Hess Deep Seismic Cruise

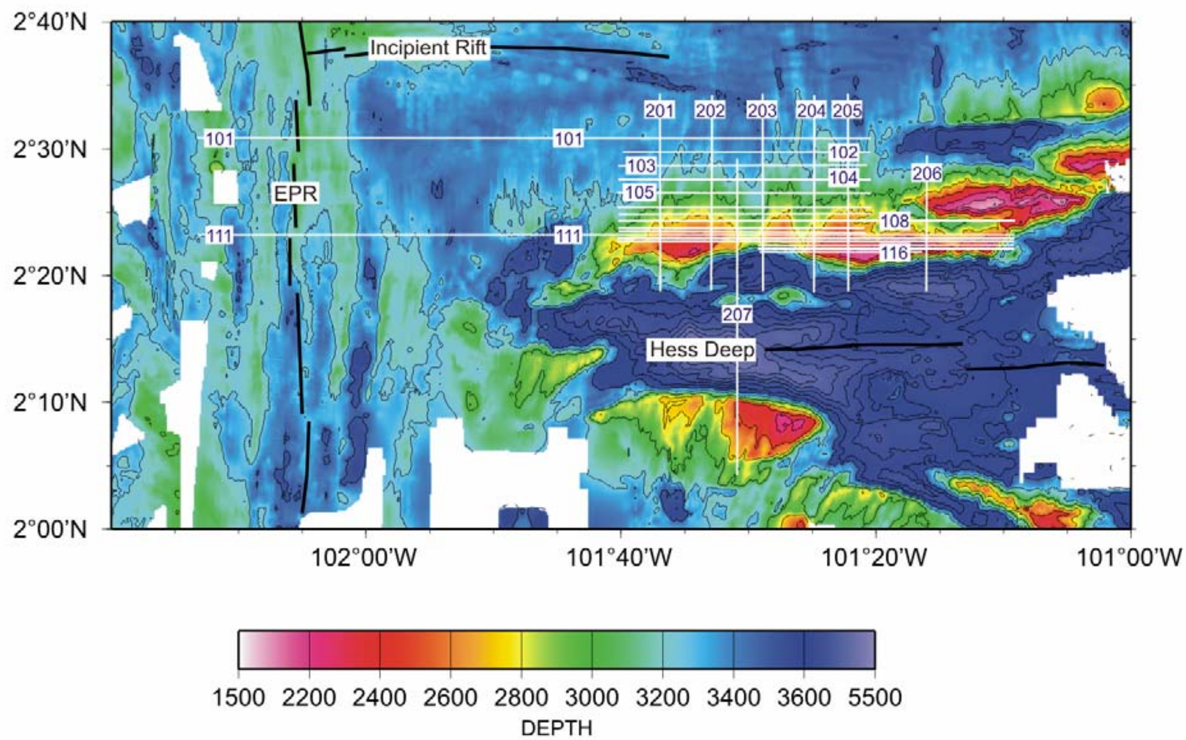
Cruise Report
July 6 – July 28, 2003
R/V *Maurice Ewing*

Table of Contents

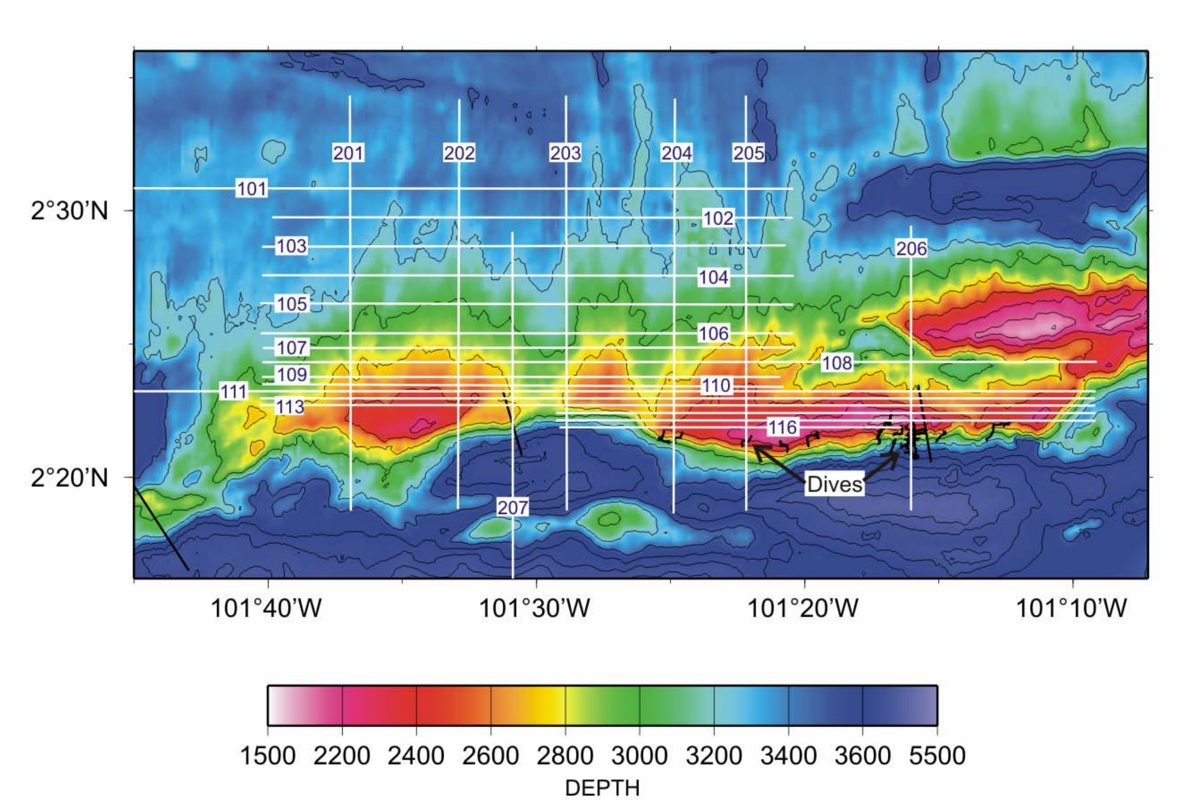
Cruise Summary

The Hess Deep seismic program was aimed at correlating the seismic structure with the observed geological structure of the oceanic crust at this location. We collected multi-channel seismic (MCS) profiles along the scarp edge and adjacent plateau. Two of the profiles were extended to, and across, the East Pacific Rise so that the shallow seismic structure could be continuously mapped from zero-age crust to the tectonic windows where the shallow stratigraphy is exposed. One of the scarp-perpendicular profiles was extended across the Hess Deep rift onto the plateau adjacent to the south wall of the rift. Ocean bottom seismographs (OBS) were deployed to constrain crustal velocity structure. Primary questions that should be addressed by the seismic experiments include: 1) Is there a correlation between seismic and geologic structure at Hess Deep? 2) Is the seismic structure at Hess Deep typical of fast-spreading crust? 3) What is the evolution of the shallow velocity structure from zero-age rise-axis crust to the 1-2 Ma crust in the study areas?

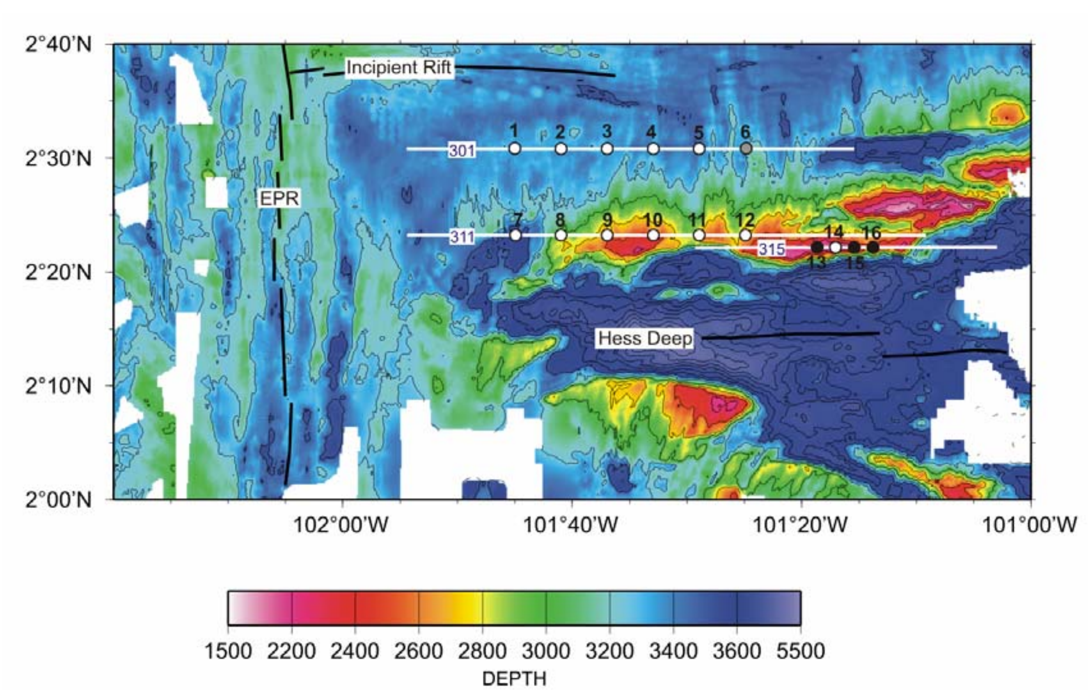
The program acquired 16 scarp-parallel MCS profiles and 7 scarp-perpendicular MCS profiles. OBSs were located along 3 of the scarp-parallel profiles, and these lines were reshot with a longer shot interval in order to minimize previous shot noise. All MCS and OBS profiles were successfully acquired with few missing shots. All 12 OBSs located on the plateau were recovered, but only 1 of the 4 OBSs located along a horst block on the north wall were recovered.



Location of MCS profiles acquired during the Hess Deep seismic cruise.

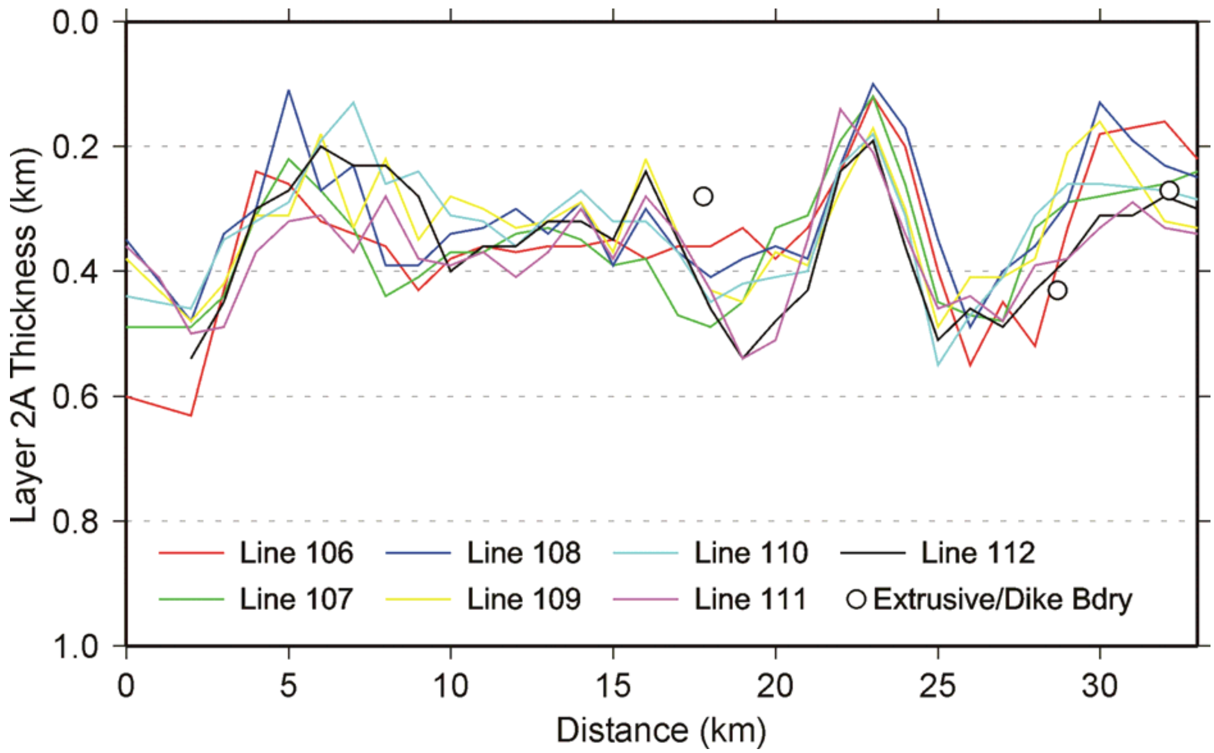


Location of MCS profiles with respect to location of submersible dives along the north wall of the Hess Deep rift.



Location of OBS profiles acquired during the Hess Deep seismic cruise. The batteries on OBS 6 failed shortly after deployment, and OBSs 13, 15, and 16 were not recovered.

Initial processing of MCS data was performed during the cruise, and images are included near the end of this report. The layer 2A reflector is observed on all profiles; further processing will better image this event. For Lines 106-112, the refractions were picked on every 10th shot gather and used to invert for depth to the seismic layer 2A/2B boundary. There is a good correlation between the depth to this seismic boundary and the depth to the extrusive/dike boundary from submersible observations. Patterns in layer 2A thickness are very consistent between these 7 profiles, which are located 0.5 – 1.0 km apart (total N-S distance between Line 106 and Line 112 is 4 km). Further processing and analysis will allow us to map the layer 2A/2B boundary across the entire survey region.



Hess Deep Cruise Crew and Scientist List

<u>Science Party (22 Persons):</u>
Gail Christeson – Chief Scientist
Kirk McIntosh – Co-Chief Scientist
Yosio Nakamura – OBS Operations
Ben Yates – OBS Operations
Steffen Saustrup – Seismic Processor
Mary Phillips – Watchstander
Alejandro Escalona – Watchstander
Daniel Brothers – Watchstander
Astrid Makowitz – Watchstander
Armando Sena – Watchstander
David Gorney – Watchstander
Joe Stennet – Science Officer
Ethan Gold – Systems Manager
Shin Ae Tissia – Electronics Tech
John Byrnes – Gunner
John DiBernardo – Gunner
Carlos Gutierrez – Gunner
Justin Walsh – Gunner
Ropati Maiwiriwir – Gunner
Mari Smultea – Marine Mammal Observer
Sarah Stoltz – Marine Mammal Observer
Howie Goldstein – Marine Mammal Observer

<u>Crew List (19 Persons):</u>
James O'Loughlin – Master
David Wolford – Chief Mate
Richard Thomas – 2nd Mate
Meredith Mecketsy – 3rd Mate
Kelly Tomas – Boatswain
Dennis Von Mehren – A/B
Arnold Sypongco – A/B
Jorge Norales – A/B
Jim Syferd – O/S
Albert Karlyn – Chief Engineer
Matthew Tucke – 1st Engineer
Dexter James – 2nd Engineer
Alejandro Santiago – 3rd Engineer
Guillermo Uribe – Oiler
Rodolfo Florendo – Oiler
Richard Lajoie – Oiler
Ryan Dennis – Steward
Shawn Lindenmuth – Cook
Luke Moqo – Utility

Science Party Watch Schedule

Watchleaders:
0000 – 1200 – Kirk McIntosh
1200 – 0000 – Gail Christeson

Watchstanders:
0000 – 0800 – David Gorney and Armando Sena
0800 – 1600 – Alejandro Escalona and Mary Phillips
1600 – 0000 – Daniel Brothers and Astrid Makowitz

Kirk has suggested that in the future to have a 'dead time' between 0200 and 0400 with no watchleader, which would give the 2 watchleaders some overlap during the day. We might also shift the watchstanders shifts by a few hours since the 0000-0800 shift was by far the worst of the 3. All agreed that having 2 watchstanders was a good idea, as it helped the time go by faster for the watchstanders to have someone to talk to, and 2 watchstanders were helpful during line changes.

Cruise Diary

July 6 – At 0800 we had a science safety meeting where we watched a video about ship safety. The ship left a few minutes before the scheduled departure time of 1000, and after a delay of about 8 months we were finally on our way! A fire and boat drill was held at 1520, and David Gorney volunteered to try on a survival suit. The evening was completed by the traditional Sunday bbq. Weather was good all day, and the seas were calm.

July 7 – At 1030 we had a science meeting where Astrid gave a presentation on the regional geology of Hess Deep. This was followed by a trip to the OBS lab where Yosio discussed how the OBSs worked, and we then went outside to see where the OBSs would be deployed and recovered. At 1520 Kirk and myself met with the captain, science officer, and marine mammal observers to discuss the mitigation procedures outlined in the IHA (Incidental Harassment Authorization). We will turn our clocks back 1 hour tonight.

July 8 – At 1030 we had another science meeting. Danny gave a presentation about the detailed Hess Deep geology, followed by a presentation from Kirk about airguns and how a tuned array works. Afterwards we went out to the fantail where we looked at an airgun up close. At 1300 the Chief Engineer arranged an engine room tour for anyone who was interested. Based on our progress to date, I expect us to arrive on site at Hess Deep early Friday afternoon.

July 9 – At our daily science meeting David gave a presentation about possible geologic interpretations for the seismic layer 2A/2B and layer 2/3 boundaries, followed by Armando's presentation about basic seismic reflection acquisition and processing. The weather for the past 24 hours has been rainy with swells, and our speed has slowed down. It now looks like we'll arrive on site Friday evening.

July 10 – The weather has greatly improved, and our speed is back up to about 11 knots. At our daily science meeting Danny gave a presentation about magma chambers, followed by Alejandro's presentation about processing of the layer 2A event. Everyone seems over their seasickness and morale is high.

July 11 – The swells have increased, but our speed has remained above 11 knots. At our daily science meeting I gave a summary presentation about our science plan for the cruise, and Mari Smultea gave an overview about the marine mammals we might expect in our region. Watches started after dinner. At 1900 local time we reached our first waypoint and started deploying 6 OBSs. All went smoothly during deployments, except OBS 6 which got caught on the ropes when the pins were pulled (we brought it back in, reset the pins, and were able to deploy it as the ship was still within 100 m of the deployment location). Tonight we turn our clocks back an hour.

July 12 – We spent several hours collecting multibeam data along the scarp, in order to confirm our basemap in this critical area (we don't want to deploy instruments into the deep by mistake!). Everything checked out, so we proceeded with deploying 6 more OBSs and 4 hydrophone-only instruments. These last 4 instruments were deployed on a narrow horst where the bathymetry was such that we didn't want instruments sitting on anchor frames on the seafloor – we were afraid some might tip over and the instruments would be caught under the frames. At 7:30 a.m. we started deploying the streamer, and had finished by 2:30 p.m. The streamer went in faster than expected considering that it hadn't been used in 9 months! We did change out one streamer section. The only glitch came as we were transferring the streamer to the towing cable, and a strand of the cable broke. But a spare cable was soon found, and within an hour the cable was switched out and the streamer was officially deployed. The marine mammal observers reported that they hadn't seen a marine mammal in 3.5 days, so we were ready to deploy the guns. An hour later the guns were in the water, and we ramped-up to the full 10-gun array.

July 13 – We've been having trouble with the middle of the streamer – birds 11-15 have been sinking. The streamer looked ok for the first 2 lines, but Kirk really had trouble during the night after the ship made a turn. We've decided to bring the streamer in after Line 106 in order to take off some weights. We've also encountered a 1 knot current running from east to west. We've had to slow the ship down to 4 knots when going east to west, and speed it up to 5 knots when going from west to east. Ok, streamer work is over. The big surprise came when we got to the suspect section and found a missing bird – the couplings were sheared right off. When we got to the next bird we found the missing bird next to it, hanging from a little cord (the bird is attached by 2 metal couplings, and the cord just wraps around the streamer). This was obviously the cause of our problem! After a break (chocolate chip cookies hot out of the oven fortuitously were available) we started putting the streamer back out. However, after putting out a few sections the streamer still seemed heavy, so we brought it back in and started taking off one weight every section. This seemed to do the trick. We also changed out two sections – one that looked low on oil, and another that had sprung a leak while being put on the reel. The whole process, including getting back on line, took about 8.5 hours. We are now acquiring data along Line 104, and the streamer looks good.

July 14 – Today was uneventful, and the streamer looks good. The highlight of the day was the construction of a ping-pong table out of a sheet of plywood resting on 2 OBS racks.

July 16 – Data acquisition has continued with only a few minor problems (missed shots when the navigation computer locked up). The watchstanders have done an excellent job of spotting problems and fixing them quickly.

July 17 – Today we had our first whale sighting, right at the edge of the 1.3-km safety radius. It happened during the shooting of Line 311, which is an OBS line. The protocol is to wait 30 minutes without seeing the whale within the safety radius, and then to ramp up the guns. Since the ship would move about 3 nm (5.6 km) during this time, I decided to turn the ship and get back to the point where we stopped shooting. This took almost 2 hours. The whale was not sighted again, and we are back along Line 311 only a little behind schedule.

July 18 – Today the streamer developed a problem and stopped recording data. Fortunately this happened while we shooting a line at OBS shot spacing and were not concerned with the

MCS data. After we finished the line we pulled in the streamer and replaced the can that seemed to be the problem according to the readings we had on board the ship. The replacement can did indeed fix the problem, so within 2 hours we were ready to go again. However by this time we were out of position for the next lines we wanted to shoot, so it took several hours to begin shooting our next profile. The weather was perfect while we were working on the streamer – not too hot because of the wind and clouds – so everyone enjoyed getting out of the lab for awhile. On another note, Steffen has put together a doubles ping-pong tournament for the weekend.

July 20 –The doubles ping-pong tournament has been a big hit, and the finals game between Steffen/Mari and Alejandro/Matt was played at 8:15 p.m. Alejandro and Matt were the winners, and were presented with t-shirts designed by Steffen. At 10:30 we finished Line 207, and began bringing in the guns and streamer.

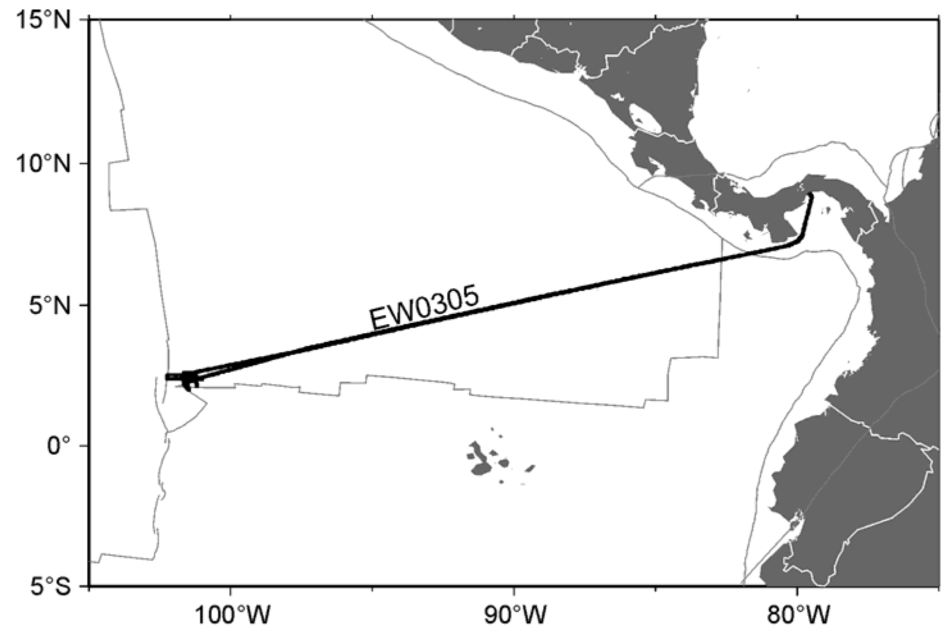
July 21 – The streamer recovery took longer than expected, and didn't finish until 6:30 a.m. Afterwards we steamed to OBS 11 to begin recoveries. The first OBS was acoustically released at 8:10 a.m., and on board by 9:14. OBS recoveries will continue until tomorrow afternoon.

