of the arc and the exhumation of the metamorphic belts, how subduction polarity reverses, and the flow patterns of the sub-lithospheric mantle beneath the region.

EW0404 Shipboard Party

Ewing Crew

Mark Landow – Master
Stan Zeigler – Chief Mate
Rick Thomas – 2nd Mate
Shankar Bhardwaj – 3rd Mate
Dave Philbrick – Bosun
Dave Guinn – A/B
Arnold Syponcgo – A/B
Igor Myachin – A/B
Roger Strimback – O/S
Nolan Osorio – O/S
Steven Pica – Chief Engineer
Miguel Flores – 1st Engineer
Matt Ingerson – 2nd Engineer
Amie Carter – 3rd Engineer
Jack Schwartz – Electrician
Rudy Florendo – Oiler
Fernando Uribe – Oiler
George Mardones – Oiler
Gary Brodock – Steward
Melissa Case – Cook
Victoria Montgomery – Utility

Science Party

Paul Mann – Co-Chief Scientist
Dale Sawyer – Co-Chief Scientist
Alejandro Escalona – Scientist
Steffen Saustrop – Seismic Data Processor
Sean Sullivan – Watchstander
Janelle Homburg – Watchstander
Trevor Aitkin – Watchstander

Meredith Keelan – Watchstander
Javier Rojas – Watchstander
Lt. Mario Leal Ramirez – Venezuelan Navy Hydrographic Office
Lt. Adrian Bracho – Venezuelan Navy Hydrographic Office
Ted Koczynski -- Science Officer
John Collins – Science Officer
Richard Oliver-Goodwin – Systems Manager
Anthony Johnson – Systems Manager
Deitmar Kathmann – Electronic Tech.
Karl Hagel – Electronic Tech.
John DiBernardo – Gunner
John Byrnes – Gunner
Carlos Gutierrez – Gunner
Justin Walsh -- Gunner
Mari Smultea – Marine Mammal Observer
Howie Goldstein – Marine Mammal Observer
Suzanne Yin – Marine Mammal Observer
Claudio Fossati – Marine Mammal Observer
Alejandro Sayegh – Marine Mammal Observer
Meike Holst -- Marine Mammal Observer
Steve MacLean -- Marine Mammal Observer

Cruise Status Reports

Ewing Daily Report -- 20 April 1200Z

Ewing reached the area near the beginning of Line 1 (West of Aruba) at 1030Z. We are currently deploying the 50 m streamer for passive marine mammal observation. On first deployment it was running too deep and we are pulling it to remove weights. It has no active depth control, so weight and speed are the only factors that control its depth. The passive monitoring of marine mammals with this system is a new requirement (specified in our IHA permit) for this cruise. It is to be monitored when shooting. It is designed to locate marine mammals based on their vocalization. It may be particularly valuable for indicating the presence of whales underwater at night. We have two marine mammal observers aboard who are specifically assigned to work with this system.

We expect to begin deploying the main streamer in an hour or two. We are currently about 2.5 hours behind the schedule. The schedule was based on a straight line transit from San Juan to the beginning of Line 1. The Captain wisely decided to go around Puerto Rico rather than cutting across the island. We should be able to recover that time if the streamer/source deployments go well.

According to the schedule, we will begin shooting Line 1 at 0220Z on 4/21.

We have had discussions with Paul Ljunggren, LDEO Marine Superintendent. He and Mike Purdy are concerned that we will disturb recreational divers around the islands of Aruba, Curacao, and Bonaire. They worry that this could become a public relations problem. They seem to prefer that we stay 10 nm away from published dive sites. Since there is diving on the NW end of Aruba, we are reluctant to shoot directly toward that end of the island (toward land seismograph per Alan's instructions to Sawyer). Our current line comes within about 5.5 nm of the diving site. We expect to be approaching Aruba at approximately 1600Z 4/21. We are awaiting communication from Paul and Mike about whether they will permit us to pass closer than 10 nm from this dive area.

Ewing Daily Report -- 21 April 1230Z

We are shooting Line 1 and have acquired 1500 shots at 50 m spacing. We came on line a bit after 0200Z 21 April. We expect to pass north of the NW end of Aruba at about 1800Z today. Our average speed is 4.8 kn through the water, but only 3.8 kn over the ground. This is slower than the 4.5 kn over the ground assumed in the schedule. Therefore, we are falling a bit behind the schedule. We attribute the slower speed to currents flowing to the west. Our speed through the water is limited by the tension limit on the streamer and the ships engines. If we are correct in assigning the slow speed to current, we would not expect to have the same problem on the main N/S OBS/Texan transects.

My current estimate for arrival at the end of Line 2 is 0115Z on 4/22. This would be about 2 hours behind the master schedule. Note also that we have moved the end of Line 2 intersection with Transect 70W about 5 nm (approximately 1.5 OBS position) north. We will provide exact coordinates later today.

Yesterday, we successfully deployed the Passive marine mammal streamer, the seismic streamer, and the 20 gun source array. The streamer is running pretty well when we are at shooting speed and not turning. The mid-section rises on turns. The source array and recording system have been reliable.

Later today, we expect to generate the first day's shot time and location table for distribution to the land group, the OBS group, and FUNVISIS. We will also provide the waypoint locations used to acquire lines BOL 1 and 2. They have been changed slightly from the master schedule in order to accommodate LDEO concerns about avoiding sport divers and to improve the geometry of the shots for recording by seismographs on Aruba.

The Ewing marine mammal observers identified probable Striped Dolphins yesterday, visually and using the passive monitoring system. They also observe a large unidentified whale before the first source deployment. They heard vocalizations for about 5 hours. Dolphins were noted in the distance as we ramped up the 20 gun source array. We slowed the ramp up of the 20 gun array until the passive array showed that the dolphins were heard faintly and presumed to move out of the area. Beaufort sea state was 5-6 yesterday.

Ewing Daily Report -- 22 April 1230Z

In the past 24 hours, we have completed Line BOL-1 (1935Z 21 Apr), acquired Line BOL-2 (2019Z 21 Apr to 0036Z 22 Apr: ~600 shots), and began acquiring Line BOL-3 (aka "70W to the north") (0116Z 22 Apr).

I estimate that we will cross OBS 101 going north at about 0030Z 23 Apr. After a turn back onto the line, we plan to shoot south with shot spacing of 150 m. It looks like we are about 1 hour ahead of schedule. We have been aided by a northward current on our present heading, but will pay that back as we head south.

The following are actual waypoints for the acquisition of Lines BOL 1, 2 and 3.

	Lat		Lon		
BOL-1	12	42.600	N 71	0.000	W
	12	34.913	N 70	20.005	W
	12	35.864	N 70	17.711	W
	12	44.946	N 70	11.112	W
	12	46.031	N 70	9.331	W
BOL-2	12	46.750	N 69	58.300	W
	12	32.537	N 69	43.263	W
BOL-3	11	35.983	N 69	36.505	W
	14	31.800	N 69	57.600	W

Streamer is running well. We had some problems with the middle part of the streamer coming to the surface during turns, but that did not recur in the past 12 hours. Other systems seem to be performing well.

Steffan is working on preparing the shot files for distribution. Yosio's software needs some modification to handle line naming convention. See his email for more details.

Marine Mammal observers report:

1. Possible Sperm Whale clicks heard faintly on Line BOL-2
2. Vocalizing Dolphins (whistles and clicks) heard during night on BOL-3 on two occasions.
3. High winds during visual observations, no sightings.
4. Seward Johnson II reported seeing Long-beaked Common Dolphins.
5. SEAMAP acoustic detection software fully up and running. Technical problems appear to be fixed. Now potentially able to locate vocal detections via triangulation bearings.

Ewing Daily Report -- 23 April 1300Z

Note: The following description of events is based on Sawyer's limited perspective only. It is certainly not complete nor authoritative in terms of the events or reasons for individual actions.

Since yesterday's report we have had a number of problems. One of the Airgun tech's fell on the fantail and had a number of worrisome symptoms. The Captain determined that he needed medical care and ordered the source array stopped and the gear pulled. This was accomplished in fine fashion by the Ewing crew. We were visited by a physician on an Aruban Navy helicopter. He determined that the crew member did not require helicopter transport to shore, but that we should have him checked out onshore soon. After the helicopter departed, it became clear that we also had a ship steering problem. Ewing headed toward Aruba with the attention of dropping the crew member off. We were contacted by Seward Johnson II offering to take the man to Aruba while Ewing continued science activities. This offer was accepted and the two ships agreed to rendezvous. When they met, there was a squall and the small boat transfer would have been difficult. At this point, Ewing was planning to go into Curacao in the morning to have the steering problem diagnosed. The two ships agreed that Ewing would transport the man to Curacao in the morning and that SJII would accompany us to Curacao in case the steering became impossible or the condition of the man worsened. We are now just off Willemstad Curacao. The Ewing plans to go in, clear customs, send the man to the hospital, have a diver inspect the rudder, and post sailing board for afternoon. The departure time will be assessed after more is known about the steering problem. The SJII may also come into port if reasonable arrangements can be made.

Ewing Daily Report -- 24 April 1600Z

The following explanation is base on my understanding of what I have been told. It is not necessarily technically accurate. I am providing it to the Scientists involved in the project so that they can better understand what has and is expected to happen.

Ewing arrived in Curacao yesterday morning. Divers looked at the rudder and discovered that one part of the rudder is no longer properly attached to the rest. It is likely that a hinge pin moved or dropped out. It is fortunate that the ruder part did not full off. The plan currently being pursued involves welding (underwater) the two parts of the rudder together. I am told that this type of temporary fix may make it possible for us to complete our experiment. The repaired rudder should allow us to accomplish all the maneuvering needed for our science as well as operate the ship safely. A permanent repair would probably require lifting the Ewing out of the water at a dry dock facility. The Curacao dry dock facility is not available until 10 May. It is likely that the currently planned repair cannot be approved and completed until Monday at the soonest.

Once we leave Curacao, it is our intention to complete the transect that we have been working on. The OBS's are still happily recording and will do so for some time. The land instrument array is being recovered and prepared for redeployment along the same line. Because of the modified rudder, when we leave Curacao we will need to do some ship maneuvering tests. After that we will go back to the line we were shooting, deploy streamers and guns, and begin acquiring seismic data.

Enjoy your time in Curacao, but: When you leave the ship in Curacao, always note the sailing time posted by the Captain. Although this time may change, it is your responsibility to check back with the ship before the sailing time that was posted when you left the ship.

Ewing Daily Report -- 28 April 1230Z

The rudder repair work on the Ewing was completed at 1745Z yesterday. We moved away from the dock in Curacao at 1815Z to begin a sea trial. The sea trial was completed successfully and the ABS inspector taken off by Pilot boat at 2015Z.

We proceeded south to deploy the streamer in the deep water between Curacao and Venezuela, putting a single gun in the water and beginning firing at 2300Z. We deployed the PAM streamer at 2300Z and completed deployment of the main streamer at about 0300Z today. Because deployment had gone quicker than expected we were a long way from the start point for Line BOL-6. We ramped up the source array from 1 to 20 guns at 0730Z. We came on line BOL-6 at 0820Z. We expect to end BOL-6 at 2330Z tonight and will turn onto Line BOL-4 (Transect 70W to the south) about 2 hours later. This will be about 3 hours after the land array begins recording.

Beginning of Line BOL-6:	11 45.000N	68 52.800W
Anticipated end of Line BOL-6:	12 37.423N	69 48.431W
Anticipated beginning of Line BOL-4:	12 39.951N	69 44.152W

We will have a presentation in the main lab tonight at 1900L about Curacao Geology by Sean Sullivan. Yes, the material will be on the test!

Marine Mammal Observer report (provided by Mari Smultea): The SEAMAP hydrophone array was launched at ~ 2300Z. Heard vocalizing dolphins (clicks, whistles and burst pulses) off and on through the night. Heard several groups, including one that approached then quickly passed very closely. Other groups heard faintly far away for several hours near dawn. SEAMAP locating system up and running but we have only been able to obtain bearings to the dolphins, not distances, probably because of distance combined with few changes in relative angles of the vessel and the dolphin headings.

Ewing Daily Report -- 29 April 1230Z

We completed shooting BOL-6 at about 2400Z/119. We turned onto Line BOL-4 (Transect 70W) at about 0130Z/120. WE have been shooting at 150 m shot spacing to the south since then. We anticipate reaching the south end of the line at about 1700Z today. We will turn back onto Line BOL-3 (Transect 70W) shooting to the north at 50 m shot spacing.

The streamer is towing well and the guns have been working well.

We have rescheduled Sean Sullivan's presentation "Curacao Geology: The Movie" for tonight at 1900L in the main lab.

Marine Mammal Observer report (provided by Mari Smultea): No maine mammals seen or heard all day or night. Last heard in very early morning hours of 28 April, between midnight and dawn local.

It now appears that we have received permission to extend the cruise. The new arrival time in Puerto Rico is likely to be the morning of 3 June. This is not an official notice, but we wanted to pass on to the Science party what we think is likely to happen.

Ewing Daily Report -- 30 April 1400Z

The RV Ewing has spent the past 24 hours acquiring data along Transect 70W.

We ended Line BOL-4 at the south end of the 70W transect at 1634Z 29 Apr. We made a turn back onto Line BOL-3A, beginning the line at 1749Z 29 Apr. We shot through the turn and those shot times will be available for OBS and land seismic data even though MCS traces were not recorded. We ended Line BOL-3A at 0553Z 30 Apr. We began Line BOL-4A immediately, changing the shot spacing to 150 m. We anticipate completing Line BOL-4A at 1845Z 30 Apr. We expect to be at the end of Line BOL-3B at the north end of the transect at 0520Z 1 May. We expect to be at the end of Line BOL-4B at 1845Z 1 May. This will complete our acquisition on Transect 70W.

Yesterday, we reorganized our naming convention for the 6 segments of MCS shooting on Transect 70W. The initial plan proved flawed because it might have lead to data files being overwritten on one of the computer systems. In the new scheme, the line number 3 is used for data acquired at 50 m shot spacing, and the line number 4 is used for data acquired at 150 m shot spacing.

Beginning and ending locations for shooting along Transect 70W after reorganizing MCS Line names.

Line BOL-3 50 m shot spacing (complete before Curacao)

12 36.468 69 43.812

13 42.377 69 51.637

Line BOL-4 150 m shot spacing (complete)

12 39.951 69 44.152

11 35.983 69 36.505

Line BOL-3A 50 m shot spacing (complete)

11 35.983 69 36.505

12 39.951 69 44.152

Shot spacing change only, no turn

Line BOL-4A 150 m shot spacing (now shooting)

12 39.951 69 44.152

13 41.308 69 51.509

Shot spacing change only, no turn

Line BOL-3B 50 m shot spacing

13 41.308 69 51.509

14 31.800 69 57.600

Streamer length run-out and run-in

Line BOL-4B 150 m shot spacing

14 31.800 69 57.600

13 41.308 69 51.509

Turn off onto Line BOL-60 to the east

The source array has been working well. We have had some trouble with parts of the streamer coming to the surface. This occurred on Line BOL-3A when we had a strong (1-1.5 kn) current behind us. We had to drop the speed through the water to about 4 knots to keep the speed over the ground down. We also experienced steady 20 kn wind from the east and building sea state.

Marine Mammal Observer report (provided by Mari Smultea): No marine mammals have been seen and no vocalizations heard for the last 44 hours. When we compared the plots of the SJII's three long-beaked common and unidentified dolphin sightings with the cluster of unidentified dolphin vocalizations we heard through the night of 28 April, we found that they were all clustered in the same area near the 1000-m isobath, midway between Curacao and Porta Manzanillo, Venezuela. Alejandro, our Venezuelan marine mammal biologist observer who studies marine mammals off Isla Margarita, believes this area may be utilized regularly by a subpopulation of long-beaked common dolphins based on available data.

Ewing Daily Report -- 1 May 1300Z

The RV Ewing has spent the past 24 hours acquiring data along Transect 70W.

Ewing is currently about 1 hour ahead of Gail's 29 Apr emailed schedule.

We ended Line BOL-4A at 1849Z 30 Apr. We changed shot spacing to 50 m and began Line BOL-3B at 1849Z 30 Apr. We ended Line BOL-3B at 0642Z 1 May at the north end of the 70 W transect. We changed shot spacing to 150 m, turned back onto the transect to the south, and began Line BOL-4B at 0853Z 1 May. We continue to shoot south on Line BOL-4B. We anticipate ending the line at 2000Z 1 May. We then plan to turn onto Line BOL-60 toward Bonaire.

The source array has been working well. We continue to have occasional trouble with parts of the streamer coming to the surface. We have experienced 15-25 knot wind from the east that has generated 6-10 ft waves on our beam.

We have elected to operate the 3.5 kHz echo sounding equipment only on one pass along each of the main (OBS and/or Land Seismograph) transects. The equipment will be turned off for all other data acquisition by the Ewing.

Marine Mammal Observer report (provided by Mari Smultea): Last night, and for the first time in 3 days, we heard one group of unidentified dolphins. They vocalized for about 30 min near midnight. The local mean depth was 4300 m. Clicks and whistles were heard faintly. We have had no visual sightings of marine mammals since leaving Curacao. The high winds and Beaufort Sea State 6 the last few days have made sighting conditions extremely poor.

Ewing Daily Report -- 2 May 1330Z

In the past 24 hours, RV Ewing completed its work on Transect 70W and turned east to acquire MCS data on its way over to Transect 67W. Although the data on the 70W transect were not acquired in the exact order we planned, it looks to us like we have acquired 100% of the data we sought. We thank the Ewing crew and Lamont/NSF marine management for overcoming the steering problem that took us to Curacao. We also owe a great deal to the land crew who recovered and redeployed the land array an extra time, and the assistance and then patience of the Seward Johnson II crew and science party.

We ended Line BOL-4B at 1933Z 1 May. This completed data acquisition on the 70W transect. We changed shot spacing to 50 m and began Line BOL-60 at 2123Z 1 May. We are headed toward Bonaire. We expect to end Line BOL-60 at about 0030Z 3 May and will turn north on Line BOL-61.

We are planning to turn south onto the 67W transect at about 2300Z 6 May, when the land array will begin recording.

The source array has been working well. The streamer has been performing well for the last 24 hours. It came up on the turn onto Line BOL-60, but flattened out nicely on the run-in. We continue to have 15-25 knot winds from the east that have generated 5-8 ft waves.

Marine Mammal Observer report (provided by Mari Smultea): We had two acoustic detections of two groups of unidentified dolphins whistling and clicking faintly at 1000L and 1200L 1 May near depths of 4300-4500 m. We were able to obtain bearings to the dolphins using SEAMAP. The first group was directly behind the vessel, > 1 km away. For the first time, we were able to triangulate on the location of the dolphins using SEAMAP. This group was located ~5 km off the starboard side and last heard aft of the ship. We also had a 5 min. acoustic detection of possible pilot whales at 1346L 1 May. Since departing Puerto Rico we have had a total of 2 visual sightings and 12 acoustic detections: 12 of these have been dolphins, 1 was possible pilot whales, and 1 was an unidentified large whale. Of these, one event was a simultaneous visual/acoustic encounter. Seven of fourteen detections/sightings have been made at night. The Beaufort sea states of mostly 5-6 continue to limit our effective sighting ability.

Ewing Daily Report -- 3 May 1300Z

We ended Line BOL-60 at 0055Z 3 May. We began Line BOL-61 at 0250Z 3 May. We ended Line BOL-61 at 1333Z 3 May and are now turning south onto Line BOL-7.

We are on time for arrival at the 67 W transect.

The source array has been working well. The streamer has been performing well for most of the last 24 hours. There have been occasional waves in the streamer during which parts of the streamer come up very shallow. We continue to have 15-25 knot winds from the east and have 5-8 ft waves.

The MCS profiles between 70W and 67W are:

BOL-60 (complete)			
13	41.308	69	51.509
12	26.047	68	34.172
BOL-61 (complete)			
12	26.047	68	34.172
13	13.143	68	14.965
BOL-7			
13	11.792	68	12.576
11	36.401	68	51.616
BOL-62			
11	36.401	68	51.616
11	25.674	68	27.640
BOL-63			
11	25.674	68	27.640

12	9.197	67	57.641
BOL-8			
12	9.197	67	57.641
12	1.800	67	46.200
BOL-9			
12	1.800	67	46.200
10	59.081	67	58.218
Transit without data acquisition			
10	59.081	67	58.218
10	53.490	67	40.295
BOL-11			
10	53.490	67	40.295
11	28.872	67	27.905
Transect 67W			

Marine Mammal Observer report (provided by Mari Smultea):

Ewing observers had no visual or acoustic detections of marine mammals in the past 24 hours. Seward Johnson II observers reported 3 groups of dolphins on Friday 30 Apr: 2 unidentified dolphin groups and 1 group of 15-20 bow-riding Atlantic spotted dolphins. Three of the dolphin sightings made from the SJII on 22 Apr were clustered in the same general region as four unidentified dolphin groups heard by the Ewing observers using SEAMAP on 28 Apr near the 1000 m isobath between Curacao and the Venezuelan coast. The SJII reports no marine mammal sightings on 1-2 May. Correction to yesterday's marine mammal report: the reported Pilot whale acoustic detection is more likely to have been Risso's dolphins.

Ewing Daily Report -- 4 May 1300Z

Yesterday, at 2000Z, we received permission from the Venezuelan Govt. to acquire data on Lines 62 and 63, which were not in the original permit request. We appreciate the efforts of Michael Schmitz, Alan Levander, and others, in obtaining that permission.

We acquired data along Line BOL-7 to the south, passing between Curacao and Klein Curacao at about 0530Z 3 May (0130 local time). We ended Line BOL-7 at 1132Z 4 May. We are now turning to come onto Line BOL-62 to the east. We can see the Venezuelan coast to our south.

We are about 2 hours ahead of schedule for arrival at the 67 W transect. We will be able to adjust this timing before arriving at the transect.

The source array has been working well. The streamer has been performing well for most of the last 24 hours. There have been occasional waves in the streamer during which parts of the streamer come up very shallow. The winds have dropped over night and the sea state is reduced.

Marine Mammal Observer report (provided by Mari Smultea):

We heard two acoustic detections of unidentified dolphins. The first group was heard briefly for ~1-2 min. at 0237Z 4 May NE of Curacao near depth 1500 m. The second group was first heard using SEAMAP at 1110Z 4 May near depth 300 m, 30 seconds later the visual observers briefly spotted presumably the same dolphins (based on matching bearings) outside the safety radius moving away from the vessel. This group was ~9 nm from the Venezuelan coast. Seward Johnson II observed pilot whales yesterday. Visual sighting conditions so far today are some of the best we've experienced yet.

Ewing Daily Report -- 5 May 1310Z

In the past 24 hours we have acquired MCS data along Lines BOL-62 and BOL-63. We are now in the turn to come onto Line BOL-8 going east.

We are about 2 hours behind the schedule for arrival at the 67 W transect. We should be able to adjust this timing before arriving at the transect.

The source array and streamer have been working well.

The processing of the MCS data is going well. Steffen, with the help of a number of the watchstanders, has produced post-stack time migrations of all of Transect 70W, and of Lines BOL-1/2/6 (spliced into a roughly W-E profile). Paul, Alejandro, and others have done an initial interpretation of the two long profiles and they are hanging in the lab. We anticipate a presentation tomorrow night on "What we have learned so far." Y'all are welcome to join us!

Marine Mammal Observer report (provided by Mari Smultea): No new marine mammal visual or acoustic detections by Ewing or SJII observers. Two Flocks of flamingos were seen by Ewing observers. Apparently they fly daily from nests in Venezuela to feed at Bonaire.

It is not official, but it appears that our cruise extension request will be approved. Paul and I believe that the Ewing will finish the cruise in San Juan, PR, on the morning of 3 June.

Ewing Daily Report -- 6 May 1300Z

In the past 24 hours we acquired MCS data along Lines BOL-8 and BOL-9. We terminated Line BOL-9 early because of a streamer failure at 0115Z 6 May. The problem was in "can" 14, which is about 2/3 streamer length from the ship. We recovered the streamer to the problem can and replaced it. We then changed out 5 sections while redeploying the streamer. The streamer is now running well.

We are moving into position to acquire data along part of Line BOL-11 beginning in 2-3 hours and then plan to turn onto the 67W transect this evening as scheduled.

Marine Mammal Observer report (provided by Mari Smultea):

We have had several acoustic detections of sperm whales and one dolphin group in the past 24 hours. Yesterday at 2005Z we acoustically detected sperm whales coda and click sounds. About 15 min later 2 sperm whales were sighted outside the safety radius near the 1000 m isobath just SW of Islas de Aves. They were traveling and blowing at the surface for 5 min then dove oriented 180° opposite from the heading of the Ewing. The total time these whales were followed acoustically was ~35 min. They were last heard faintly apparently behind the Ewing. (Our SEAMAP acoustic plotter is currently not functioning so we cannot obtain range and bearing estimates.) During the night (May 6) and early morning we heard faint and unidentified dolphin whistles as well as three bouts of sperm whale clicks and codas primarily near depths of 2000 m south of Islas de Aves.

Ewing Daily Report -- 7 May 1350Z

In the past 24 hours we acquired MCS data along Lines BOL-11, BOL-12A and BOL-13. BOL-12A is our name for the southern part of the 67W marine transect shot at 50 m spacing toward the south. We started shooting BOL-12A at 2158Z on 6 May. This was less than an hour before the land array began recording. We ended Line BOL-12A at 0946Z on 7 May. We turned and came onto Line BOL-13 (also the 67W transect) at 1113Z on 7 May shooting at 150 m spacing toward the north. We turned on the 3.5 kHz echo-sounder to record data along Line BOL-13. We expect to be acquiring MCS/OBS data on Line BOL-13 going north for about 41 hours.

We turned off our source array last night for land explosive shots at 0401Z and 0431Z 7 May.

Shots at 0359:40Z and 0403:22Z bracketed the first silent period.

Shots at 0429:38Z and 0433:03Z bracketed the second silent period.

Alan called to let us know that both land shots had been fired in these primary windows.

We plan to acquire an XBT (Water temperature vs. depth) measurement this afternoon.