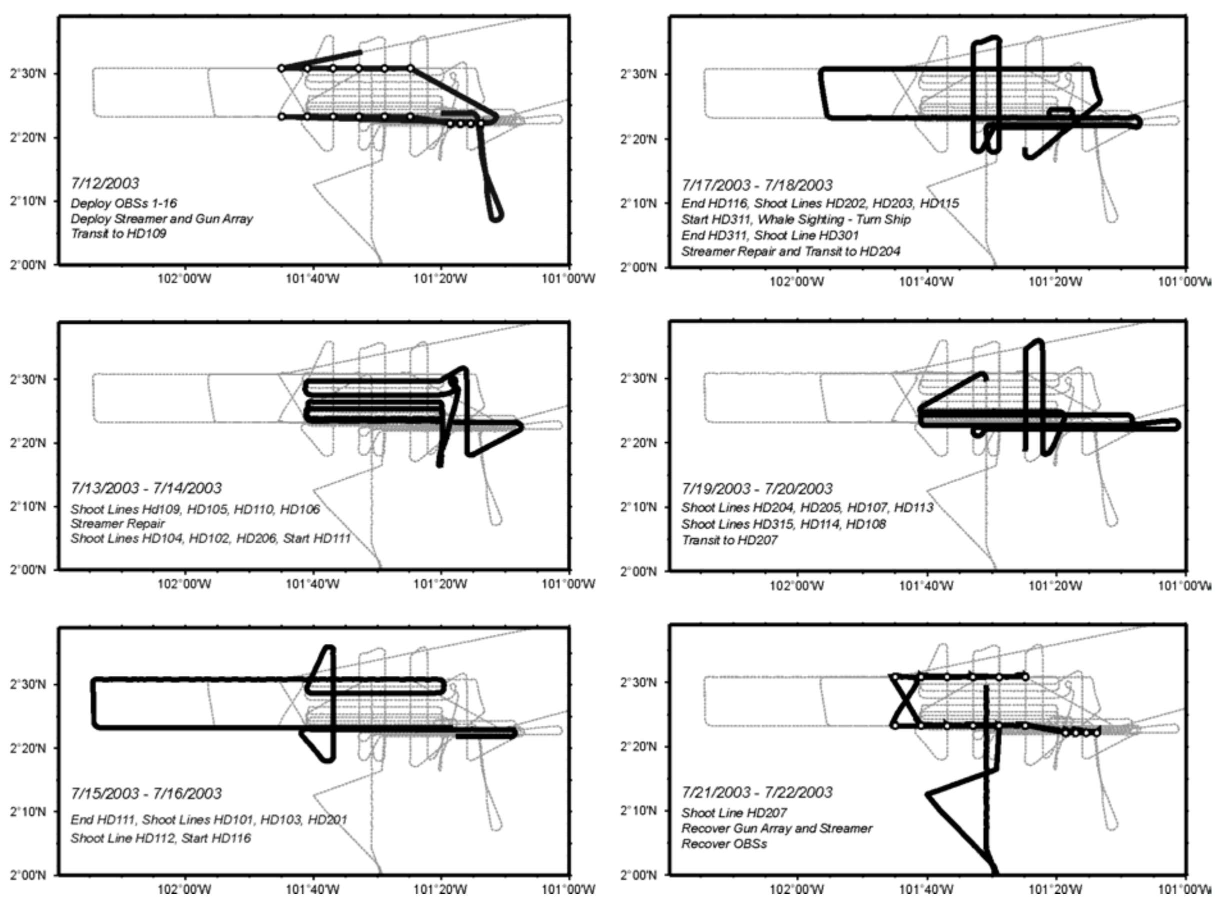
July 22 – OBS recoveries continued uneventfully until the last 5 instruments. OBS 12 did not come up on the acoustic release, but did come up on the timed release. OBSs 13, 15, and 16 did not come up on timed release and were not recovered. These instruments were located in a topographically rough region, and had been modified so that they were tethered ~1 m above an anchor. Although this design had been tested, it obviously didn't work as expected in our study region (although OBS 14 did come back). After waiting around for an extra hour listening to all 3 beacon channels, we started our transit back to Panama.

Detailed Summary, Cruise Activities

Task	Time (Date, GMT)
Leave Panama	7/6/2003 15:00
Deploy OBS #1	7/12/2003 1:11
Deploy OBS #2	7/12/2003 1:45
Deploy OBS #3	7/12/2003 2:19
Deploy OBS #4	7/12/2003 2:52
Deploy OBS #5	7/12/2003 3:28
Deploy OBS #6	7/12/2003 4:06
Start of Scarp Multibeam	7/12/2003 5:45
Deploy OBS #7	7/12/2003 9:35
Deploy OBS #8	7/12/2003 10:09
Deploy OBS #9	7/12/2003 10:41
Deploy OBS #10	7/12/2003 11:13
Deploy OBS #11	7/12/2003 11:47
Deploy OBS #12	7/12/2003 12:23
Deploy OBS #13	7/12/2003 13:16
Deploy OBS #14	7/12/2003 13:31
Deploy OBS #15	7/12/2003 14:00
Deploy OBS #16	7/12/2003 14:20
Finish Streamer and Gun Deployment	7/12/2003 21:19
SOL HD109	7/13/2003 0:07
EOL HD109	7/13/2003 3:58
SOL HD105	7/13/2003 4:48
EOL HD105	7/13/2003 9:45
SOL HD110	7/13/2003 10:38
EOL HD110	7/13/2003 14:22
SOL HD106	7/13/2003 15:05
EOL HD106	7/13/2003 20:30
Finish Streamer Repair	7/14/2003 3:00
SOL HD104	7/14/2003 5:03
EOL HD104	7/14/2003 8:41
SOL HD102	7/14/2003 9:30
EOL HD102	7/14/2003 15:00
SOL HD206	7/14/2003 16:30
EOL HD206	7/14/2003 19:14
SOL HD111	7/14/2003 22:22
EOL HD111	7/15/2003 10:19
SOL HD101	7/15/2003 12:12
EOL HD101	7/16/2003 1:38
SOL HD103	7/16/2003 2:21
EOL HD103	7/16/2003 6:15
SOL HD201	7/16/2003 8:40
EOL HD201	7/16/2003 12:19
SOL HD112	7/16/2003 14:12
EOL HD112	7/16/2003 21:50
SOL HD116	7/16/2003 23:24
EOL HD116	7/17/2003 2:28
SOL HD202	7/17/2003 3:43
EOL HD202	7/17/2003 7:08
SOL HD203	7/17/2003 8:25
EOL HD203	7/17/2003 11:50

SOL HD115	7/17/2003 13:20
EOL HD115	7/17/2003 18:11
SOL HD311	7/17/2003 19:14
Whale Sighting, Turned Ship	7/17/2003 21:23
Back on Line, Firing	7/17/2003 23:17
EOL HD311	7/18/2003 6:45
SOL HD301	7/18/2003 9:00
EOL HD301	7/18/2003 19:00
Finish Streamer Repair	7/18/2003 20:43
SOL HD204	7/19/2003 0:00
EOL HD204	7/19/2003 3:28
SOL HD205	7/19/2003 4:36
EOL HD205	7/19/2003 8:06
SOL HD107	7/19/2003 10:14
EOL HD107	7/19/2003 14:25
SOL HD113	7/19/2003 15:07
EOL HD113	7/19/2003 22:47
Switch to OBS Shooting	
SOL HD315	7/20/2003 1:08
EOL HD315	7/20/2003 6:56
Switch to MCS Shooting	
SOL HD114	7/20/2003 8:42
EOL HD114	7/20/2003 13:25
SOL HD108	7/20/2003 14:00
EOL HD108	7/20/2003 20:55
SOL HD207	7/21/2003 0:06
EOL HD207	7/21/2003 5:34
Finish Streamer and Gun Recovery	7/21/2003 13:30
Recover OBS #11	7/21/2003 16:14
Recover OBS #9	7/21/2003 18:10
Recover OBS #7	7/21/2003 20:14
Recover OBS #2	7/21/2003 22:19
Recover OBS #4	7/22/2003 0:35
Recover OBS #6	7/22/2003 2:51
Recover OBS #5	7/22/2003 4:37
Recover OBS #3	7/22/2003 6:44
Recover OBS #1	7/22/2003 8:50
Recover OBS #8	7/22/2003 11:02
Recover OBS #10	7/22/2003 13:05
Recover OBS #12 (On timed release)	7/22/2003 17:04
OBS 13 Not Recovered	
Recover OBS #14 (On timed release)	7/22/2003 19:52
OBS 15 Not Recovered	
OBS 16 Not Recovered	
Leave Hess Deep	7/22/2003 23:30
Anticipated Arrival, Panama	7/28/2003 15:00


15°N
10°N
5°N
0°
5°S
100°W
90°W
80°W
EW0305


2°30'N
2°20'N
2°10'N
2°00'N
102°00'W
101°40'W
101°20'W
101°00'W
7/12/2003
Deploy OBSs 1-16
Deploy Streamer and Gun Array
Transit to HD109
7/17/2003 - 7/18/2003
End HD116, Shoot Lines HD202, HD203, HD115
Start HD311, Whale Sighting - Turn Ship
End HD311, Shoot Line HD301
Streamer Repair and Transit to HD204
7/13/2003 - 7/14/2003
Shoot Lines Hd109, HD105, HD110, HD106
Streamer Repair
Shoot Lines HD104, HD102, HD206, Start HD111
7/19/2003 - 7/20/2003
Shoot Lines HD204, HD205, HD107, HD113
Shoot Lines HD315, HD114, HD108
Transit to HD207
7/15/2003 - 7/16/2003
End HD111, Shoot Lines HD101, HD103, HD201
Shoot Line HD112, Start HD116
7/21/2003 - 7/22/2003
Shoot Line HD207
Recover Gun Array and Streamer
Recover OBSs

Source Array for Hess Deep reflection profiling:

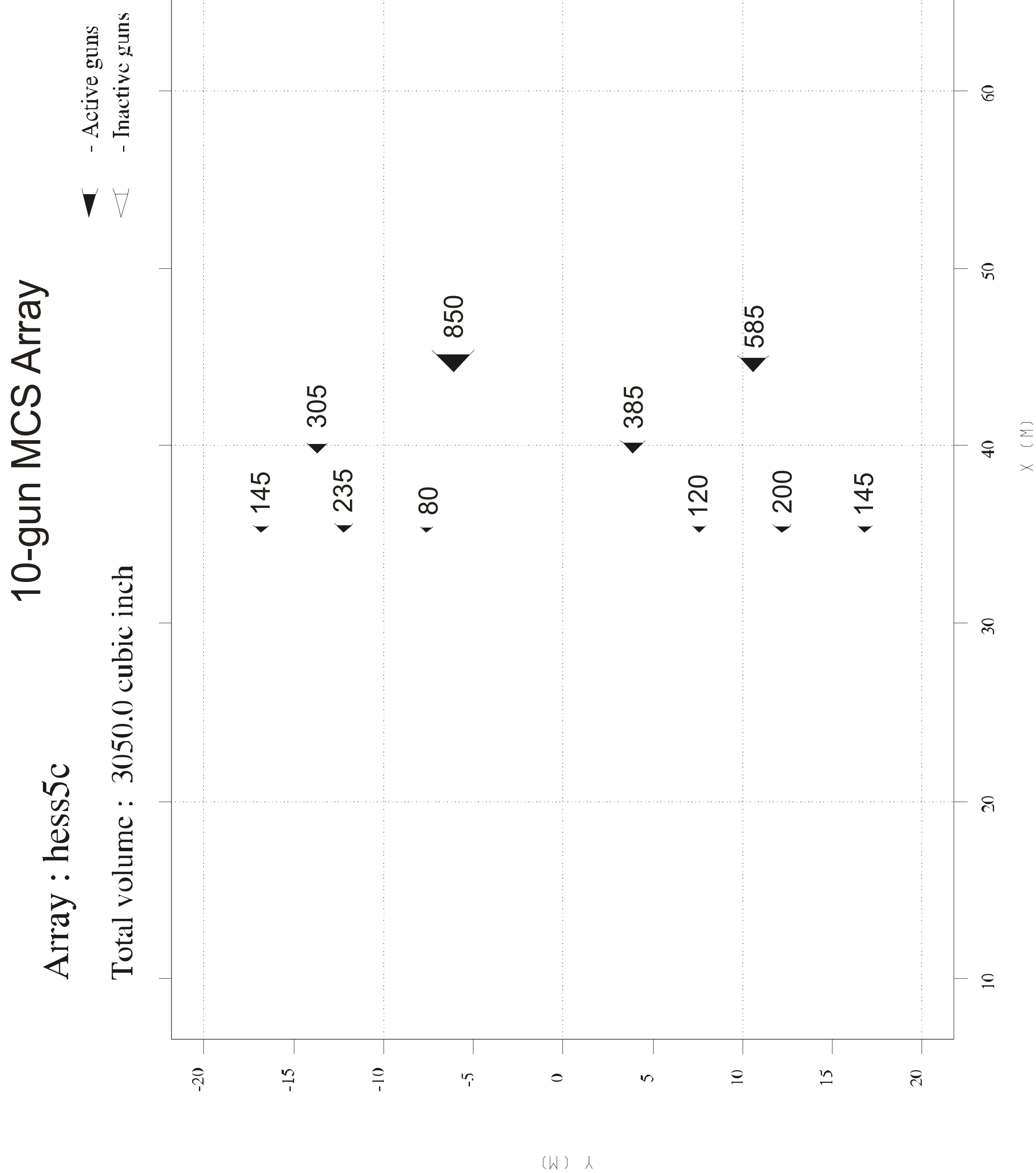
We made one modification to the typical R/V Ewing (Diebold), 10-airgun array for oceanic crustal profiling. We removed the 540 cu.in. airgun from y=-3.9 (position 9) and added a 585 cu.in. airgun at y=10.6m (position 16). We towed the array at 7 m depth using floats.

Number of guns (Bolt 1500C): 10

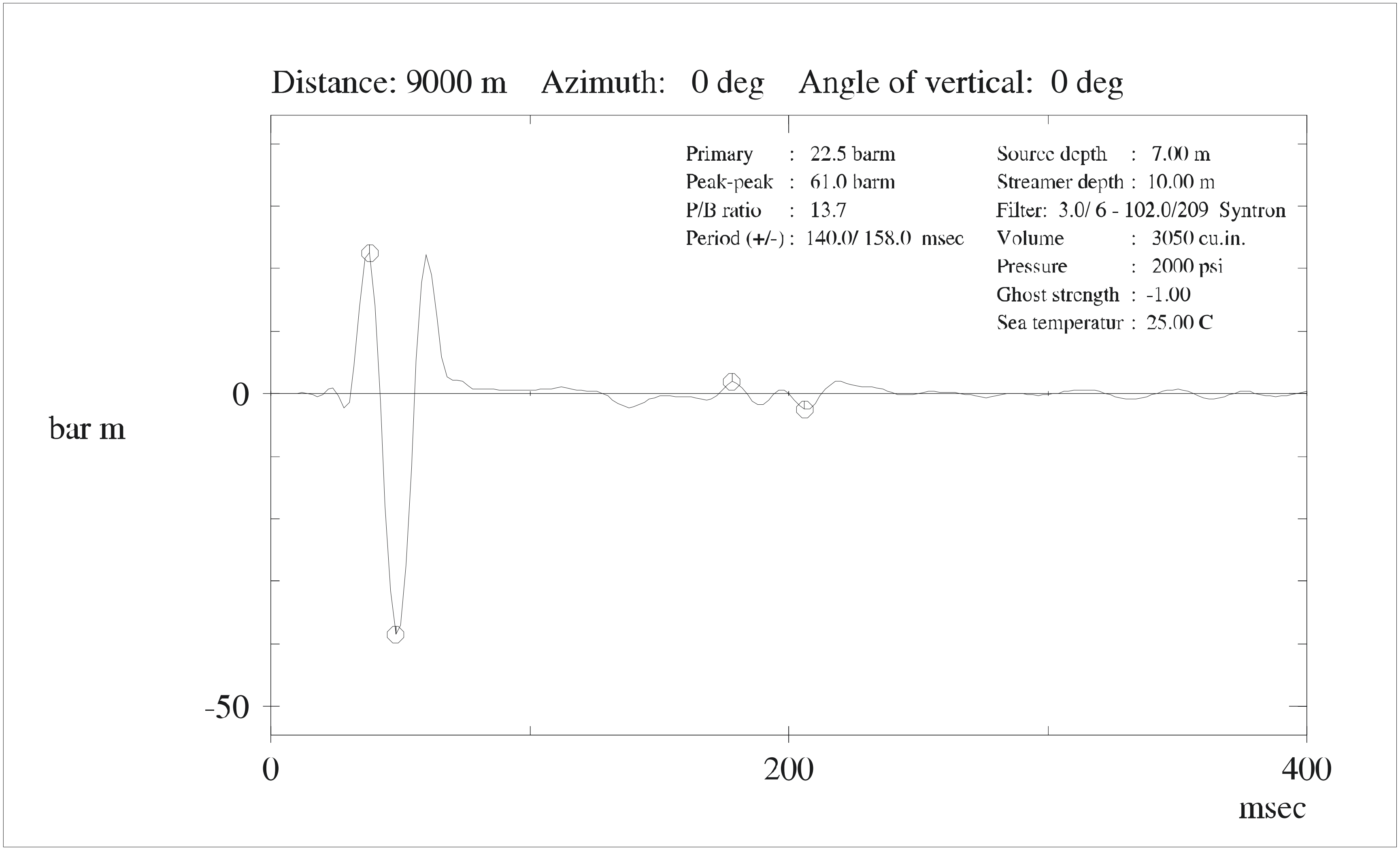
Gun numbers relative to the R/V Ewing 20 airgun array:
(gun numbers increasing from starboard to port)

GUN	X(m)	Y(m)	Z(m)	VOL(cu)	PR(psi)
1	35.10	-16.80	7.00	145.00	2000.0
3	39.60	-13.70	7.00	305.00	2000.0
4	35.10	-12.20	7.00	235.00	2000.0
7	35.10	-7.60	7.00	80.00	2000.0
8	44.20	-6.10	7.00	850.00	2000.0
12	39.60	3.90	7.00	385.00	2000.0
14	35.10	7.60	7.00	120.00	2000.0
16	44.20	10.60	7.00	585.00	2000.0
17	35.10	12.20	7.00	200.00	2000.0
20	35.10	16.80	7.00	145.00	2000.0
SPARE:					
2	39.60	-15.30	7.00	850.00	2000.0

Shot spacing was 37.5 m, and we attempted to keep the ship speed over ground at ~4.5 knots. A strong (~1 knot) current from east to west made this difficult, and thus the ship speed was often faster when shooting from east to west and slower when shooting from west to east. After the first 2 profiles the recording length was decreased from 12 sec to 11 sec because some shots were being missed when shooting from east to west. Recording length was increased again to 12 sec for profile 207 which crossed over the rift axis.


10-gun MCS Array
Array : hess5c
Total volume : 3050.0 cubic inch
- Active guns
- Inactive guns
145
235
80
305
850
385
120
200
145
585
X (M)
Y (M)
10
20
30
40
50
60
70
-20
-15
-10
-5
0
5
10
15
20

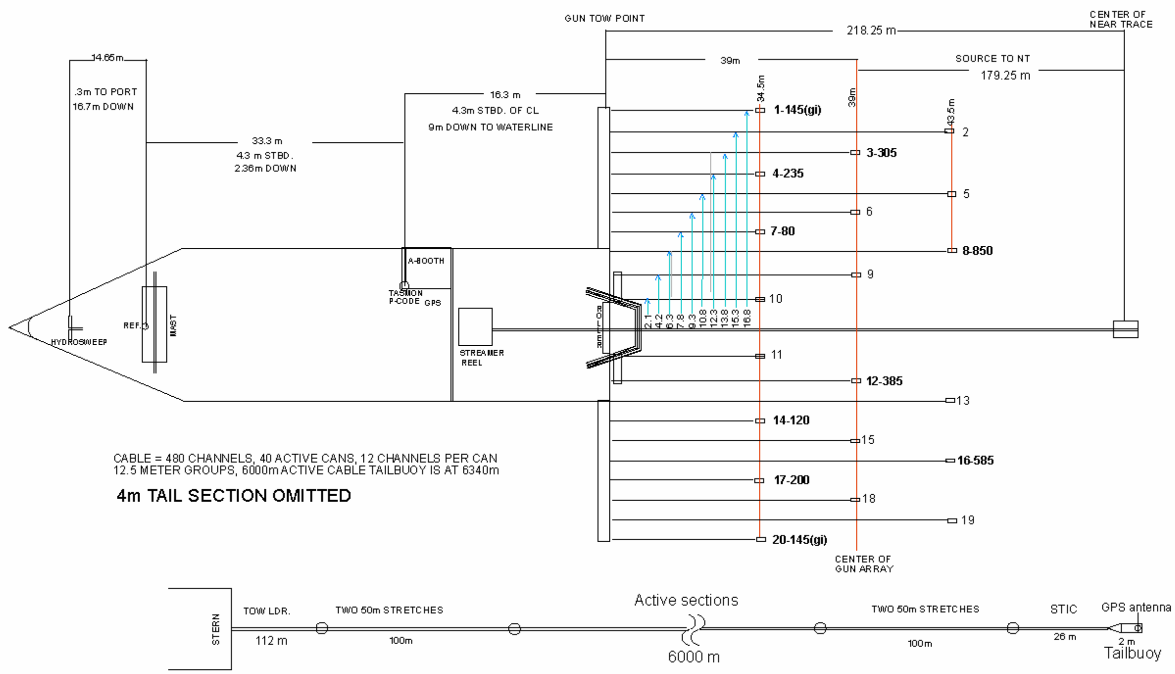
Far-field signature of array: hess5c



hess5c: Same as Diebold except rem 540@-3.9 add 585@10.6

EW-0305 Christeson

MAURICE EWING MCS SETBACK AND OFFSET DIAGRAM



SCI OFF Joe Stennett July 2003

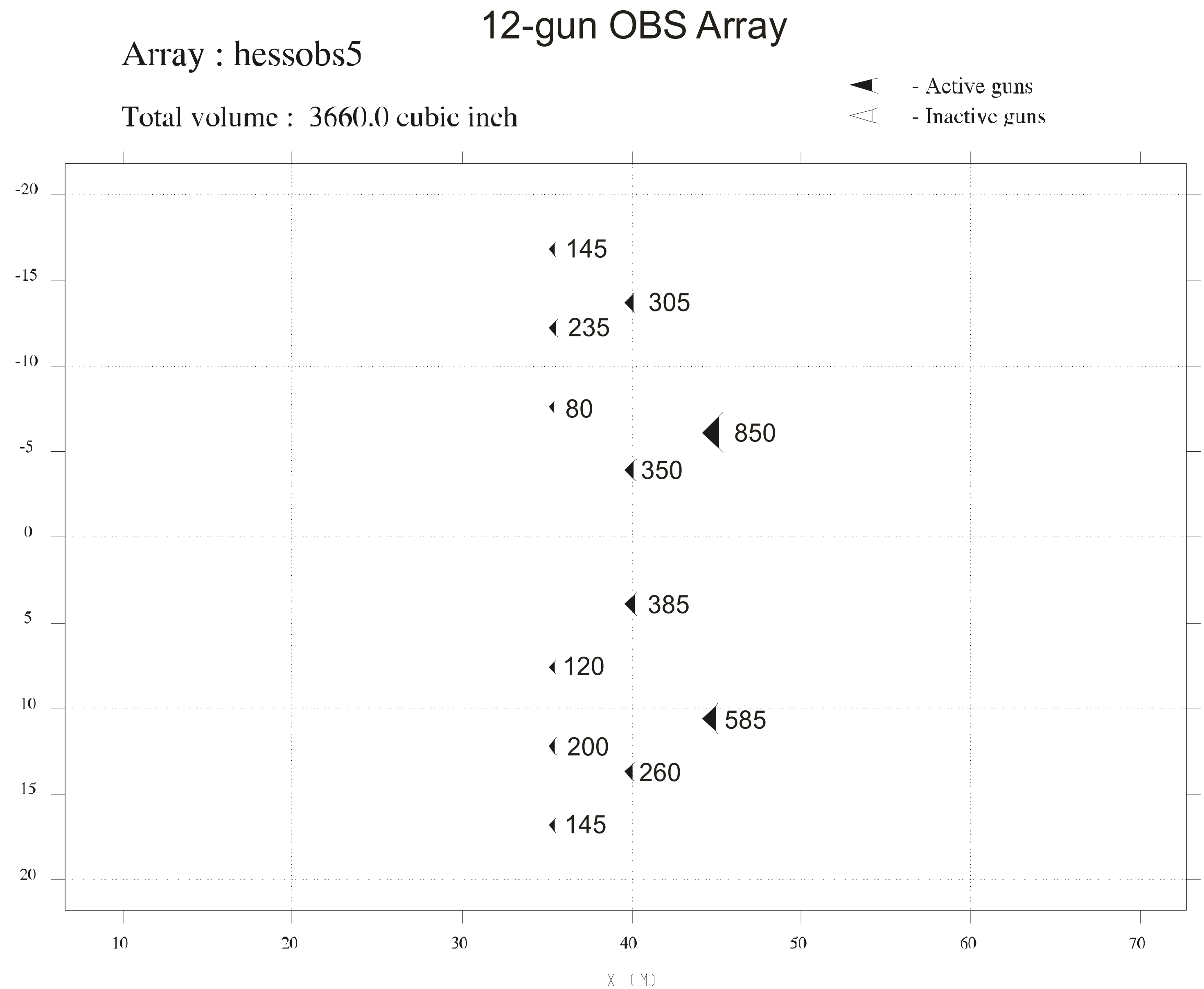
Source Array for Hess Deep refraction shooting:

For **REFRACTION PROFILING**, we added **two additional airguns** to the MCS array in positions 9 and 18:

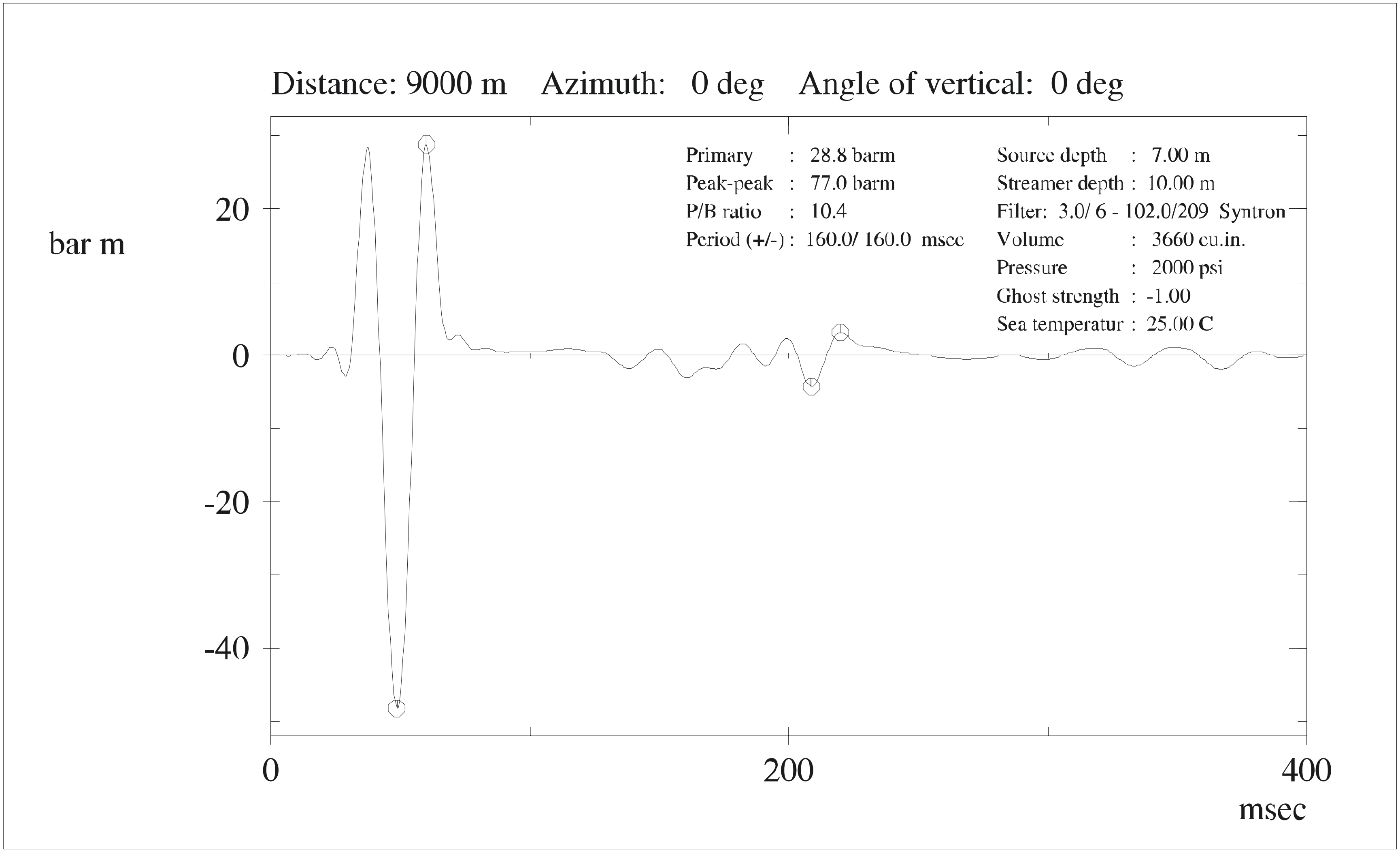
Number of guns: 12

GUN	X(m)	Y(m)	Z(m)	VOL(cu)	PR(psi)
1	35.10	-16.80	7.00	145.00	2000.0
3	39.60	-13.70	7.00	305.00	2000.0
4	35.10	-12.20	7.00	235.00	2000.0
7	35.10	-7.60	7.00	80.00	2000.0
8	44.20	-6.10	7.00	850.00	2000.0
9	**39.60**	**-3.90**	**7.00**	**350.00**	**2000.0**
12	39.60	3.90	7.00	385.00	2000.0
14	35.10	7.60	7.00	120.00	2000.0
16	44.20	10.60	7.00	585.00	2000.0
17	35.10	12.20	7.00	200.00	2000.0
18	**39.60**	**13.70**	**7.00**	**305.00**	**2000.0**
20	35.10	16.80	7.00	145.00	2000.0
SPARE:					
2	39.60	-15.30	7.00	850.00	2000.0

Shot spacing was 200 m when going from east to west (Lines 311 and 315), and 150 m when going from west to east (Line 301).