Marine Mammal Observer report (provided by Mari Smultea):

We've heard four acoustic detections since yesterday morning, but no visual detections. We've been busy! All have been unidentified dolphins. Three of four were detected at night, including 2 detection sessions lasting 1-2 hours, all clustered in an area approximately midway between Islas de Aves and the Venezuelan coast. All detections were in waters between 1700 and 2000 m deep. The longest (~2 hour) detection last night appeared to be spread out subgroups of dolphins initially heard ahead of the Ewing. They appeared to pass the vessel in separate sub-groups based on strengths of sound signals and bearings as detected by SEAMAP. SEAMAP has not been able to determine distances due to technical problems. SJII had no sightings on 5 May and none as of when we saw them yesterday morning.

Ewing Daily Report -- 8 May 1300Z

In the past 24 hours Ewing has acquired MCS data along Line BOL-13. We expect to be on Line BOL-13 going north, shooting at 150 m spacing, until about 0900Z 9 May. The seismic system appears to be working well.

We acquired an XBT measurement (depth vs temperature, from which sound velocity vs. depth is calculated) at 0050Z 8 May, between OBS's 229 and 230. We plan to acquire another XBT measurement today.

Marine Mammal Observer report (provided by Mari Smultea):

Since the last report yesterday morning, we have had three more acoustic detections: 2 unidentified dolphin groups and one sperm whale detection (2 at night). One group of dolphins was heard whistling very near the easternmost Islas de Aves near depth 800 m. The other two detections were again heard in a clustered area measuring approx. 14 x 7x 13 nm between Islas de Aves and the Venezuelan coast. Within this area near 1500-2000 m depth we have had 8 detections, most of which have been dolphins. We are interested to see if the SJII observes a similar concentration of marine mammals and to see what species the dolphins may be. Our grand total for the Ewing so far is 26 detections: 22 acoustic only, 3 acoustic/visual matches, and 1 visual only. Of the total 26, 17 have been at night. Of the 26 total, 19 have been unidentified dolphins, 5 have been sperm whales, 1 has been probable Risso's dolphins, and 1 was unidentified large whales. Totals for Seward Johnson II per our most recent communications: 9 visual detections: 4 unidentified dolphins, 3 long-beaked common dolphins, 1 group of bow-riding Atlantic spotted dolphins, and 1 group of pilot whales.

Ewing Daily Report -- 9 May 1400Z

In the past 24 hours Ewing has acquired MCS data along Lines BOL-13, 13A, and 12B. All three are along the 67W transect. BOL-13 and 13A were shot to the north at 150 m shot spacing. BOL-12B is being shot to the south at 50 m shot spacing. We expect to turn off Line BOL-12B and complete our shooting on the 67W transect at 1700L 10 May. The seismic system appears to be working well.

We responded to the MMO shutdown of the source array (described below) by circling back on the profile. After clearance from the lead MMO, we ramped up the array to full strength during the turns and came back onto the profile at the point the guns were ordered stopped. We believe that we recovered complete shot coverage at 150 m spacing across the gap. We did not worry about backtracking to make the streamer straight at the tie because this pass on the line is targeted for the OBS's and land stations. The event and our response consumed about 2.5 hours. Straightening the streamer would have added ~1.4 hours to the turn. Yesterday afternoon, we discussed the event and our response in order to improve communications and speed of response for (likely) future occurrences.

FYI: If the same event occurs while we are shooting at 50 m shot spacing for optimal MCS data on one of our major OBS/land station transects, we plan to turn back far enough to overlap the line with straight streamer. If the same event occurs while we are

shooting MCS-only lines between the major transects, we plan to continue down the line and accept the shooting gap created by the source powerdown/shutdown.

We acquired a second XBT measurement on the 67W transect at 1937Z 8 May, near OBS 214.

Acquisition plan - After 67W:

Lat	Long	Begins Line
11.48120	67.56409	BOL-15
12.12047	67.24240	BOL-16
12.10825	66.54727	BOL-17
11.80500	65.77500	BOL-66
10.38333	65.77500	BOL-67
10.41667	65.88333	BOL-18
12.14606	65.15544	BOL-19
10.35032	64.66369	BOL-20
10.36326	64.54027	BOL-24
11.12000	64.54000	BOL-25
11.74000	64.25000	BOL-26
13.35000	64.30000	BOL-27
10.70987	63.69775	BOL-28
13.35000	64.30000	BOL-29

Marine Mammal Observer report (provided by Mari Smultea):

We had one visual/acoustic detection of ~30 pantropical spotted dolphins yesterday at 1341Z 8 May, headed north on Line 13, near water depth 4500 m. The dolphins were sighted (~30 seconds before they were heard) near the bow then headed toward the stern area in a Beaufort 5/6. A powerdown to 1 airgun was implemented followed by a shutdown of all airguns. No acoustic detections all night. The SJII reports no marine mammal sightings for the last 3 days.

Ewing Daily Report -- 10 May 1345Z

In the past 24 hours Ewing has acquired MCS data along Line BOL-12B (Transect 67W). We expect to turn off Line BOL-12B and complete our shooting on the 67W transect at 1800L 10 May. The seismic system continues to work well.

We responded to the MMO power down to 1 gun (described below) by continuing on line. After clearance from the lead MMO, we ramped up the array to full strength. No shots were missed, although the power was reduced over a period of about 30 minutes. We elected to continue on line (rather than circling) because we were over relatively uniform Venezuelan basin crust north of the wedge, and because the sea turtle rapidly left the safety zone so that the time with severely reduced source energy was short.

We are now discussing (with Alan and Gail) changes to the Ewing track provided yesterday. However it seems likely that we will use the waypoints given for lines BOL-

15, 16, and part of 17 (at least). I will update as soon as possible.

Marine Mammal Observer report (provided by Mari Smultea):

Yesterday the only sighting we had was an unidentified sea turtle seen briefly off the starboard beam. A power down to one gun was implemented. No marine mammals were heard on SEAMAP. The SJII saw pilot whales on Transect 67W. Tonight we will return to an area south of Islas de Aves where we had 8 acoustic detections of mostly apparently large groups of unidentified dolphins.

According to John Diebold, LDEO Marine Science Coordinator, it is definite that we are authorized to end the Ewing cruise the morning of 3 June in San Juan, Puerto Rico.

Ewing Daily Report -- 11 May 1445Z

In the past 24 hours Ewing has acquired MCS data along Line BOL-12B (Transect 67W), BOL-15, and BOL-16. We turned off Line BOL-12B at 2153Z/131. We started Line BOL-15 at 2304Z/131. We ended line BOL-15 at 1019Z/132. We began Line BOL-16 at 1058Z/132.

The seismic system continues to work well. Steffen has been keeping up with processing. He and our watchstanders have picked velocities carefully, and we have seen time-migrated versions of most of the profiles. The images along the transects and long lines look to be excellent!

We still expect to arrive at the north end of 65W at 2300Z on 13 May.

Profiles acquired or planned between 67W and 65W

BOL-15

11 28.872 67 27.905

12 07.228 67 14.544

BOL-16

12 07.228 67 14.544

12 06.495 66 32.836

BOL-17

12 06.495 66 32.836

11 49.800 65 36.600

BOL-47

11 49.800 65 36.600

12 36.661 65 17.000

BOL-19 (includes 65W transect)

12 36.661 65 17.000

10 21.019 64 39.822

Marine Mammal Observer report (provided by Mari Smultea):

Only one faint unidentified dolphin detected last night near the 1500 m depth, near the cluster of ~8 detections we had a few days ago south of Islas de Aves. SJII also reports no sightings yesterday.

Ewing Daily Report -- 12 May 1330Z

In the past 24 hours Ewing has acquired MCS data along Line BOL-16 and BOL-47. We ended Line BOL-16 at 0928Z/133. We started Line BOL-47 at 1114Z/1331.

We experienced a failure of the gun control system yesterday afternoon 1702Z. The Gun QC system was rebooted several times with no success and eventually reloaded. The guns were fired manually, to comply with IHA requirements, during part of the interval. About one hundred shots were lost on Line BOL-16. During this event, we continued on line.

We had a marine mammal event (see below) at 1800Z and a sea turtle event at 1857Z. In both cases, we continued on line, and ramped up the array as permitted by the MMO.

We still expect to arrive at the north end of 65W at 2300Z on 13 May.

Marine Mammal Observer report (provided by Mari Smultea):

We heard sperm whales clicking @ 1755Z and saw them 30 sec later just outside the safety radius near depth 700 m, about 17 nm N of Islas las Roques. We powered down to 1 gun. We observed three spread out subgroups totaling at least 6 sperm whales, including one calf during this encounter. They remained nearly stationary at the surface as we passed within about 500 m, blowing over a period of about 15-30 min. We heard their clicks for a total of 90 min. During the subsequent ramp-up we sighted a hawksbill sea turtle off the bow and implemented another power-down to 1 gun. We briefly heard dolphins during the night and heard sperm whales briefly again this morning.

Ewing Daily Report -- 13 May 1400Z

In the past 24 hours Ewing has acquired MCS data along Lines BOL-47 and BOL-19. We ended Line BOL-47 at 0620/134. We started Line BOL-19 at 0744/134. BOL-19 is our line name for the 65W transect, with an MCS extension to the north. We expect to cross onto the originally planned part of the 65W transect at about 1900L this evening. At that point, we will begin crossing the 7 OBS's and the land array will begin recording. We are shooting to the south at 50 m shot spacing. At the south end of the transect we will turn and shoot to the north at 150 m shot spacing for optimal OBS records.

We have been experiencing problems with the Seisnet system. The problematic part of the system writes the data to a RAID disk. This problem is not compromising the primary data recording to 3490 cartridges, but is periodically interrupting the flow of data to

Steffen for shipboard processing, the flow to a near-real-time brute stack for QC, and the flow to two 4 mm backup tapes.

Marine Mammal Observer report (provided by Mari Smultea):

Since yesterday morning's report, we have heard 4 groups of whistling unidentified dolphins near depths of 4000-4900 m NNE of La Orchila. Three of these acoustic detections were heard at night. We had very poor sighting conditions on 13 May due to Beaufort 6 and large swells. The frequency of bird sightings appears to be increasing as we move east. SEAMAP has been up and running for one week now: we have been able to obtain bearings of vocalizing cetaceans but very few distance estimates. The SJII reports no marine mammal sightings.

Ewing Daily Report -- 14 May 1330Z (distributed late)

In the past 24 hours Ewing has acquired MCS data along Line BOL-19. BOL-19 is our line name for the 65W transect, with an MCS extension to the north. We passed over the originally planned start of the 65W transect at about 1855L, about the same time the land array began recording. We are shooting to the south at 50 m shot spacing. At the south end of the transect we will turn and shoot to the north at 150 m shot spacing for optimal OBS records.

We paused the source array for 3 minutes at 0400Z and 0430Z/135 last night for land shots.

We acquired an XBT measurement at 0226Z/135. This was between OBS's 501 and 502.

The Seisnet system failed yesterday and has been disconnected. We have replaced the functionality of Seisnet by having watchstanders copy the 3490 tapes to the RAID and 2 DDS tapes using scripts developed by Richard. So far, this has eliminated the near-real-time brute stack display that we found quite useful. We plan to try to recreate that today. When Seisnet was still connected (but failing) we experienced a series of events in which the shot recording buffers, 8 of them, would fill up and we would lose the recording of a few shots. The problem seemed to fix itself, but we lost about 5 shots on several occasions. We see the loss of data as a serious problem. This problem has not recurred since Seisnet was disconnected, so we hope this problem does not recur.

This morning there are a number of small fishing boats operating over the bank between Margarita Is. And Las Tortugas Is. They only rarely respond to radio calls. We responded to this morning's marine mammal ramp-down (see below) by continuing on line and ramping up as permitted.

Marine Mammal Observer report (provided by Mari Smultea):

Unidentified dolphins were heard whistling yesterday afternoon at 2018Z for ~16 nm near depth 4000 m ~40 nm NW of La Blanquilla. Another group of unidentified dolphins was heard briefly last night at 0729Z. A group of at least 3 unidentified dolphins (possible bottlenecks) were seen passing well outside the safety radius at 1032Z this

morning near depth 800 m; this group was heard whistling about 7 min later until 1054. At 1147Z this morning a group of about 55 Atlantic spotted dolphins was sighted feeding with seabirds (boobies) directly ahead of the Ewing outside the safety radius at about 3 km near depth 150 m. They were first heard vocalizing at 1150Z. The dolphins appeared to mill and feed and pass the vessel obliquely. A power-down to 1 airgun was implemented at 1102Z when the dolphins entered the safety radius. Their closest observed approach was about 300-400 m. A ramp-up was begun after the dolphins moved out of the safety radius at 1223Z. The SJII reported seeing an unidentified whale at the southern end of Line 27 near depths of 30 m.

Ewing Daily Report -- 15 May 1400Z

In the past 24 hours Ewing has acquired MCS data along Line BOL-19 and BOL-20, both along the 65W transect. We completed BOL-19 at 2201Z/135. The sunset and view of the Venezuelan coast were great. We turned and are proceeding north on BOL-20 shooting at 150 m shot spacing. We expect to end line BOL-20 and turn off onto BOL-80 to the west at about 1400Z. We will go to shooting at 50 m spacing.

We paused the source array for 3 minutes at 1619Z for a Quarry shot onshore.

We acquired an XBT measurement at 1837Z/135, located north of OBS 506 in the Cariaco Trough.

The Seismic recording system buffer over-run problem reported yesterday does not seem to have recurred. The system of copying 3490 tapes seems to be working fine. There has been some work on the Seisnet system, but it has not been reconnected to the main system.

We deviated from Line BOL-20 early this morning to avoid passing too close to an anchored fishing vessel.

We completed the transfer of three people to the Seward Johnson II this morning. We sent large scale paper records, interpreted and uninterpreted, of Transects 70W and 67W to Gail and received a high resolution version of the 70W first arrival model. Thanks Gail! Power_boat_net is significantly broader bandwidth than Ewing email!

We responded to two marine mammal ramp-down events along BOL-19 yesterday by continuing on line and ramping up as permitted.

We received email yesterday pointing out several, more restrictive, marine mammal mitigation procedures published in the Federal Register version of our IHA permit. The expanded provisions have not yet negatively affected our work, but we are meeting today to discuss their possible impact through the remainder of the cruise.

Marine Mammal Observer report (provided by Mari Smultea):

Since yesterday's report, we have had 3 night-time acoustic detections of unidentified dolphin whistles along Line 20. These detections were clustered near where we had two visual detections of large (~50) groups of long-beaked common and Atlantic spotted dolphins yesterday morning. This area is characterized by fairly steep underwater slope about 30 nm northeast of Isla la Tortuga. We had excellent sighting conditions yesterday (Beaufort 2/3).

Ewing Daily Report -- 16 May 1230Z

Ewing completed shooting on Line BOL-20 (Transect 65W) at 1410Z/136 (yesterday). Shortly thereafter, the Ewing shutdown its seismic operations, and is awaiting permission from LDEO to resume. Questions regarding this shutdown should be directed to the Marine Office at LDEO.

The Seisnet system seems to have been fixed last night. Broken insulation and/or wires in the power supply were the culprit. We will probably try to return it to service when we resume acquisition.

Steffen continues to turn out excellent migrated seismic profiles! Last week, under the able leadership of Paul and Alejandro E., we conducted an interpretation exercise in which a different newly acquired profile was selected by each watch team. They had a couple of days to interpret their section and then presented their work at our evening science seminar session. The groups had very different amounts of experience with seismic data (including none) but all did an excellent job of interpreting and presenting. This week, the plan is to have each watch group select a recent line and do the processing of the line through time migration. They will present their work to the group at the end.

In the past few days, we have enjoyed excellent scientific presentations by Trevor Aitkin, Alejandro E., Paul Mann, Mari Smultea, and Sean Sullivan. Having exhausted the pool of relevant and high quality talks, Sawyer will be presenting an overview of the Ocean Drilling Program and results from drilling Leg 210 off Newfoundland.

Marine Mammal Observer report (provided by Mari Smultea):

We has one acoustic detection of unidentified dolphins last night @ 0035Z, near depth 1620 m while the airguns were off. We pulled in the SEAMAP hydrophone at 0130Z last night.

Ewing Daily Report -- 17 May 1430Z

The Ewing has not conducted multichannel seismic operations for the past 48 hours. We are awaiting instructions from LDEO regarding if and when we may continue our scientific program. We have recovered the source array and streamer and are performing minor maintenance on both.

Yesterday, in a respectful ceremony on the fantail, Justin Walsh consigned the ashes of his Uncle to the sea.

Ewing Daily Report -- 18 May 1450Z

Yesterday afternoon, Ewing was given permission to resume MCS operations. After a whoop and a holler, we deployed a single airgun and the Passive Acoustic Monitoring streamer shortly before sundown. Over the next hours, we deployed the streamer and the rest of the airgun array. We came onto profile BOL-26 at 0541Z/139, and are continuing to shoot north at 50 m shot spacing. We currently estimate turning onto BOL-27 (aka Transect 64W) at about 0400Z/140 or midnight tonight. We will be shooting the OBS pass first, to the south, at 150 m shot spacing. The OBS's are in place and recording. The land array is being deployed now and will begin recording Wednesday at sunset when we get closer to shore.

The Ewing seismic system is working well, although the front of the streamer is running a bit deep and feathering to the west as we have a strong current pushing us north and west.

Those of us on the Ewing can only imagine the efforts that were occurring onshore to make it possible for us to continue acquisition. We are all grateful that the support system for Ewing operations is as strong as it is. Paul and I thank you all!

We also understand that the events of the last few days have stressed the officers, the crew, the technical staff, the marine mammal observers, and the science party of Ewing. Paul and I are grateful that you all hung together, helped build the case that we should be allowed to continue, and positioned us to resume our work when the permission came. Thanks!

Marine Mammal Report (provided by Howie Goldstein):

Last night there were acoustic detections of unidentified dolphins. At about 1410Z today 3 Sperm Whales were sighted outside the safety radius.

Ewing Daily Report -- 19 May 1300Z

We completed BOL-26 at 0304Z/140. We turned onto BOL-27 (aka the 64W transect) at 0451Z/140 shooting to the south at 150 m shot spacing.

The Ewing seismic system is not working well. I have not had a chance to talk with those who worked for 5 hours this morning to get things back, but base the following on the log entries. Almost immediately upon starting BOL-27, the seismic system stopped recording streamer data. Recording of streamer data was not restored for about 4.5 hours. The cause appears to be related to the problems with Seisnet that have been noted over the past few days. With this loss of several hours of MCS data, we clearly perceive this to be a major ongoing problem for us. Before this morning it was something that I thought we could work around.

Impact on the 64WTransect: Despite the serious recording failure, I believe that the 64W transect dataset can still be complete. During the recording gap, we fired the airgun array using the cycle timer (independent of the seismic recording system) set to 60 sec rep rate. These shot times are being recorded by the backup system developed by Yosio Nakamura and installed by Steffen. This system was a lifesaver this morning! This means that the OBS dataset should still be complete, although the shot spacing will not be uniform. The land seismic array was not recording this morning, so nothing was lost there. We expect that we will be able to acquire the northern part of the transect at the MCS shot spacing on Friday when we come north on the transect. Therefore we expect to obtain the full MCS dataset for the transect.

We have already had two marine mammal power-downs (to one gun) this morning. We continued online, powering up as permitted when the animals moved away.

We are moving into a fairly strong current as we go south along the transect. I suspect that this will reduce our speed over the ground to 4.1 knots or less and delay our arrival at the south end of the line. We can expect to get some of this time back on the northward trip.

The following is from an email sent yesterday to all hands on the Ewing by the Captain: Thanks for cooperating with our request to not pass on any information about the whale carcass that was spotted from the Seward Johnson II this past Saturday. At this point, we are no longer requesting that people refrain from talking about the whale carcass. The Lamont Marine Office appreciates the effort on the part of science party, marine mammal observers, technicians and crew in supporting our efforts to conduct a thorough review of events associated with the sighting of the carcass and allowing us to speak with one voice.

Ewing Daily Report Addendum –19 May 1900Z

Marine Mammal Report (provided by Mari Smultea):

May 16: One nighttime acoustic detection of whistling unidentified dolphins while the airguns were off.

May 17: One visual sighting of 4 unidentified dolphins feeding ~100-200 m from the ship with diving feeding birds while airguns were off. Very good sighting conditions all day. One group of 15 possible bottlenose dolphins were seen crossing the bow while airguns were off.

May 18: Two nighttime and one daytime acoustic detections of unidentified (possible bottlenose) dolphins between depths of ~150-3000 m. A group of at least 3 sperm whales (including one possible calf) was first heard clicking on SEAMAP and then sighted ~2500 m away. The whales rested and blew at the surface, then continued traveling

parallel to and in the opposite direction of the ship near depth 3700 m. The whales passed by about 1300 m away but did not enter the safety radius.

Ewing Daily Report -- 20 May 1300Z

We have spent the past 24 hours acquiring line BOL-27 (aka the 64W transect) at to the south at 150 m shot spacing. We encountered significant (several knot) current slowing us down and setting the streamer to the west on the central part of the line. We can expect to get some of this time back on the northward trip, although we may need to switch to shooting at 75 m spacing to allow recording of 14 sec of data and to avoid overloading the ships compressors.

We are now acquiring data in shallow water to the East of Margarita Island. We have not been able to follow the transect line, which traverses water too shallow for the equipment we are towing. We have deviated to the East in order to stay in water 30 m deep or greater. We are staying as close to the transect as practical.

The Ewing seismic system is working well today!

We have had two marine mammal power-downs (to one gun) this morning. We continued online, powering up as permitted when the animals moved away.

We paused the guns last night at 0400Z/141, 0430Z, and 0500Z, for land shots into the array. The pause at 0500Z proved unnecessary, but we had not received the call confirming that the primary shots had been successful (it came during the pause). We plan to pause again at 1619Z/141 and 1939Z/141 for 4 minutes for quarry blasts.

Marine Mammal Observer Report (provided by Mari Smultea):

The airguns were powered down to one gun when two large unidentified whales were sighted at dawn. The airguns were powered down again at 1146Z when dolphins were sighted off the bow in Beaufort 5 seas. Three groups of unidentified dolphins were heard on SEAMAP last night E of La Blanquilla Island. One was a large spread-out group of about 11 subgroups of unidentified dolphins heard whistling almost continuously for nearly 4 hours.

The SJII sighted probable sharks and a whale shark on 18 May. On May 19 they had 4 bowriding bottlenose dolphins. They later sighted over 600 long-beaked common dolphins and one unidentified whale ~10 nm from Isla de Margarita. The whale breached out of the water. The dolphins porpoised and swam parallel to the ship at a fast pace. They slowed down when they reached the ship where about 20 of them stayed for a few minutes, then swam away.

Ewing Daily Report -- 21 May 1300Z

We completed line BOL-27 (aka the 64W transect) to the south at 150 m shot spacing at 2042Z/141. We deviated from the planned line on a number of occasions: once due to a

persistent whale off Islas Las Frailes. We turned and began Line BOL-28A to the north at 50 m shot spacing at 2145Z/141. After an apparent tape drive failure, we looped back and began BOL-28B at 0112/142. All this was accomplished with fishing boats all around. We have now left the shallow (<100 m) water near Margarita Island, and are glad to have it behind us!

We anticipate reaching the north end of the 64W transect at about 0200L 22 May.

The Ewing seismic system is working smoothly at this time.

We have had one marine mammal shutdown this morning. We continued online, powering up as permitted when the animals moved away.

We paused the guns for 4 minutes yesterday afternoon at 1619Z/141, 1929Z/141, and 1939Z/141, for onshore quarry blasts.

We completed a personnel transfer with the SJII yesterday after lunch. The weather was nice and the transfer of 1 MM observer to the SJII and 2 new MM observers to the Ewing went well. Gail visited for about an hour to confer with us. We thank the SJII for assisting with picket duty as Ewing worked its way through the fishing fleet last night.

Marine Mammal Observer Report (provided by Mari Smultea):

The airguns were powered down twice for a Bryde's whale sighted just inside the safety radius near Margarita Island. The whale breached several times. It did not appear to move much and the Ewing maneuvered around it. No acoustic detections were made all day in the Beaufort 1-2 conditions.

The SJ2 also spotted a probable Bryde's whale today near Margarita Island as they were getting ready for the personnel and stores transfer. This whale may have been the same one the Ewing sighted earlier based on its location and timing. This whale also breached. About 10 bowriding bottlenose dolphins swam directly to the SJ2's bow, swam under the ship, and then swam slowly behind the ship. A 2-m long manta ray was also sighted from the SJ2.

Ewing Daily Report -- 22 May 1245Z
Position: 12 59.7N 64 03.4 W

We completed line BOL-28 (aka the 64W transect) to the north at 50 m shot spacing at 0636Z/143. This completes our work on Transect 64W. We turned onto line BOL-30 (aka the Trinidad Transect) at 0813Z/143. We are now moving to the SE acquiring data at 50 m shot spacing. We are heading into a current of about 0.4 knot and making 4.7 knots over the ground at this time. We anticipate reaching the SE end of the Trinidad transect the morning of 25 May.

The Ewing seismic system is working smoothly at this time.

We acquired an XBT measurement this morning near the confluence of Lines BOL-26, 28, and 30.

Marine Mammal Observer Report (provided by Mari Smultea):

Yesterday, between 11:14-47, a Bryde's whale mother and calf were seen passing the Ewing outside the safety radius near the 100-m depth contour. From 11:32-11:42Z, a group of about 50 spinner dolphins approached the port side of the Ewing then changed directions and swam behind the ship, remaining outside the safety radius about 2.7 km away. Another group of about 80 spinner dolphins approached the Ewing bow at 12:08Z, resulting in a power down to 1 airgun then a shut down of the airguns. They then spread out and swam all around and past the aft of the ship, and were heard whistling on SEAMAP. (This may have been a subgroup of a large spread-out group, including the dolphins seen about 30 min earlier). Near this time, a possible Bryde's whale surfaced once at 12:20Z about 2 km away, outside the safety radius. It was not sighted again. Vocalizing dolphins were heard for about 30 min in deep (~3000 m) water last night near the end of Line 28B.

The SJII saw 60-100 Atlantic spotted dolphins yesterday, some with the unique spots that show they were sexually mature, as well as others that were sub-adults, with white-tipped beaks. They also saw at least 8 short-finned pilot whales.

Ewing Daily Report -- 23 May 1255Z
Position: 11 57.9N 62 23.7 W

We have spent the past 24 hours acquiring MCS data along line BOL-30, the Trinidad Transect. We are shooting the line from west to east at 50 m shot spacing. Overnight, we crossed the Aves ridge and are now over the Grenada Basin. There is little current at this time and we are making good progress along the line. We anticipate reaching the SE end of the Trinidad transect during the morning of 25 May.