12-gun OBS Array
Array : hessobs5
Total volume : 3660.0 cubic inch
- Active guns
- Inactive guns
145
305
235
80
850
350
385
120
585
200
260
145
-20
-15
-10
-5
0
5
10
15
20
Y (M)
10
20
30
40
50
60
70
X (M)

Far-field signature of array: hessobs5

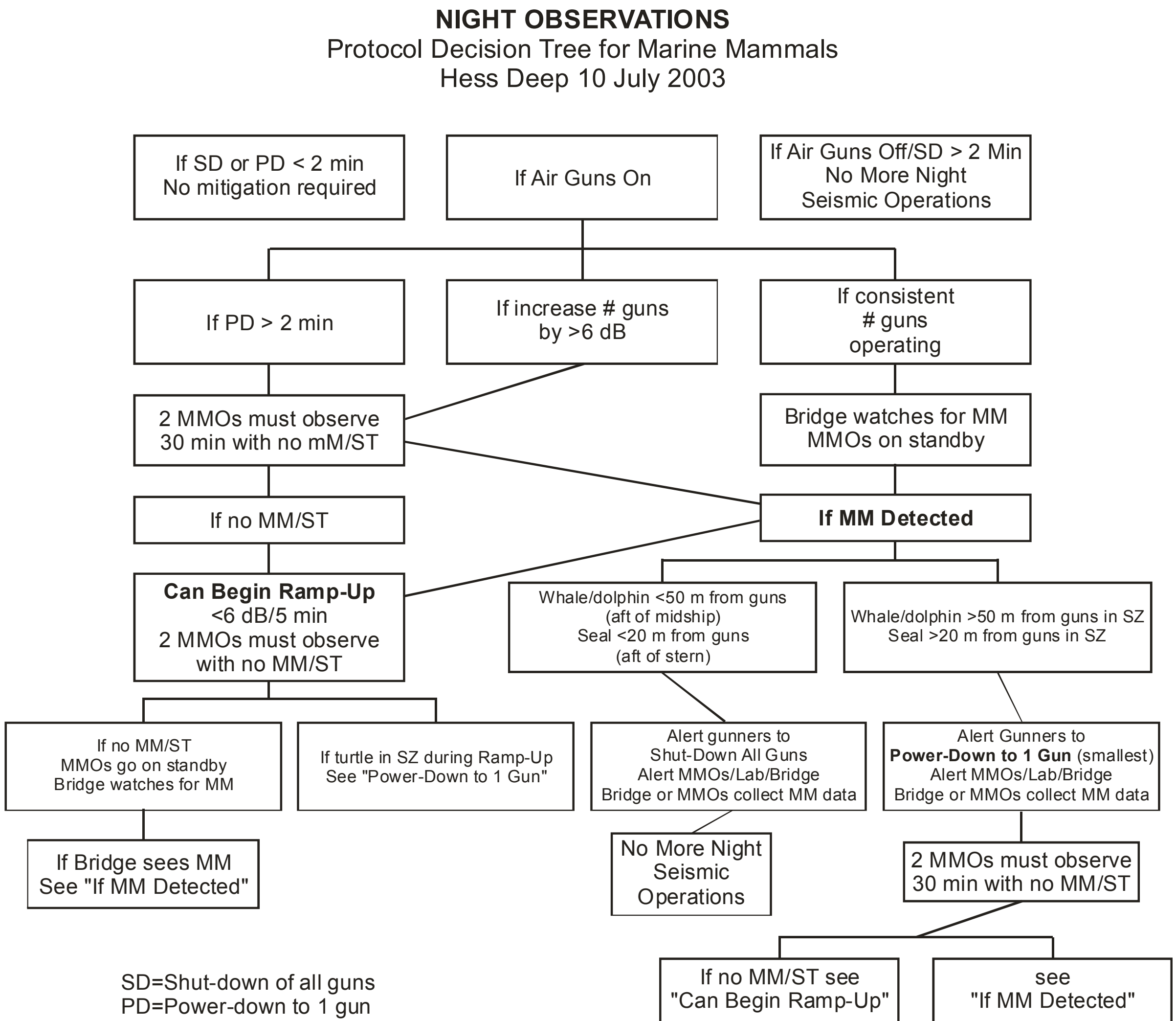


Modified Hess.obs4: substitute 260 for 305 #18

First and last recorded shots for each MCS line

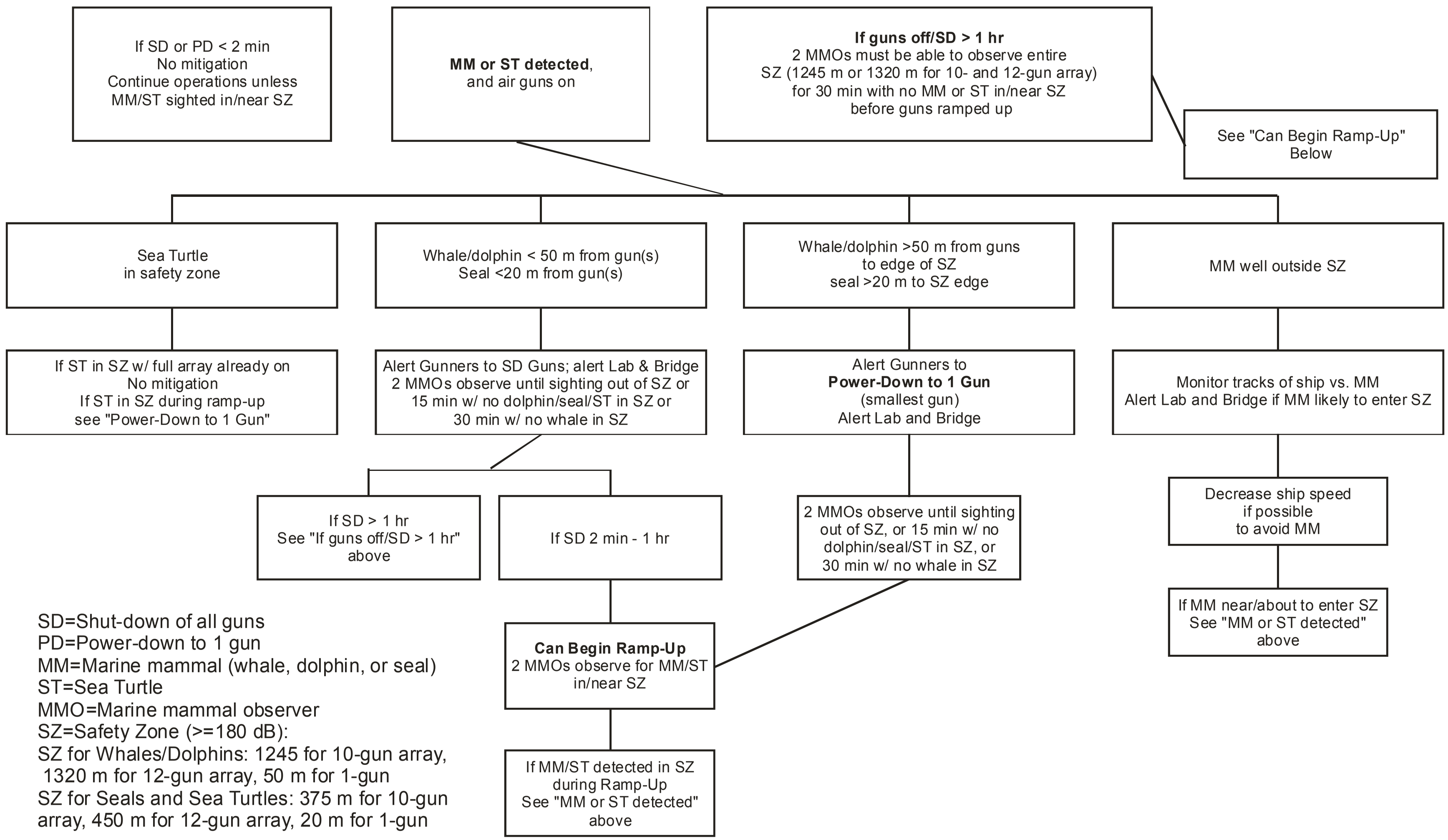
Line	First Shot	Latitude	Longtitude	Last Shot	Latitude	Longtitude
109	29	2.39607	-101.34832	984	2.39612	-101.67031
105	2	2.44213	-101.67152	984	2.44127	-101.34042
110	23	2.38985	-101.34629	984	2.39162	-101.67031
106	3	2.42336	-101.67118	984	2.42330	-101.34042
104	5	2.45934	-101.34022	984	2.45959	-101.67033
102	24	2.49584	-101.66410	983	2.49562	-101.34074
206	42	2.49077	-101.26719	567	2.31273	-101.26731
111	4	2.38724	-101.15228	3170	2.38726	-102.21974
101	1	2.51423	-102.22064	2614	2.51368	-101.34037
103	20	2.47832	-101.34525	984	2.47762	-101.67028
201	1	2.57219	-101.61565	767	2.31241	-101.61531
112	2	2.38263	-101.67157	1540	2.38270	-101.15301
116	69	2.36460	-101.27331	699	2.36450	-101.48573
202	9	2.31355	-101.54859	765	2.56995	-101.54788
203	1	2.57219	-101.48162	766	2.31278	-101.48112
115	1	2.36904	-101.48757	994	2.36879	-101.15277
311	1	2.38678	-101.15122	421	2.38707	-101.90641
301	2	2.51364	-101.90730	409	2.51387	-101.35837
204	1	2.31084	-101.41474	766	2.57026	-101.41392
205	1	2.57219	-101.36992	767	2.31243	-101.36957
107	3	2.41445	-101.33948	983	2.41424	-101.66993
113	1	2.37845	-101.67192	1540	2.37813	-101.15303
315	1	2.36930	-101.04936	245	2.36905	-101.48810
114	1	2.37354	-101.48759	994	2.37356	-101.15277
108	3	2.40569	-101.15189	1540	2.40524	-101.67011
207	3	2.48674	-101.51474	1227	2.07167	-101.51466

Marine Mammal Protocol Decision Trees



SD=Shut-down of all guns
PD=Power-down to 1 gun
MM=Marine mammal (whale, dolphin, or seal)
ST=Sea Turtle
MMO=Marine mammal observer
SZ=Safety Zone (>=180 dB):
SZ for Whales/Dolphins: 1245 for 10-gun array, 1320 m for 12-gun array, 50 m for 1-gun
SZ for Seals and Sea Turtles: 375 m for 10-gun array, 450 m for 12-gun array, 20 m for 1-gun

DAYTIME OPERATIONS
Protocol Decision Tree For Marine Mammals
Hess Deep 10 July 2003



SD=Shut-down of all guns
PD=Power-down to 1 gun
MM=Marine mammal (whale, dolphin, or seal)
ST=Sea Turtle
MMO=Marine mammal observer
SZ=Safety Zone (>=180 dB):
SZ for Whales/Dolphins: 1245 for 10-gun array, 1320 m for 12-gun array, 50 m for 1-gun
SZ for Seals and Sea Turtles: 375 m for 10-gun array, 450 m for 12-gun array, 20 m for 1-gun

EW0305 Hess Deep Processing Shell Scripts

Steffen Saustrup July '03

in /d6/PROGS:

rcp.csh	Copies all SEGY files for a given line from heezen to tico.
segy2focus.csh	Converts individual SEGY files for a given line to Focus format.
marine.csh	Runs marine geometry job for a line.
vel1500.csh	Creates 1500m/s velocity model in database for a given line.
sort.csh	Reads all Focus format files for a line and sorts to cdp.
brutestack.csh	Runs a near-20 channel brute stack using water velocity nmo.
hess.csh	Calls all 6 of the above scripts in turn.
wbvel.csh	Creates water-bottom-based velocity function in database. This need be run only once, other lines will call the velocity function from this line. In this instance I used line 112 and all other lines called the function from line 112.
wbstack.csh	Performs a full-fold stack using a single water-bottom-based velocity function. Writes stacked section as SEGY and Focus format. Optionally, creates a plotfile. User must have picked seafloor time as horizon wb.wb (from brute stack, for instance) for this script to work.
focusplot.csh	Sends all plotfiles in the /GDscr directory to the Atlantek plotter on heezen, deleting them afterwards
shotselect.csh	Selects a single shotgather from a SEGY file, writes to a new SEGY file.
shotrange.csh	Selects a range of shotpoints from a SEGY file, writing to a new SEGY file
shots.csh	Selects a range of shotpoints, separated by an increment, from a SEGY file and writes to individual files, one shot per file.

WB velocity function used in Hess Deep stacks:

Time relative to sf	Interval vel above
seafloor	1500
350 ms	3200
1000	5850
1800	6350
3000	6850
end	7200

EW0305 Hess Deep Scripts for Copying and Processing Seisnet MCS files

Steffen Saustrup July '03

EW0305 was the first cruise to use the new .tcl scripts and accompanying sioseis/csh scripts, developed by Ethan Gold and Paul Henkart, to reformat, copy, and process "seisnet" MCS files in real-time.

Seisnet Files

Seisnet files are MCS shotfile data written in "seisnet" format (pseudo-SEGD) to /data, a RAID filesystem of about a terabyte on host heezen. Each seisnet file contains exactly one shot record, and is written in real-time using a naming convention that includes FFID (SEGD file number, as opposed to shot number) and a time stamp (strange units, something like "seconds since 1/1/1970"). For instance, seisnet file "FFID_248%1058593648" contains a single shot record, corresponding to one SEGD file on a 3490 tape, with an FFID of 248 and time stamp of 1058593648. Note that this time stamp is neither the time given to the UI script nor the time listed in the trace headers. Also note that FFID will not be unique during the course of a cruise, but that the time stamp will be unique. For EW0305 (240 channel, 12 seconds, 4 ms), each seisnet file was ~2.9 Mbytes.

As seisnet filenames are somewhat cryptic, you can use the "seisinfo" utility to list information about a single seisnet file or a list of files. Just type "seisinfo" and the pathname for one or more seisnet files in a terminal window. For instance, the command:

seisinfo /data/seisnet/0305/ FFID_248%1058593648

will return Line #, shotpoint, and jday/gmt information about this file. This is most useful when restarting the scripts after a stoppage or when limiting the files to input into a real-time stack job.

All seisnet files will be written to the same directory on /data. See the directory structure below.

In general, the seisnet files are a direct image of what's being written to 3490 tape; if data are being recorded to 3490 they're also being written to /data in seisnet format. However, during EW0305 we did have one instance when the seisnet computer crashed and data were written to tape but not to disk. Should this occur, the only clues to watchstanders will be that the RAID drive (behind watchstanders at knee level) will not blink after every shot, and that the seisnet screen (in the right hand corner of the watchstander station) will not update with an image of each new shot record. This is easy to miss, since the shot records look very similar. Should seisnet fail, alert the sysadmin and then later recover the shots from 3490 tape.

About the Scripts

The seisnet scripts run on heezen, write to disk on heezen, write to tape on heezen, and plot to the Atlantek on heezen. The actual script names are somewhat cumbersome, so I've included them in the path for user sioseis and I've aliased them in the .cshrc file as simply "seis2disk", "seis2tape", "tape2tape", and "seis2stack".

The 4 scripts are:

seis2disk – Reads seisnet, writes as SEGY on disk.
seis2tape – Reads seisnet, writes as SEGY on tape.
seis2stack – Reads seisnet, performs a simple "real-time" stack, writes stacked section as SEGY, writes an output plotfile. This script is generally accompanied by running the sioseisprocess "atlantek", which plots a sioseis plotfile as it is being generated.
tape2tape – Reads SEGD 3490, writes SEGY on tape.

Each script consists of a user interface (UI) written in tcl, and an accompanying sioseis cshell script which is called by the UI. The sioseis script actually does the work, the UI manages input file lists, tape drives, etc. Users may choose to use the default sioseis scripts, which are centrally located, or may copy these scripts and edit them to perform customized functions. Users maintain "config" files to save UI parameter sets.

Any user tape devices (DAT or other) for SEGY output should be mounted on heezen and given an "nrst" link such that /dev/nrst# points to /dev/rmt/#bn. This # then becomes the "drive number" called by the UI.

You must run a copy of the script for each process. If writing to more than one tape device, run a copy of seis2tape for each tape device. Each script must be run in a different working directory so as not to corrupt the sioseis temporary files. During EW0305 we concurrently ran a seis2disk script, 3 seis2tape scripts (DLT and 2 DAT copies), and a seis2stack script – for a total of 5 scripts running on heezen. The CPU was able to keep up easily.

The UI scripts and their associated sioseis scripts are all located in /data/sioUI. For each script I have created a symbolic link which points to a .tcl script, which in turn calls a sioseis script. The UI manages the sioseis script, which does the actual work. They are:

my link		actual UI script	sioseis script
seis2disk	=>	sioUI-seis2disk.tcl	seis2disk_sioseis.csh
seis2tape	=>	sioUI-seis2tape.tcl	seis2tape_sioseis.csh
tape2tape	=>	sioUI-tape2tape.tcl	tape2tape_sioseis.csh
seis2stack	=>	sioUI-seis2stack.tcl	seis2stack_sioseis.csh

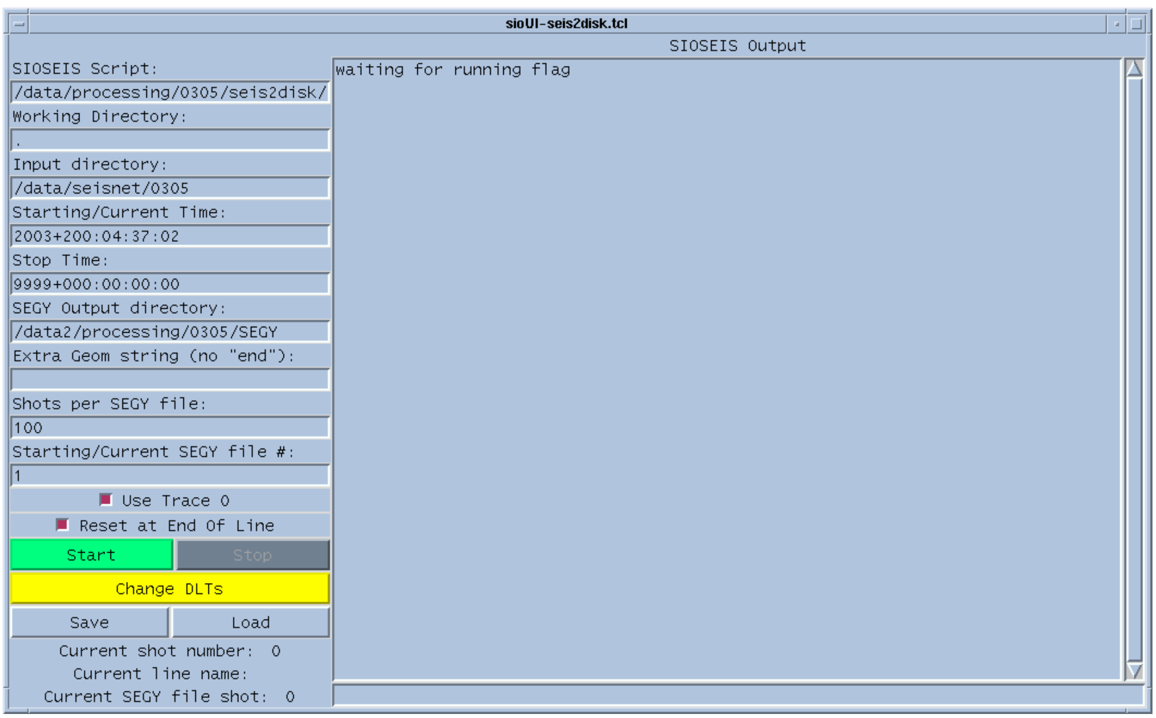
For EW0305, all scripts were run via a telnet session to heezen from one of the UTIG machines and using the $DISPLAY environment variable. If watchstanders are running the scripts it may be more convenient to run directly on heezen, located behind the watchstanders. In either case, login to heezen as user "sioseis". The UI scripts and the default sioseis scripts are not to be altered or customized by users. Any customization should be done by copying the default sioseis scripts to a working directory on /data and editing this copy.

Customizing the Scripts

To customize the scripts, some knowledge of sioseis is necessary. First, login as user "sioseis" (pw is siosieis) to heezen and create the proper working directory as described below. Copy the desired sioseis script (whatever_sioseis.csh) to this working directory and make changes to your copy. You may add, remove, or edit sioseis processes as you wish. Some of the scripts include writing a "circular" SEGY file of every nth shot to disk, this is to be used for real-time data qc. The seis2stack script is the one likely to require user customization. Whatever changes are made, this new sioseis script will then be referenced in the UI.

Script Parameters

The *seis2disk* UI window looks like this:



The parameters are:

-*SIOSEIS script* – defaults to the basic script in /data/sioUI, otherwise give the pathname of a customized sioseis script that you have created. In this example, I'm using my own script (the full pathname is truncated).

-*Working directory* – directory from which to run the sioseis job. In general, use "." if you've already cd'd to your working directory. Note that more than one script using the same working directory will cause bad things to happen.

-*Input directory* – location of seisnet files, in general /data/seisnet/cruise#.

-*Starting/Current Time* – year/jday/gmt of first seisnet file to process. While a script is running, this time will automatically increment with the time of the last file processed, greatly simplifying restarts.

-*Stop Time* – year/jday/gmt of last seisnet file to process. Generally use the default, which is some time in the future (i.e. just keep going).

-*SEGY Output directory* – pathname in which to write SEGY files. Files will be named "Lineno.#.segy", where Lineno is the line name taken from the LDEO header and # is from the "SEGY File #" parameter described below.

-*Extra Geom String* – If desired, enter sioseis "geom" parameters here to write geometry information (cdp #, source-receiver offset, etc) to the trace headers. This requires knowledge of sioseis.

-*Shots per SEGY File* – Number of shots to write into a single output SEGY file. The default is 10, for EW0305 I used 100.

-*Files per Tape* – Number of SEGY files to write to an output tape. Calculate a maximum files based on media capacity and "Shots per Tape File". For EW0305 I used 125 for DLT type 4 and 35 for DDS3.