The Ewing seismic system is working smoothly.

We had one power-down event this morning due to a sperm whale sighting and acoustic detection.

Ewing Daily Report -- 24 May 1420Z
Position: 11 02.5N 60 55.8 W

We have spent the past 24 hours acquiring MCS data along line BOL-30, the Trinidad Transect. We are shooting the line from west to east at 50 m shot spacing. We passed Grenada yesterday and are currently in Galleons Passage between Trinidad and Tobago. The current began to pick up yesterday afternoon and we are now headed into a current of

about 2.5 knots. We anticipate reaching the SE end of the Trinidad transect during the morning of 25 May.

The Ewing seismic system is generally working smoothly. There is a minor problem with one or more of the 3490 tape drives, but it is being watched closely.

Marine Mammal Report (provided by Mari Smultea):

May 22: The Ewing had 2 unidentified whale sightings outside the safety radius near depths of 1800 and 1200 m, and one acoustic detection during the night of unidentified dolphins near depth 3200 m. No sightings by the SJ2.

May 23: In addition to the 2+ sperm whales seen and/or heard near water depth 2000 m, resulting in a powerdown, we had 2 unidentified dolphin groups heard during the night in waters near 3000 m deep.

May 24: We heard 2 unidentified dolphins groups whistling faintly during the night near depths of 200 m.

Ewing Daily Report -- 25 May 1310Z

Position: 10 10.4N 59 34.2 W

We have spent the past 24 hours acquiring MCS data along line BOL-30, the Trinidad Transect. We are shooting the line from west to east at 50 m shot spacing. We passed out of the shallow water in Galleons Passage between Trinidad and Tobago and entered the Atlantic Ocean. Atlantic swells are giving us a bit of rock and roll, but currents are not affecting our progress on the line.

We have (slightly) modified the track plan for the upcoming lines in the Atlantic offshore of Trinidad and Venezuela. The modifications were necessary to avoid acquiring data in areas not permitted by Venezuela. New line endpoints follow. We anticipate reaching the extended SE end of the Trinidad transect at about 1400L 25 May.

New SE end of BOL-30

10 03.638 N 59 23.748 W

Line BOL-31

10 03.638 N 59 23.748 W

09 55.936 N 60 07.308 W

Line BOL-32

09 55.936 N 60 07.308 W

10 56.500 N 60 52.500 W

Line BOL-33

10 56.500 N 60 52.500 W

11 09.000 N 60 35.000 W

Line BOL-34

11 09.000 N 60 35.000 W
10 32.000 N 59 34.000 W

Line BOL-35

10 32.000 N 59 34.000 W
10 16.666 N 59 43.920 W

Line BOL-36 (Trinidad Transect to the NW at OBS shot spacing)

10 16.666 N 59 43.920 W
13 00.126 N 64 04.080 W

The Ewing seismic system is generally working smoothly. The minor problem with the 3490 tape drives continues, but is not impeding acquisition and recording.

Marine Mammal Report (provided by Mari Smultea):

May 24: Things were quiet for the marine mammal observers on the Ewing --no visual or acoustic detections, and hardly any birds, between the islands of Trinidad and Tobago heading SE. We did see 4 oil platforms.

The SJ2 saw a group of about 60 Atlantic Spotted Dolphins, that were porpoising parallel to the vessel @ about 100 meters away. Shortly after a small group, about 10, quickly swam towards the vessel to bow ride. The rest of the pod remained porpoising in their original position about 100 meters away. They were porpoising and riding the waves adjacent to the ship on the port-side. There were many that were sexually mature (lighter cape, fewer spots), as well as several physically mature (darker cape, more spots). They were recognized by their spots on their sides, as well as their white tips on their beaks. There were a couple of sub-adults, but most were either sexually or physically mature. They also were reasonably spread out while swimming and often times they appeared to be in single file. It was an exciting sighting because the dolphins stayed around for about 15 minutes.

Ewing Daily Report -- 26 May 1300Z

Position: 10 18.1N 60 23.8 W

We have spent the past 24 hours acquiring MCS data along lines BOL-30 (Trinidad Transect), BOL-31, and BOL-32. We are currently shooting to the northwest along the Atlantic coast of Trinidad. We can see a number of oil rigs, mostly to the west of us, and there are a number of other seismic vessels operating in the general area.

The Ewing seismic system is working smoothly. The streamer has been noisier than we experienced in the earlier part of the cruise. We attribute this to the generally higher

waves and swells. We now have a following sea and current, so our speed through the water is low. The birds are having trouble keeping the streamer flat.

The source array continues to work superbly! This wouldn't be "active source" seismology without the efforts of the Ewing gunners and engineers and techs and MMO's! Thanks for the booms and the air and the sparks and the eyes.

Ewing Daily Report -- 27 May 1300Z
Position: 11 05.8N 60 25.5 W

We have spent the past 24 hours acquiring MCS data along lines BOL-32 (to the NW along the coast of Trinidad, BOL-33 (to the NE parallel to the Tobago Coast) , and BOL-34 (to the SW away from Tobago). We are currently in a loop back onto the line after a brief ship-wide power failure at 1047Z this morning. We have now ramped up the array and believe that the recording system is ready to resume acquisition in about an hour.

The streamer has been noisy and the middle of the streamer was running at the surface for the north part of BOL-34. We attribute this to the generally higher waves and swells and strong winds overnight.

We estimate that we will be in position to start shooting to the NW on the Trinidad transect at about 0800Z tomorrow morning. We plan to shoot the line, optimized for the OBS's, at 175 m shot spacing.

The steward staff, Gary, Victoria, and Missy (before she left us last week), have done an incredible job supporting our science activities on the Ewing! This has been a long cruise for us, but also for them. They have fed us well and never fail to have a kind word for everyone. Victoria draws the most beautiful menus I have ever seen. We appreciate their efforts to make the ship feel a lot like a home! Thanks from all of us.

Marine Mammal Observers Report (provided by Mari Smultea)

May 27: It's been slim pickings for Ewing marine mammal sightings, and the high swells and high Beaufort forces have limited our visibility...Since May 25, we have had two acoustic detections on the night of May 26 (both unidentified dolphins along Line 31) and another group of unidentified dolphins heard last night near (< 10 km) where the SJ2 had 2 groups of bottlenose dolphins and one group of Atlantic spotted dolphins on May 25. During these 3 encounters from the SJ2, the dolphins swam to the bow to bowride. The sightings occurred near Tobago, off the SE shore. Since then, the SJ2's sightings have been of tropical fish while snorkeling off Tobago. It's most definitely the rainy season now as we experience intermittent squalls. The sea waters are brown from the runoff from the Orinoco River. Ewing MMOs sighted a ~10-ft hammerhead shark today, that was exciting! And Claudio gave a very interesting presentation on marine mammal sounds, playing back recorded sounds of various species.

Ewing Daily Report -- 28 May 1645Z
Position: 10 28.3N 60 02.1 W

We have spent the past 24 hours acquiring MCS data along lines BOL-34A (to the SW away from Tobago), line BOL-35 (a short SW line back to the SE end of the Trinidad Transect), and BOL-36 (the Trinidad Transect to the NW at 175 m shot spacing for OBS data).

The streamer has been intermittently noisy and the middle of the streamer was running at the surface for parts of BOL-34. For part of BOL-34 and BOL-35 we set the birds to run at 8 m (rather than 7 m) depth. This seemed to bring the recalcitrant sections into line. After coming onto line BOL-36, we reset them to 7 m, where they are now running well.

We are making good speed up the line and expect to be able to shoot for between 15 and 24 hours after completing the OBS transect.

Paul and I appreciate the efforts of the Bosun and his deck crew in keeping the Ewing ship-shape. We have always been amazed at the amount of ship care and maintenance that is done while a ship is at sea. Not living on a ship month after month, we do not see the beating it takes. The deck crew makes our science possible, and we thank you for your hard work!

Ewing Daily Report -- 29 May 1245Z
Position: 11 30.1 N 61 39.5 W

We have spent the past 24 hours acquiring MCS data along line BOL-36 (the Trinidad Transect to the NW at 175 m shot spacing for OBS data).

The seismic acquisition system is working well. With the current behind us, our speed over the ground is about 5.4 knots. We currently anticipate completing shooting on BOL-36, the Trinidad Transect, at about 2200L 30 May.

Yesterday, along the Trinidad transect, we operated close to the S/V Western Patriot, an industry seismic vessel. We did not try to determine if she was shooting data or doing streamer maintenance. We anticipate that the OBS data at the SE end of the transect may show noise from this and/or other seismic vessels.

Engineers and oilers and electricians make the science go, literally! For most of us “part-time science sailors, the engine room is a mysterious, hot, noisy, place under the water line. When it is working smoothly, we do not give it a second thought. When a hiccup happens, we think about nothing else. When the ships steering was broken, it was the engineering team that literally steered the ship manually. When hydraulic lines break it is the engineering team that takes a shower in hydraulic fluid. We appreciate the difficult and often unrecognized job that you do! Thanks for making the science happen!

Ewing Daily Report -- 30 May 1310Z
Position: 12 40.3 N 63 32.0 W

We have spent the past 24 hours acquiring MCS data along line BOL-36 (the Trinidad Transect to the NW at 175 m shot spacing for OBS data).

The seismic acquisition system is working well. With the current behind us, our speed over the ground is about 5.8 knots. We currently anticipate completing shooting on BOL-36, the Trinidad Transect, at about 1700L 30 May. We expect to turn south on line BOL-37 towards Islas Los Testigos where we are likely to conclude seismic data acquisition for EW0404. In informal calculations (not audited/cooked by the accounting firm of Arthur Anderson) it looks like we will have acquired more than 6000 km of MCS seismic data during the cruise.

Paul and I have had many opportunities to interact with the Mates as we planned and conducted the cruise. We appreciate their efforts to help us find the best and safest ways to accomplish our objectives. They were patient as we made seemingly endless changes in the planned route. At times they probably felt like they were Dale's answering service as the calls came in from the land seismic crew and elsewhere. We thank them for making our science possible! (Oh Rick, I do have a few hundred new waypoints that I am eager to get entered for some special end-of-cruise activities, although I cannot guarantee which ones we will actually use or in what order! Don't tell anyone, but they are the lat and lon of every bar in Old San Juan!)

Marine Mammal Report by Mari Smultea

May 28: The Ewing had 1 nighttime and 1 late afternoon acoustic detections of vocalizing unidentified dolphins SE of Tobago. The SJ2 saw 4-7 probable Atlantic spotted dolphins approach and swim alongside the ship for ~3 min.

May 29: The Ewing had 1 nighttime unidentified dolphin acoustic detection near the same location where the SJ2 saw Atlantic spotted dolphins on May 24. In this general area E and S of Grenada along approximately 100 nm of OBS Survey Line 36, there have been 9 visual or acoustic detections of dolphins.

May 30: So far, the Ewing MMOs have heard one group of unidentified dolphins whistling on and off for ~ 1.5 hr on Line 36 during the late night hours before sunrise.

Tonight, the Ewing MMOs will present a talk on what all the MMOs have observed so far during the EW0404 SE Caribbean cruise during their >1300 hours spent listening on SEAMAP and looking for marine mammals from the Ewing and SJ2.

Ewing Daily Report -- 31 May 1300Z
Position: 12 11.2 N 63 31.0 W

We completed line BOL-36 (the Trinidad Transect to the NW at 175 m shot spacing for OBS data) at 2021Z yesterday. We turned south on line BOL-37 towards Islas Los Testigos where we expect to conclude seismic data acquisition for EW0404 at about 0130L or 0530Z tonight. We are shooting MCS data at 50 m shot spacing and making about 4.0 knots over the ground.

The seismic acquisition system is working smoothly at the moment. We are engaged in end-of-cruise data documentation and backup.

My (Dale's) Illinois small-town grandfather used the words, "Did you cut your foot," to mean, "Did you step in dog or cow feces." Well, in his terms, I definitely "cut my foot" the other day in this report. I credited the steering of the ship during the broken rudder transit to Curacao to the Ewing engineering department. It seems that this was both wrong, and a violation of fundamental nautical principle/tradition. I am told that 1) the manual steering during that event was actually done by the deck department, and that 2) engineers never steer the ship; only the deck department steers the ship, ever, ever, ever! It was also pointed out to me that problems aboard ship are solved by the teamwork of everyone aboard. I could not agree more, and never really meant to imply otherwise. My apologies to those whose hard work I slighted, and my respect to the entire Ewing crew for teamwork that solves problems and creates successes!

Victoria's design was the overwhelming choice for a cruise t-shirt! Thanks to all those who submitted designs.

Marine Mammal Report & Up-to-Date Cruise Sighting Summary by Mari Smultea

May 30: The Ewing is hearing lots of dolphin vocalizations again as we head W and now S to the more productive eastern Venezuelan waters. We had 2 nighttime and 4 daytime acoustic detections of unidentified whistling dolphins today, spread out along Line 36.

The SJ2 saw 40 long beaked common dolphins today which approached the vessel and bowrode. They had no sightings the day previously.

Last night, the Ewing MMOs gave a presentation entitled "Marine Mammal Monitoring & Mitigation: Background, Marine Seismic Effects, and SE Caribbean Monitoring Results". The talk summarized preliminary results of what all the MMOs have observed so far on the EW0404 cruise during their >700 hours spent listening on SEAMAP and >700 hours spent looking for marine mammals from the Ewing and SJ2 vessels. So far through May 30, there have been approximately 106 acoustic or visual detections of marine mammals made by the Ewing or SJ2 MMOs. Most (n = 76) have been acoustic detections, 14 of which were also visual detections. Both the Ewing and SJ2 have made 22 visual detections each. A total of 9 different species have been observed. The most frequently sighted identified species have been bottlenose dolphins, Atlantic spotted dolphins, long-beaked common dolphins, sperm whales, Bryde's whales, and short-finned pilot whales.

Alejandro Sayegh talked about how the distribution of species we have found compares to what is known or expected in the project region, and in some areas it is different than expected, particularly the distribution and occurrence of sperm whales.

Ewing Daily Report -- 1 June 1615Z
Position: 12 37.3 N 63 18.5 W

We completed line BOL-37 near Islas Los Testigos where we concluded seismic data acquisition for EW0404 at 0430Z/153. We did a brief test of the compressor capacity and a 10 airgun array planned for use on a future experiment. We swapped out the seismic tow leader, only to discover that the one we put in was at least as bad as the one we took out. The streamer was then recovered without incident. We had acquired a large number (perhaps 10-15) of fishing floats (plastic bottles) and a rock weight and nylon line.

We are engaged in end-of-cruise data documentation and backup. We anticipate arrival in San Juan Puerto Rico on the morning of 3 June.

An Important Announcement from the Co-chief Scientists: Given that seismic acquisition for EW0404 is complete, we now officially lift the ban on acting giddy and excited when marine mammals or sea turtles are sighted or heard. It is again permissible to race to the flying bridge and talk about how cool it is to see a breaching Bryde's Whale or bow-riding dolphins. The words "click" and "whistle" no longer have to be greeted with frowns and concern, or the timid question, "How close do you think they are, and are they moving away?" Finally, will the individuals responsible for locking up the MMO's last week please provide the key to the lock so that we can get them out for some air? Thank you and carry on.

Ewing Daily Report -- 2 June 1600Z
Position: 17 04.53 N 64 49.6 W

We are in transit to San Juan, Puerto Rico, and anticipate arrival tomorrow morning.

Ewing 0404 Datasets

Shot times and locations

Shot times were being recorded by two independent systems during EW0404. The first is the SPECTRA system that controls the MCS seismic acquisition. The SPECTRA system captures all shot points fired under its control. During EW0404, this corresponds to shots fired during run-ins, along the profile, and on the run-out of MCS profiles. It was our typical procedure to disable the SPECTRA system during turns. We typically fired all or part of the source array during these turns using the cycle timer. No shot time records were generated by SPECTRA for these shots.

The second is a system built by Yosio Nakamura of UTIG. It captures shot time records by identifying the electronic shot pulse being sent to the source array. This method should recover the times of all shots, regardless of whether they were triggered by SPECTRA or by the cycle timer. Yosio's system therefore captured all the shots, even in turns, or in parts of lines where SPECTRA was malfunctioning. The times captured by Yosio's system are merged with shipboard navigation and ship heading to create shot time and position files. These data will be important for the land and OBS data acquired during the BOLIVAR experiment.

Navigation

The cruise data set includes navigation data from at least 4 GPS units on the ship. Probably the most useful navigation record is the processed product `n.ddd`, which gives smoothed ship locations at 1 minute intervals for the entire cruise. These smoothed locations have been merged with a number of other data products.

Magnetic Total Field

A Geometrics G-886 Marine Magnetometer was used during EW0404. This is a proton-precession magnetometer. The sensor was towed 305 m behind the ship. The sensor was pulled in when we traversed areas shallower than about 30 m. The data are reported in "gammas" at an interval of 1 sec. The observation is the Total Magnetic Field Strength.

Gravity

A Bell Aerospace BGM-3 marine gravimeter was used during EW0404. Various gravity data files are available. Some are in units of raw counts while others are in units of milligal. The raw files include measurements every 6 seconds. The more processed versions include smoothed data at 1 min. interval. These data are gravity in mgal, smoothed using a Gaussian filter over 350 raw data observations.

MCS

We used a 20 airgun source array (designed by Gail Christeson) during the cruise. The array was towed at a nominal depth of 7 meters. Figure 1 shows the distribution of gun chamber sizes in the array and the physical layout of the gun array with respect to the ship and streamer. Figures 2-3 show the calculated source signature of the array. The array was towed at a depth of 6 m.

We used the full array for most of the data acquisition. There were two types of marine mammal events that affected the use of the source array during the cruise. At times, we were ordered to power-down the array to one gun. In this case, the “one gun” refers to an 80 cu in airgun. In other cases, we were ordered to shutdown the gun array. In this case the array was turned off entirely. After either of these events and after the marine mammal causing the event had left the safety zone, the gun array was ramped up at a rate of not more than 6 dB per 5 minutes. These events were logged and are visible in the MCS data.

We used a 480 channel, 12.5 m group length Syntron digital streamer. Figure 2 shows the configuration of the streamer sections with respect to the ship and source array. We used 28 DigiCourse compass/depth/temperature/fin angle equipped depth control birds on the streamer. We ran the streamer at 7 m depth for most of the cruise. For most of line BOL-34, we ran the streamer at 8 m to prevent it from rising to the surface. For most of the cruise the streamer ran flat. On occasions, noted in the logs and obvious in the data, the middle part of the streamer rose to the surface. This was usually a result of low speed through the water due to currents and winds.

We produced preliminary stacked sections and preliminary time-migrated sections on the ship. SEG-Y versions of these sections are available. Paper records were produced for the migrated sections. PDF files at lower resolution were produced of each migrated section for inclusion in this report.

We stacked and migrated each of the reflection profiles acquired at a shot spacing of 50 m. We did not process the lines shot at 150 m or 175 m spacing. These were shot primarily as sources for the OBS and land arrays. However, they could be processed at a later time. In every case, the line shot at OBS spacing was duplicated by a line at 50 m spacing.

Onboard processing involved the following steps:

- Conversion from SEG-Y to FOCUS format
- Geometry definition
- CDP Sort (12.5 m bins; 120 fold)
- Definition of water velocity function for brute stack
- Brute stack of near half of cable using water velocity
brute stack is used for seafloor picking and velan guide
- Picking of seafloor time from brute stack
- Velocity analysis every 2-4 km
- Bad trace edit
- Broad-band filter
- Geometric spreading correction
- NMO Correction
- Offset (Stretch) Mute
- Internal mute
- CDP Stack

- SEG Y Output
- F/K migration at water velocity
- SEG Y Output
- Broad band filter
- 5-trace running mix
- Time-varying filter
- AGC
- Trace Decimation
- Display

MCS profiles are labeled with the 3 letter code BOL. The lines were not acquired in numerical order and the numbers used are discontinuous. We began the cruise with a set of numbered profiles, in order from 1. As the cruise evolved, we planned some new profiles and gave them numbers outside the original range. We also skipped some of the originally planned profiles. Some of the original profile endpoints were changed and we used the original planned line number. The following table lists the data acquired and the approximate endpoints of the lines. In a few cases the lines are not straight, and therefore the endpoint locations do not describe the line completely. The shot and navigation files contain a complete record of the profile locations.

MCS Profiles Acquired During EW004 – 6093 km Total

Line	Shot Spacing	First Shot	Last Shot	First File	Last File	Start Time	End Time	Start Location	End Location	SEGY Tapes
BOL-1	50	2	2501	1	2499	0130/112	1935/112	12° 43.115 71° 02.656	12° 46.650 69° 59.720	1,2
BOL-2	50	62	660	2600	3198	2017/112	0037/113	12° 45.615 69° 57.073	12° 34.367 69° 45.166	2,3
BOL-3	50	2246	4694	3500	5949	0117/113	1442/113	12° 36.440 69° 43.804	13° 42.377 69° 51.635	3,4
BOL-6	50	6074	8795	6074?	8792	0840/119	2350/119	11° 46.387 68° 54.270	12° 37.427 69° 48.445	5,6
BOL-4	150	1389	2174	9000	9786	0136/120	1632/120	12° 39.657 69° 44.151	11° 37.427 69° 48.445	6,7
BOL-3A	50	131	2367	10000	12236	1744/120	0555/121	11° 39.494 69° 39.844	12° 39.960 69° 44.149	7,8
BOL-4A	150	792	1552	13000	13761	0556/121	1849/121	12° 39.960 69° 44.149	13° 41.447 69° 51.519	8,9
BOL-3B	50	4664	6709	14000	16846	1849/121	0624/122	13° 41.447 69° 51.519	14° 36.763 69° 58.418	9,10
BOL-4B	150	9	625	17200	17817	0853/122	1933/122	14° 31.082 69° 57.515	13° 41.285 69° 51.508	10
BOL-60	50	1	4120	18000	22120	2123/122	0055/124	13° 43.556 69° 53.839	12° 24.796 68° 32.938	10-13
BOL-61	50	4	1738	23000	24735	0250/124	1333/124	12° 24.624 68° 34.819	13° 08.302 68° 16.919	13-15
BOL-7	50	173	3852	25000	28679	1420/124	1132/125	13° 07.452 68° 14.399	11° 34.867 68° 52.260	15-17
BOL-62	50	1	1138	28900	30038	1309/125	2123/125	11° 37.740 68° 54.569	11° 24.987 68° 26.115	17,18
BOL-63	50	29	2120	31024	33115	2304/125	1148/126	11° 23.831 68° 29.102	12° 10.504 67° 56.721	18
BOL-8	50	2	678	34000	34676	1318/126	1705/126	12° 10.836 68° 00.408	12° 00.863 67° 44.367	19
BOL-9	50	3	1081	35000	35974	1857/126	0103/127	12° 04.894 67° 45.626	11° 35.710 67° 51.209	19,20
BOL-11	50	1518	2354	36000	36853	1617/127	2109/127	11° 12.780 67° 33.544	11° 33.389 67° 26.323	20
BOL-12A	50	5704	7787	37000	39064	2158/127	0946/128	11° 33.439 67° 28.282	10° 39.152 67° 23.062	20-22
BOL-13	150	18	1569	40000	41552	1113/128	1341/129	10° 37.245 67° 23.365	12° 43.590 67° 43.648	22,23
BOL-13A	150	1572	2594	42000	43023	1608/129	0950/130	12° 43.292 67° 34.592	14° 06.243 67° 42.100	23
BOL-12B	50	38	6052	44005	50020	1136/130	2153/131	14° 08.156 67° 42.217	11° 25.662 67° 27.616	23-28
BOL-15	50	42	1655	51000	52614	2304/131	1019/132	11° 28.417 67° 28.417	12° 07.862 67° 14.350	28,29
BOL-16	50	24	3827	53000	56803	1058/132	0928/133	12° 07.218 67° 14.180	11° 49.266 65° 34.875	29-31

BOL-47	50	60	3379	5700	60320	1114/133	0620/134	11 47.137 65 36.851	13 17.703 65 25.142	31-33
BOL-19	50	96	6742	60500	67108	0744/134	2201/135	13 14.707 65 27.223	10 20.601 64 39.563	33-38
BOL-20	150	35	898	68000	68863	2323/134	1410/136	10 21.019 64 39.822	11 31.532 64 59.090	38
BOL-26	50	70	4022	6900	72952	0541/139	0304/140	11 36.814 64 19.449	13 23.922 64 17.999	39-41
BOL-27	150	230	2069	?	73000	0451/140	2042/141	13 21.665 64 18.152	10 44.502 63 40.322	41-43
BOL-28	50	56	86	15000	15029	2122/141	2132/141	10 44.995 63 37.699	10 45.880 63 37.736	43
BOL-28A	50	123	281	15100	15304	2145/141	2237/141	10 46.795 63 37.729	10 51.711 63 38.016	43
BOL-28B	50	169	15632	15300	20962	0112/142	0636/143	10 48.011 63 37.899	13 09.912 64 15.467	44-47
BOL-30	50	20	12894	21000	33879	0813/143	1719/146	13 10.157 64 20.099	10 02.470 59 21.407	47-56
BOL-31	50	215	1964	34000	35749	1916/146	0508/147	10 03.923 59 22.877	9 55.046 60 06.762	56-57
BOL-32	50	252	3135	830	38883	0754/147	2232/147	09 56.025 60 07.357	10 58.797 60 54.455	57-59
BOL-33	50	85	1025	39000	39940	0034/148	0626/148	10 55.976 60 53.273	11 11.537 60 32.180	59
BOL-34	50	127	620	40000	~40493	0734/148	~1039/148	11 08.892 60 34.876	11 02.386 60 24.081	59-60
BOL-34A	50	535	2714	41000	43179	1417/148	0615/149	11 03.117 60 25.299	10 31.951 59 34.405	60-61
BOL-35	50	494	863	43500	44274	0621/149	1148/149	10 31.639 59 34.405	10 14.986 59 44.915	61-62
BOL-36	175	49	3298	43000	46230	1253/149	2021/151	10 16.131 59 42.933	13 01.460 64 07.212	62-65
BOL-37	50	23	4208	47000	51202	2122/151	0430/153	13 00.126 64 57.150	11 27.733 63 01.777	65-67

Hydrosweep Data

The Ewing DSS Hydrosweep swath bathymetry system was run almost the entire cruise. The full data records are available in “183” format. This format has meaning to the processing system called “mbsystem” which is available for free download at ftp://ftp.ldeo.columbia.edu/pub/swath_data/MB-System.tar.gz.

The centerbeam depth (in meters) from the Hydrosweep system is used as the basic water depth observation during the cruise and is merged with numerous other datasets in the digital data products from the cruise.

The full hydrosweep data records are in 10 min chunks that may be concatenated for subsequent processing with MBSYSTEM or other swath bathymetry software.

XBT data

We attempted 18 XBT observations during the cruise. An XBT measured sea water temperature vs. depth. We used Sippican T-5 XBT sensors that have the capability to record data to a depth of 1830 m. We deployed the XBT's from the end of the leeward airgun boom on the Ewing. Some of the XBT's deployed failed to reach the bottom. We suspect that the XBT wires became tangled in the streamers and/or airgun cables being towed behind the Ewing.

Ewing 0404 XBT Datasets

Date of Launch: 05/05/2004
Time of Launch: 21:17:25
Sequence # : 2
Latitude : 11 53.24402N
Longitude : 67 47.84229W

Date of Launch: 05/08/2004
Time of Launch: 00:12:17
Sequence # : 3
Latitude : 11 53.6106N
Longitude : 67 47.7749W

Date of Launch: 05/08/2004
Time of Launch: 00:40:04
Sequence # : 4
Latitude : 11 53.6106N
Longitude : 67 47.7749W

Date of Launch: 05/08/2004
Time of Launch: 00:50:27
Sequence # : 5
Latitude : 11 53.6106N
Longitude : 67 47.7749W

Date of Launch: 05/08/2004
Time of Launch: 19:28:34
Sequence # : 6
Latitude : 12 59.31116N
Longitude : 67 35.99463W

Date of Launch: 05/08/2004
Time of Launch: 19:37:05
Sequence # : 7
Latitude : 12 59.97876N
Longitude : 67 36.05615W

Date of Launch: 05/14/2004
Time of Launch: 02:16:17
Sequence # : 8
Latitude : 11 49.97827N
Longitude : 65 4.1709W

Date of Launch: 05/14/2004
Time of Launch: 02:26:39
Sequence # : 9
Latitude : 11 49.16846N
Longitude : 65 3.94141W

Date of Launch: 05/14/2004
Time of Launch: 19:02:03
Sequence # : 12
Latitude : 10 34.27209N
Longitude : 64 43.44482W

Date of Launch: 05/22/2004
Time of Launch: 08:33:46
Sequence # : 14
Latitude : 13 9.44177N
Longitude : 64 18.97168W

Date of Launch: 05/25/2004
Time of Launch: 09:14:38
Sequence # : 16
Latitude : 10 19.47809N
Longitude : 59 48.32617W

Date of Launch: 05/25/2004
Time of Launch: 09:21:12
Sequence # : 17
Latitude : 10 19.21637N
Longitude : 59 47.91846W

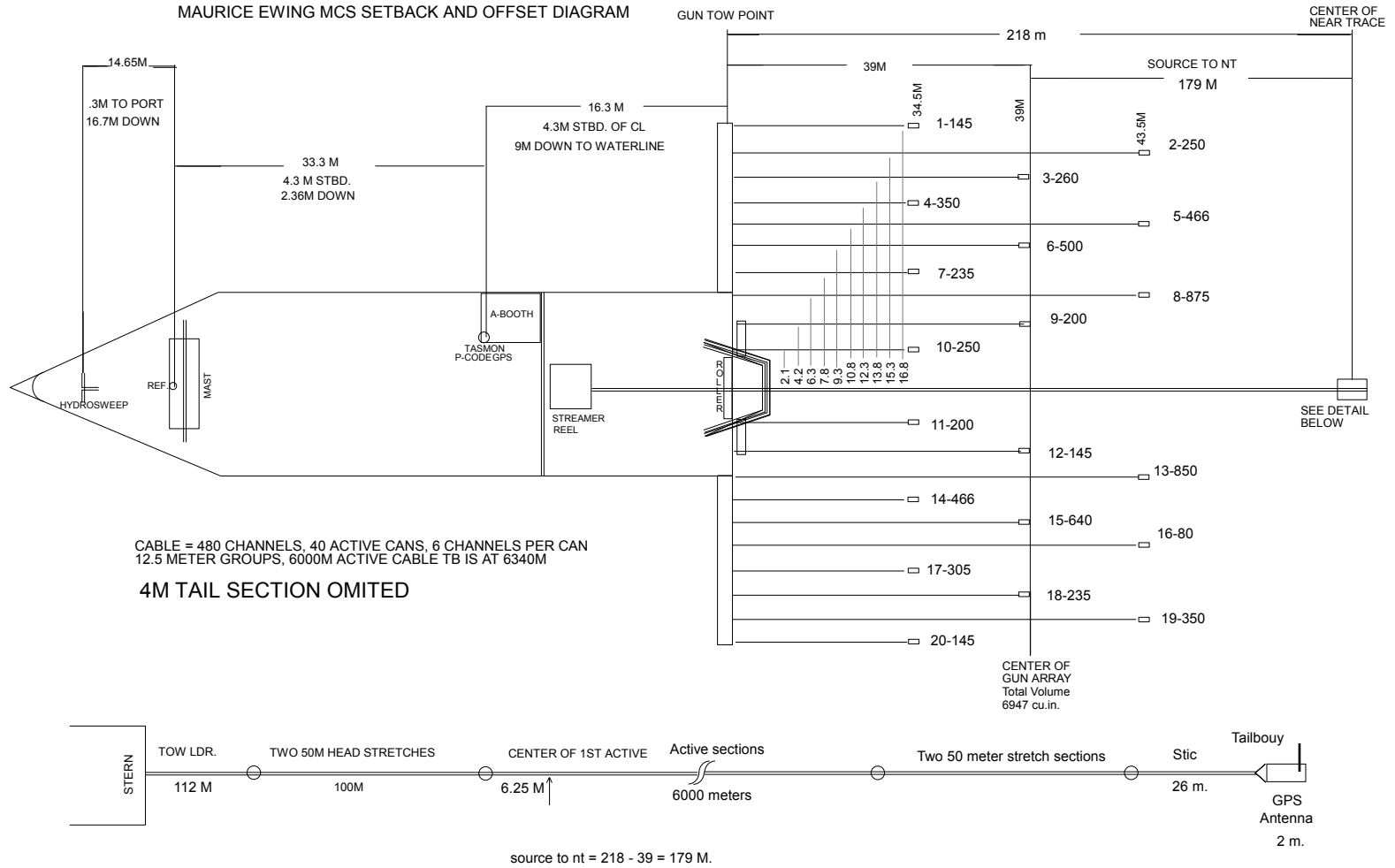
Date of Launch: 05/27/2004
Time of Launch: 21:07:02
Sequence # : 18
Latitude : 10 48.81299N
Longitude : 60 1.71631W

Date of Launch: 05/27/2004
Time of Launch: 21:10:13
Sequence # : 20
Latitude : 10 48.70874N
Longitude : 60 1.54199W

Date of Launch: 05/28/2004
Time of Launch: 04:36:49
Sequence # : 21
Latitude : 10 34.8656N
Longitude : 59 38.71484W

Date of Launch: 05/28/2004
Time of Launch: 04:42:11
Sequence # : 22
Latitude : 10 34.71301N
Longitude : 59 38.46338W

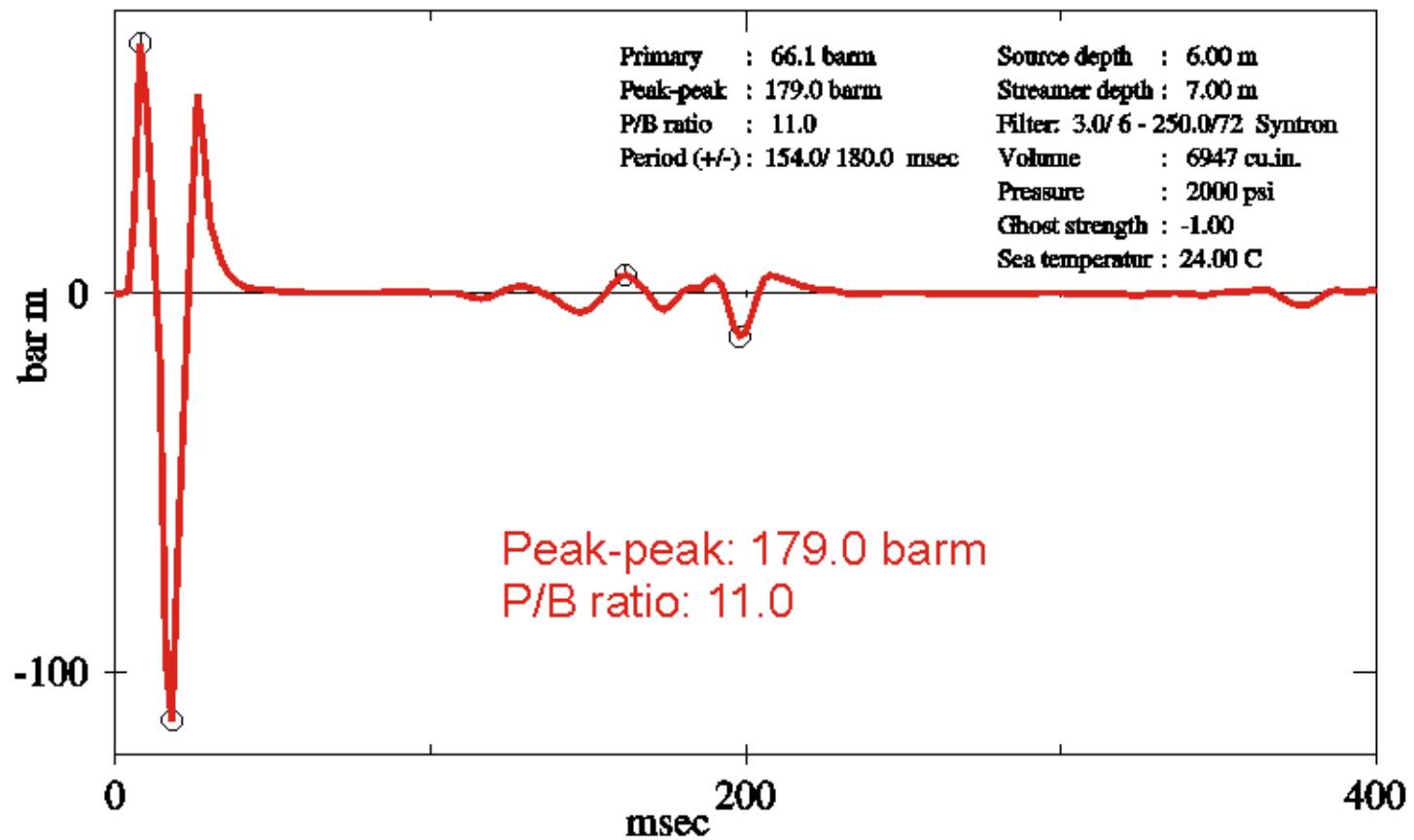
EW-04-04 Levander- S.E. Carib. Apr-Jun 2004



GUNS ARE FIRED WHEN REF. POINT AT THE MAST IS OVER THE PRE-PLOTTED SHOTPOINT.

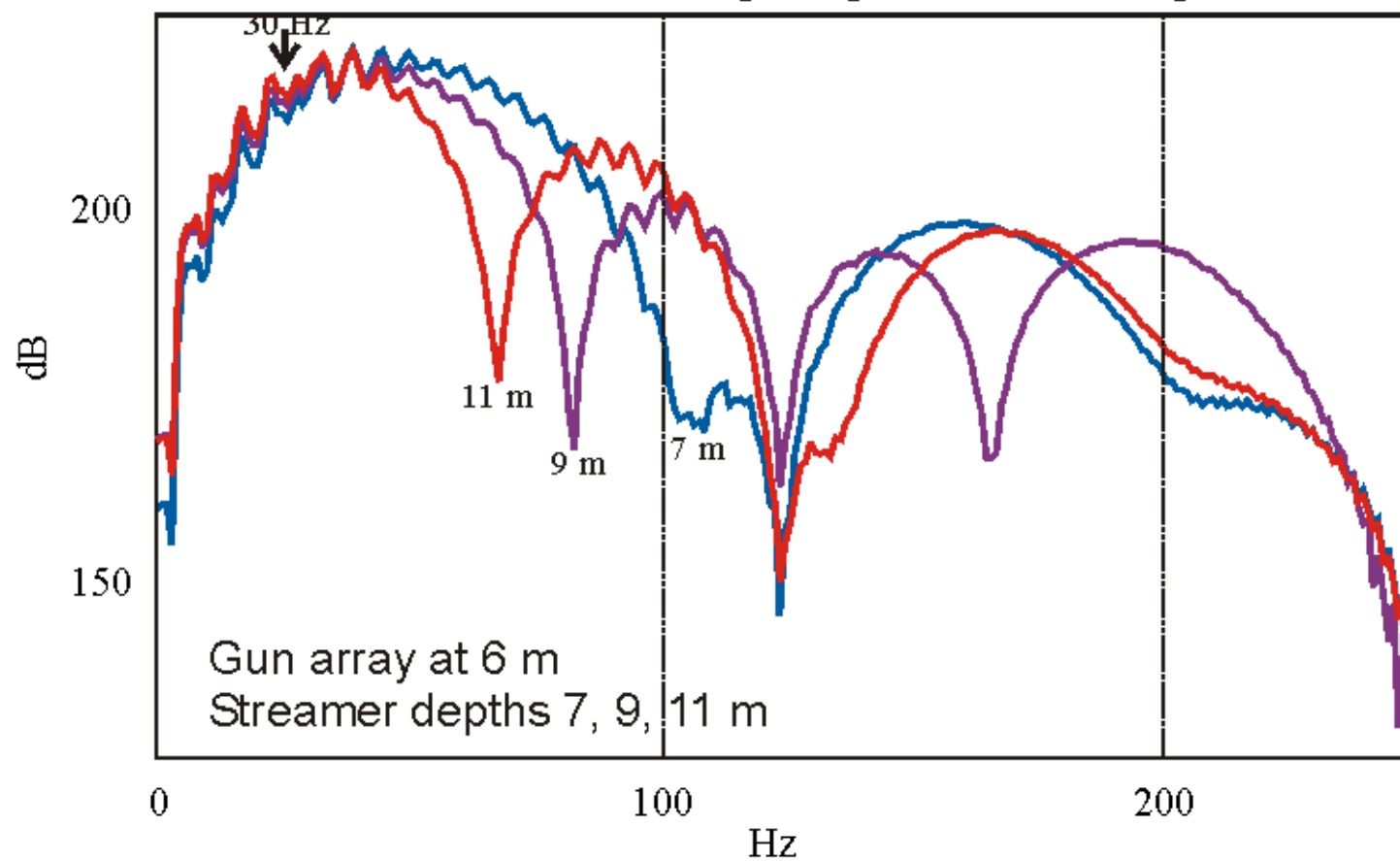
Far-field signature of array: chicx6

Distance: 6000 m Azimuth: 0 deg Angle of vertical: 0 deg

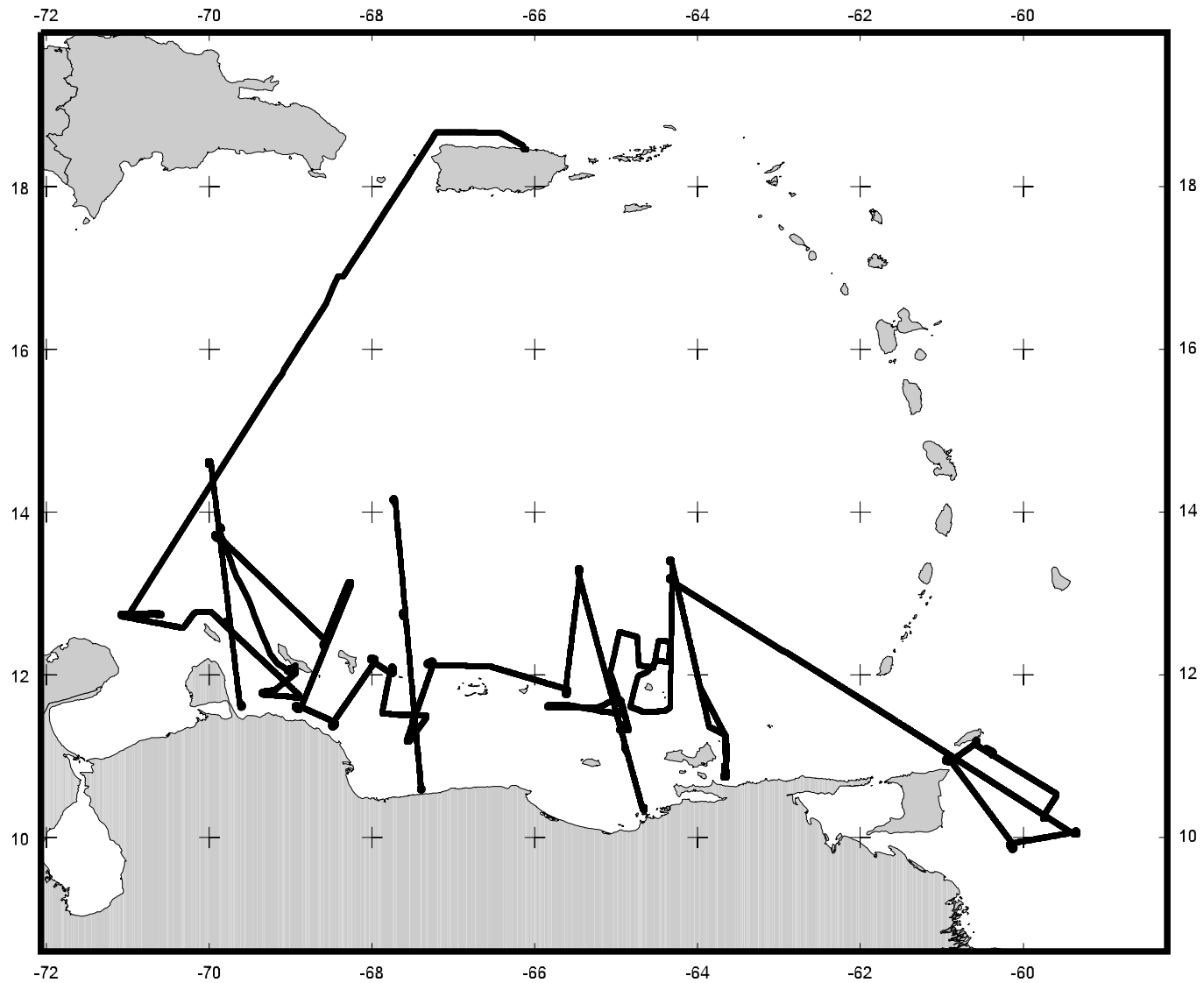


Amplitude spectrum of far-field signature of array: chicx6

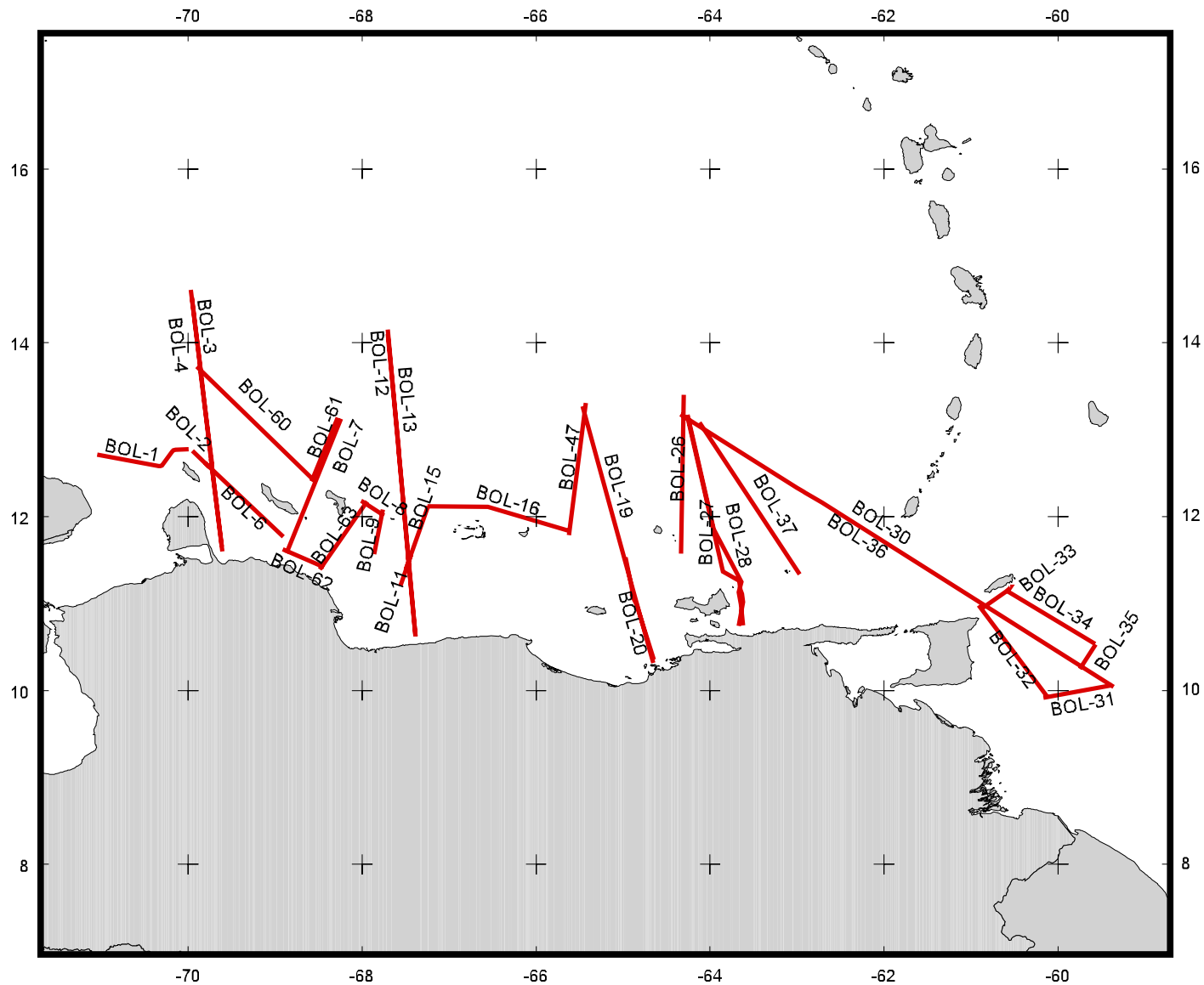
Distance: 6000 m Azimuth: 0 deg Angle of vertical: 0 deg



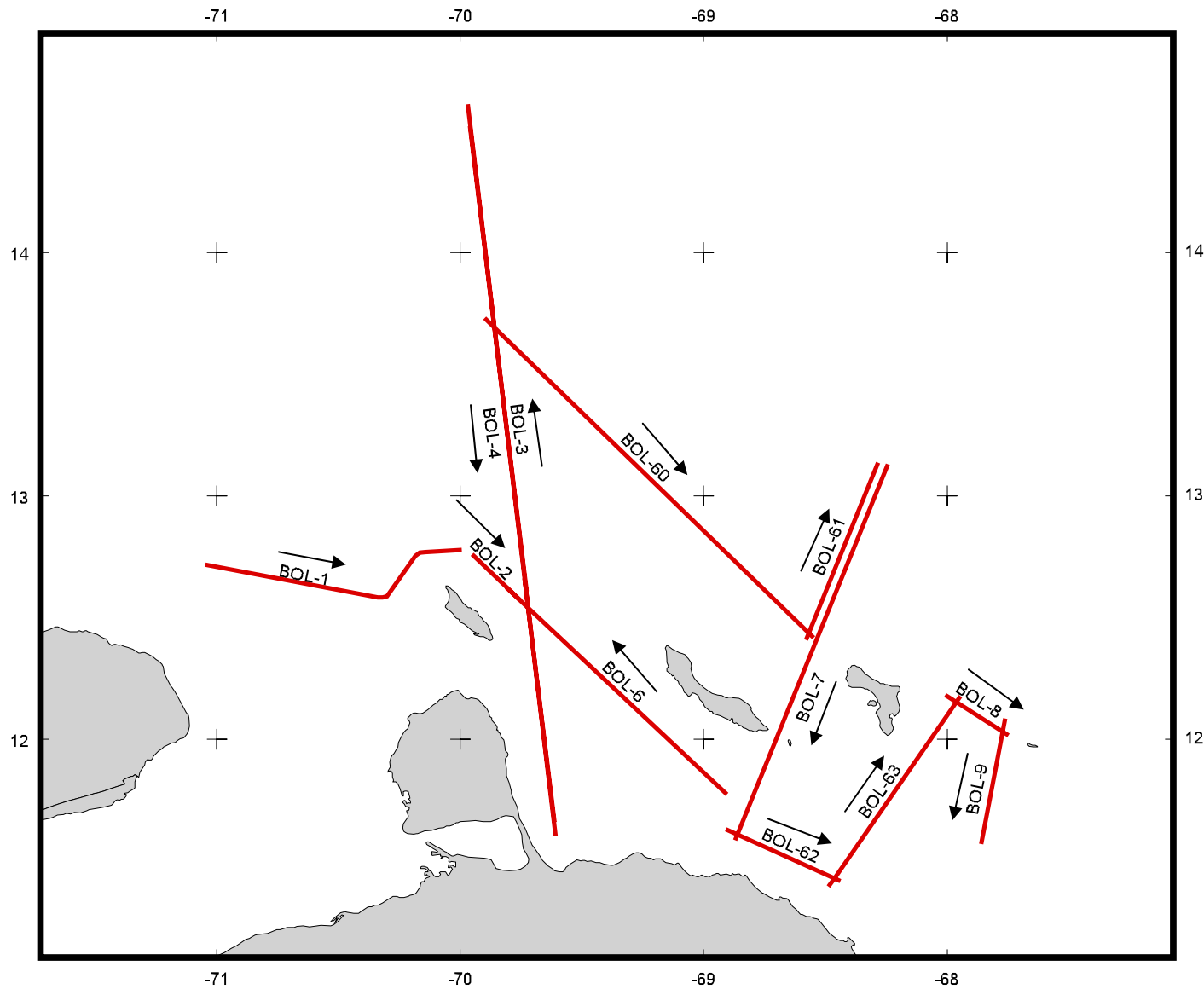
EW0404 SE Caribbean
San Juan, Puerto Rico-San Juan Puerto Rico