-*Starting/Current SEGY File #* - This will be the file number used in the output SEGY file name. Use "1" to start. This # will automatically increment with each file written and will reset to 1 at the beginning of a line, so you don't really have to fool with this parameter unless you're restarting after a stoppage.

In addition, the following toggle buttons are found at the bottom of the script:

-*Use Trace 0* – keys the writing of LDEO trace 0 to output disk/tape. In general, toggle this on.

-*Reset at End of Line* – keys the closing of the current output SEGY file and the writing of a new output file when a new line is reached. I find this helpful for bookkeeping.

-*Start* – Starts the script using the current parameters (or restarts after a stoppage).

-*Stop* – Uses the sioseis parameter "in" to halt a script. Wait for the output to show that sioseis has ended, then you may change a tape or restart the script at any time.

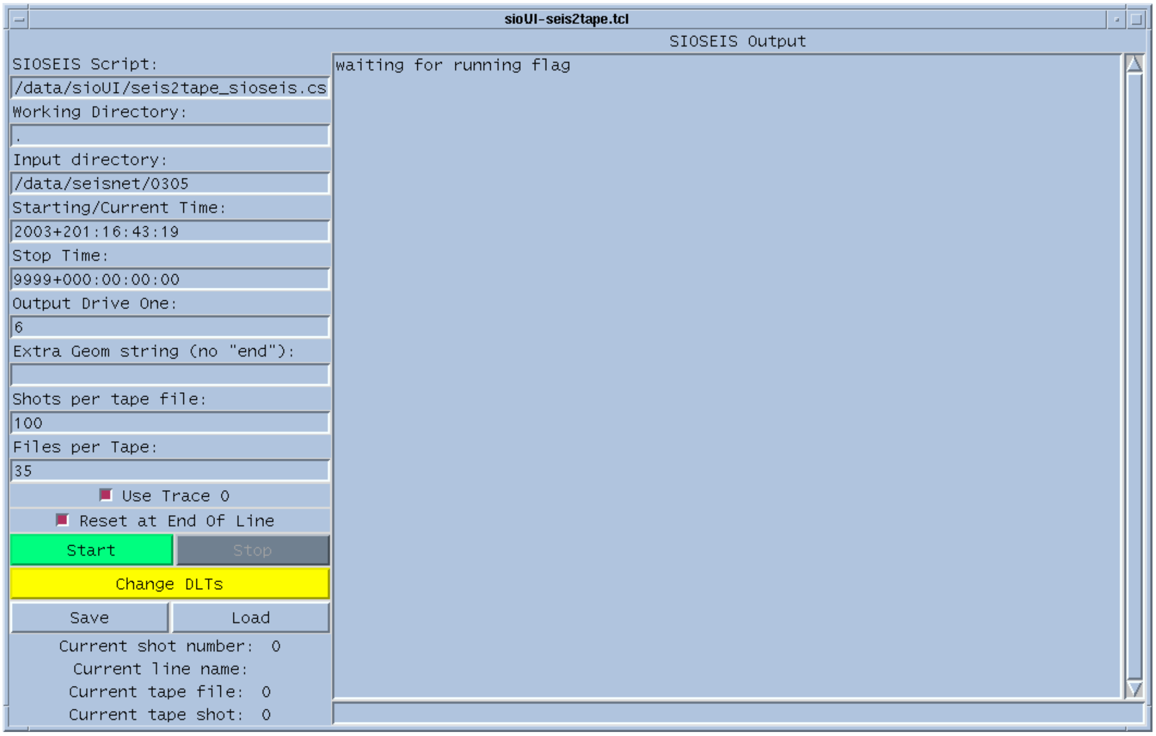
-*Change DLT's* – Rewinds and offlines the tape device. Make sure you hit "Stop" first. This parameter only works in the seis2tape script.

-*Save* – Save the current parameters to a config file. Use this early and often, especially after any stoppage.

-*Load* – Load the contents of a previously-saved config file as the current parameter list.

Note that the current line #, shot #, and output SEGY file # will update at the bottom of the window as the script runs.

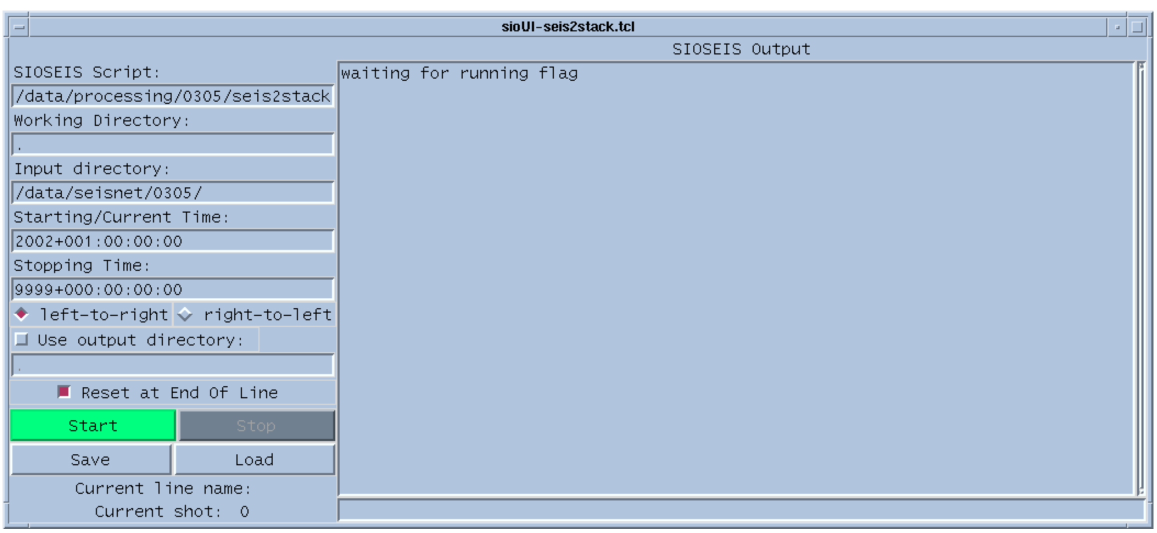
The *seis2tape* UI window looks like this:



The parameters are the same as listed above, with the addition of the following:

-*Output Drive 1* – The number of the output tape drive to write to. Sioseis will attempt to write to drive /dev/nrst#, so make sure the symbolic link mentioned above has been created. The "6" in this example causes SEGY data to be written to /dev/nrst6, which has been aliased to /dev/rmt/6bn.

The *seis2stack* UI window looks like this:



Parameters are the same, with the addition of:

left-to-right/right-to-left – toggle this button to determine the output plot direction. Plotfiles are written to the "stacked_plots" subdirectory of the working directory.

Use output directory – toggle this on and give the pathname of a directory to send stacked SEGY output somewhere other than the default, which is the "stacked_lines" subdirectory of the working directory.

Running the Scripts

Note: The UI scripts handle saving and loading user-named "config" files. These config files save previously-entered parameters and are extremely useful, especially when restarting the scripts after a stoppage. Give the config file a name that identifies its calling script, such as "configstack" or "configrmt2". Saving config files often, especially after any stoppage, will make your life much simpler.

1) Login as user "sioseis" on heezen. Open a new terminal window for each script. If running from a telnet or rlogin session, set the $DISPLAY variable to point back to your host.
2) Start the UI script (simply type the name of the UI script or its alias). Using my aliases I simply type "seis2disk", for example. A UI window will appear.
3) Either load a previously-saved config file with the "load" button or type the parameters in the spaces given. Limit the start/end shots using jday/gmt, or leave these tiimes wide open for continuous processing.
4) Press "Start" and the sioseis script should kick off shortly. It may take a moment to build an input file list first. Output from the script will stream to the right-hand portion of the UI window.
5) To stop or pause a job, press "Stop". You may then change a tape or make any changes you like. To resume the job press "Start". Stopping and starting jobs is fairly robust but may lead to shortened output files.

A logfile will be maintained in the working directory. The scripts seem to run trouble-free, but monitor the window output regularly to make sure that they haven't stopped.

Plotting the real-time stacked data to the Atlantek plotter is accomplished by cd'ing to the plot directory (stacked_plots subdirectory of the working directory) running this:

atlantek *plotfilename*

Line Change

No action is necessary for seis2disk or seis2tape during a line change, the scripts will simply wait for the next incoming seisnet file, will recognize a line change from the linename in the headers, and will automatically close the old SEGY files and open new ones. However, you may wish to save the config file at this time so that the starting/current time will be updated in the config file.

A line change is a good time to stop the seis2stack script, kill the "atlantek" process, and restart them both.

A line change is also a good time to copy SEGY data to your host machine, if desired.

Tape Change

When the user-specified number of files have been written to a tape, the UI script will pause and will prompt the user for a tape change. Press "Stop" and then press "Change DLT" to offline the tape -- or unload the tape manually. Insert a new tape, wait a moment for the new tape to load, and press "Start". That's it.

Restarting after a Stoppage

Once the scripts are running, they seem to be fairly robust and trouble-free. Pressing "Stop" and "Start" is very safe and copying will continue seamlessly. But should a script crash or or should a user kill a UI script and want to resart, here's what to do:

1) Determine the last SEGY shot written to tape or disk (use lst or lsd on output tapes/files or look in the logfile or read the screen ouput).
2) Use "seisinfo" to determine the seisnet file corresponding to the last shot written to tape or disk. Copy the year/jday/gmt info from the seisinfo output.
3) Make sure the output tapes are positioned correctly, or just change tapes if you're unsure.
4) Restart the UI script, if necessary.
5) Load your paramers from a configfile, if available. Otherwise type in your parameters manually.
6) Update the Starting/Current Time to reflect the last shot written.
7) If not using a new tape, reduce the "Files per Tape" by the number of files already written. If writing to disk, change the "Starting/Current SEGY File #" to reflect the next output SEGY disk file for the current line.
8) Press "Start".

Directory Structure on Heezen

Please use the following convention for processing seisnet data on heezen:

disk	directory	subdir	subdir	description
/data/				RAID disk on heezen. About a terabyte.
	sioUI/			All UI and sioseis scripts. Read-only.
	seisnet /			All seisnet files.
		cruise#/		Seisnet files for your cruise. Read-only.
	processing/			All user processing/copying of data.
		cruise#/seis2disk/ cruise#/seis2tape/ cruise#/tape2tape/ cruise#/seis2stack/		These are the working dirs for each of the scripts. CD to the proper dir before running the script, then enter "." as the working directory. If writing to more than one output tape, create a subdirectory as a working dir for each device, e.g. seis2tape/0305/rmt2 for writing to device rmt2 on cruise EW0305.
/data2/				100 Gbyte disk on heezen. General use.
	processing/cruise#			Working dirs or output from scripts. We've used /data2/processing/0305/SEGY for the SEGY output from seis2disk. Be careful of filling up this disk.

Recovered Shot Times

Shot times were recorded in the main lab as part of the MCS recording system, and separately in the OBS lab. In this manner some shot times were collected that were not part of the MCS shot files either because a) the SPECTRA navigation system was firing at the correct location, but there was some problem with the MCS recording, or b) firing during a profile was switched from shooting on distance to shooting on time while the SPECTRA system was rebooted. Below is a list of the recovered shots, generated by Yosio Nakamura.

```
Line 109
 no shot missed
Line 105
 no shot missed
Line 110
 one shot missed before shot  189 at 194:11:15:49.893   1 recovered
 one shot missed before shot  535 at 194:12:36:53.120   1 recovered
Line 106
 no shot missed
Line 104
 one shot missed before shot  669 at 195:07:29:34.533   1 recovered
Line 102
 one shot missed before shot  219 at 195:10:46:34.399   1 recovered
Line 206
 no shot missed
Line 111
  6 shots missed before shot   11 at 195:22:21:26.085   2 recovered
 36 shots missed before shot 1415 at 196:03:37:31.391  24 recovered
Line 101
  6 shots missed before shot    8 at 196:12:14:17.981   4 recovered
 25 shots missed before shot 1455 at 196:19:43:14.630  28 recovered
Line 103
 no shot missed
Line 201
 no shot missed
Line 112
 no shot missed
Line 116
 no shot missed
Line 202
 no shot missed
Line 203
 no shot missed
Line 115
  7 shots missed before shot    9 at 198:13:23:05.247   7 recovered
Line 311
 33 shots missed before shot   35 at 198:19:59:14.379  34 recovered
 27 shots repeated from shot   84 at 198:23:04:53.592
Line 301
  8 shots missed before shot   12 at 199:09:10:45.692  18 recovered
```

Line 204
56 shots missed before shot 58 at 200:00:14:42.248 55 recovered
one shot missed before shot 188 at 200:00:50:18.976 1 recovered
Line 205
34 shots missed before shot 36 at 200:04:45:52.878 32 recovered
one shot missed before shot 42 at 200:04:47:38.330 0 recovered
Line 107
no shot missed
Line 113
8 shots missed before shot 10 at 200:15:06:48.740 7 recovered
Line 315
3 shots missed before shot 5 at 201:01:12:59.286 5 recovered
one shot missed before shot 7 at 201:01:15:44.626 2 recovered
Line 114
42 shots missed before shot 44 at 201:08:54:38.291 41 recovered
Line 108
no shot missed
Line 207
no shot missed

Hess Deep R/V Ewing navigation data processing on grampus

Yosio Nakamura

Step 1: Obtain line time information for general reference
 Program getlinetimes.f
 Input: shotlog.Line* in /data/raw/0305
 Output: linestend.hd in hd/navs
  - Lists start and end times of each line
  - Automatically updated with program run

Step 2: Obtain a set of shot times and coordinates for each line
 Program tsn2tsl.f
 Input: ts.n* in /data/processed/0305
 Output: ts.l* in hd/navs
  - Contains shot number, shot time and coordinates of the ship's navigation reference point in decimal degrees for each shot

Step 3: Perform a simple QC of file ts.l*, and fill gaps, if possible.
 Program tslqc.f
 Input: ts.l* in hd/navs
 Output: tslqc.* in hd/navs
  - Lists gaps in shot numbers, if any, and range and mean of shot intervals, latitude increments and longitude increments
  - Gaps may be either (A) what appears to be a logging miss by ship's computer or (B) a loss of shot control lasting for an extended time.
  - In case (A), running program findmsts.f will tell us if the missed shot times are available in PowerBook-logged shot time file, stpb.* in hd/shottimes. If so, run program recovms.f to recover the missed shots in file ts.l* with those from file stpb.*. Linear interpolation for shot coordinates is used because shot spacing is known to be highly regular.
  - In case (B), PowerBook-logged shot time file stpb.* in hd/shottimes may show that shots were fired at constant time intervals during the gap. If so, make a subset of file stpb.*, named stpb.*.s*, in hd/shottimes containing the missed shots, and run program findll4stpb.f to generate a list of shot times and shot coordinates to be filled into file ts.l*. The ship's reference coordinates are taken form file gp4,c* in /data/reduction/0305/clean. Then manually edit these lines into file ts.l*.

Step 4: Obtain ship's heading at each shot time
 Program tsl2tslh.f
 Input: hdt.s* in /data/reduction/0305/clean
 Output: tslh.* in hd/navs
  - Ship's heading is added to the list of file ts.l*

Step 5: Obtain water depth

Program hb2wd.f
Input: hb.n* in /data/processed/0305
Output: wd.* in hd/navs
- Lists water depth from Hydrosweep center beam at 1 minute interval

Step 6: Apply necessary corrections and generate OBSTOOL-format shot files
Program navcorrhd.f
Input: tslh.* and wd.* above
Output: shotfile.* in hd/forobstool
- Shot coordinates are computed from the coordinates of the ship's navigation reference point first by moving it to the gun tow point at the stern of the ship in the reverse direction of the ship's heading and then by moving it from there to the center of the gun array backtracking its path.
- Water depth is computed by estimating the time when the Hydrosweep transducer was at or near the current shot point and interpolating the Hydrosweep center beam depth to that time.
- The parameters used for the corrections are:
  * Distance from the ship's navigation reference point to the gun tow point is 49.6 m.
  * Distance from the gun tow point to the center of the gun array is 39 m.
  * Hydrosweep transducer is located 14.65 m ahead of the ship's navigation reference point.

All programs used in these steps are in /home/nakamura/hd/progs of grampus.

Shot File Details

When firing on time, shots were recorded in the OBS Lab. Occasionally more shots were fired then the number of missing shots (e.g. SPECTRA missed 10 shots, but 11 shots were fired at 15 sec intervals while SPECTRA was down) – this means that a shot number is duplicated when the two sets of shot times are combined. At other times there is a gap in shots. Below is a list of all gaps or repeats, generated by Yosio Nakamura.

Line 109
 no gaps or repeats
Line 105
 no gaps or repeats
Line 110
 no gaps or repeats
Line 106
 no gaps or repeats
Line 104
 no gaps or repeats
Line 102
 no gaps or repeats
Line 206
 no gaps or repeats
Line 111
   4 shots missed at shots   7 -   10
  12 shots missed at shots 1403 - 1414
Line 101
   2 shots missed at shots   6 -   7
   3 shots repeated at shots 1455 - 1457
Line 103
 no gaps or repeats
Line 201
 no gaps or repeats
Line 112
 no gaps or repeats
Line 116
 no gaps or repeats
Line 202
 no gaps or repeats
Line 203
 no gaps or repeats
Line 115
 no gaps or repeats
Line 311A
 one shot repeated at shot   1
Line 311
 no gaps or repeats
Line 301
 no gaps or repeats
Line 204

one shot missed at shot 57
Line 205
2 shots missed at shots 34 - 35
one shot missed at shot 41
Line 107
no gaps or repeats
Line 113
one shot missed at shot 9
Line 315
one shot repeated at shot 5
one shot repeated at shot 7
Line 114
one shot missed at shot 43
Line 108
no gaps or repeats
Line 207
no gaps or repeats

OBS Deployment, Recovery and Data Summary

Station	Chassis S/N	Sphere S/N	Disk Drive S/N	Deployment			Recovery			Acquired Data			
				Time	Location	Depth m	Time	Location	Depth m	Channels	Period	Hrs.	Mb
1	92-2	55427	IBM 7L4Q0227	193/01:11	2°30.857'N 101°44.952'W	3350	203/08:49	2°30.886'N 101°45.273'W	3345	1,2,3,4	7/13 00:00 - 7/22 07:27	223.5	1158.0
2	92-7	59105	IBM 97L23957	193/01:45	2°30.839'N 101°40.960'W	3331	202/22:19	2°30.951'N 101°41.122'W	3331	1,2,3,4	7/13 00:00 - 7/21 21:06	213.1	1097.0
3	93-11	55454	IBM 7L4C0505	193/02:19	2°30.840'N 101°36.957'W	3366	203/06:44	2°30.815'N 101°37.067'W	3330	1,2,3,4	7/13 00:00 - 7/22 05:22	221.4	1143.5
4	94-8	59368•	IBM 7L4G2383	193/02:52	2°30.835'N 101°32.955'W	3360	203/00:35	2°30.857'N 101°32.926'W	3330	1,2,3,4	7/13 00:00 - 7/21 08:06	200.1	782.5
5	94-10	55496	IBM 97M04125	193/03:27	2°30.825'N 101°28.913'W	3423	203/04:37	2°30.865'N 101°28.934'W	3399	1,2,3,4	7/13 03:06 - 7/22 03:17	216.2	676.0
6	94-11	57112	IBM 9ZKV7721	193/04:06	2°30.854'N 101°24.843'W	3211	203/02:49	2°30.904'N 101°24.792'W	3222	1,2,3,4	7/13 00:23 - 7/13 00:42	0.3	1.5
7	94-12	52239	IBM 97M04155	193/09:35	2°23.238'N 101°44.940'W	3408	202/20:14	2°23.291'N 101°45.290'W	3654	1,2,3,4	7/13 00:00 - 7/21 18:52	210.9	1088.5
8	94-13	55472	IBM 97LZ09164	193/10:10	2°23.243'N 101°40.978'W	2896	203/11:02	2°23.272'N 101°41.203'W	2886	1,2,3,4	7/13 00:00 - 7/22 09:49	225.8	1084.5
9	94-15	55478	IBM 97M00323	193/10:41	2°23.235'N 101°36.953'W	2550	202/18:10	2°23.306'N 101°37.179'W	2629	1,2,3,4	7/13 00:00 - 7/21 17:01	209.0	1080.0
10	94-16	44568	IBM 97LZ9273	193/11:14	2°23.241'N 101°32.931'W	2571	203/13:05	2°23.389'N 101°32.990'W	2562	1,2,3,4	7/13 00:00 - 7/22 12:02	228.0	1169.5
11	93-10	59126	IBM 7L4Q0481	193/11:48	2°23.246'N 101°28.899'W	2726	202/16:15	2°23.247'N 101°29.097'W	2732	1,2,3,4	7/13 00:00 - 7/21 15:05	207.1	1070.0
12	94-7	56962	IBM 97M00452	193/12:23	2°23.229'N 101°24.874'W	2656	203/17:04	2°23.402'N 101°24.981'W	2686	1,2,3,4	7/13 00:00 - 7/22 15:03	231.0	1192.5

Deployment and recovery times are in UTC.
Water depths are from Hydrosweep center beam and have been corrected for sound speed and transducer depth (5.5 m).
•Sphere 59368, deployed at station 4, has Oyo GS-11D geophones, while all others have Mark Products L-15B geophones.

Station	Chassis S/N	Sphere S/N	Disk Drive S/N	Deployment			Recovery			Acquired Data			
				Time	Location	Depth m	Time	Location	Depth m	Channels	Period	Hrs.	Mb
13	94-4	67138	Toshiba 44015599W	193/13:15	2°22.150'N 101°18.648'W		Not recovered						
14	94-1	67137	Toshiba 94J30878W	193/13:38	2°22.154'N 101°17.028'W	2710	203/19:52	2°22.368'N 101°17.076'W	1932	4	7/13 00:00 - 7/22 18:12	234.2	317.5
15	98-1	67091	IBM 7L1Q4981	193/14:00	2°22.145'N 101°15.425'W	2031	Not recovered						
16	98-2	58732	IBM 7L4Q0301	193/14:20	2°22.149'N 101°13.814'W	2490	Not recovered						

Deployment and recovery times are in UTC.

Water depths are from Hydrosweep center beam and have been corrected for sound speed and transducer depth (5.5 m).

Hess Deep OBS Data Irregularities

The following data related problems with OBS equipment were encountered during the Hess Deep experiment, July 2003. Many of these problems resulted in data loss, or other irregularities.

Station 1: IBM 1.2-Gb disk drive S/N 7L4Q0227 was difficult to read on a SUN workstation. The data were retrieved completely using a Macintosh PowerBook.

Station 2: IBM 10-Gb disk drive S/N 97L23957 had several disk write problems, mostly disk write time-outs, that resulted in extended inter-record gaps on 7/21, fortunately after the shooting ended.

Station 4: IBM 1.2-Gb disk drive S/N 7L4G2383 had numerous bad disk blocks that produced many data gaps, some of which lasted for several hours, severely affecting recording of line 107 and after. About 30%, or 65 hours, of data were lost. Also, SUN workstation was not able to read the disk beyond the first bad disk block, and Macintosh PowerBook was used to retrieve the remaining data.

Station 5: IBM 10-Gb disk drive S/N 97M04125 had numerous disk write problems, mostly disk write time-outs, that resulted in many missed recordings throughout the experiment totaling about 33 %, or 71 hours, of data.

Station 6: CPU battery pack died shortly after the recording started, resulting essentially in no useful data recorded.

Station 8: IBM 10-Gb disk drive S/N 97LZ09164 had numerous disk write problems, mostly disk write time-outs, that resulted in many missed recordings totaling about 4%, or 8 hours of data.

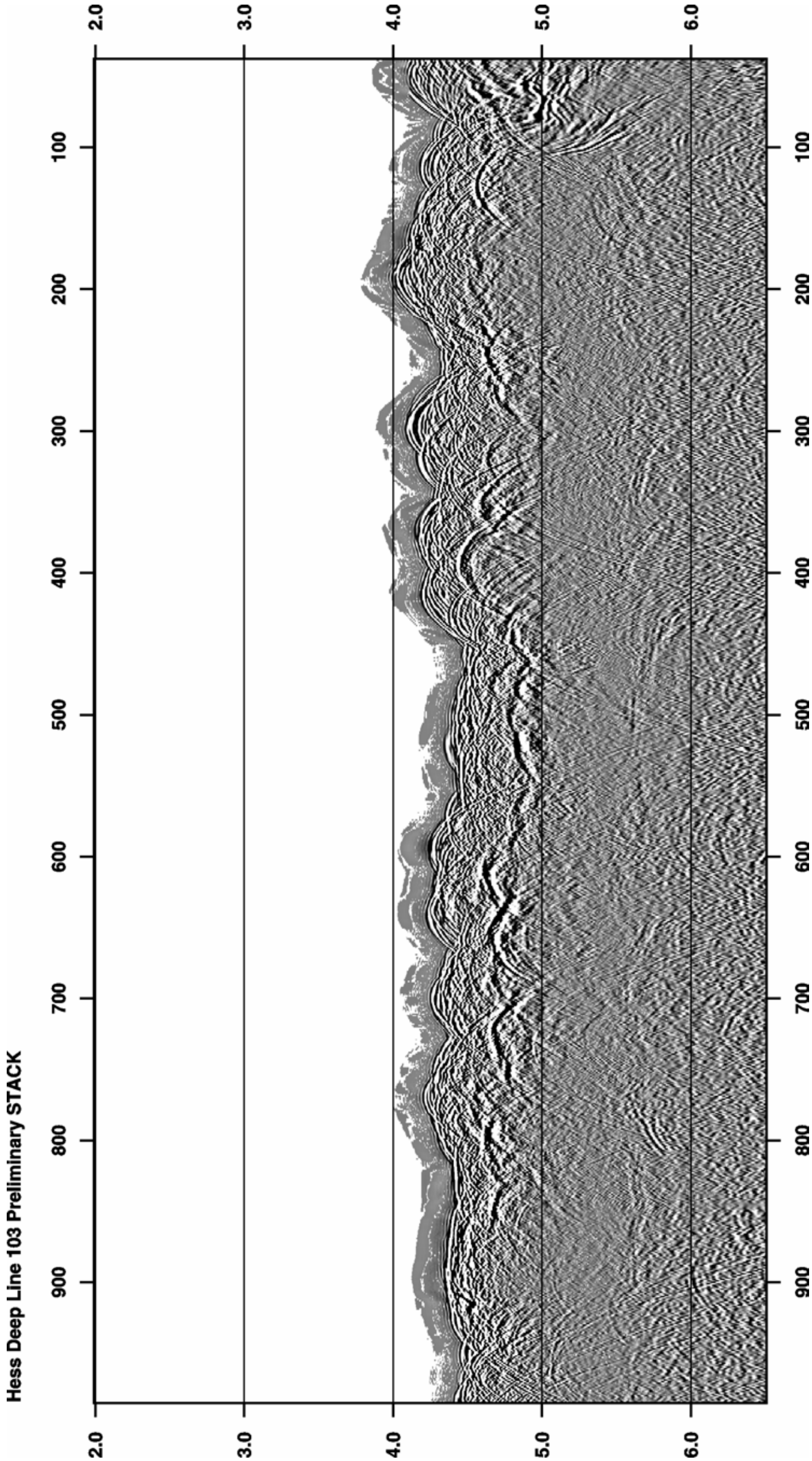
Station 9: Bit errors affected the first 69 hours of recording till 7/15/21:04, when the problem disappeared. The least significant bit of some odd-numbered bytes were set when it was not supposed to, and occasionally it was cleared when it was supposed to be set. A program was written to correct the error when it was found in the data header, but it could not be identified when it occurred in the data stream. Fortunately, the error affected only the least significant bit of the data value, and thus its effect was insignificant, being below the level of general background noise. Memory board S/N 163 used in OBS 94-15 or IBM 10-Gb disk drive S/N 97M00323 is suspected in causing the problem.

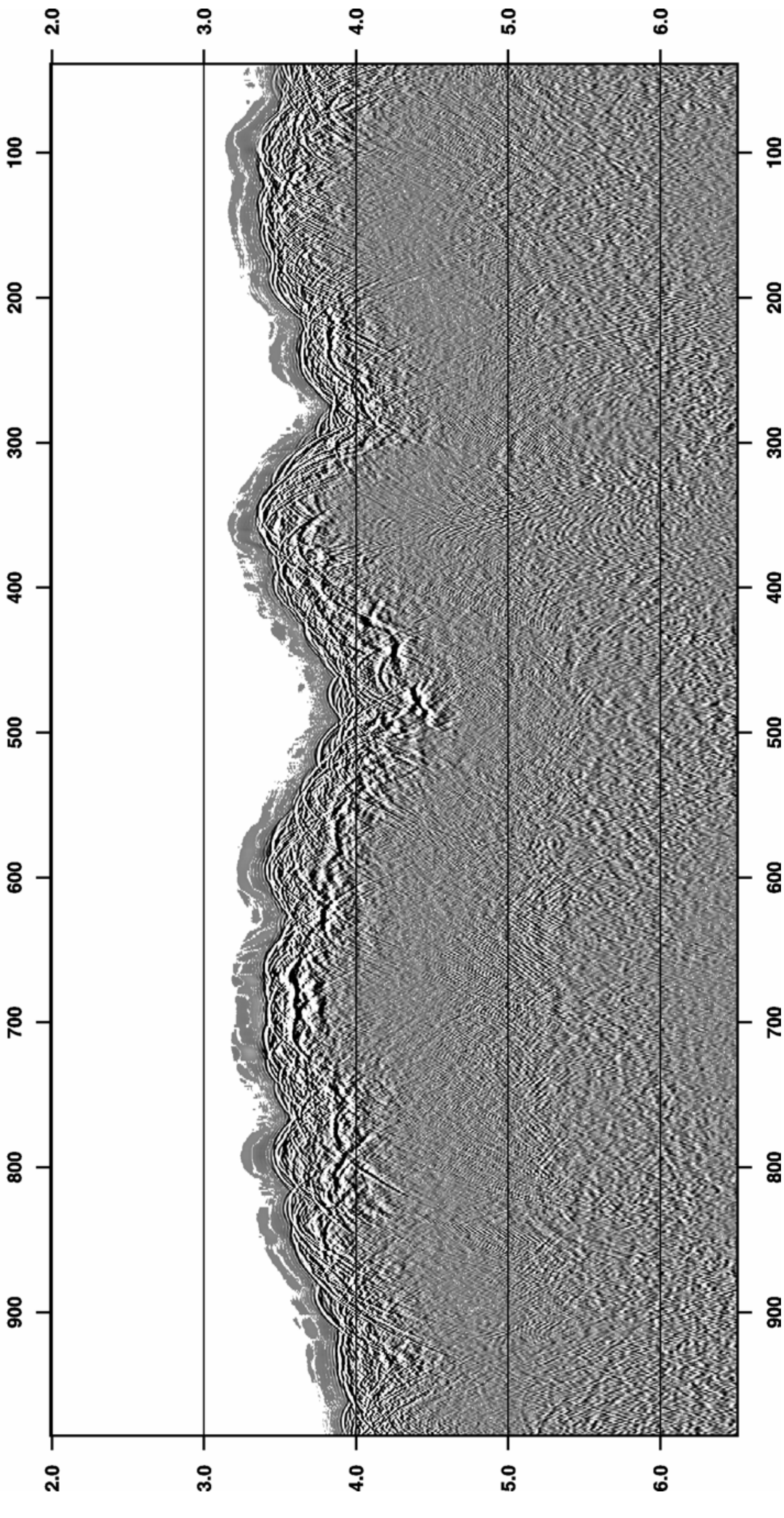
Station 10: IBM 10-Gb disk drive S/N 97LZ9273 had numerous disk write problems, mostly 'drive not ready,' that resulted in extended inter-record gaps throughout the recording.

Station 12: IBM 10-Gb disk drive S/N 97M00452 had two disk write time-outs that resulted in extended (68 sec) inter-record gaps twice near the beginning of the experiment.

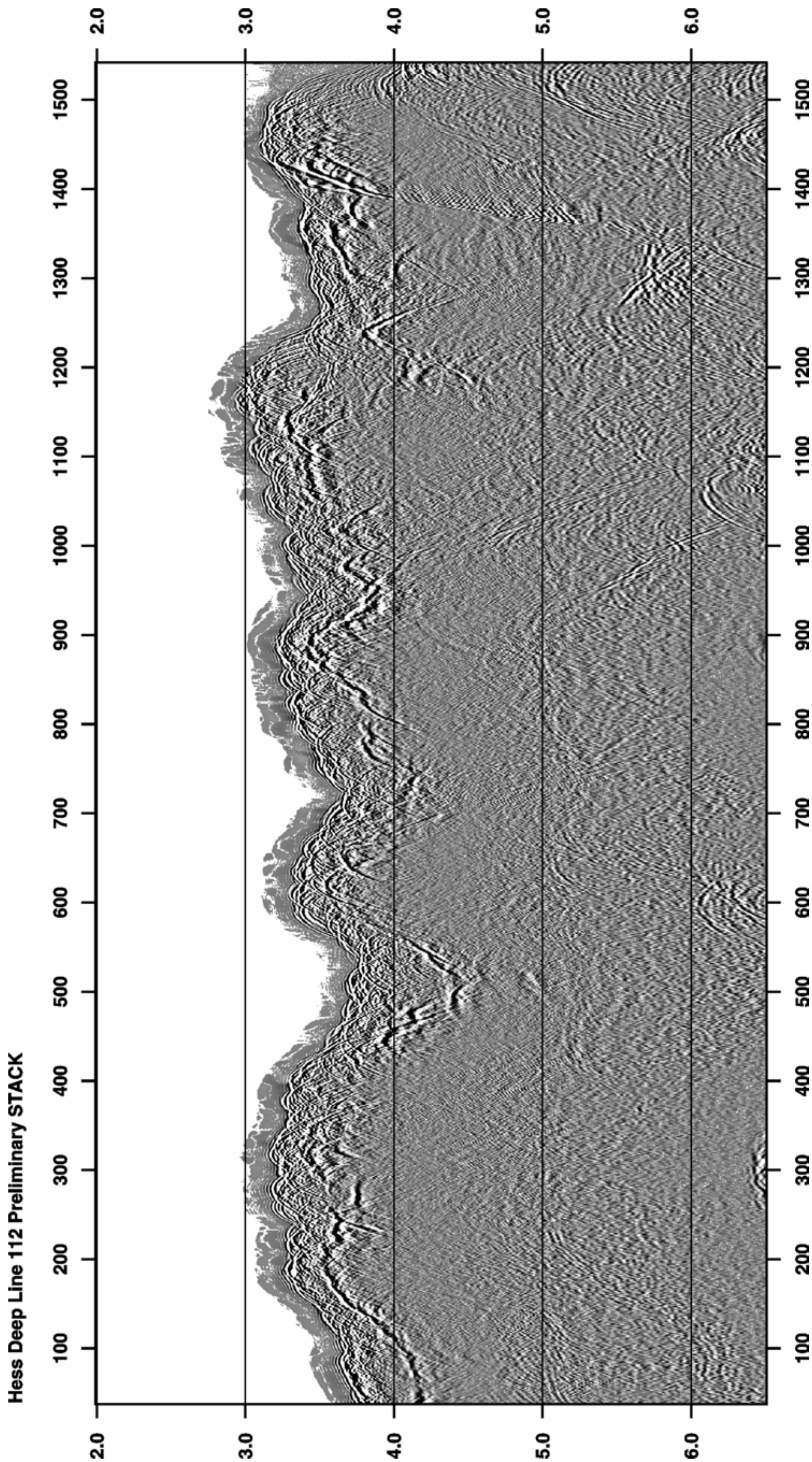
MCS Record Sections

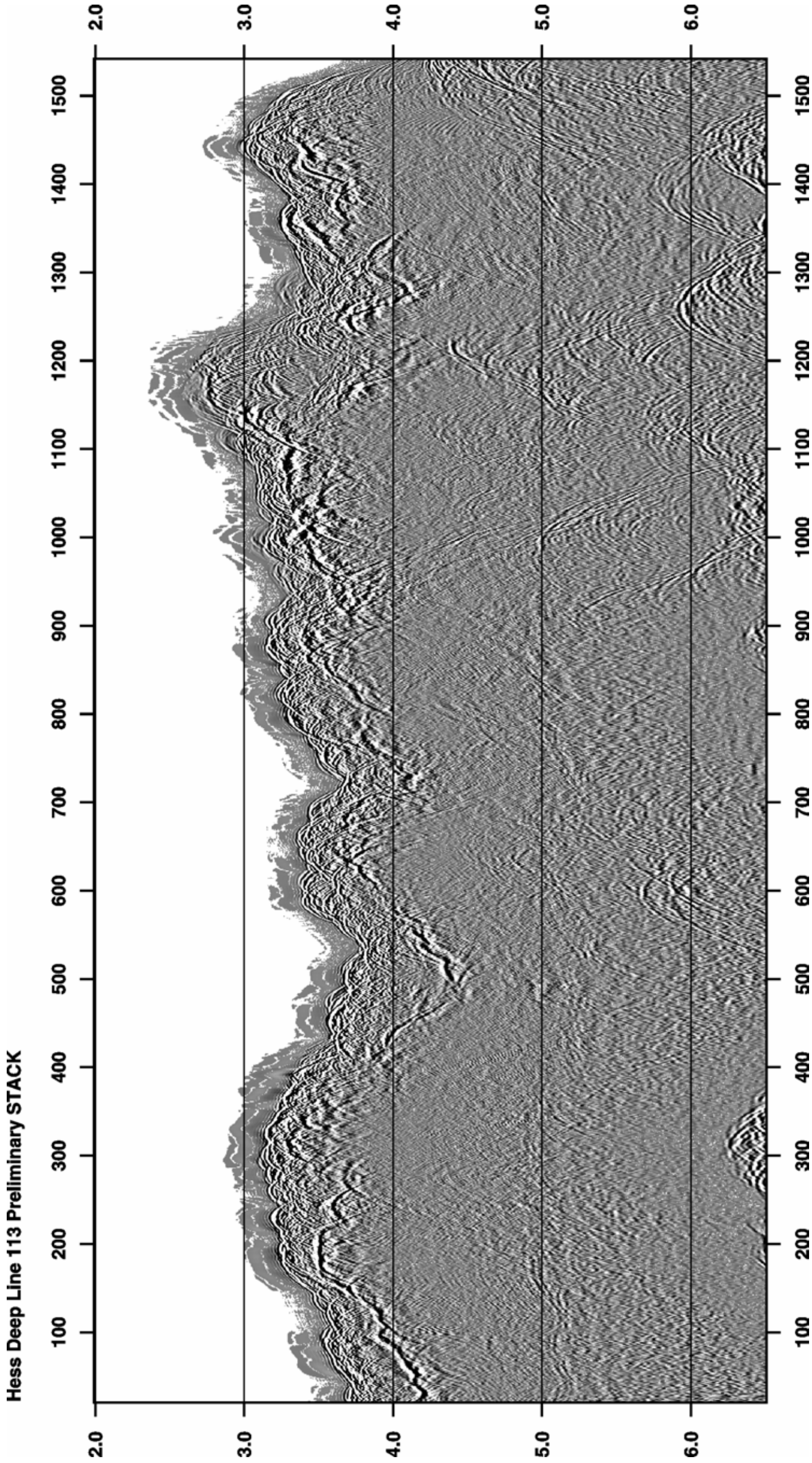
Record sections for all lines were produced using a single velocity function hung from the seafloor (Steffen's wbstack routine). Images are shown for lines 101-116 and 201-207. Additional processing (especially velocity picking) will improve the images – the first 4 record sections shown (lines 103, 109, 112, and 113) do include some coarse velocity analyses.

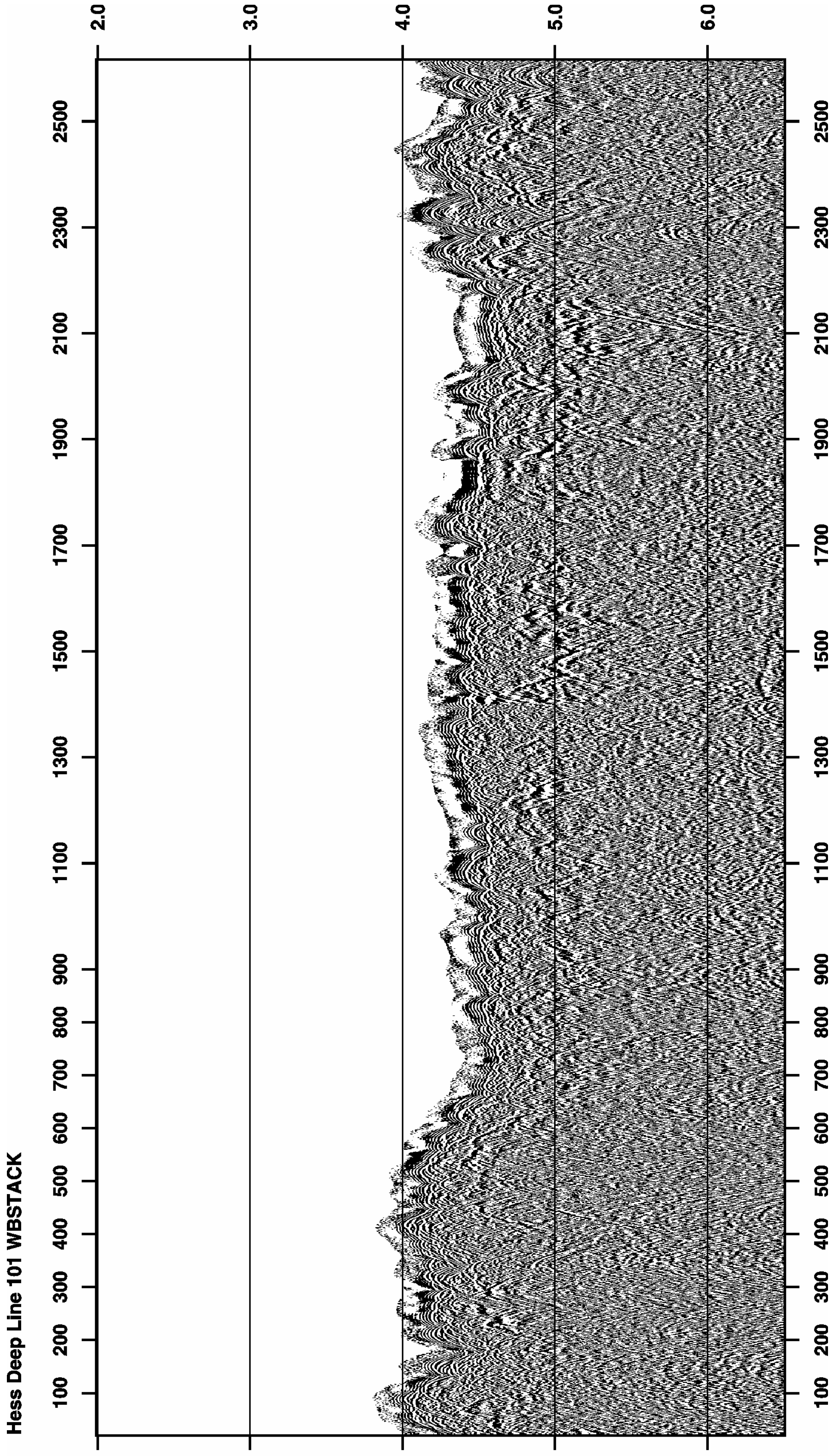

Hess Deep Line 103 Preliminary STACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500
600
700
800
900