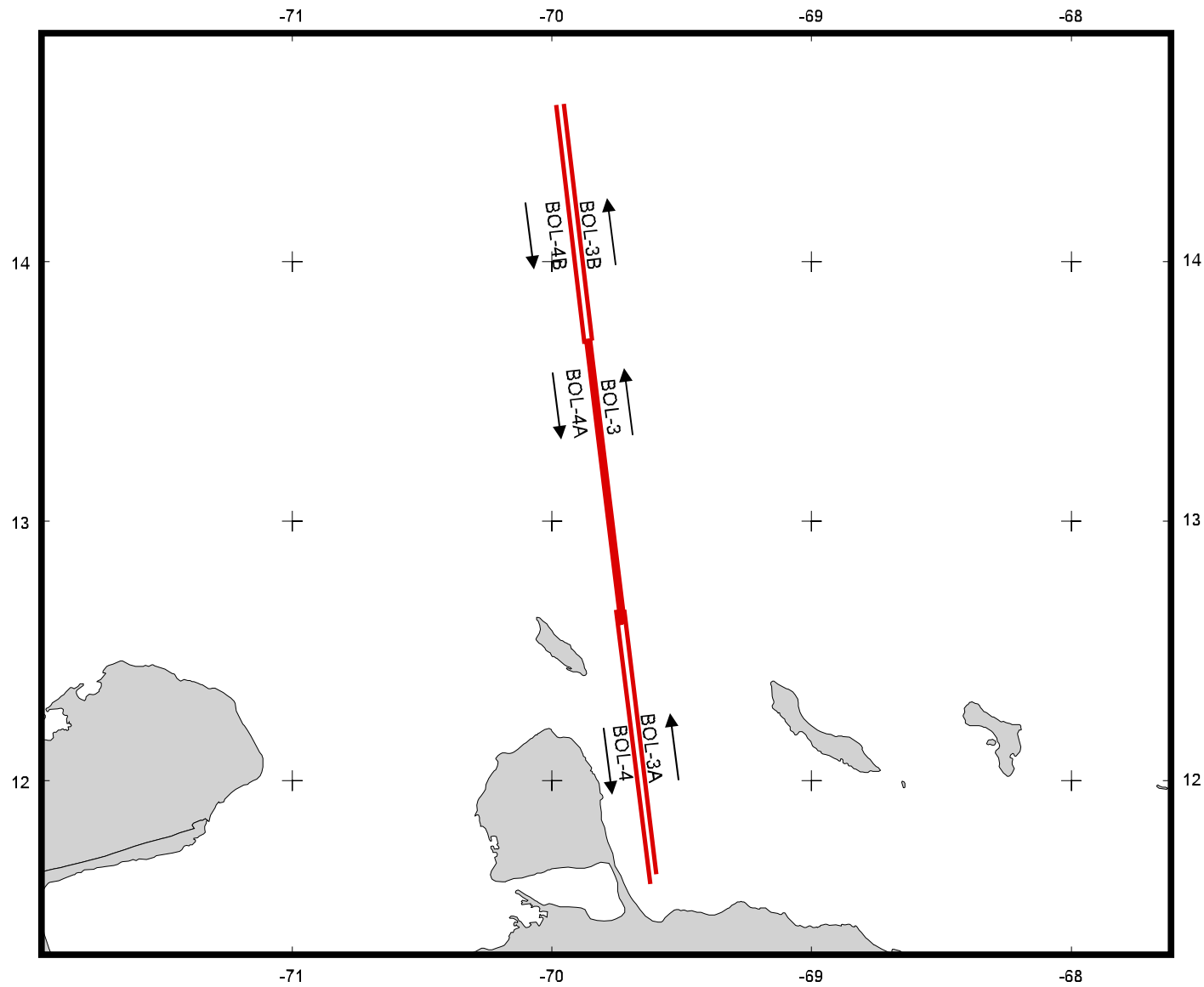
EW0404 seismic lines acquired



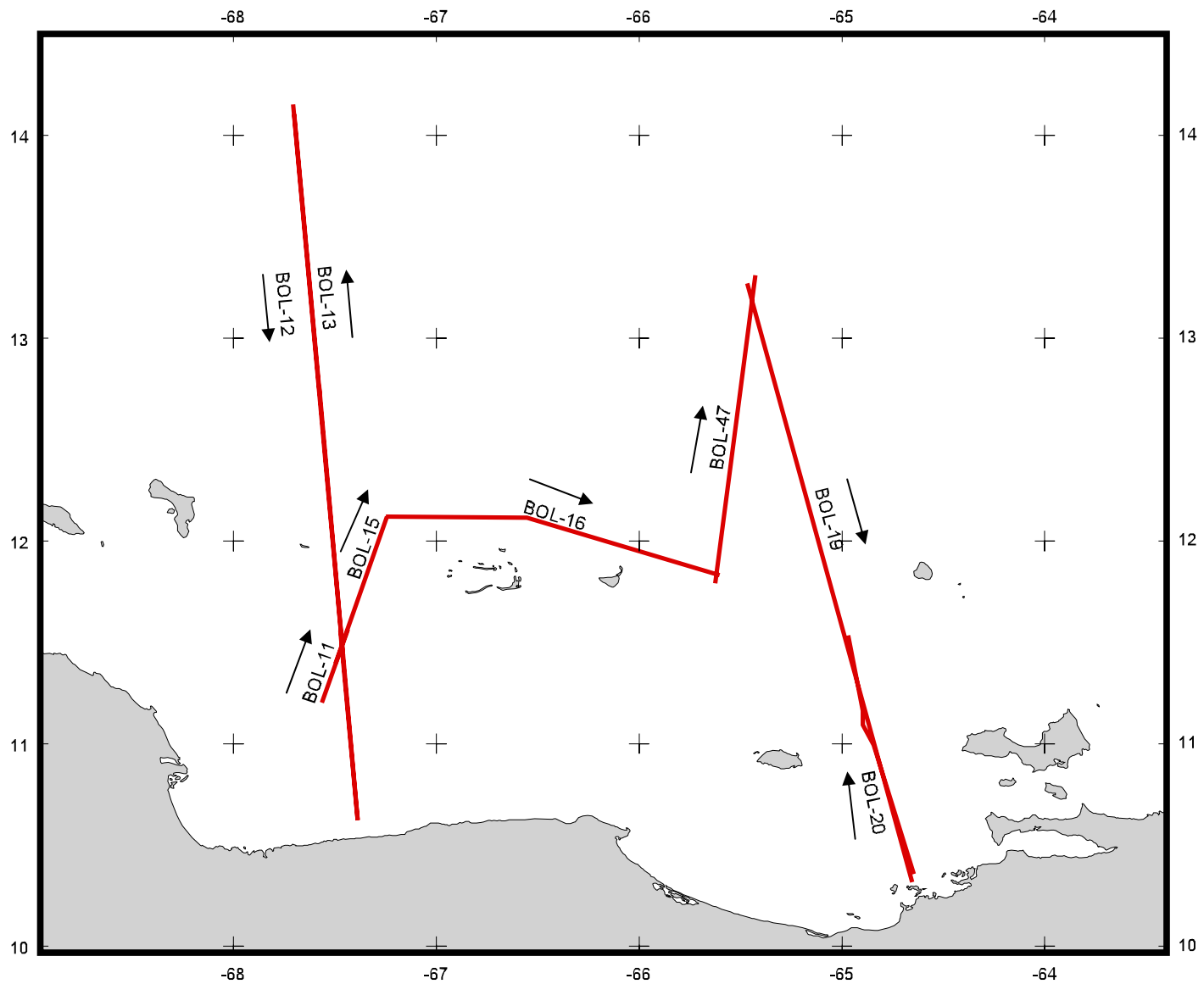
Western Venezuela



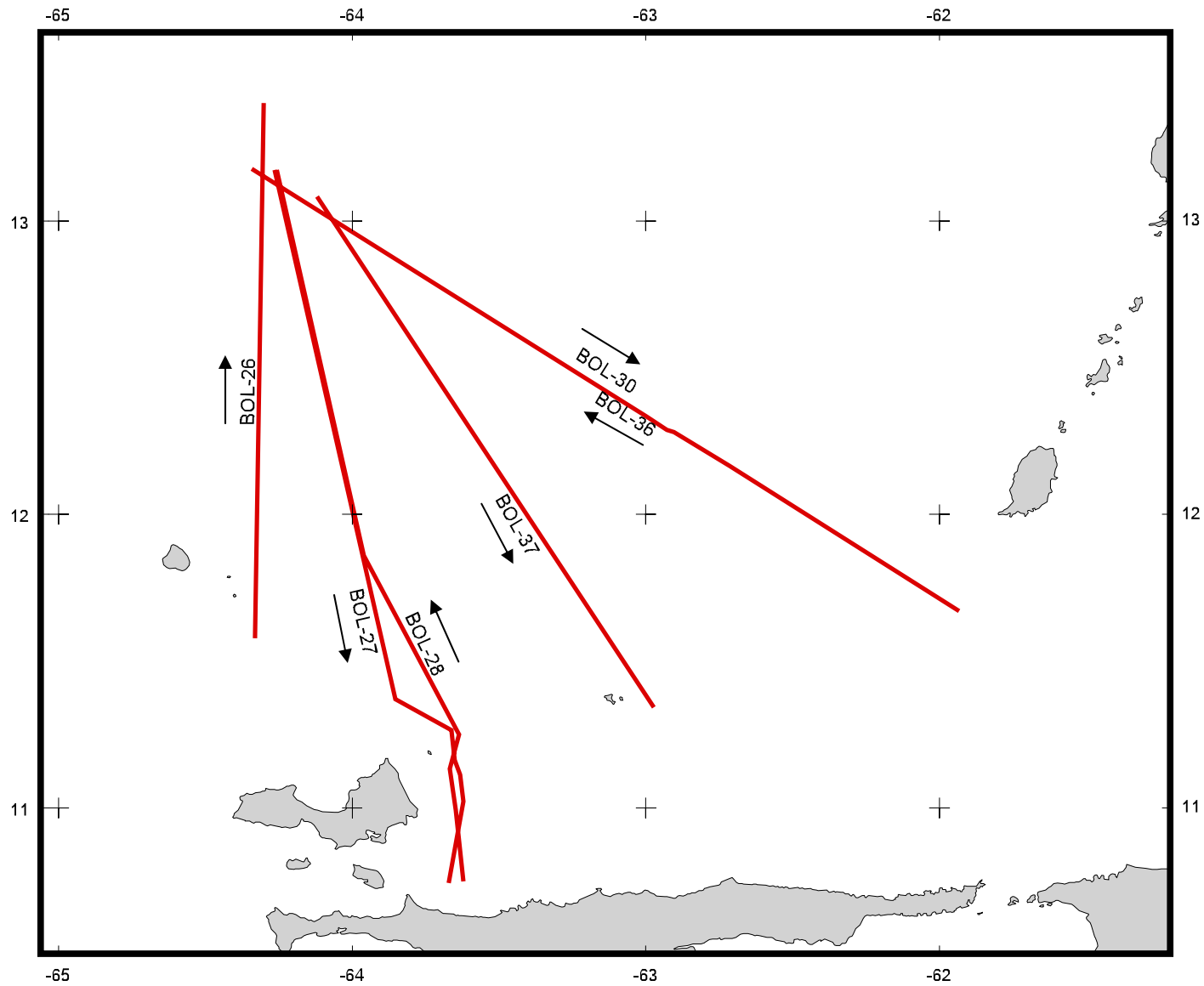
Bol-3 and Bol-4



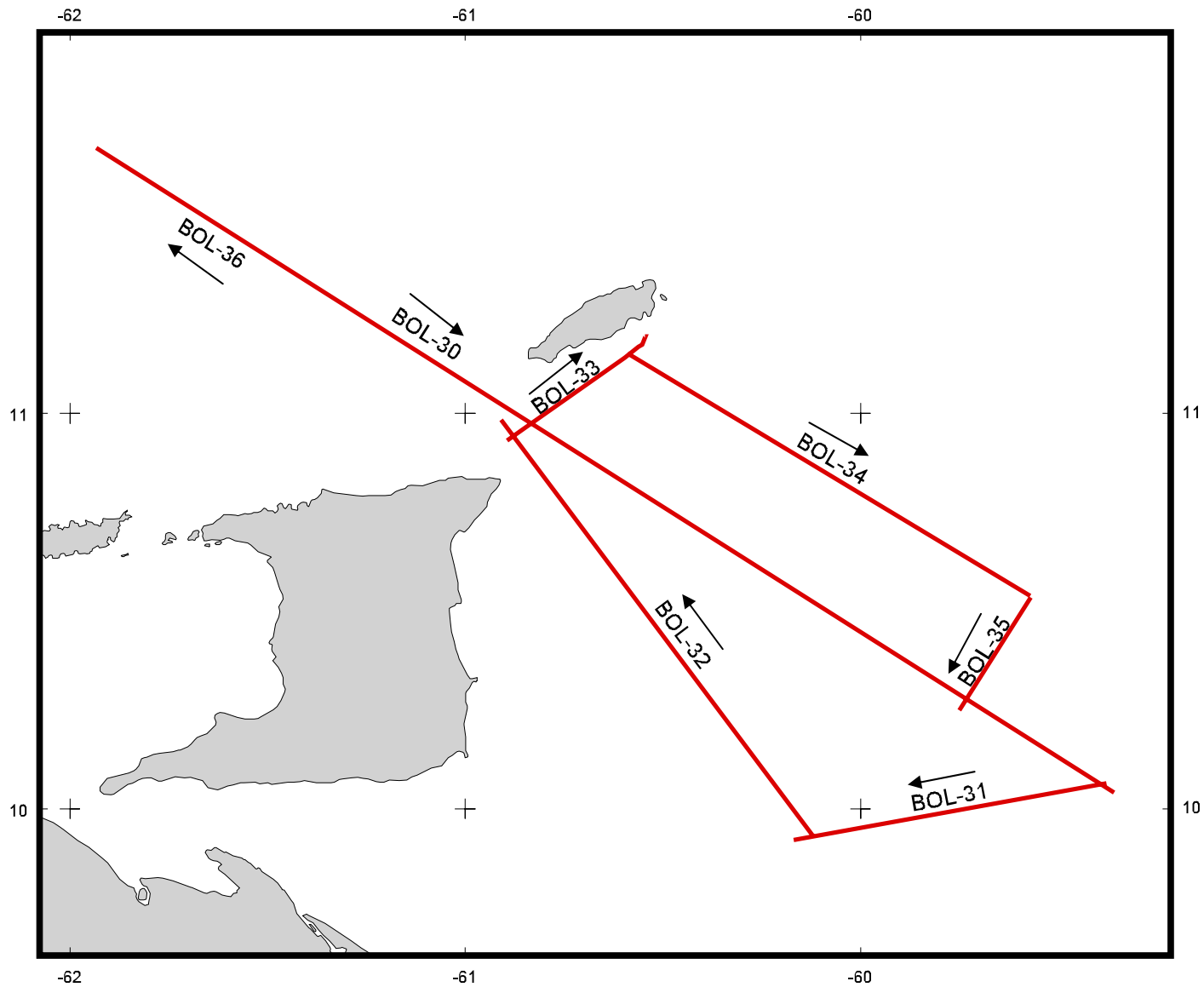
Central Venezuela



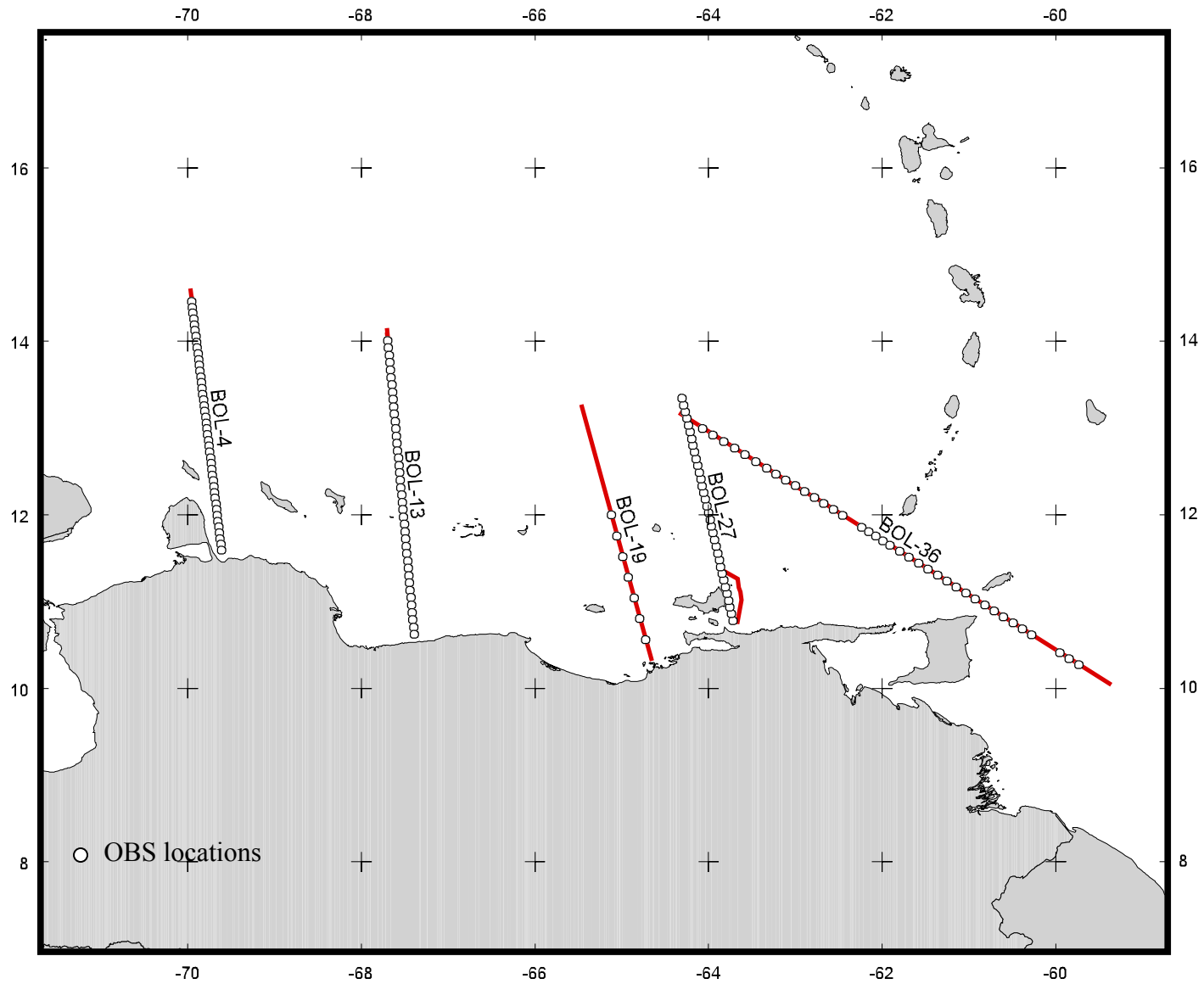
Eastern Venezuela



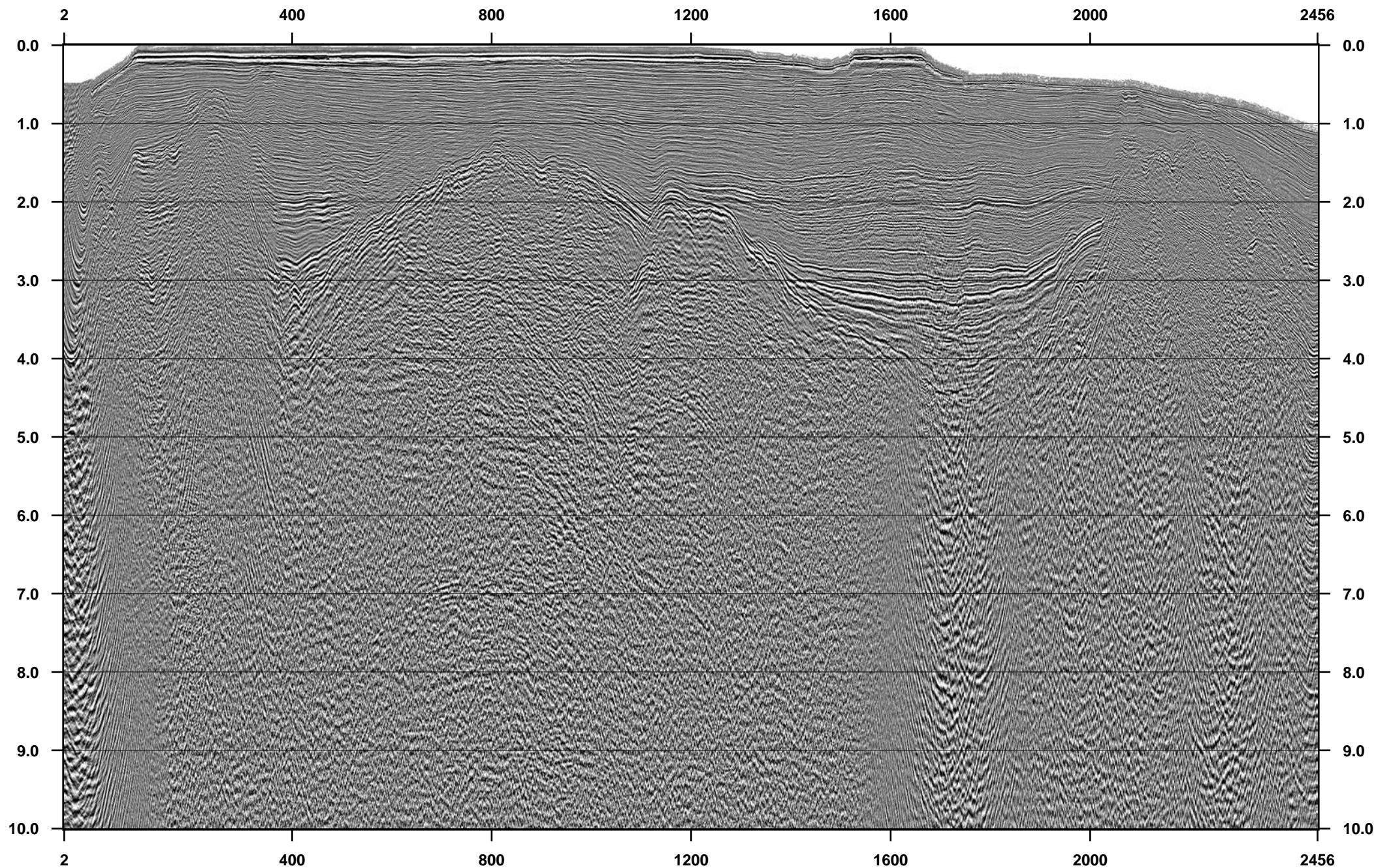
Trinidad area



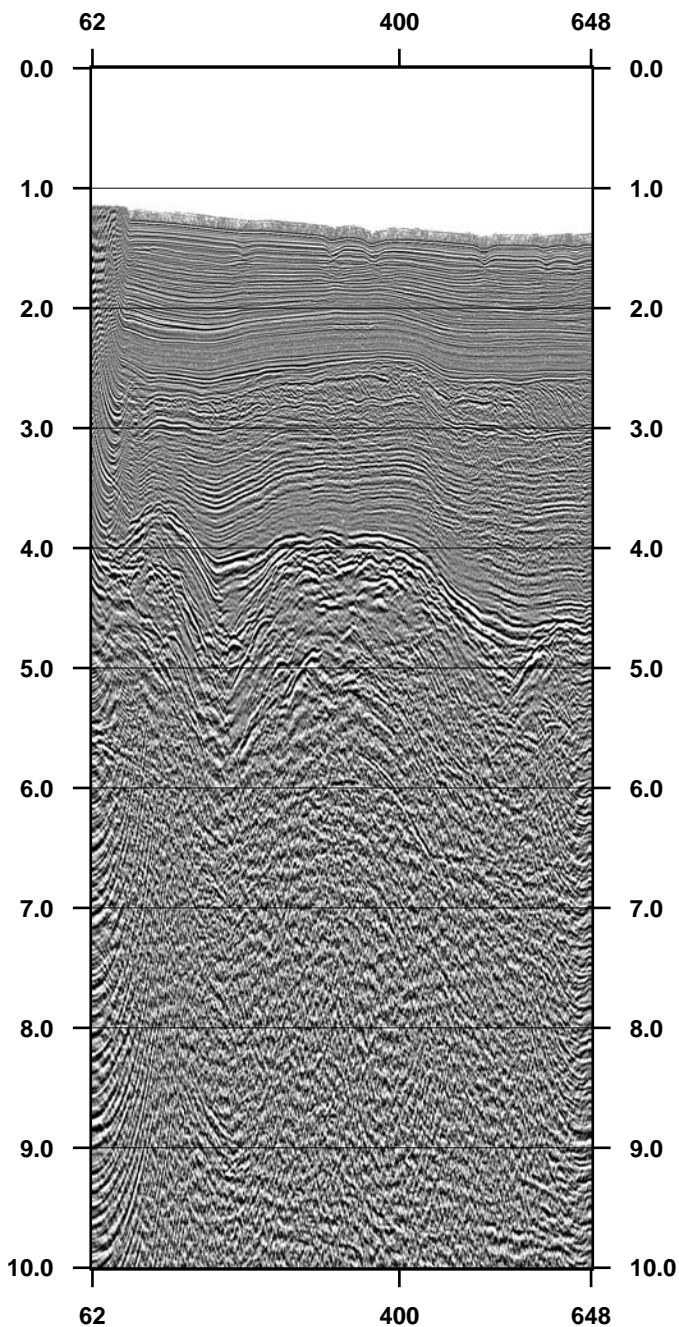
MCS-OBS acquisition. Shot spacing 150 m



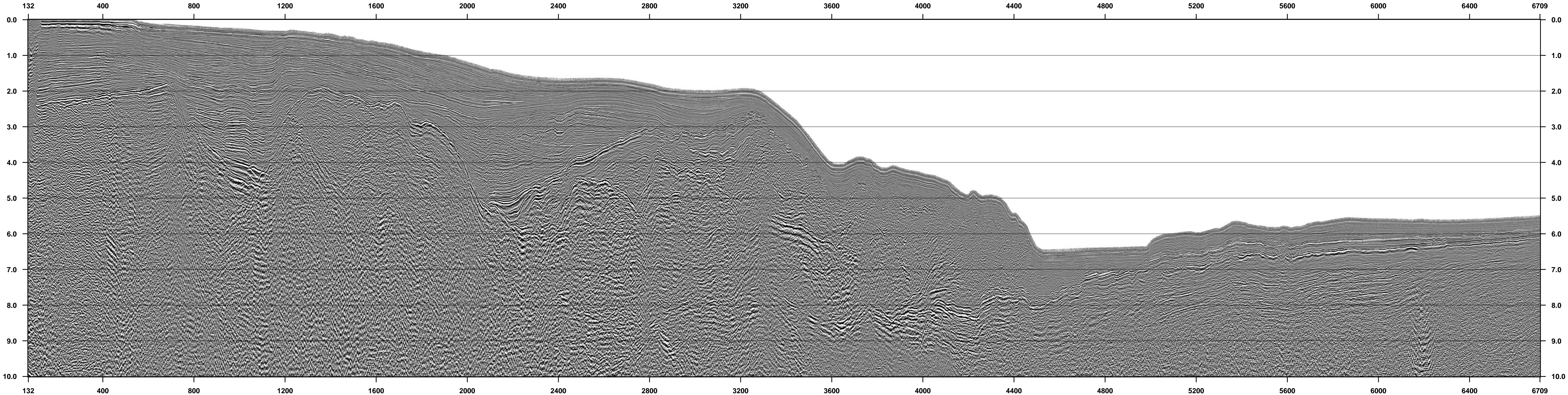
BOL1 FKMIG OF SHIPBOARD STACK



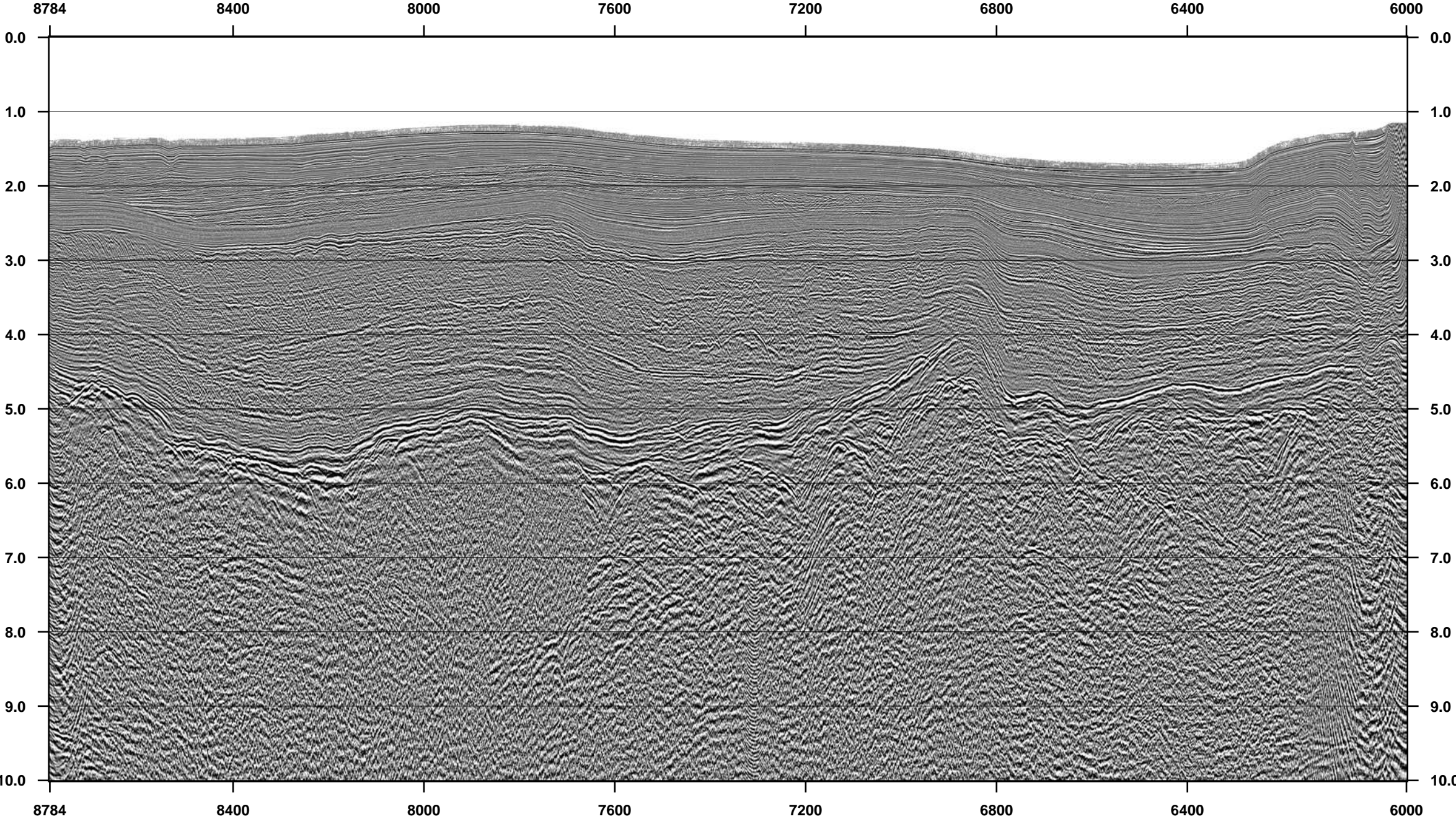