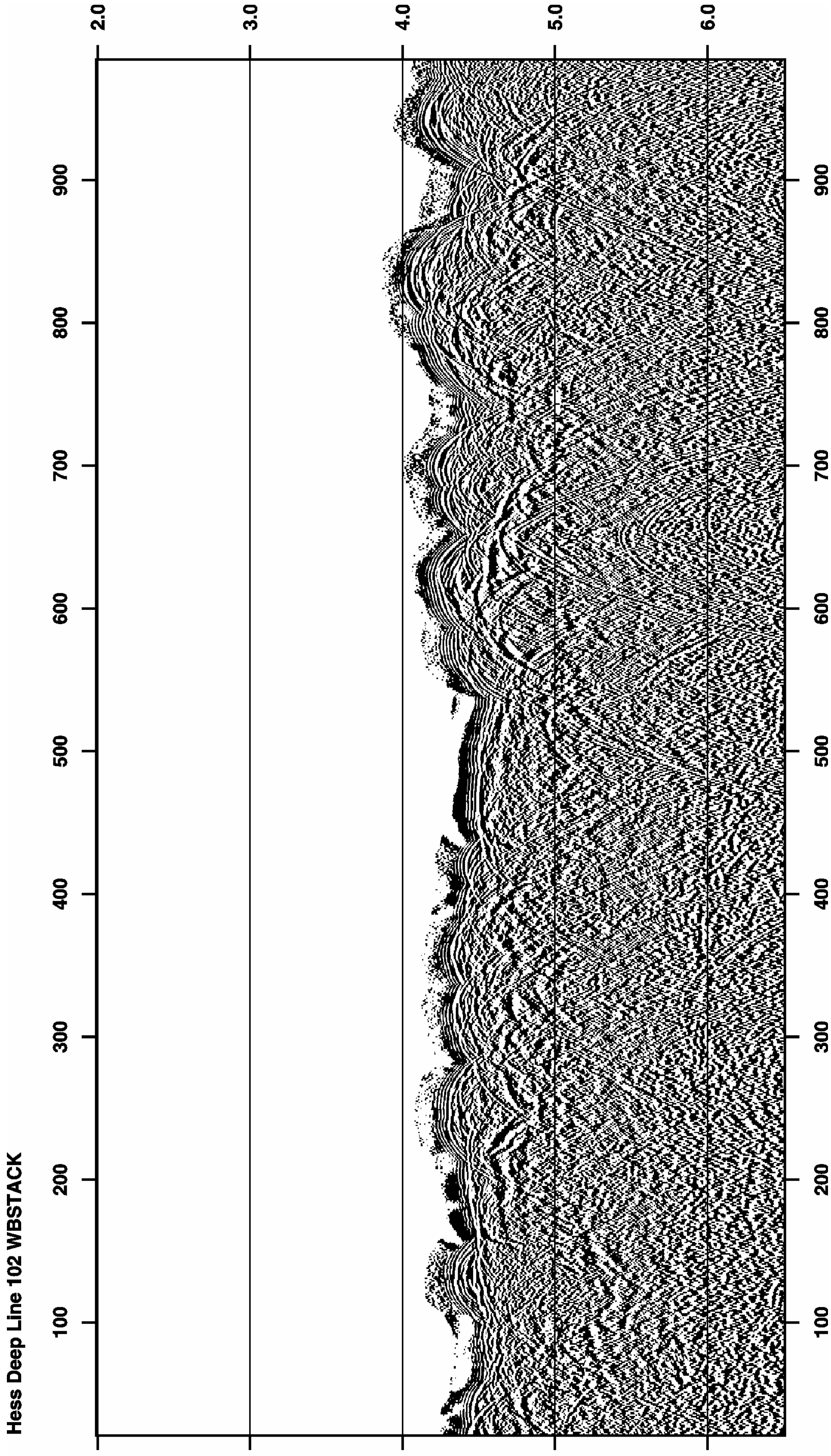


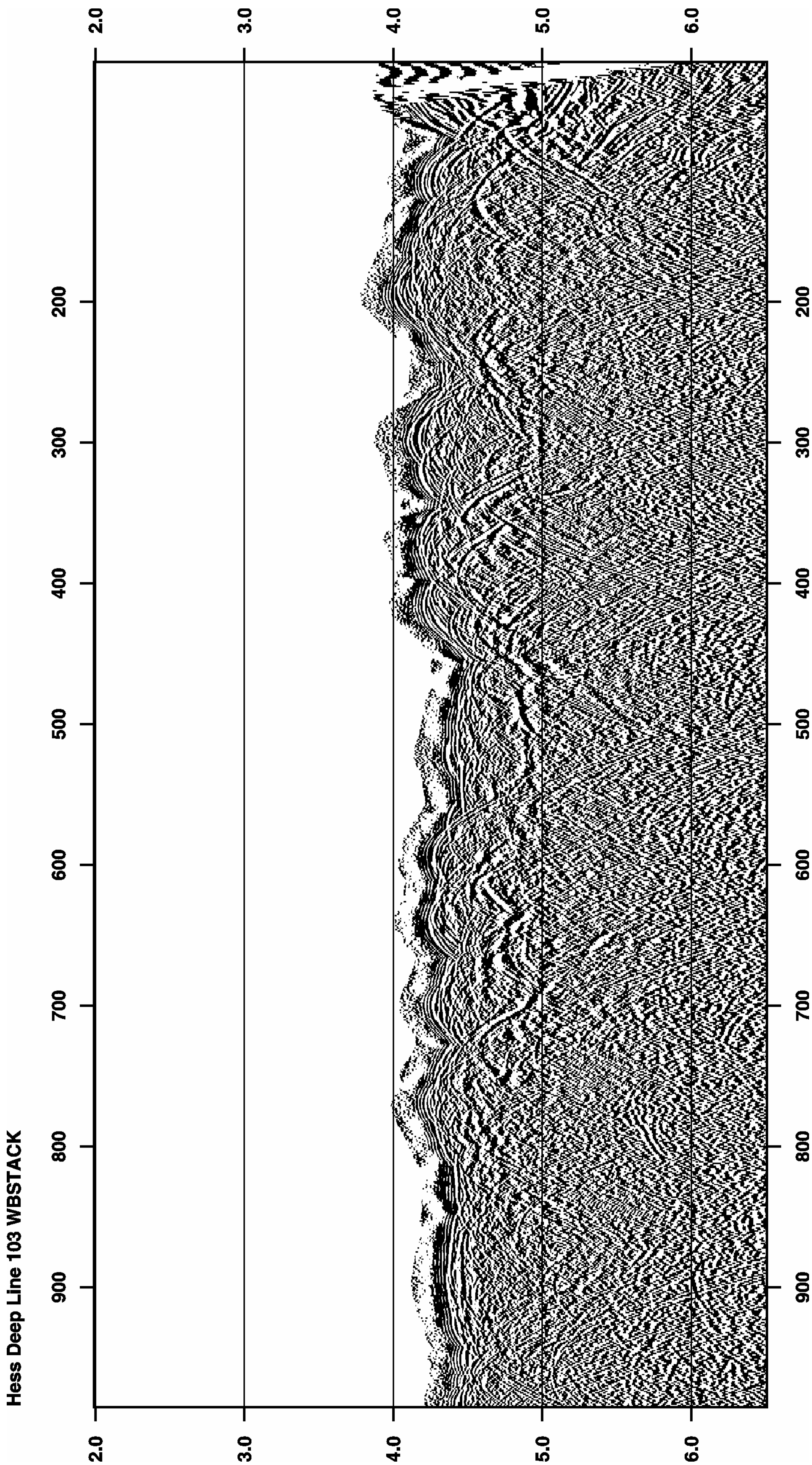
Hess Deep Line 109 Preliminary STACK

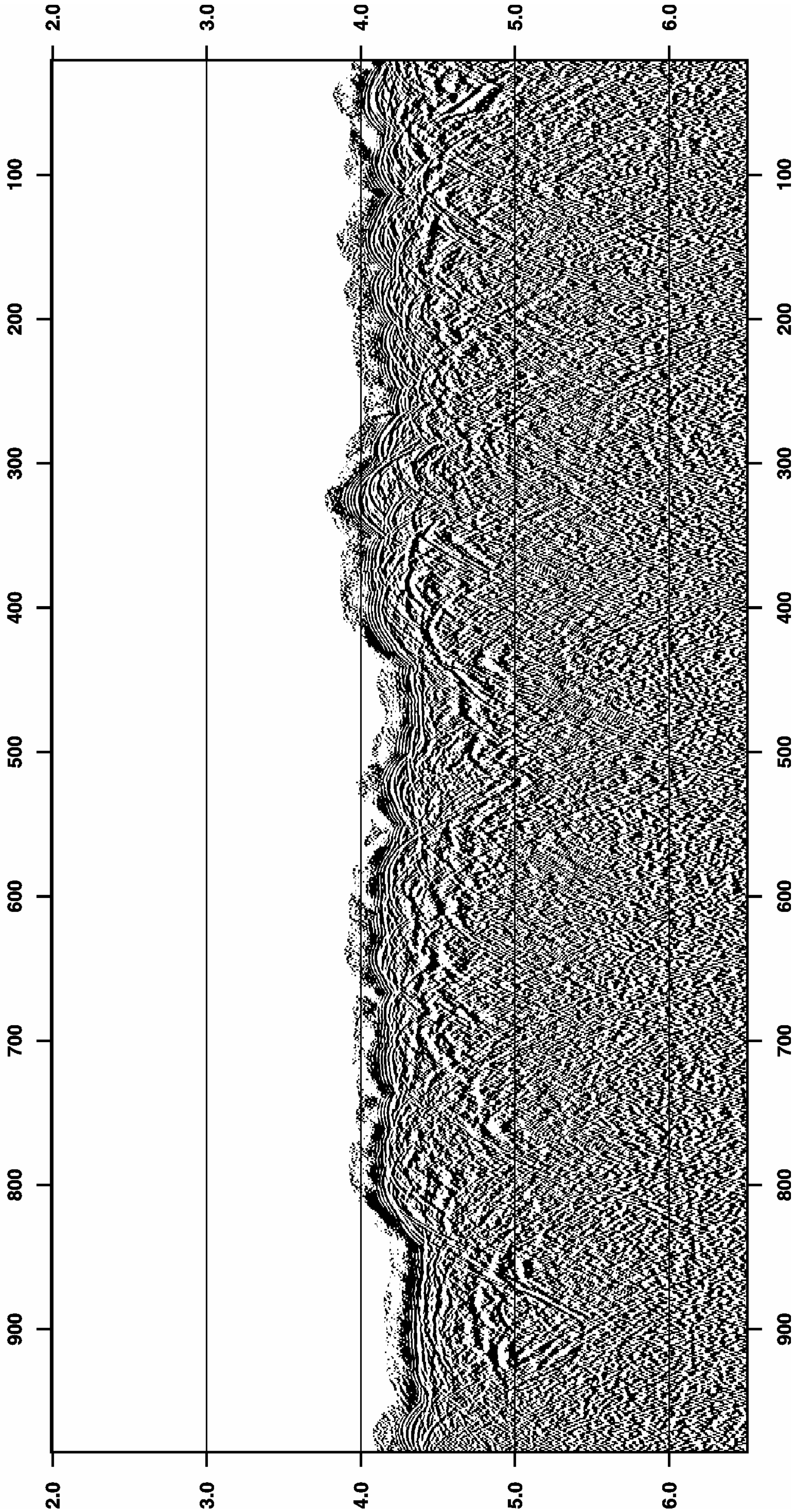

Hess Deep Line 112 Preliminary STACK
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
2.0
3.0
4.0
5.0
6.0


Hess Deep Line 113 Preliminary STACK
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
2.0
3.0
4.0
5.0
6.0

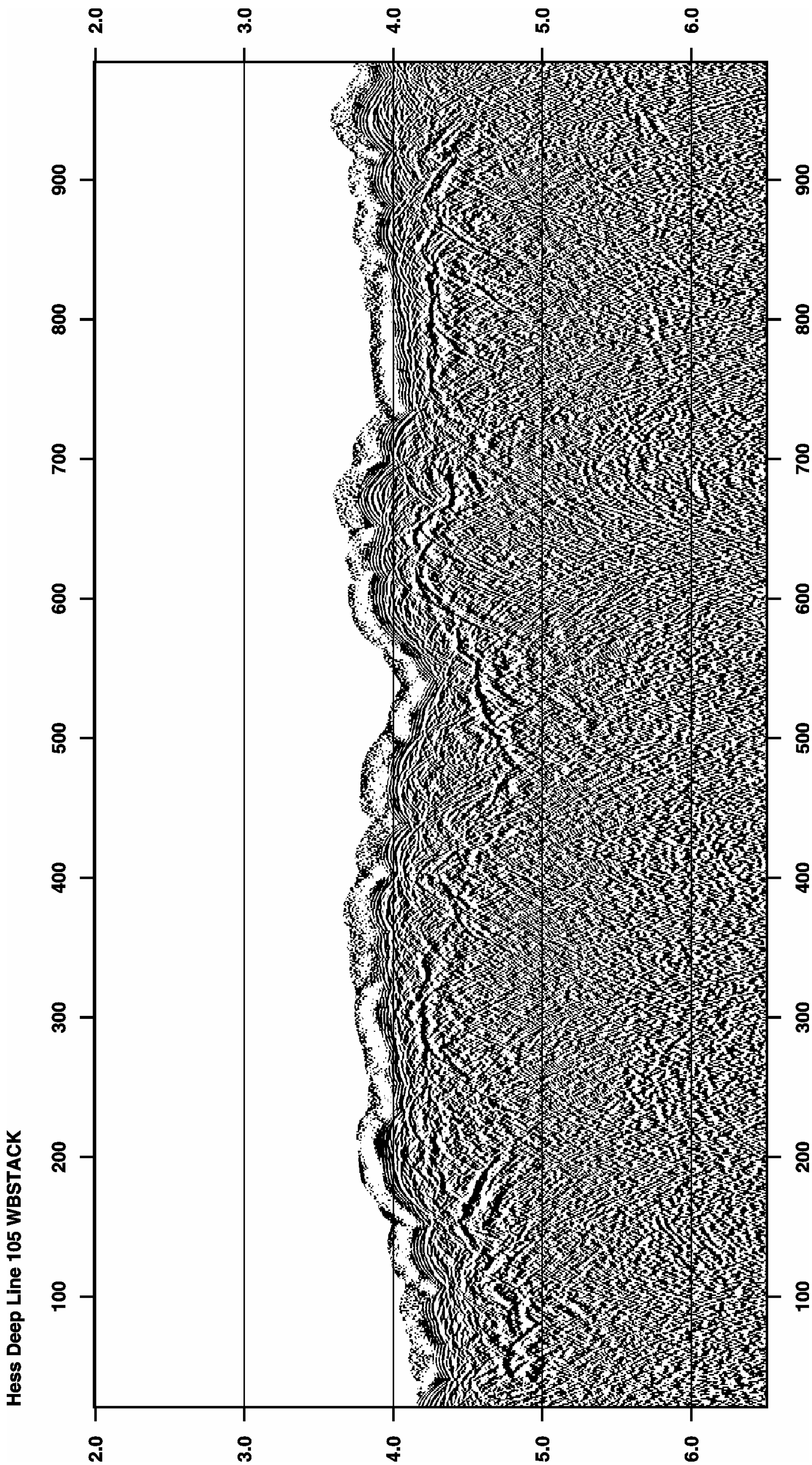

Hess Deep Line 101 WBSTACK

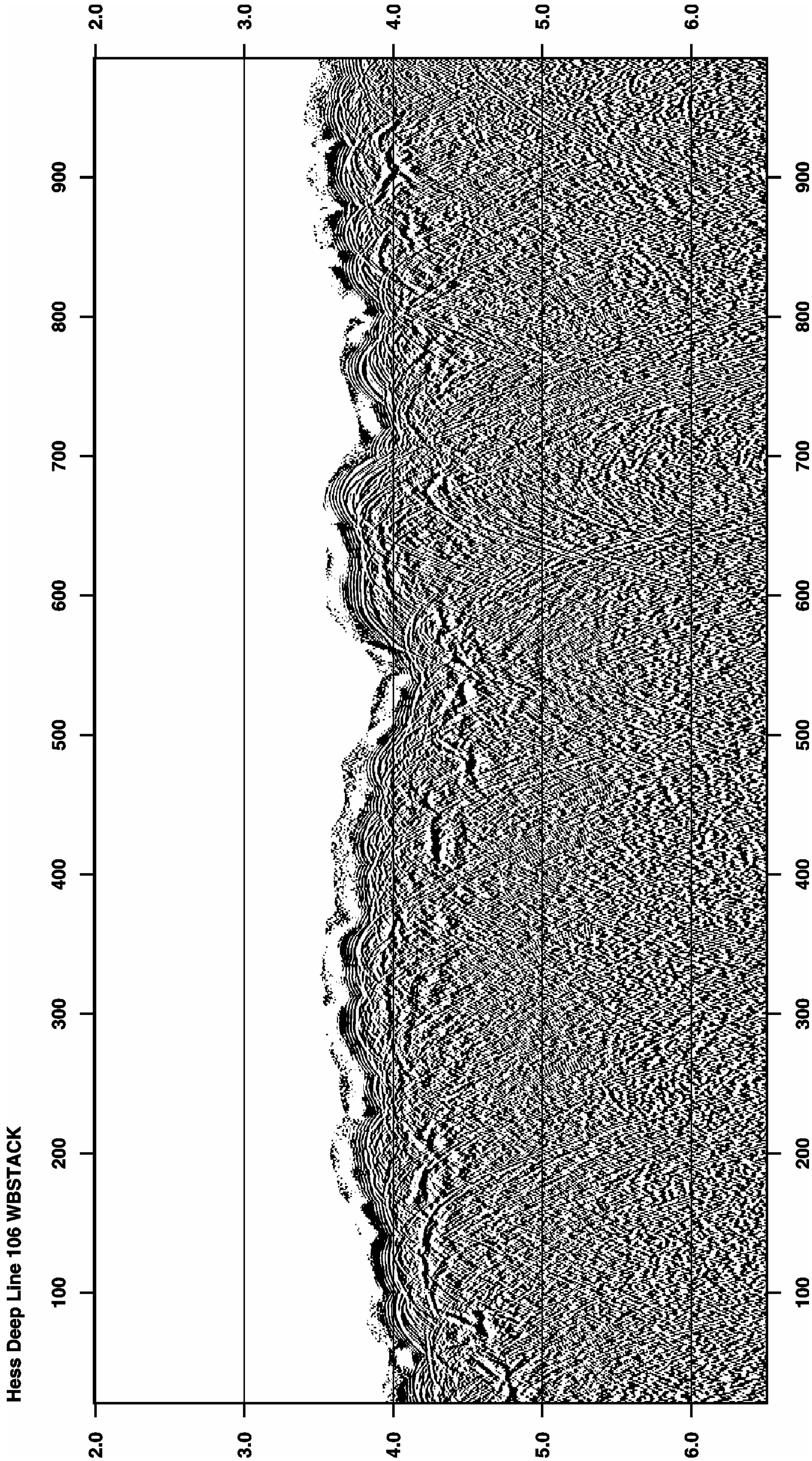

Hess Deep Line 102 WBSTACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500
600
700
800
900

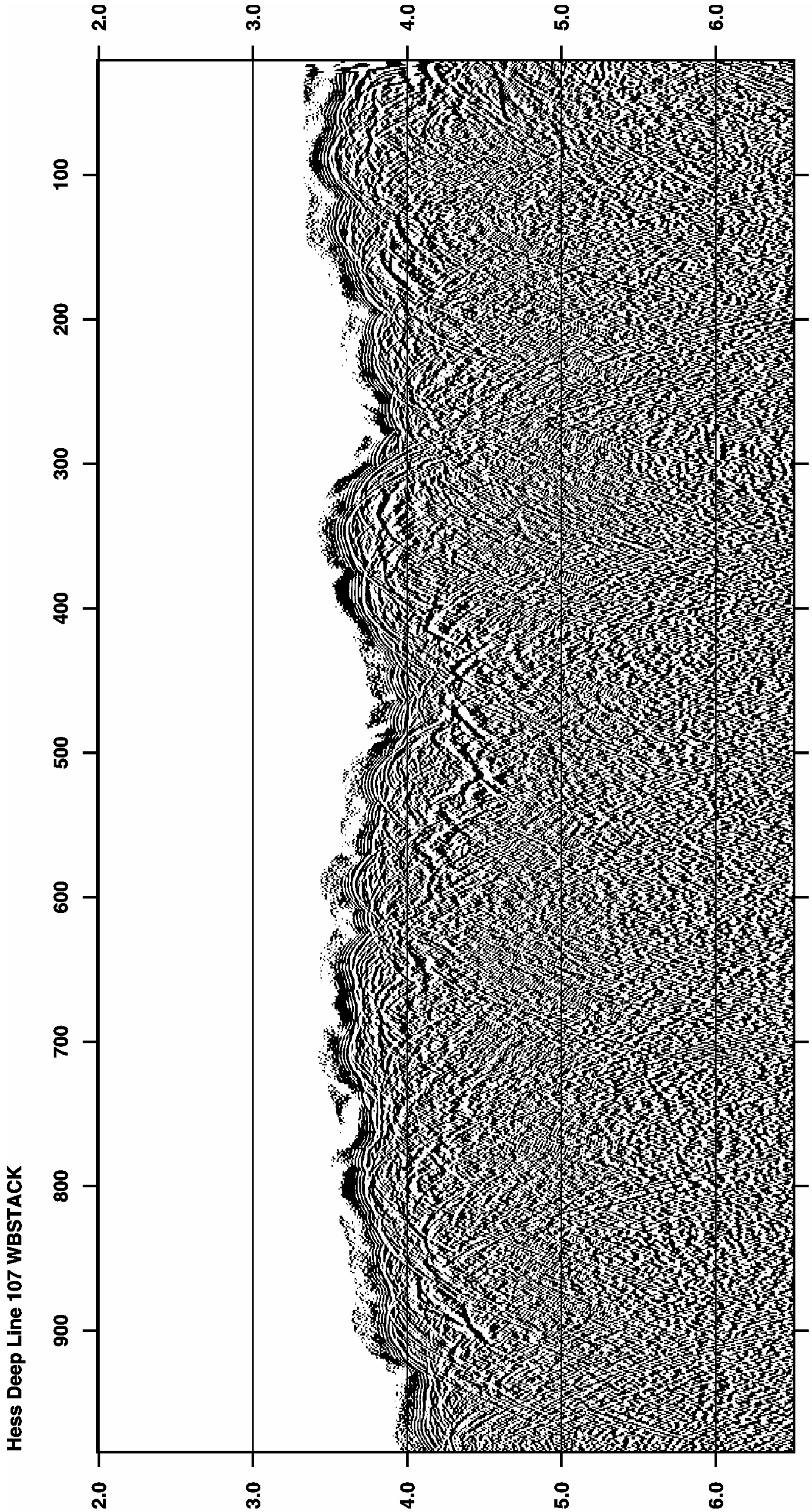

Hess Deep Line 103 WBSTACK
2.0
3.0
4.0
5.0
6.0
200
300
400
500
600
700
800
900

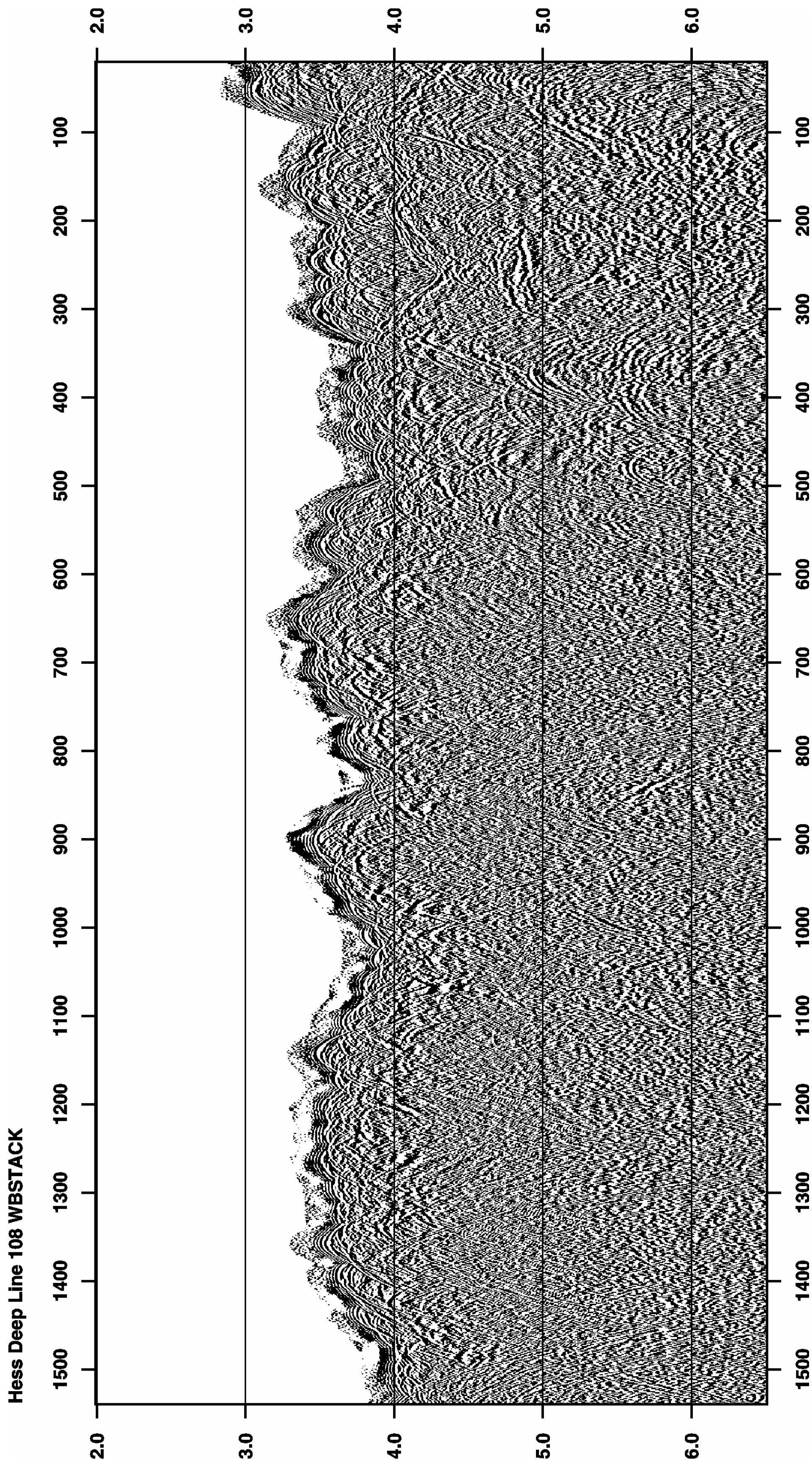


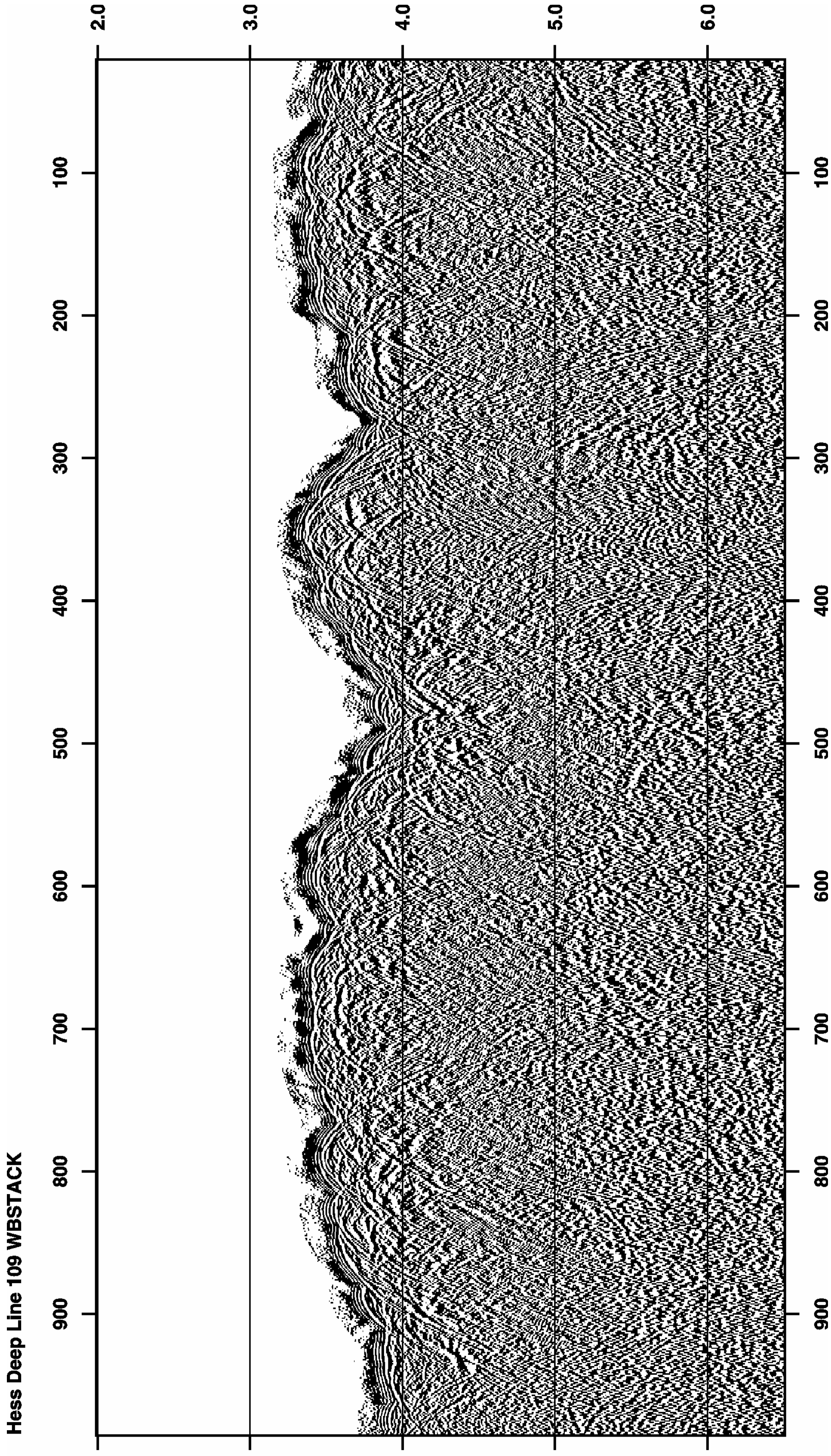
Hess Deep Line 104 WBSTACK

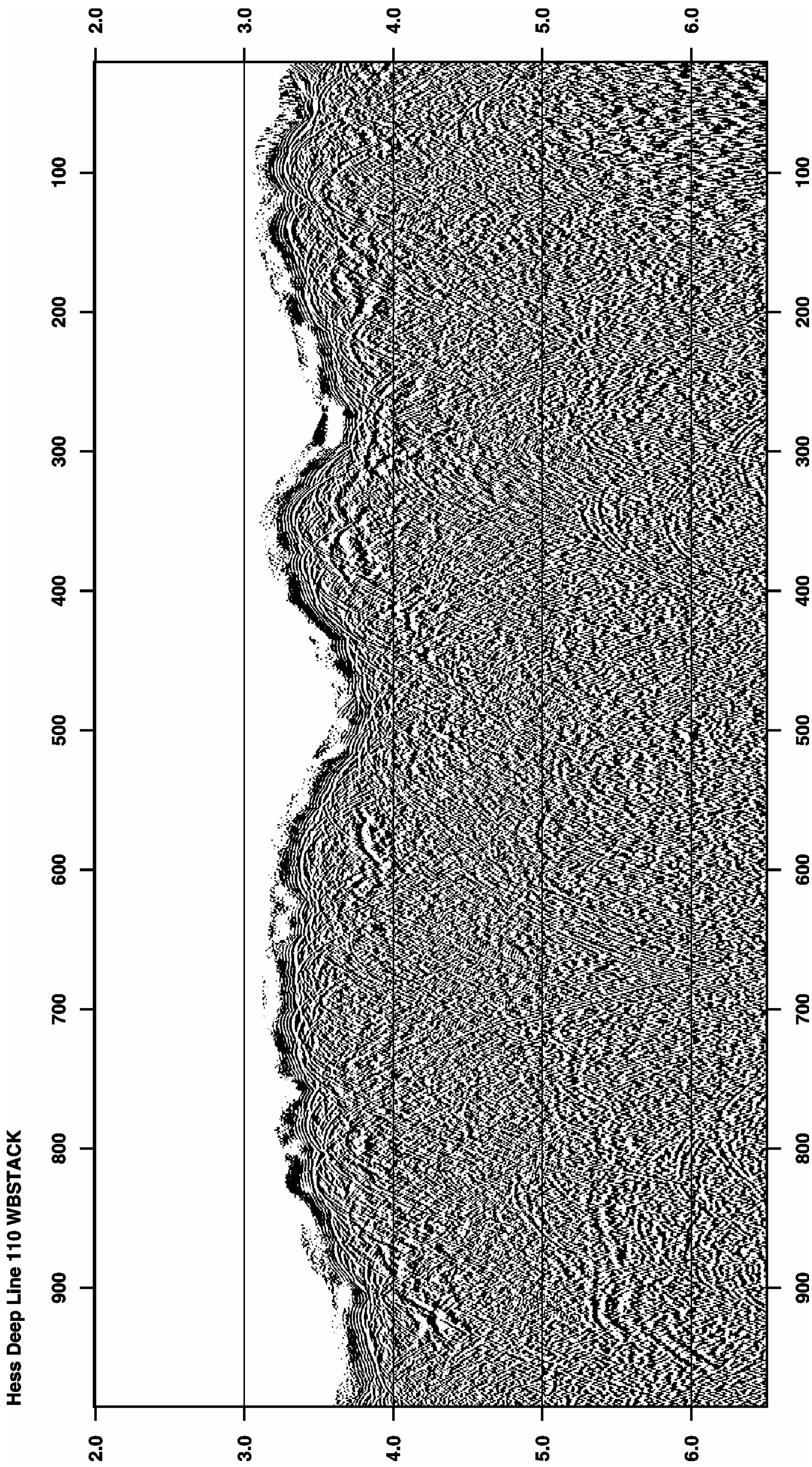

Hess Deep Line 105 WBSTACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500
600
700
800
900

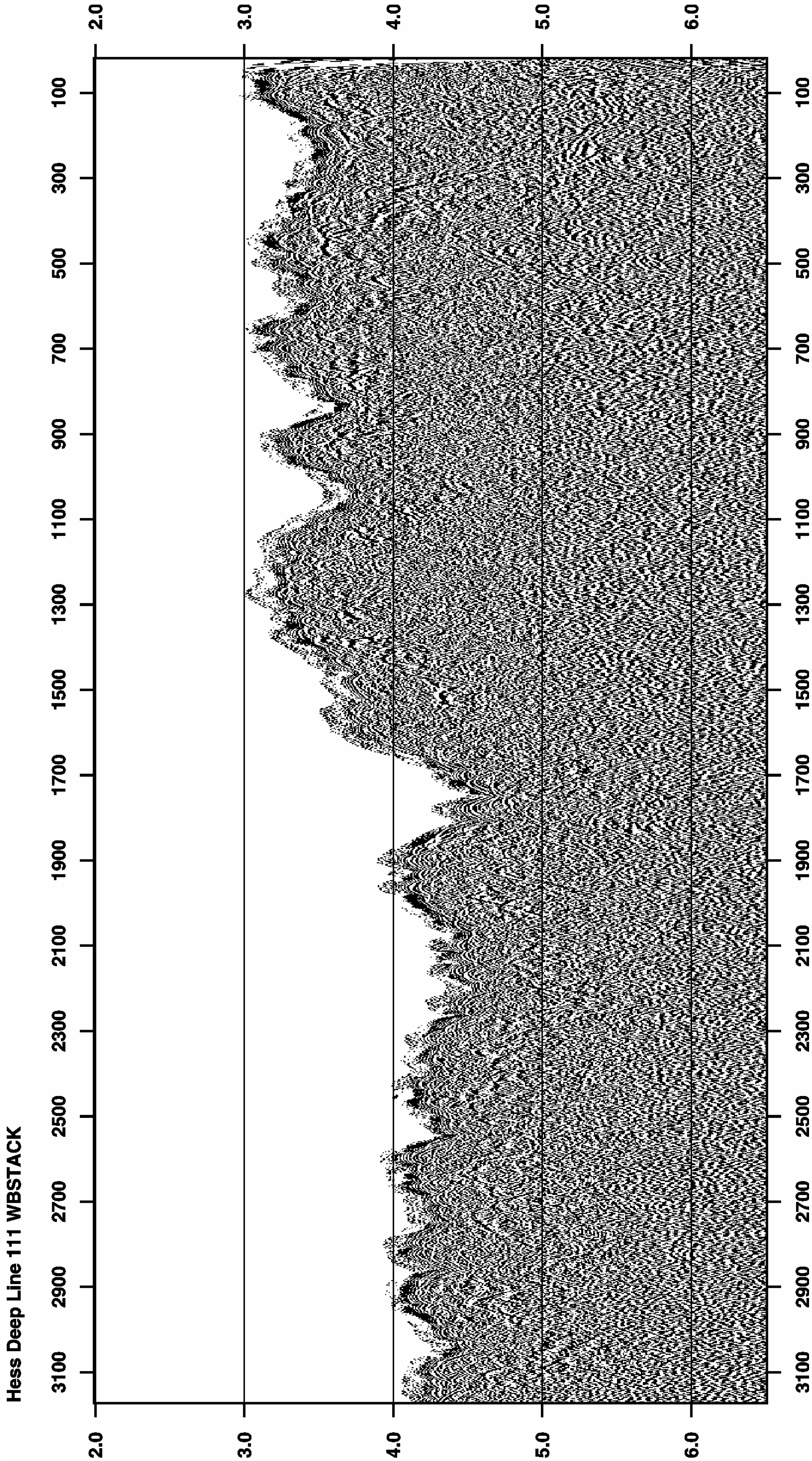

Hess Deep Line 106 WBSTACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500
600
700
800
900

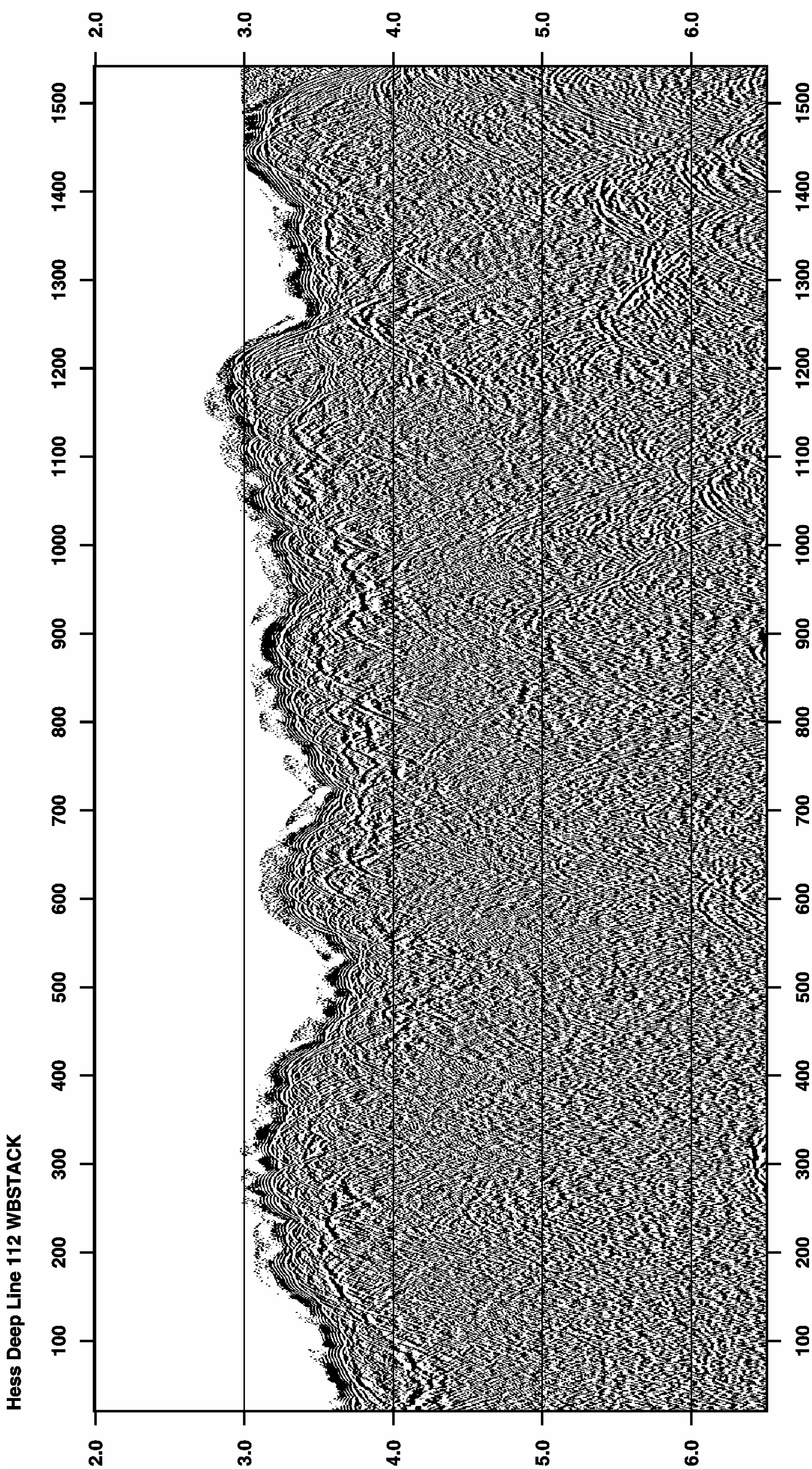

Hess Deep Line 107 WBSTACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500
600
700
800
900

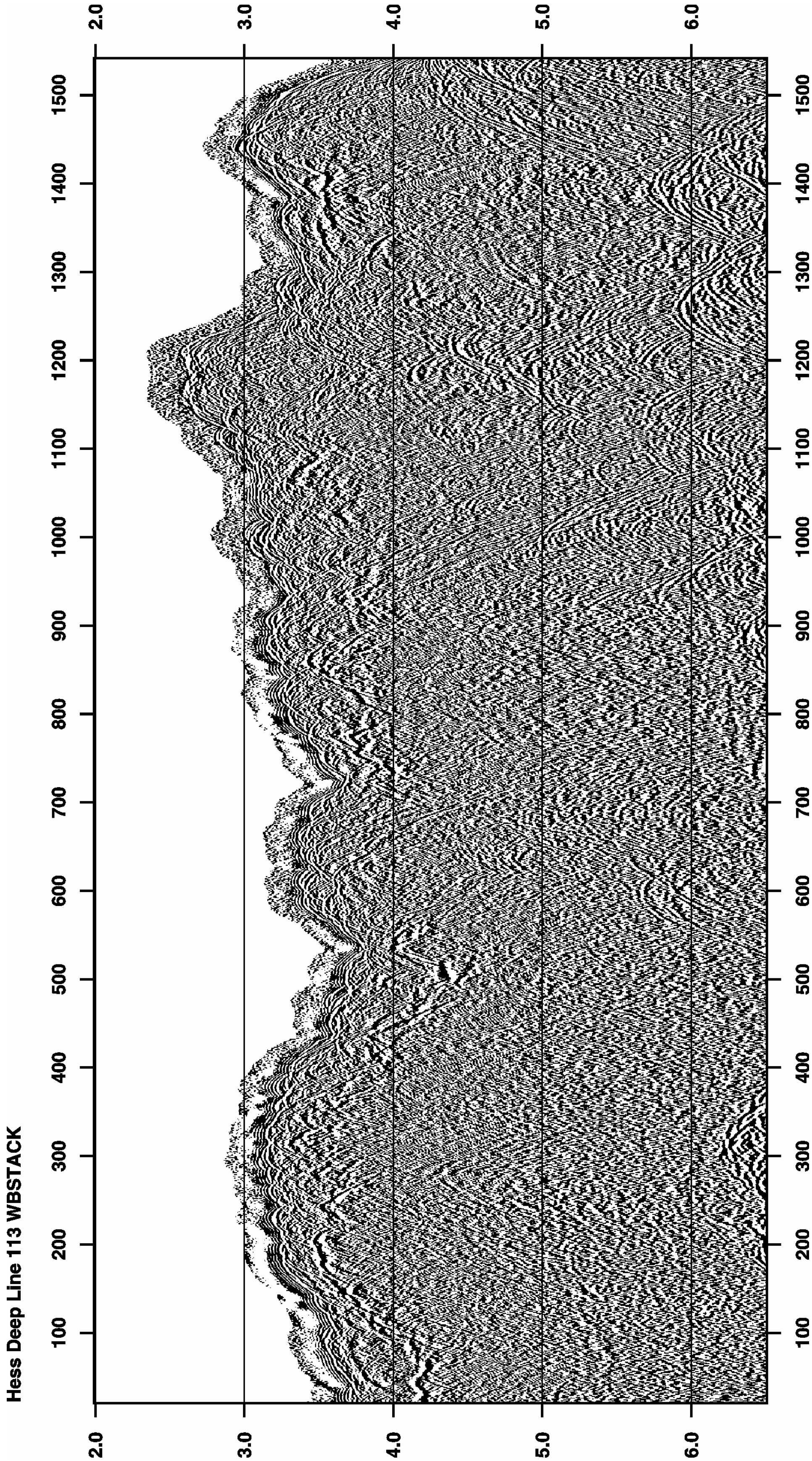

Hess Deep Line 108 WBSTACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

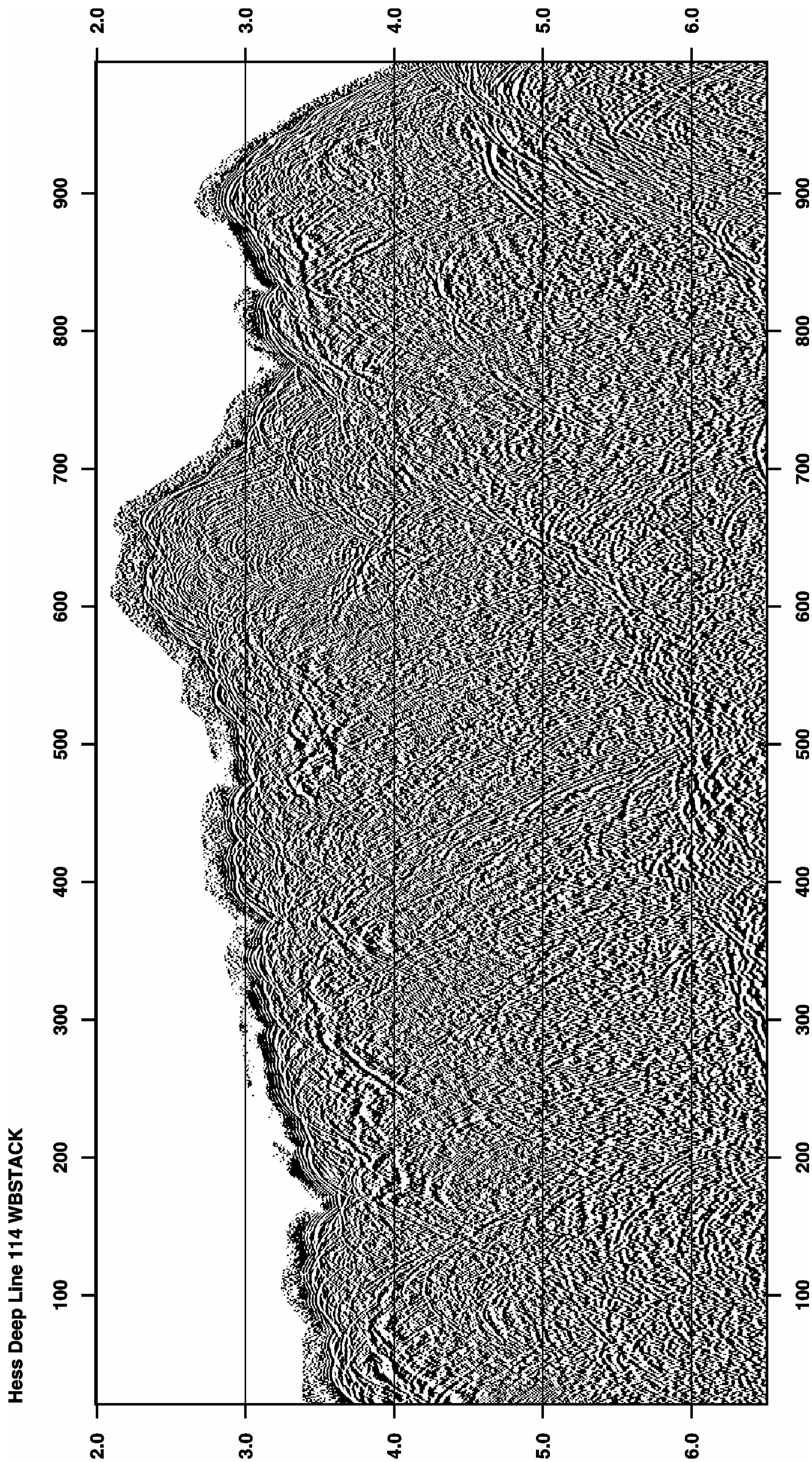

Hess Deep Line 109 WBSTACK
100
200
300
400
500
600
700
800
900
2.0
3.0
4.0
5.0
6.0

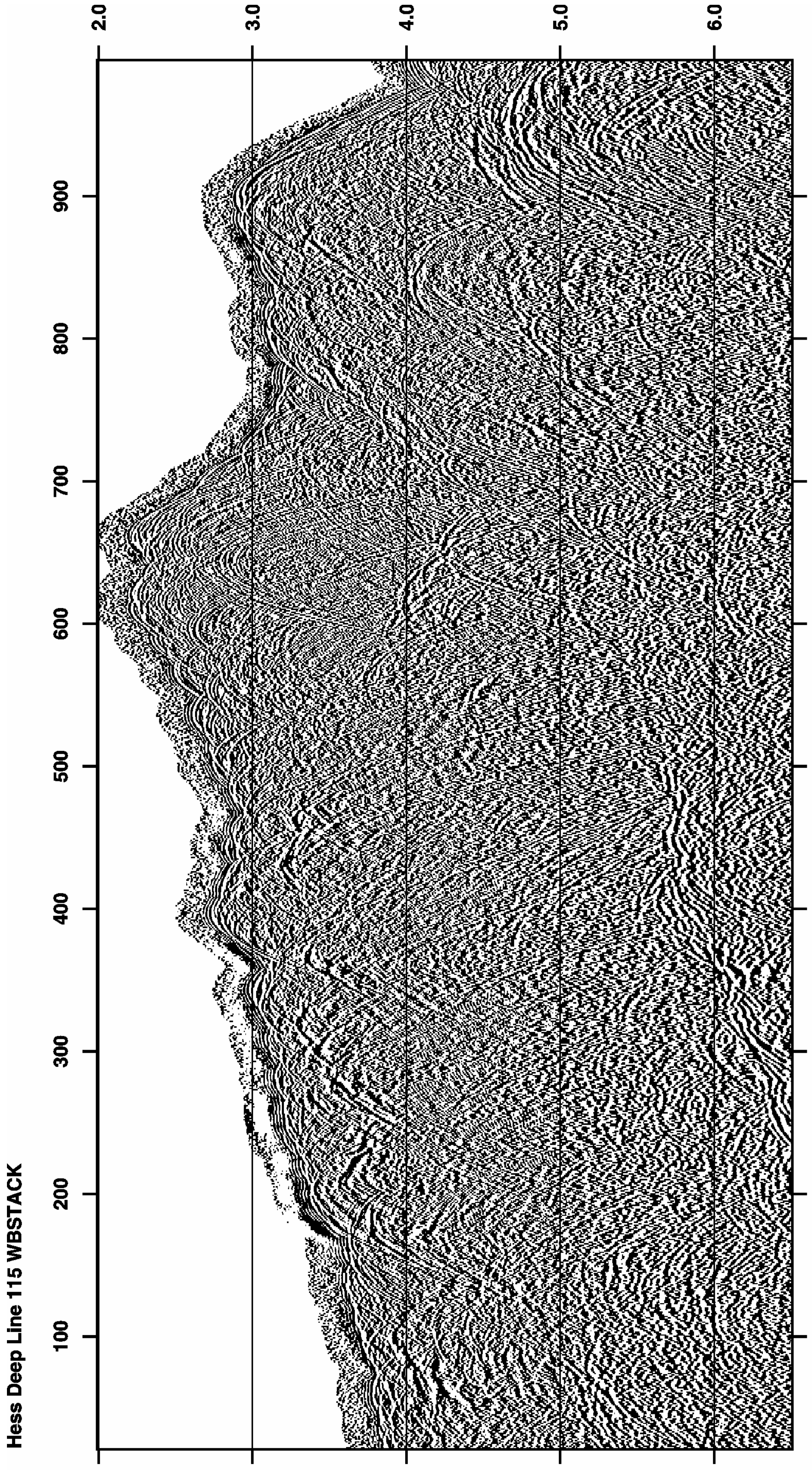

Hess Deep Line 110 WBSTACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500
600
700
800
900

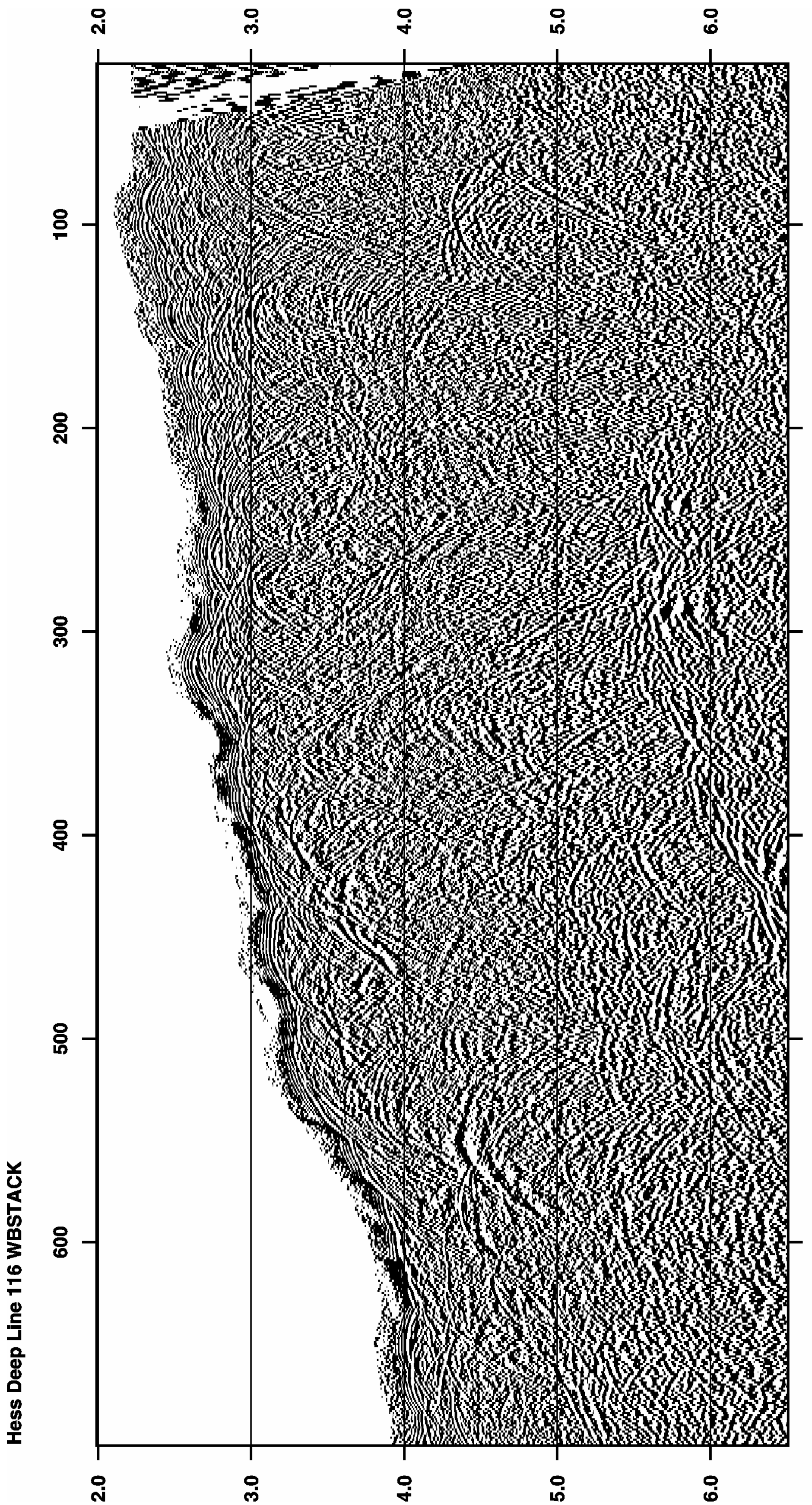

Hess Deep Line 111 WBSTACK
100
300
500
700
900
1100
1300
1500
1700
1900
2100
2300
2500
2700
2900
3100
2.0
3.0
4.0
5.0
6.0