BOL2 FKMIG OF SHIPBOARD STACK



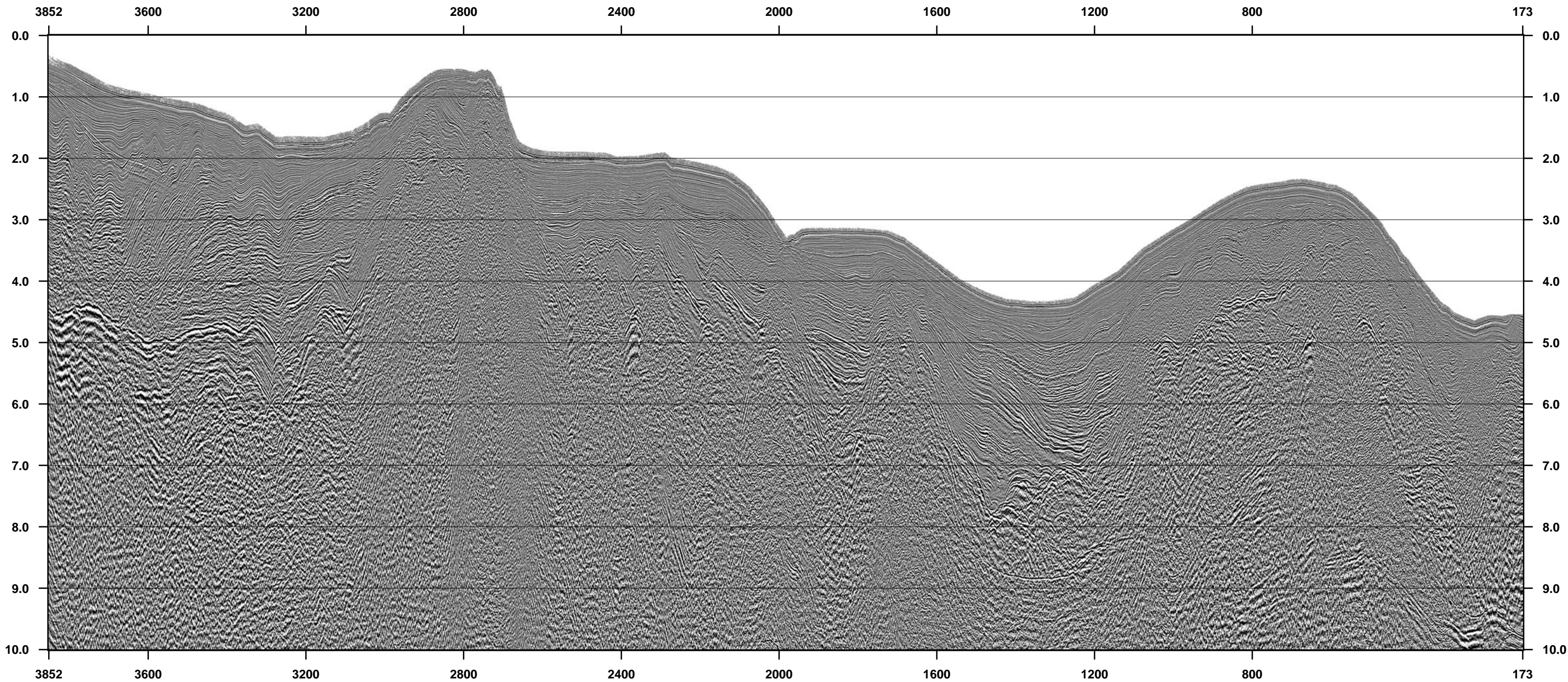
BOL3ALL TRANSECT 70W FKMIG OF SHIPBOARD STACK



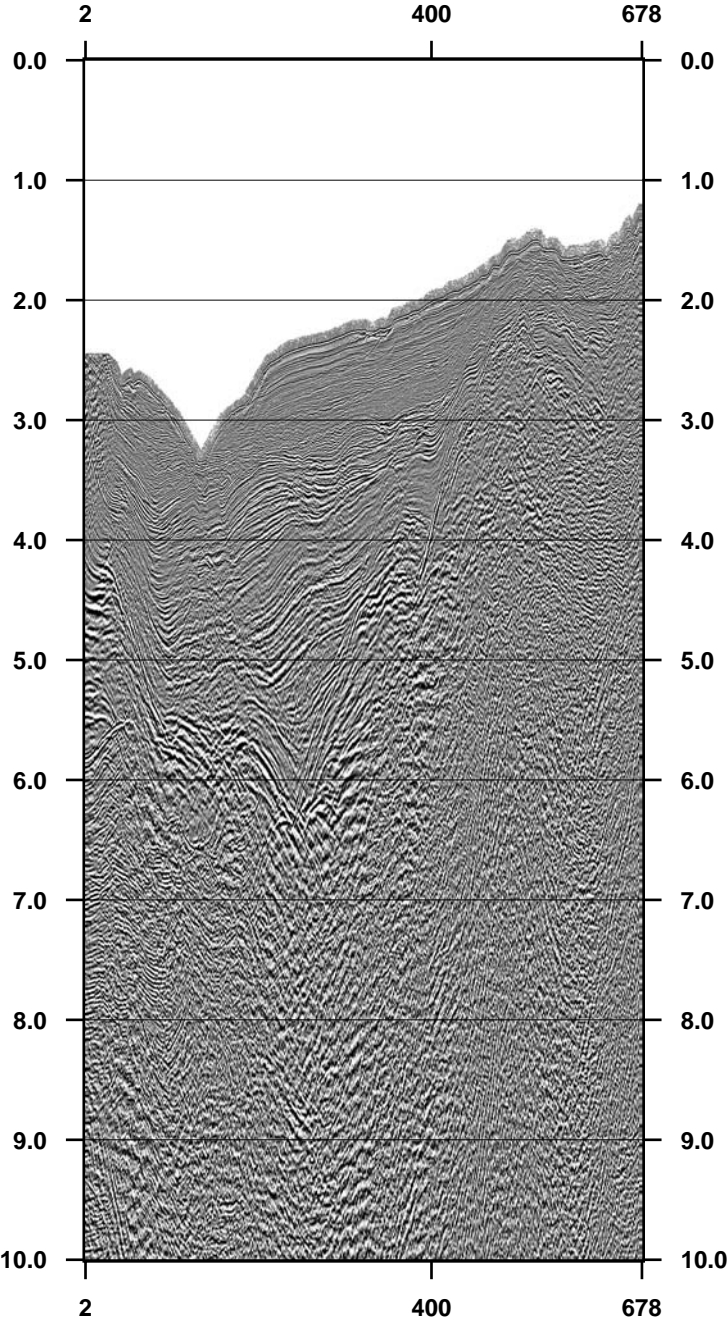
BOL6 FKMIG OF SHIPBOARD STACK



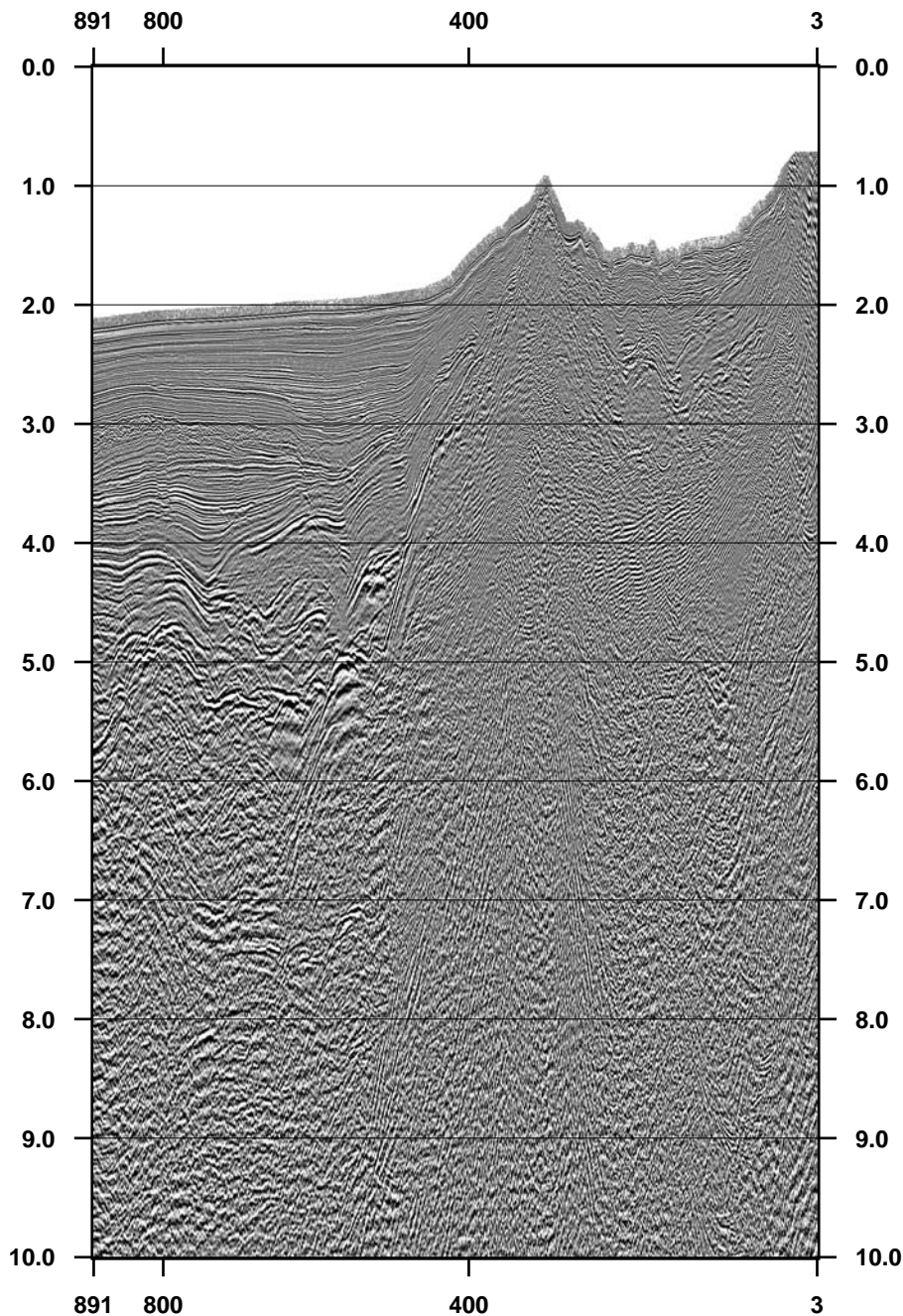
BOL7 FKMIG OF SHIPBOARD STACK



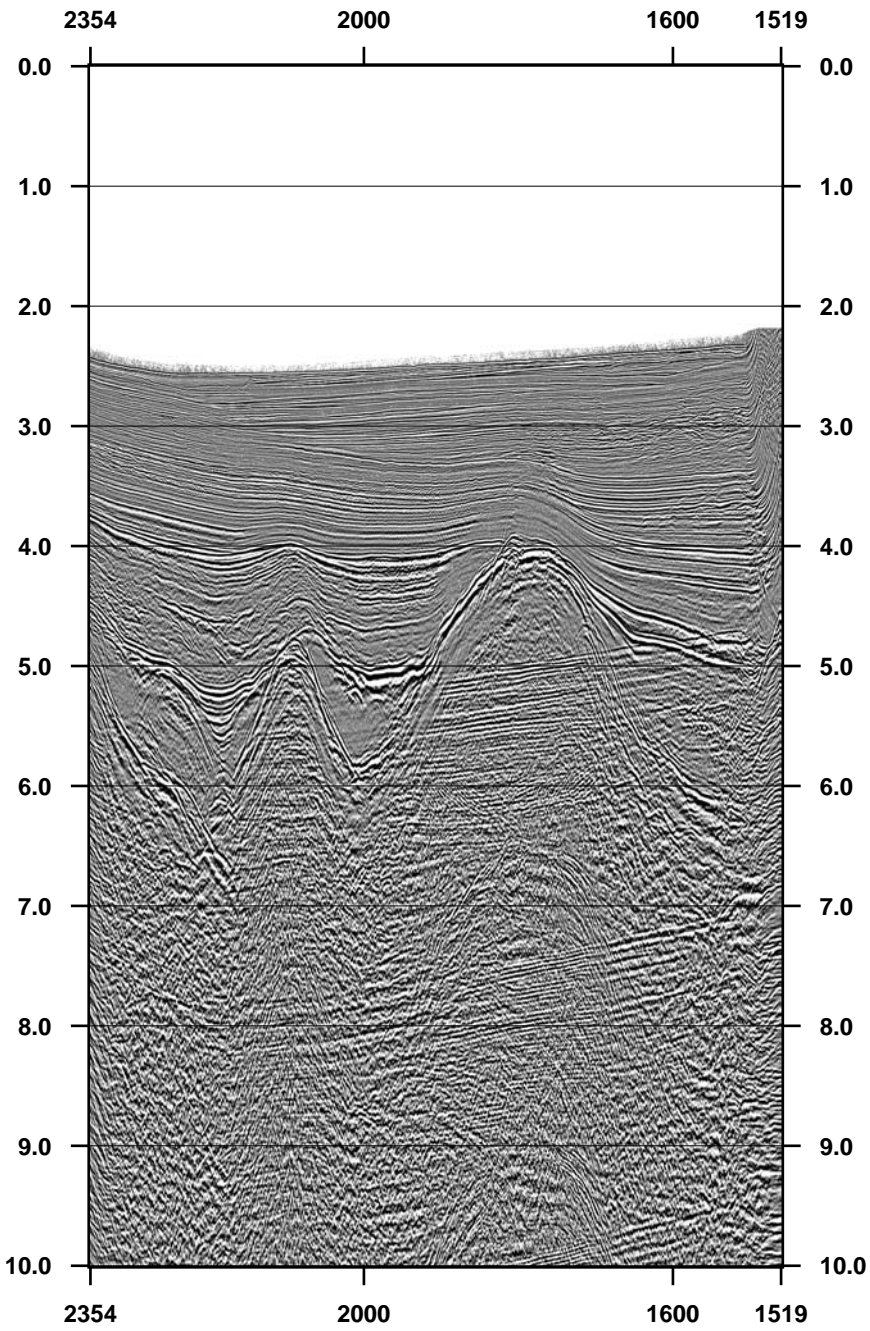
BOL8 FKMIG OF SHIPBOARD STACK



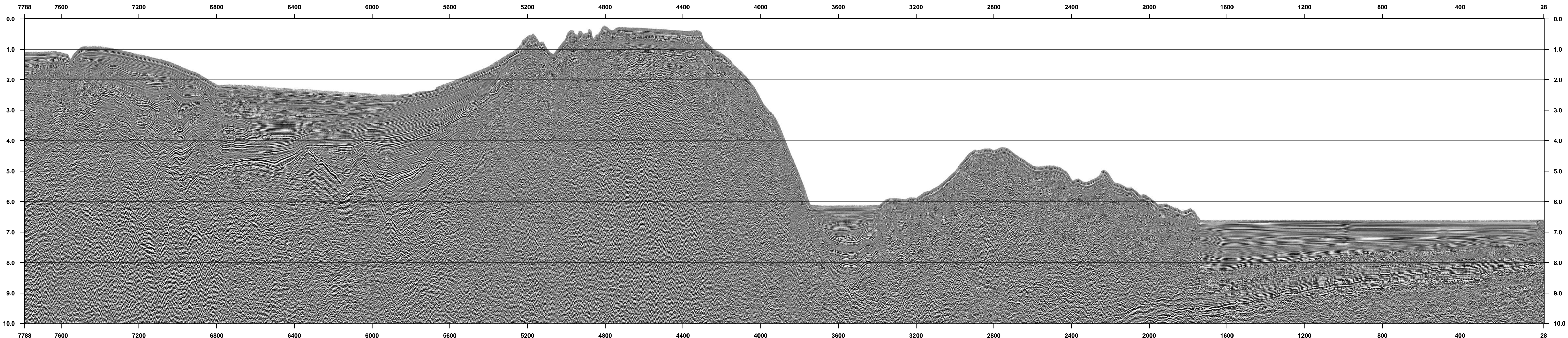
BOL9 FKMIG OF SHIPBOARD STACK



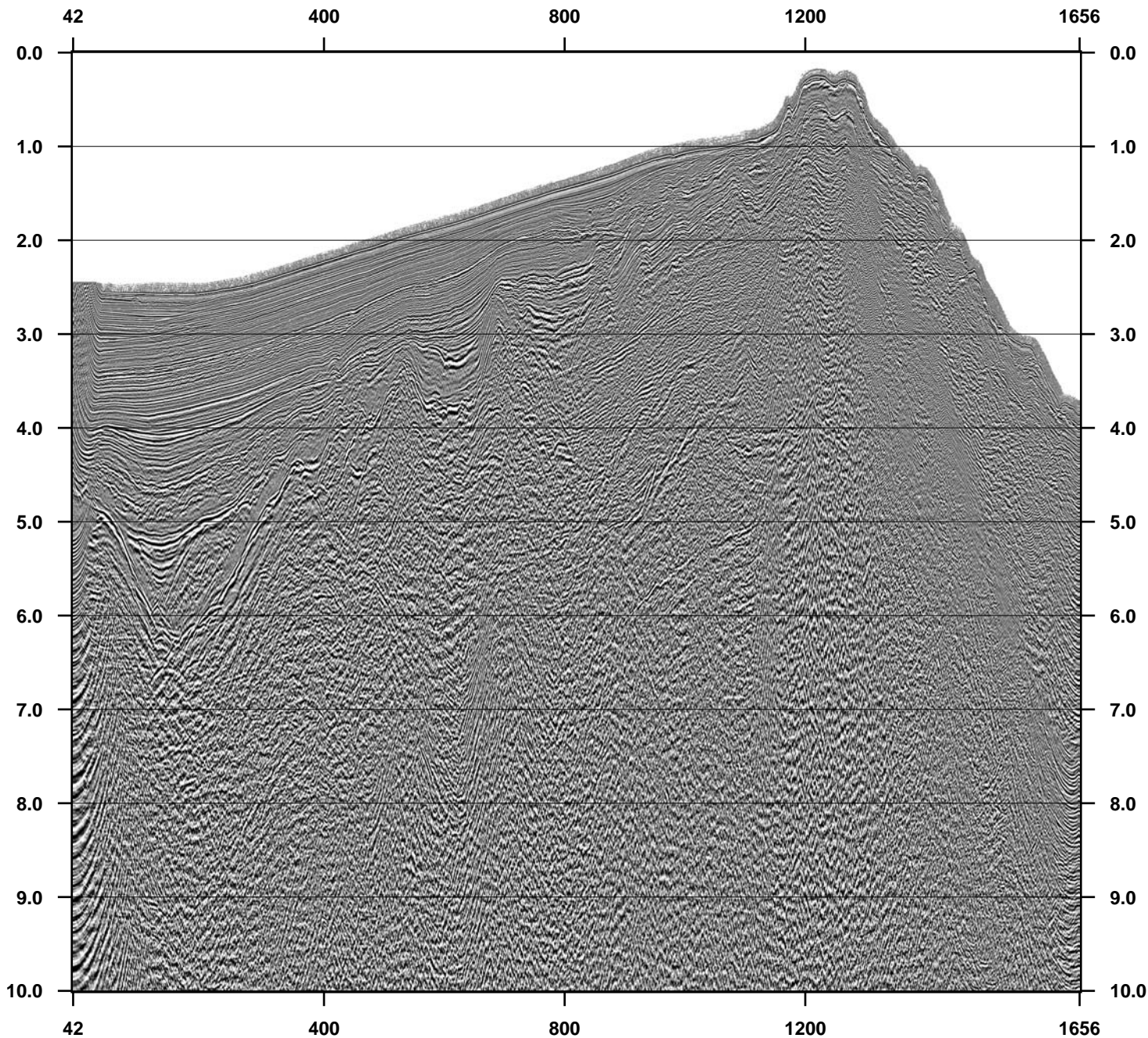
BOL11 FKMIG OF SHIPBOARD STACK



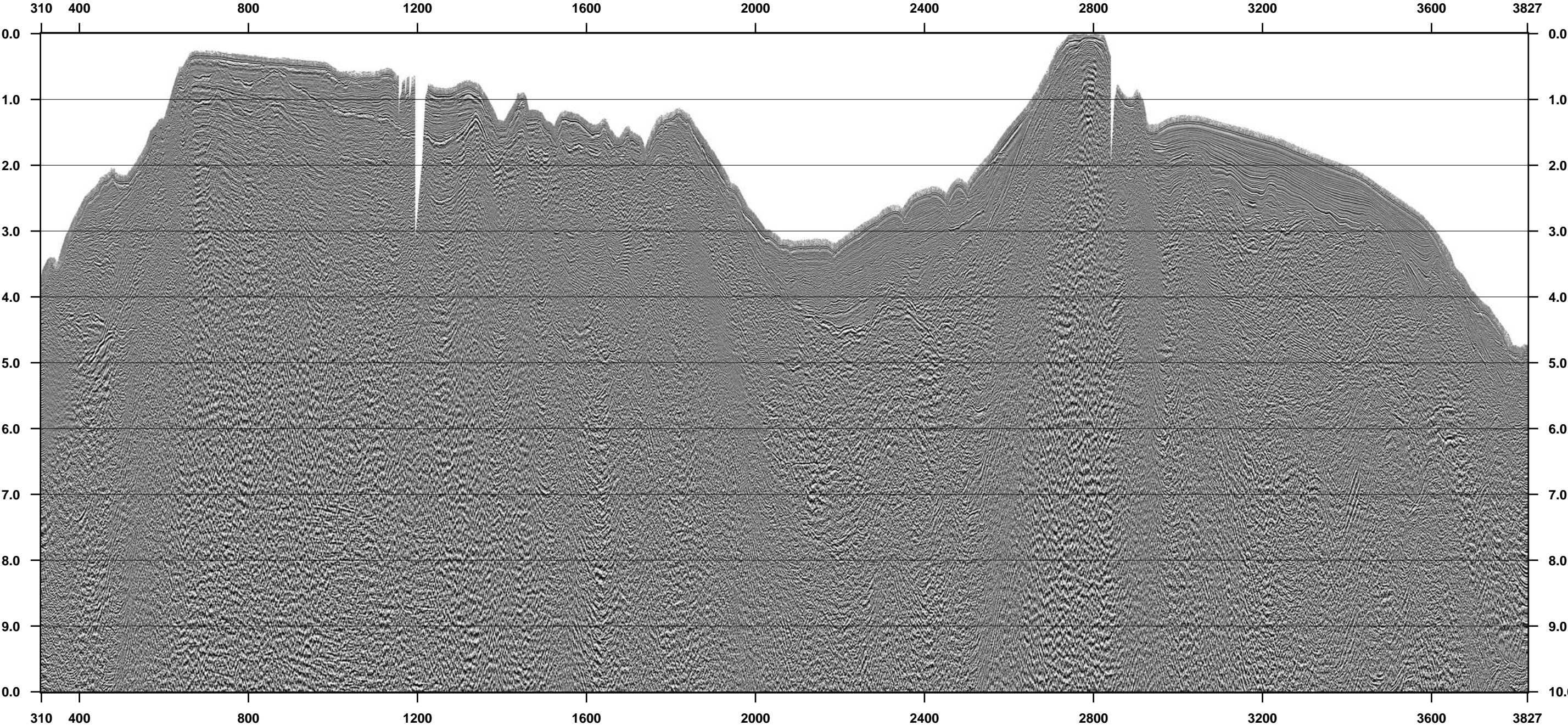
BOL12ALL TRANSECT 67W FKMIG OF SHIPBOARD STACK



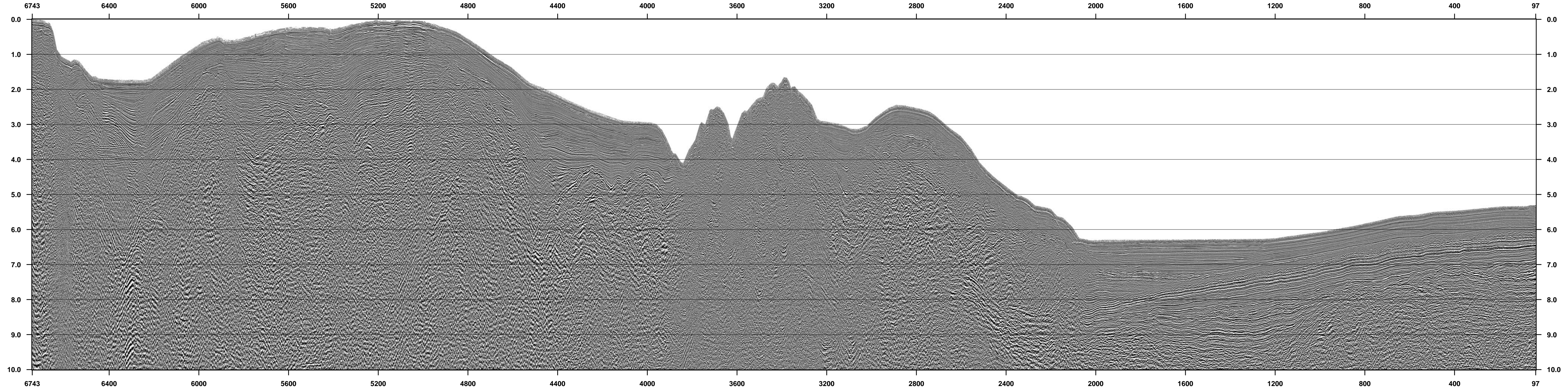
BOL15 FKMIG OF SHIPBOARD STACK



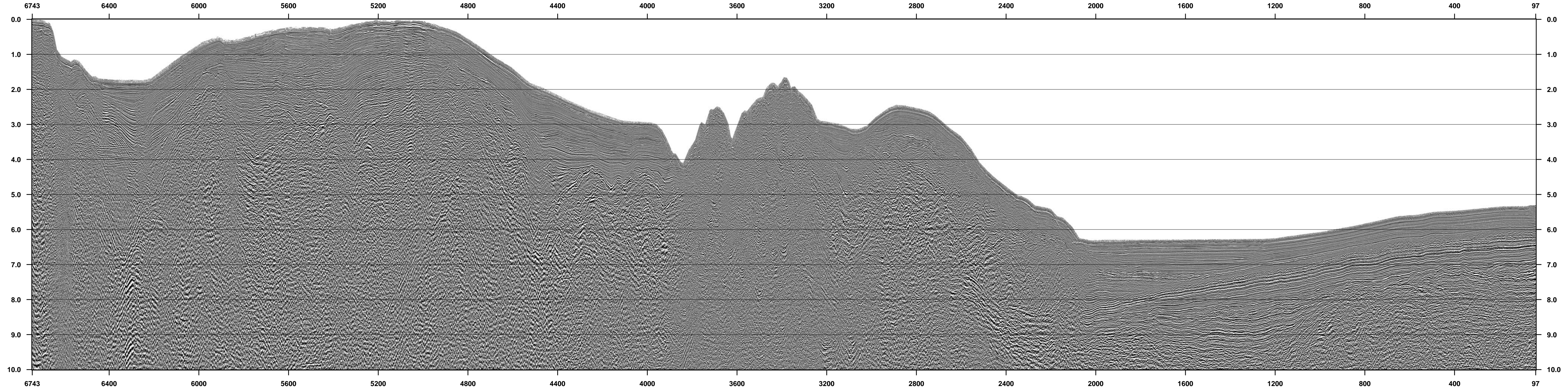
BOL16 FKMIG OF SHIPBOARD STACK



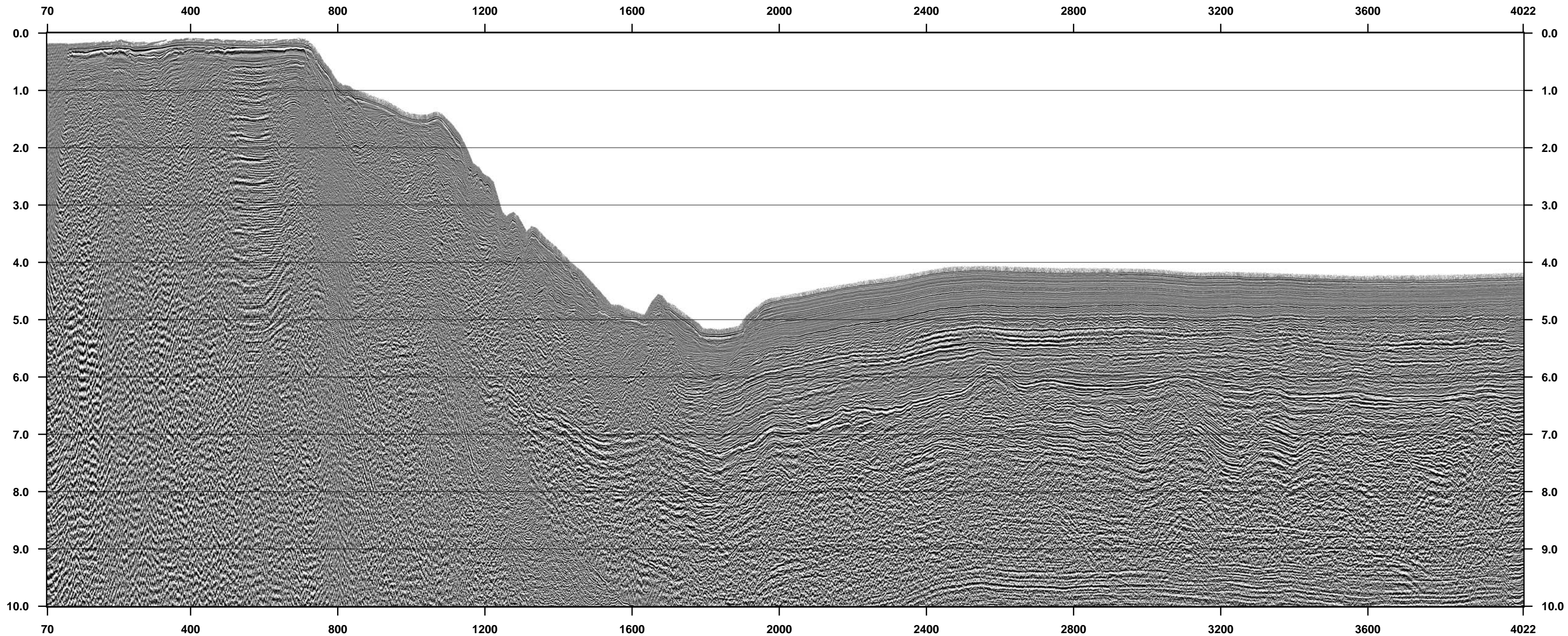
BOL19 TRANSECT 65W FKMIG OF SHIPBOARD STACK



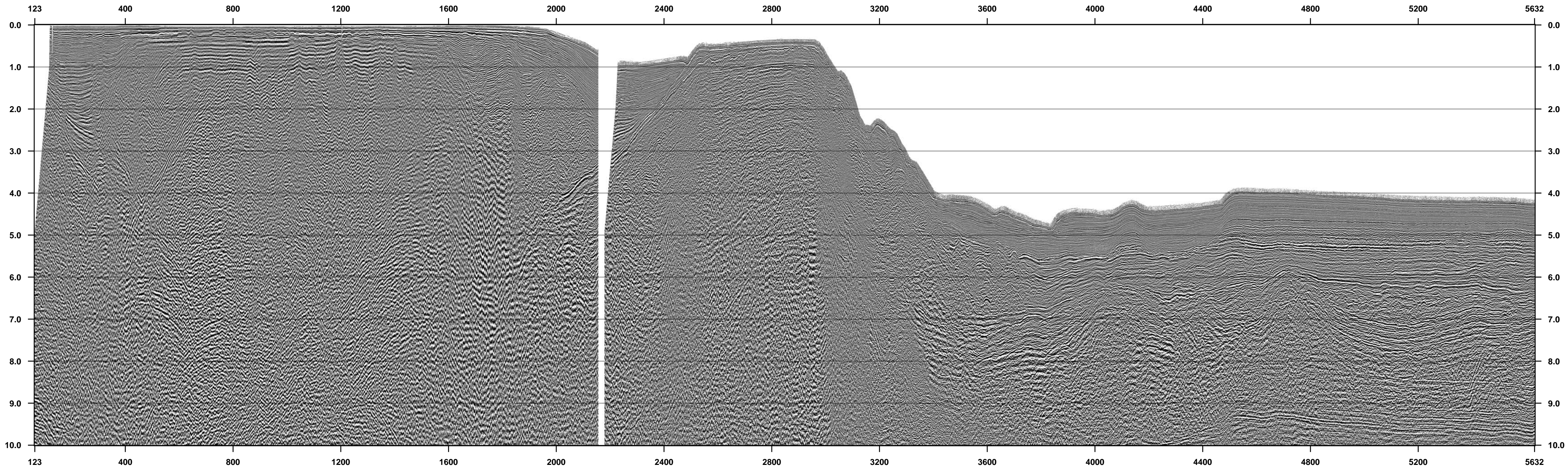
BOL19 TRANSECT 65W FKMIG OF SHIPBOARD STACK



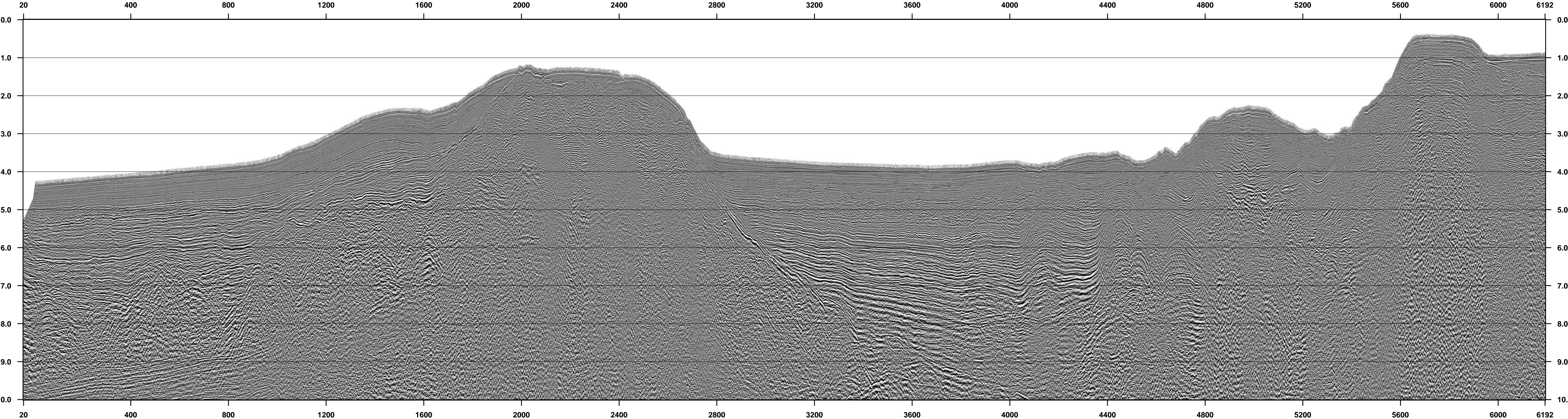
BOL26 FKMIG OF SHIPBOARD STACK



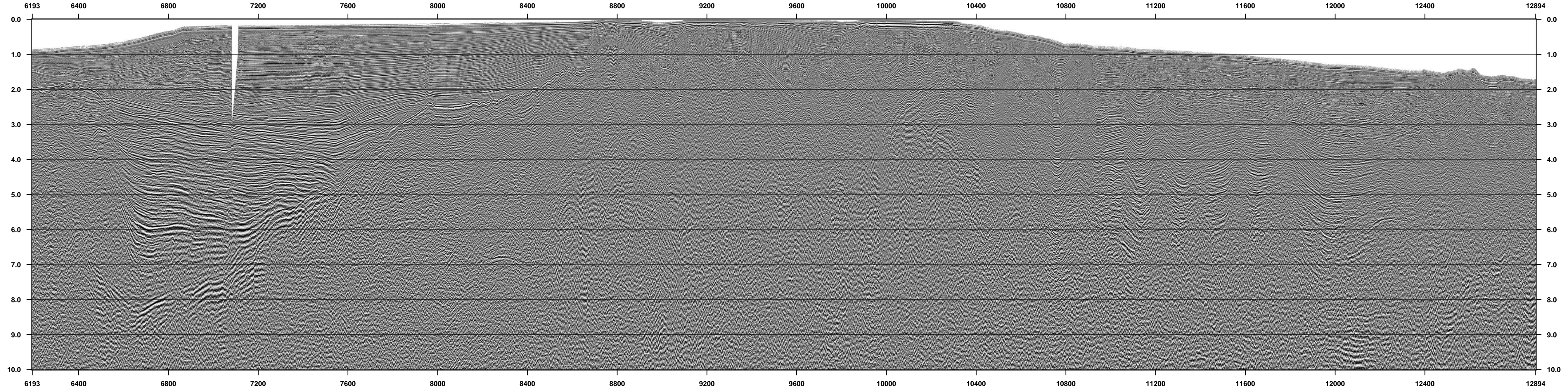
BOL28 TRANSECT 64 W FKMIG OF SHIPBOARD STACK



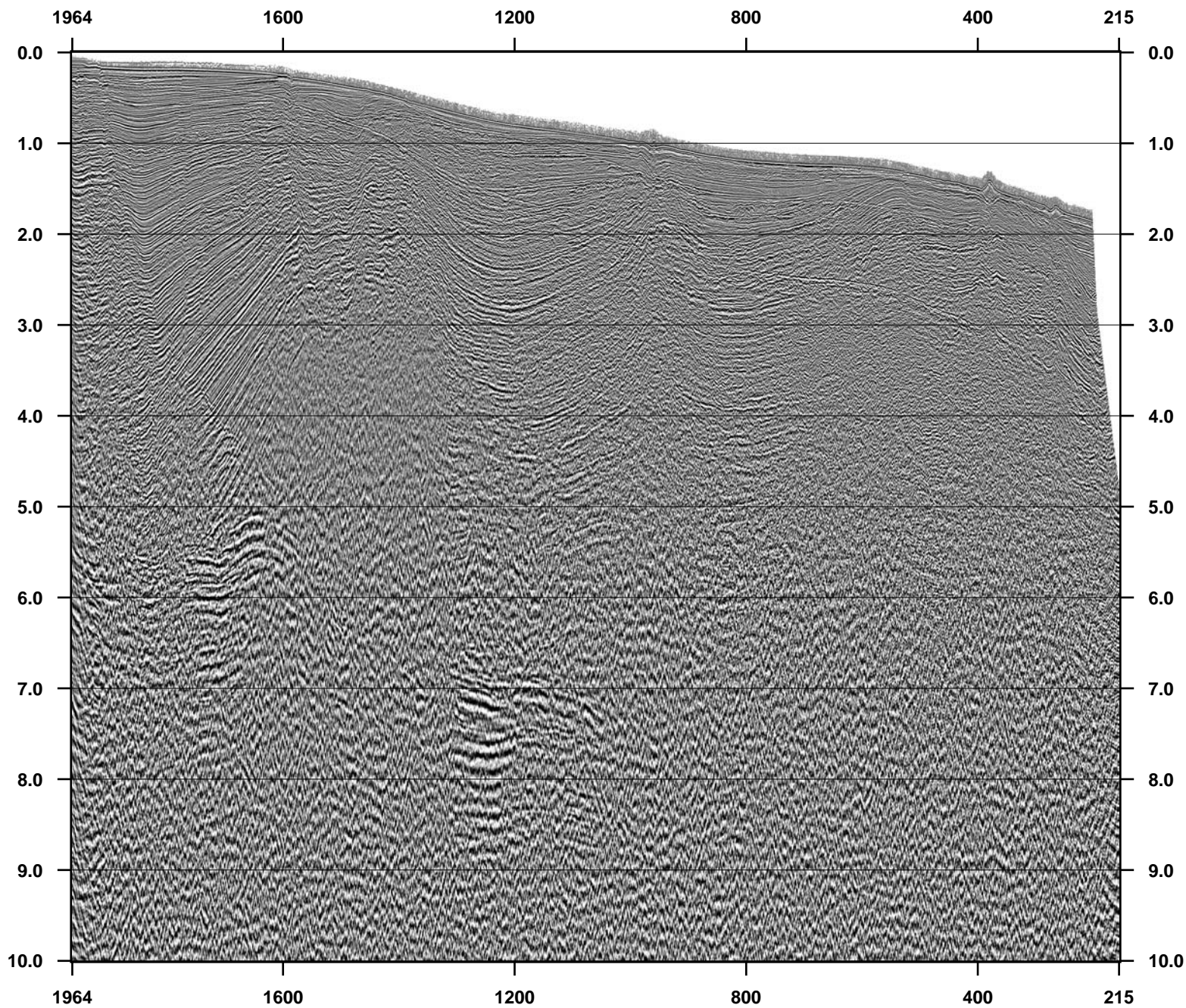
BOL30 TRANSECT TRINIDAD FKMIG OF SHIPBOARD STACK



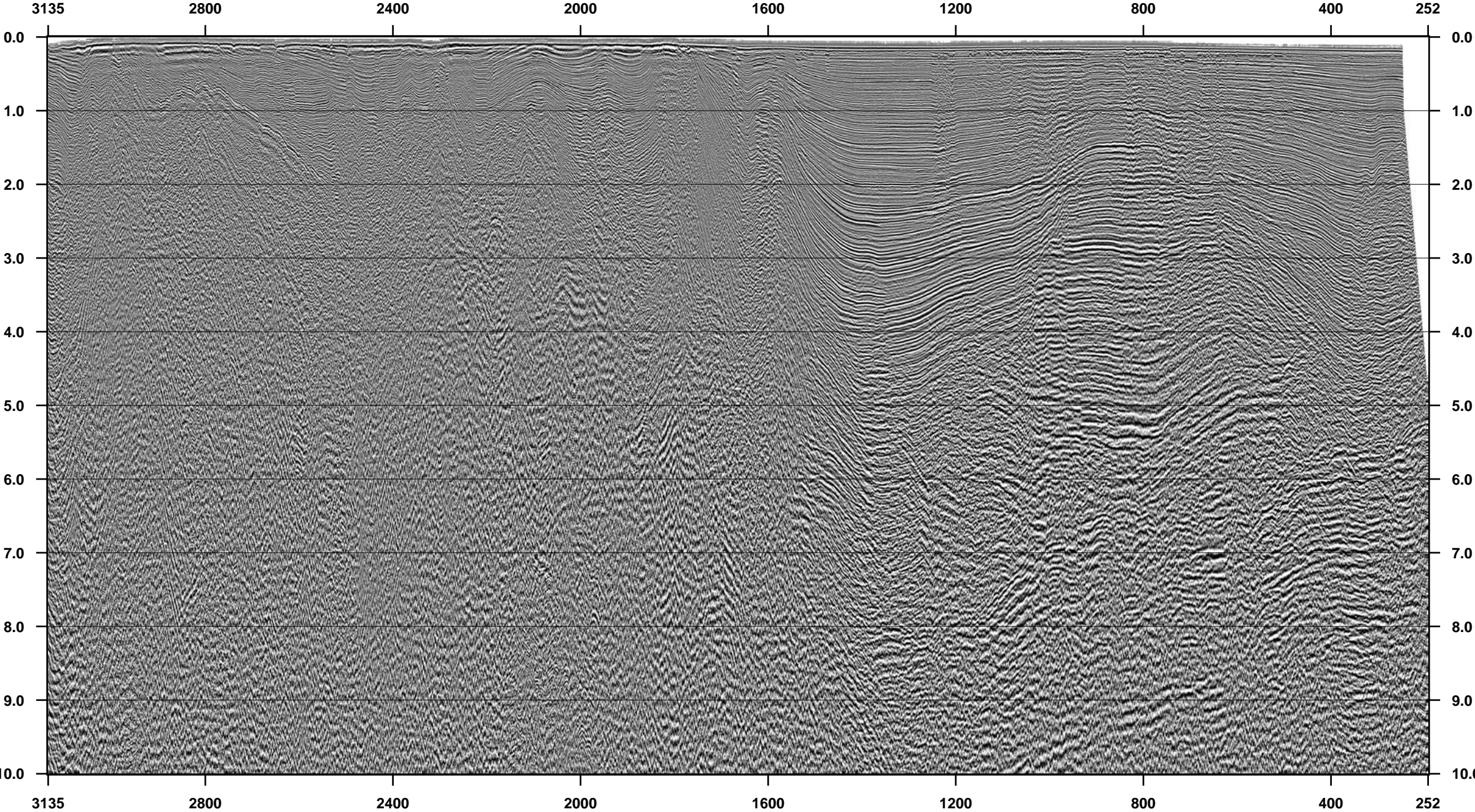
BOL30 TRANSECT TRINIDAD FKMIG OF SHIPBOARD STACK



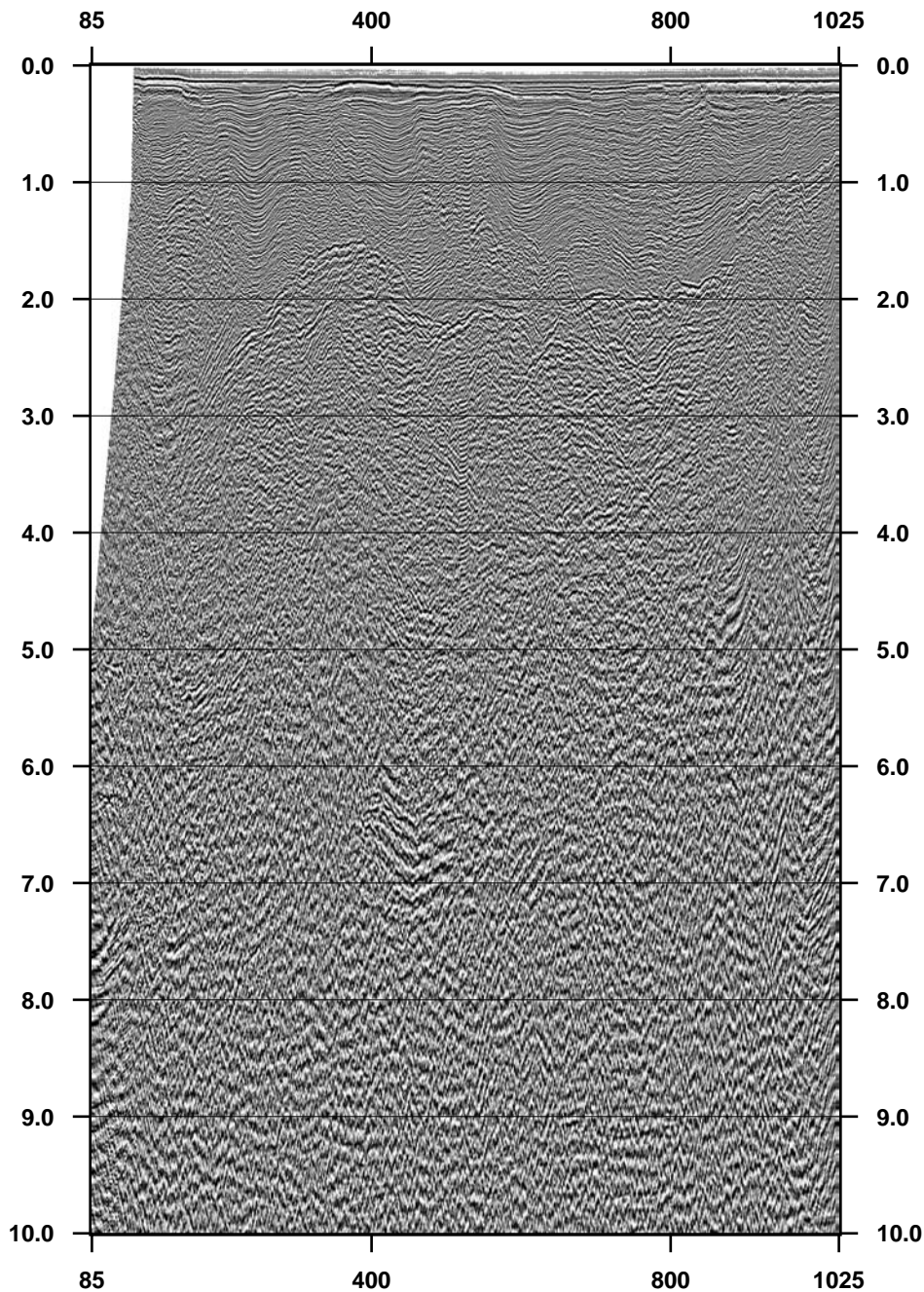
BOL31 FKMIG OF SHIPBOARD STACK



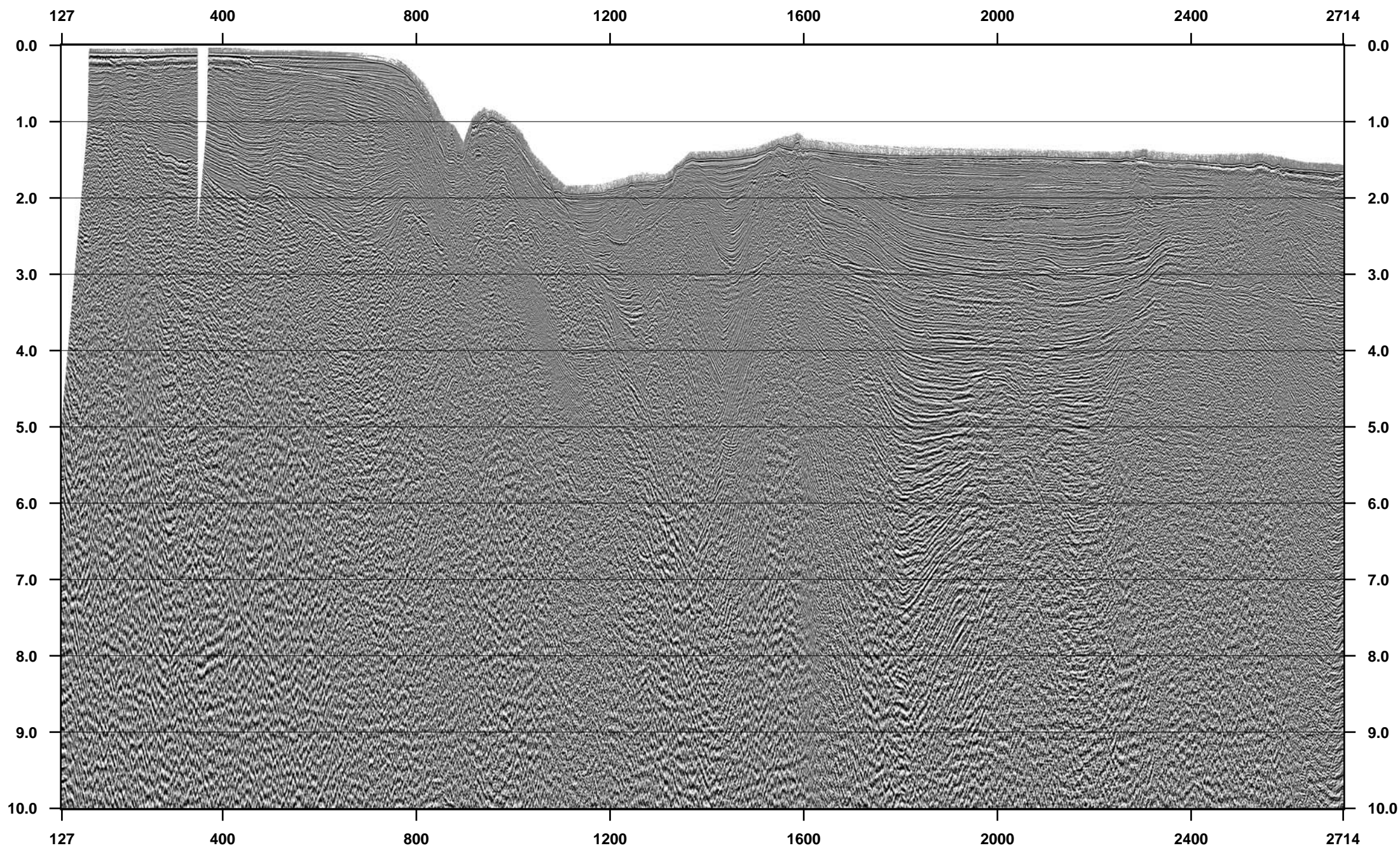
BOL32 FKMIG OF SHIPBOARD STACK



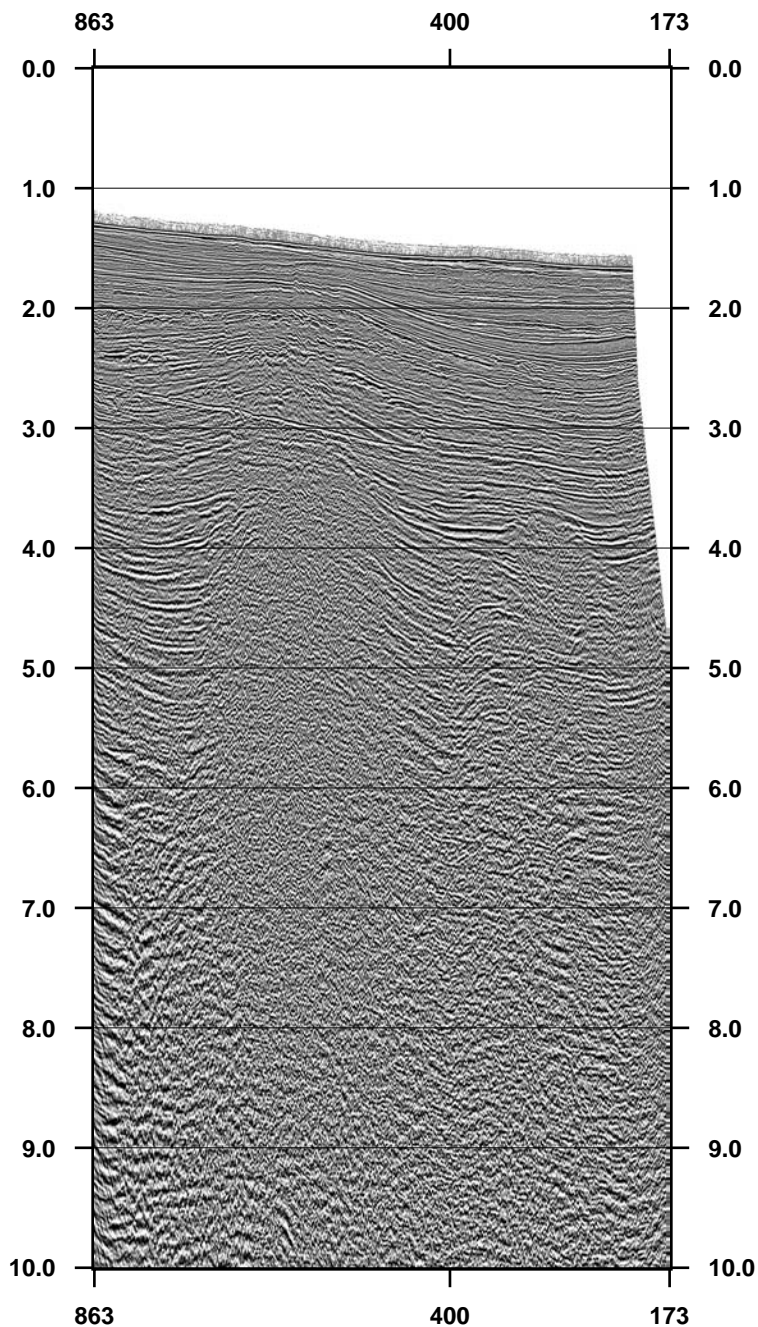
BOL33 FKMIG OF SHIPBOARD STACK



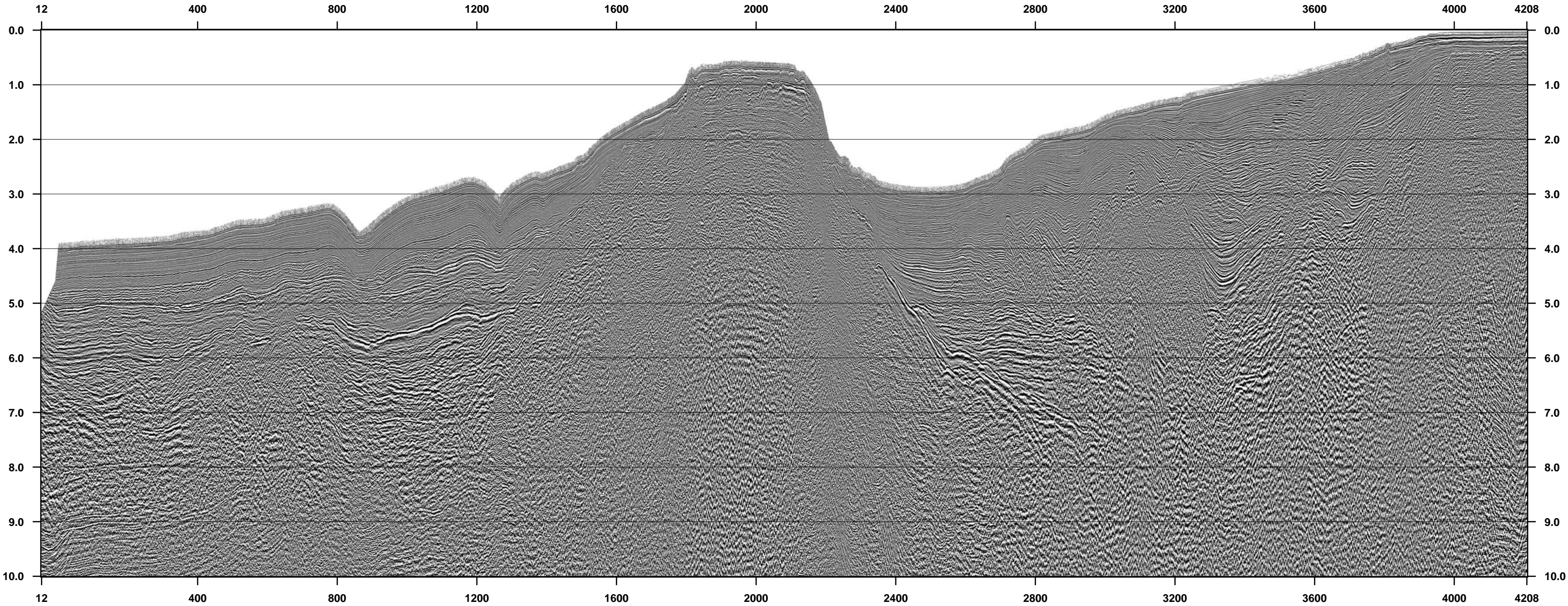
BOL34 FKMIG OF SHIPBOARD STACK



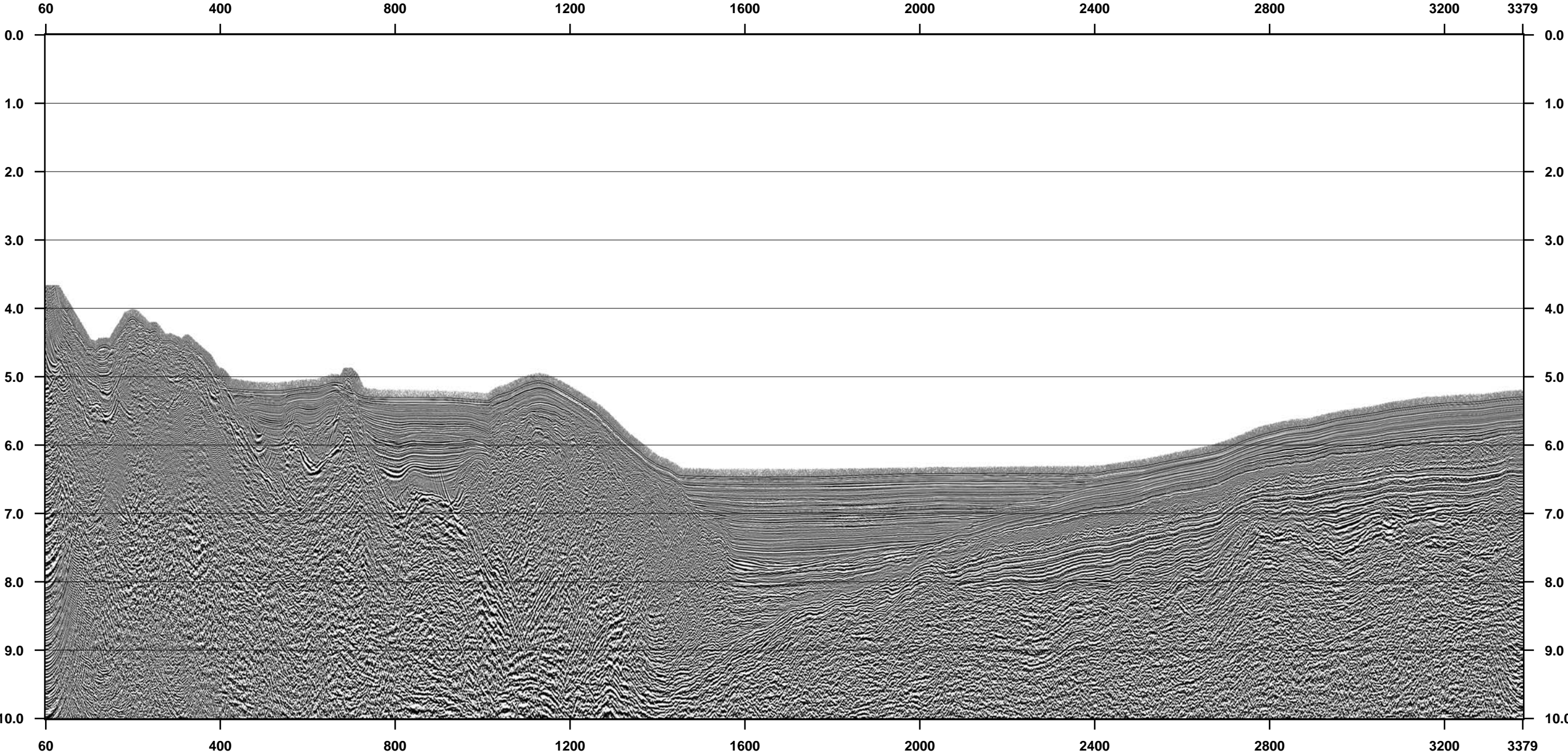
BOL35 FKMIG OF SHIPBOARD STACK



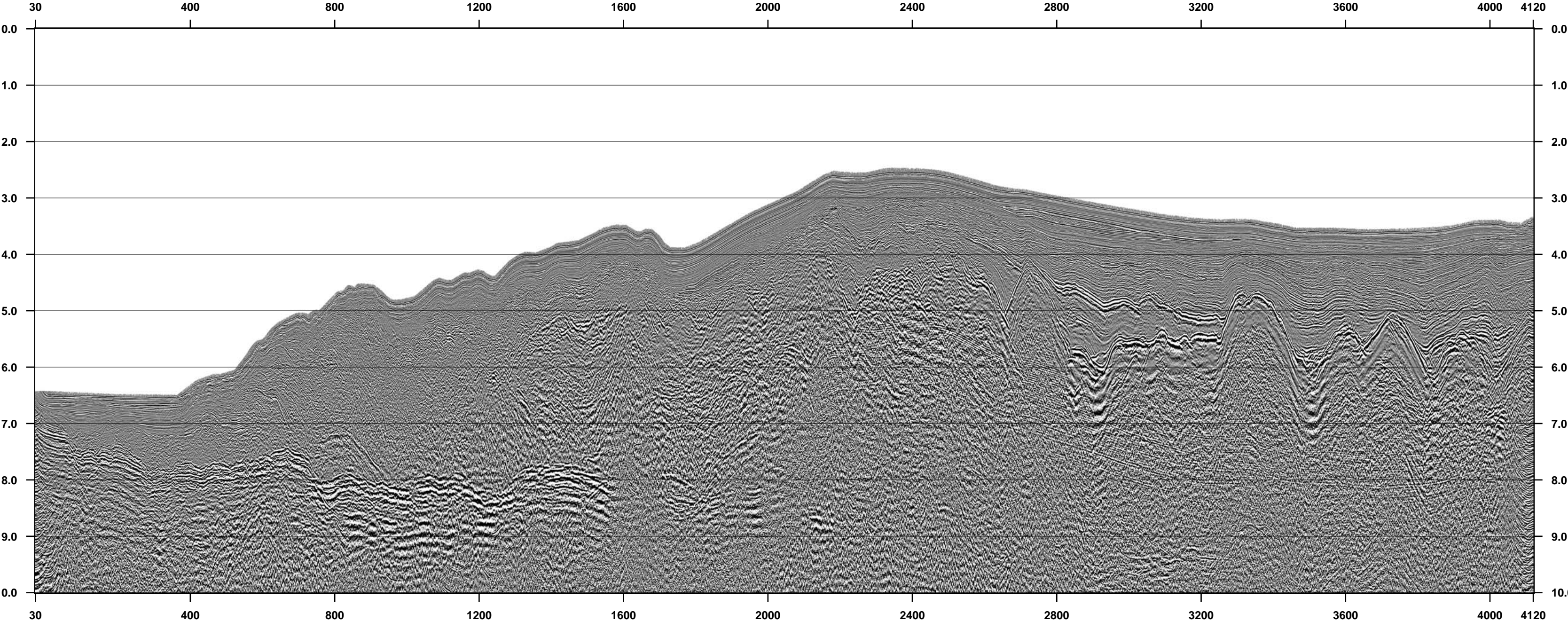
BOL37 FKMIG OF SHIPBOARD STACK



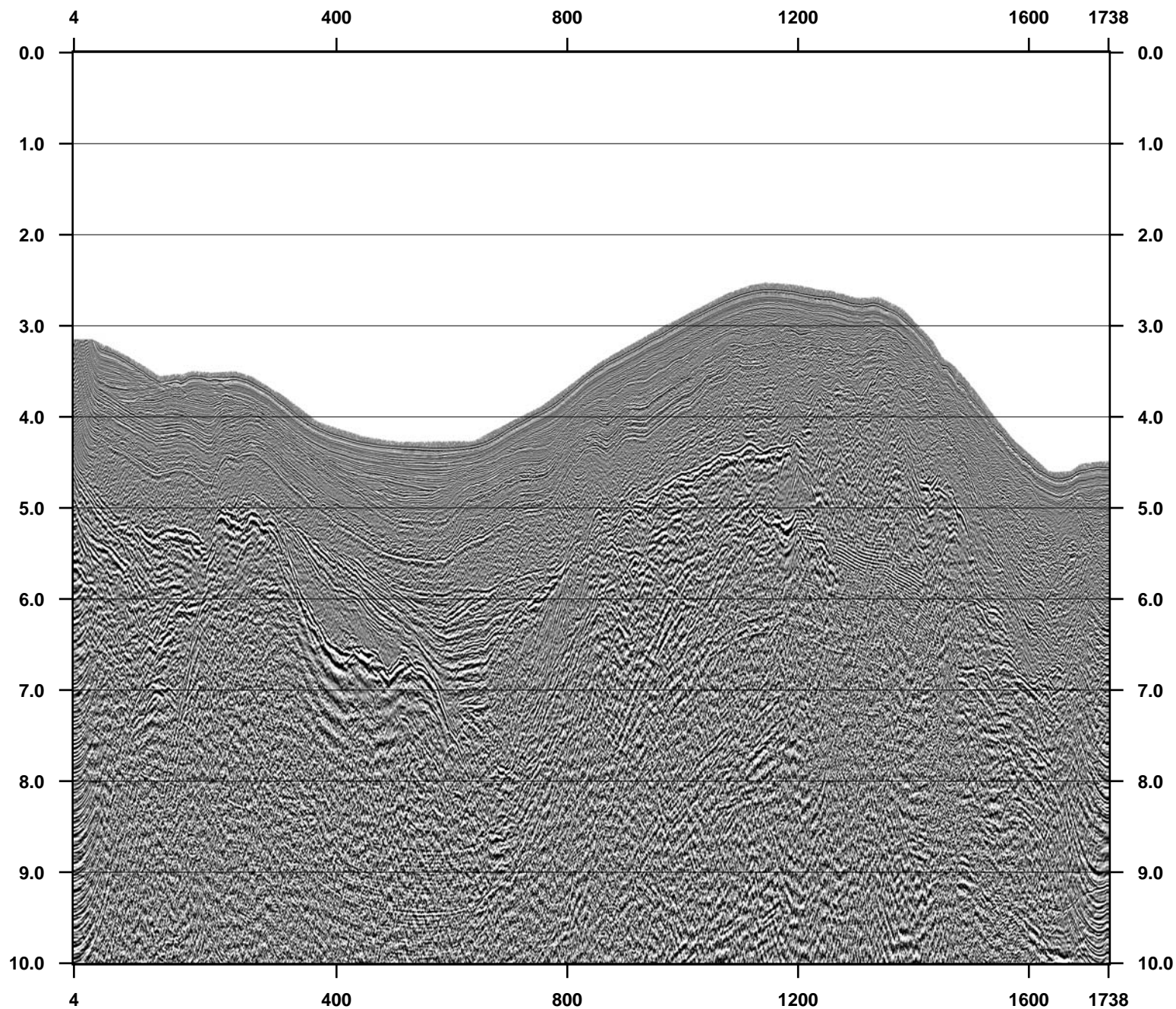
BOL47 FKMIG OF SHIPBOARD STACK



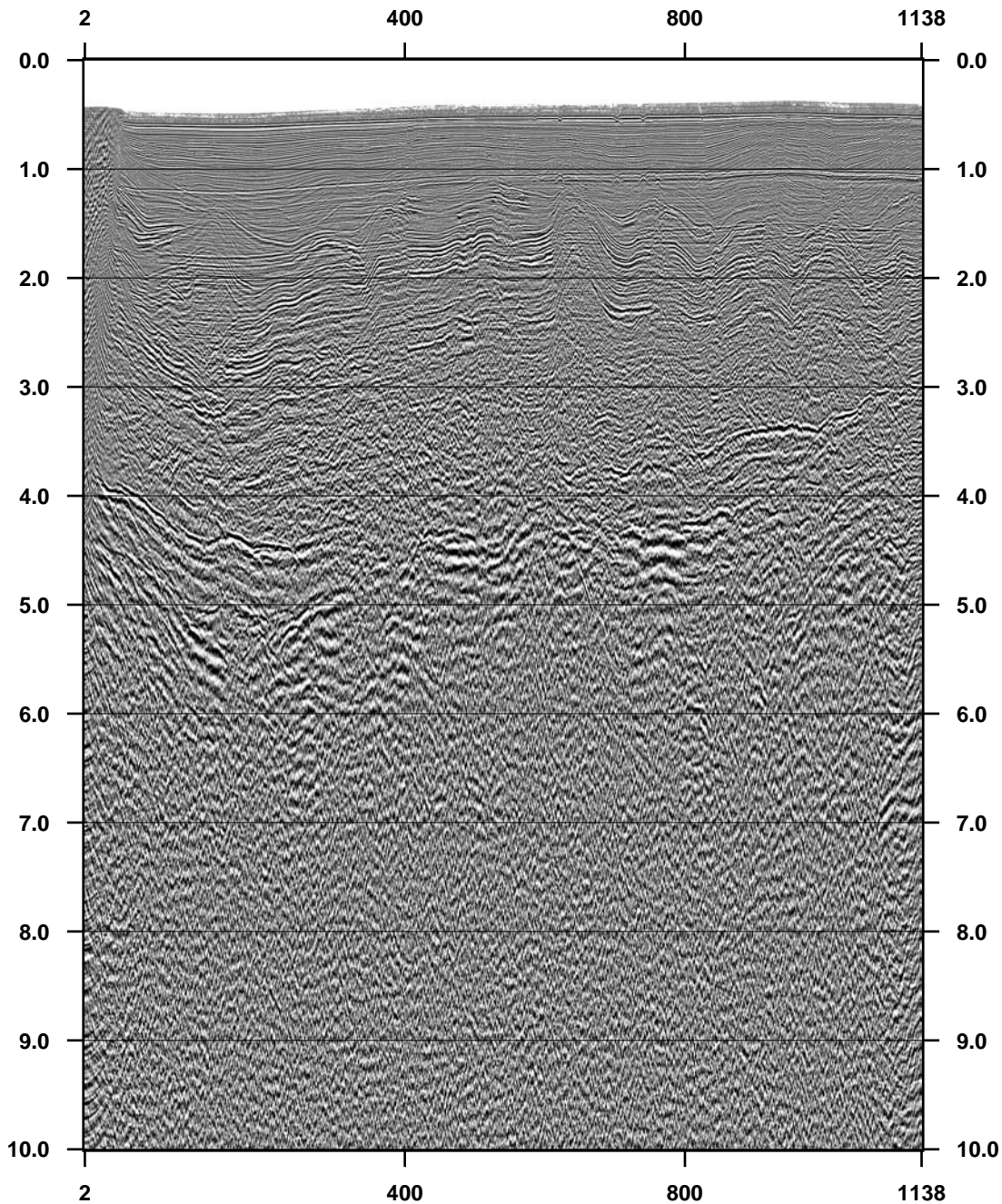
BOL60 FKMIG OF SHIPBOARD STACK



BOL61 FKMIG OF SHIPBOARD STACK



BOL62 FKMIG OF SHIPBOARD STACK



BOL63 FKMIG OF SHIPBOARD STACK