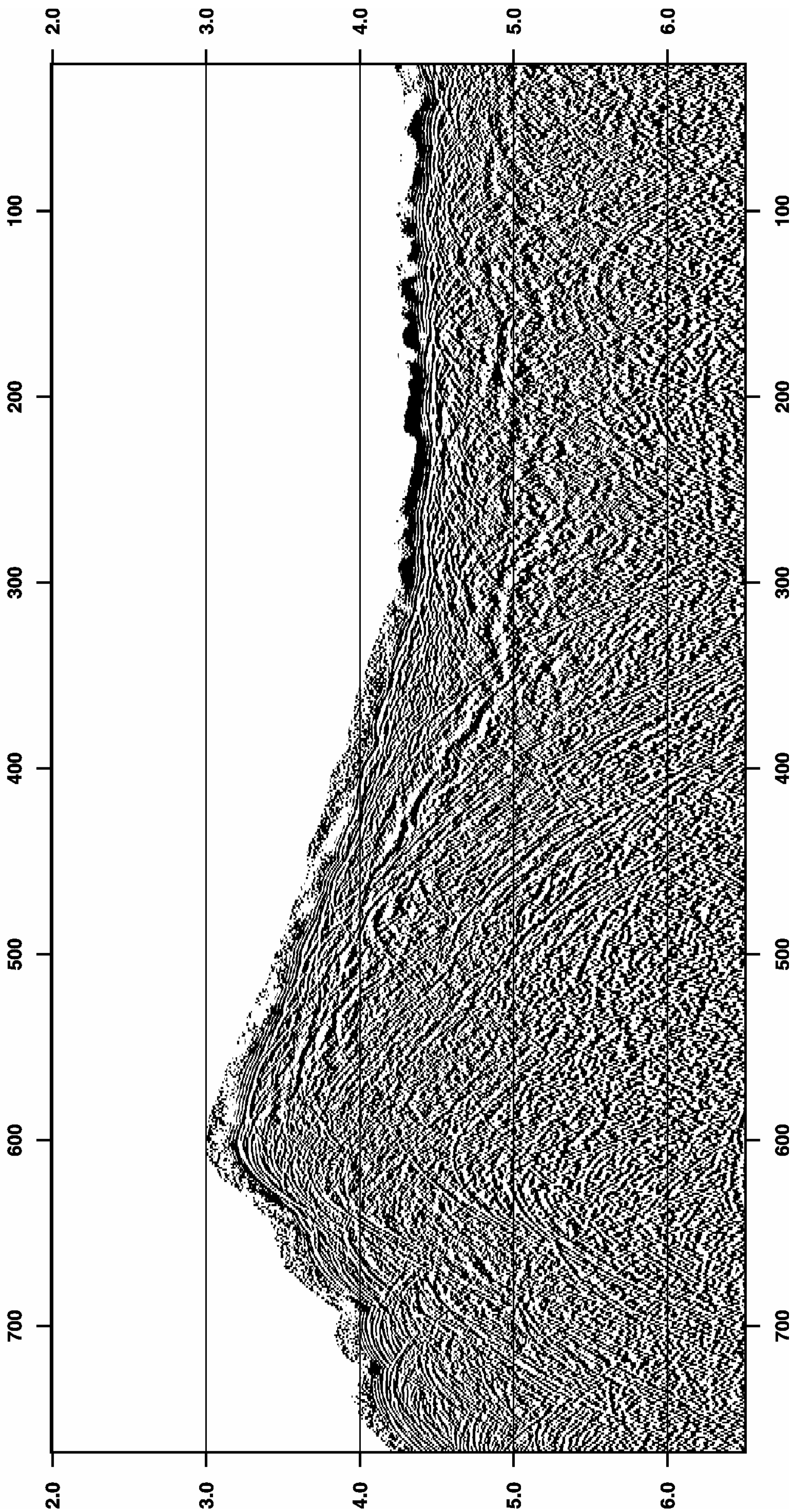

Hess Deep Line 112 WBSTACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500


Hess Deep Line 113 WBSTACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

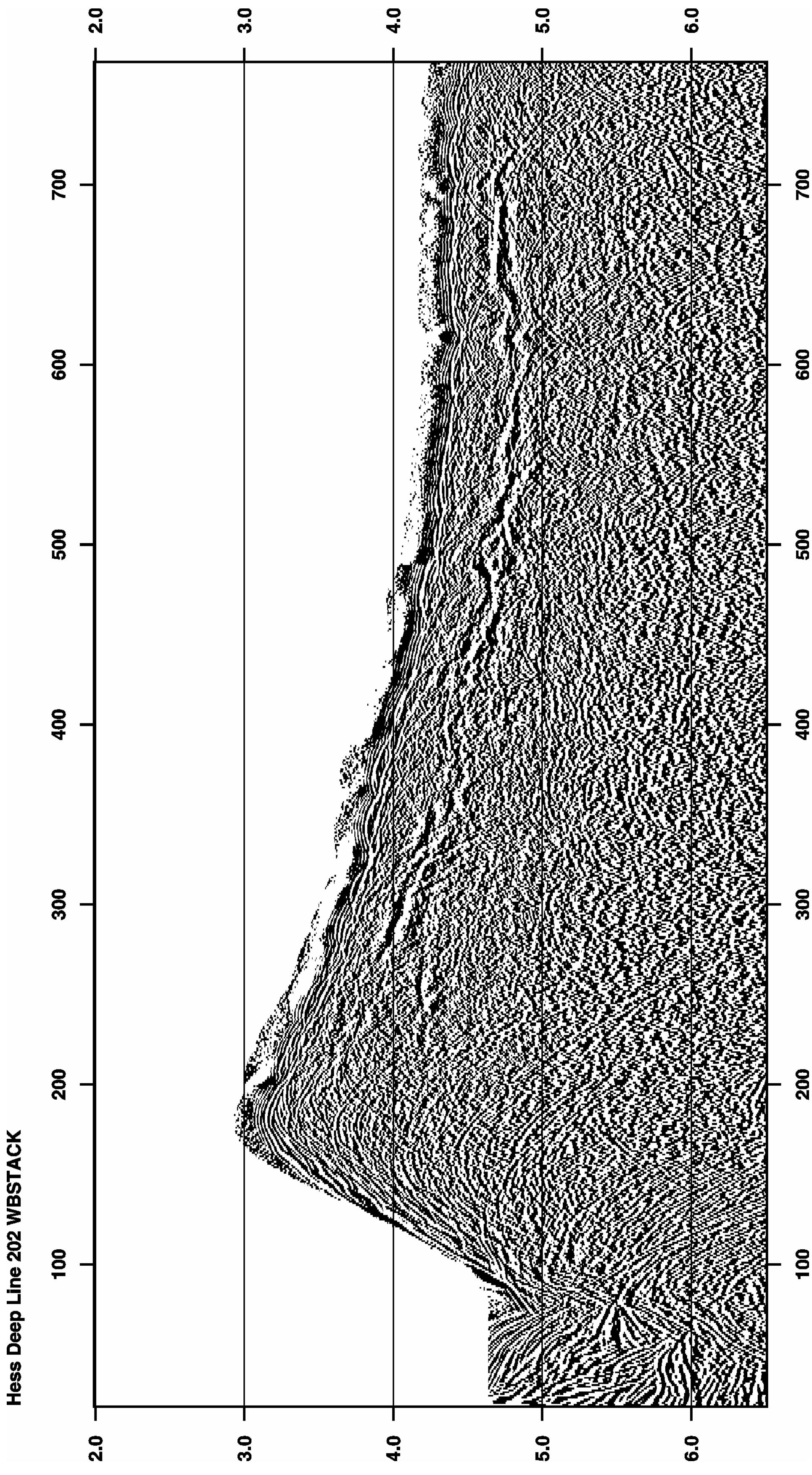

Hess Deep Line 114 WBSTACK
100
200
300
400
500
600
700
800
900
2.0
3.0
4.0
5.0
6.0

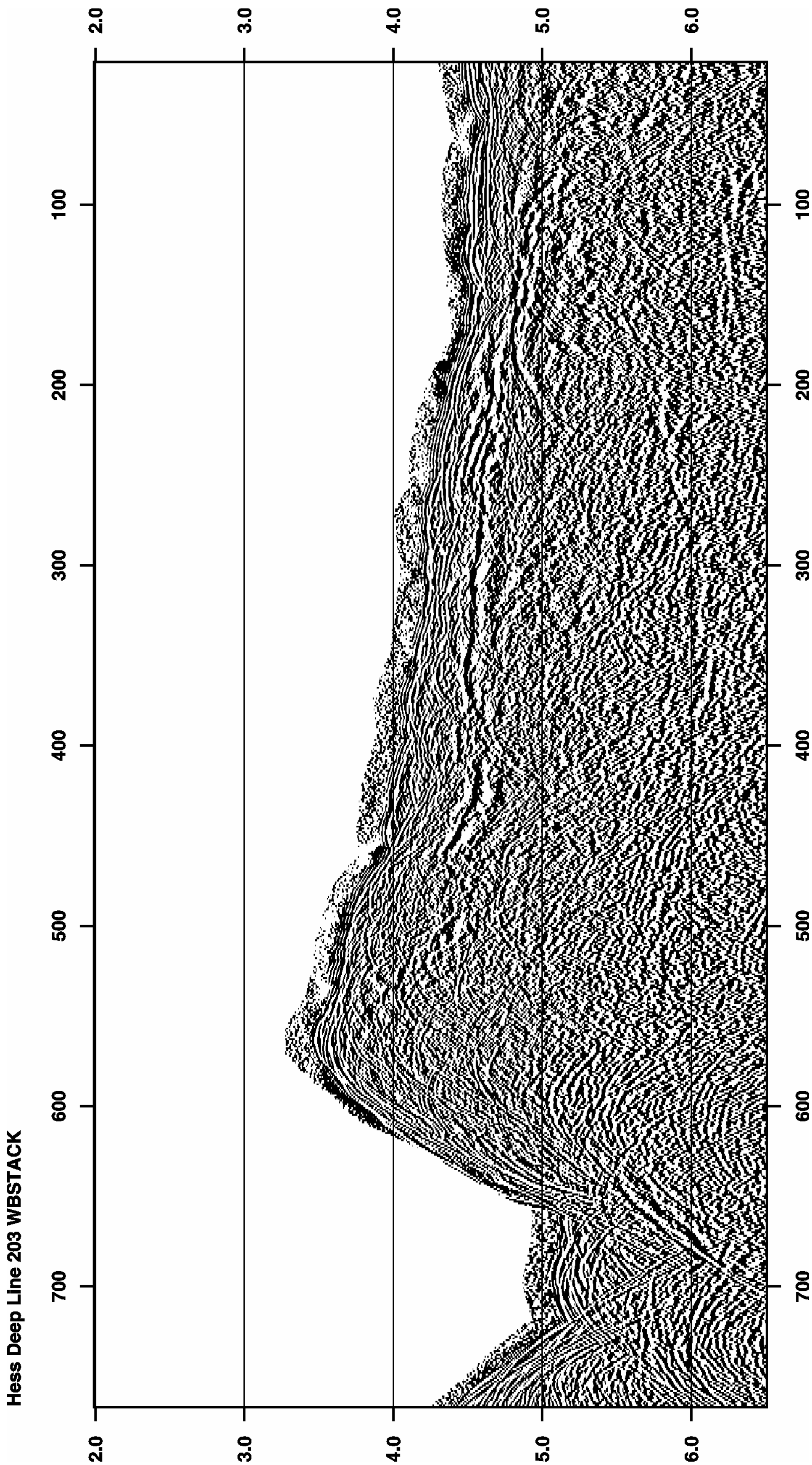

Hess Deep Line 115 WBSTACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500
600
700
800
900

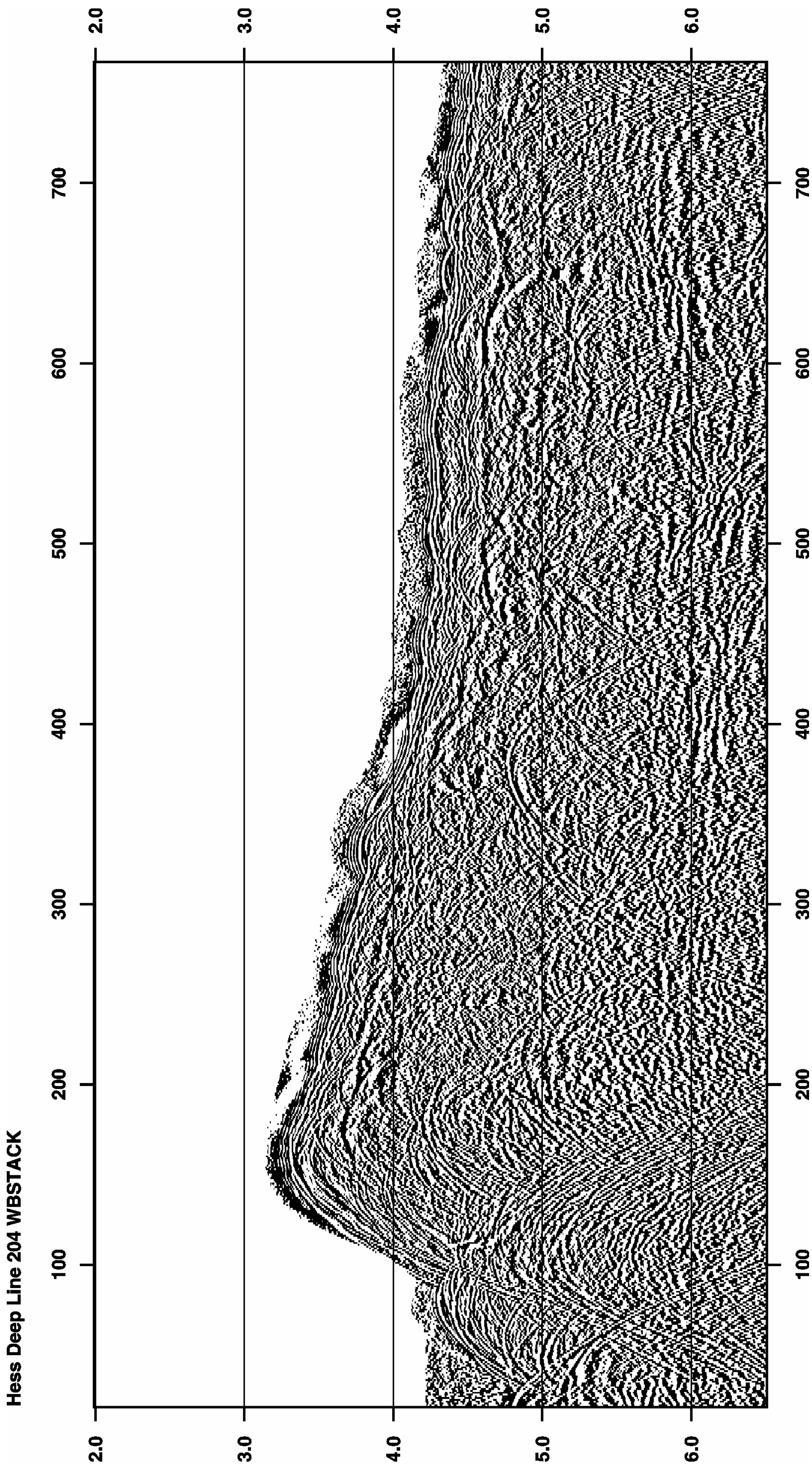

Hess Deep Line 116 WBSTACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500
600

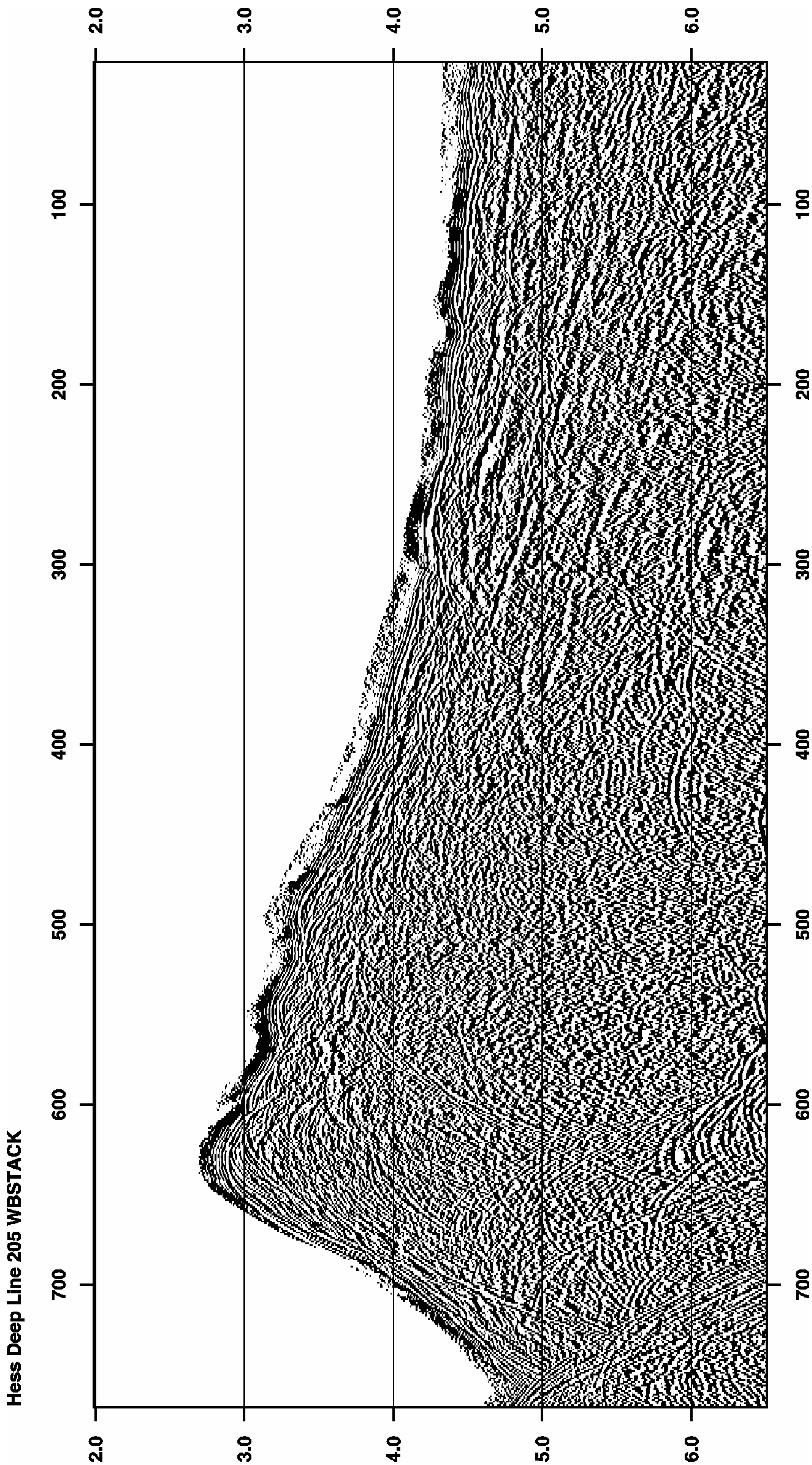


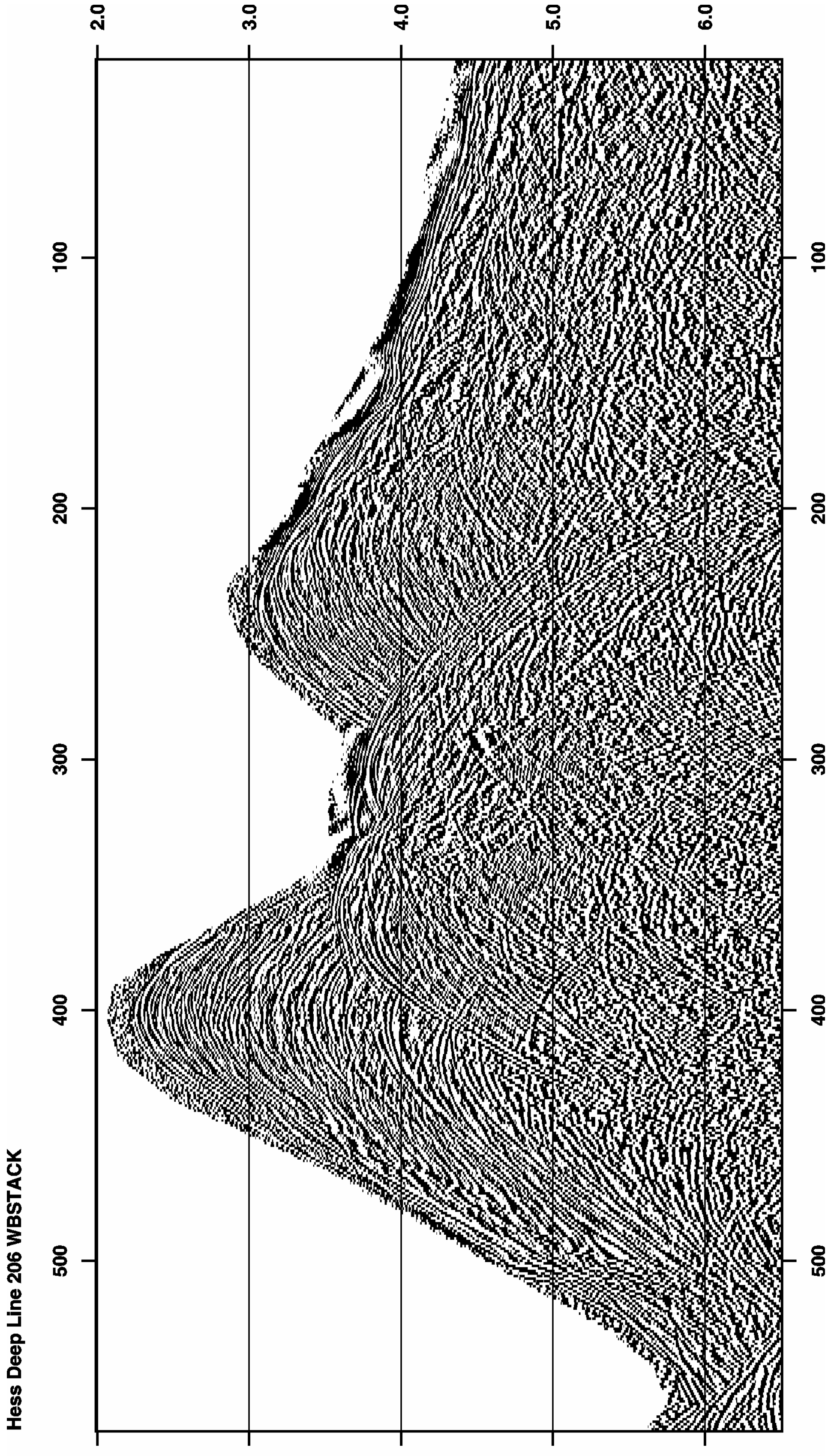
Hess Deep Line 201 WBSTACK

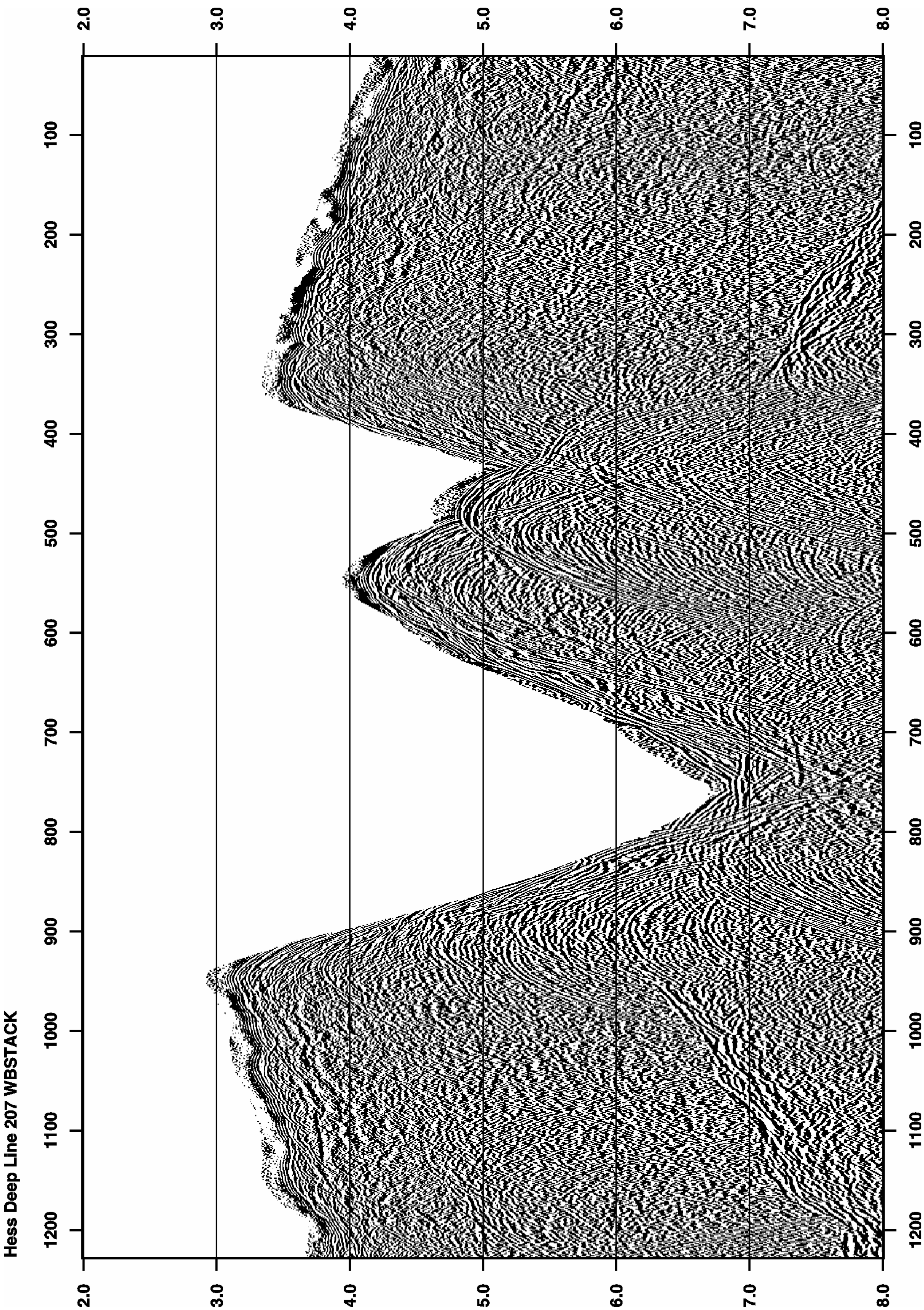

Hess Deep Line 202 WBSTACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500
600
700


Hess Deep Line 203 WBSTACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500
600
700


Hess Deep Line 204 WBSTACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500
600
700

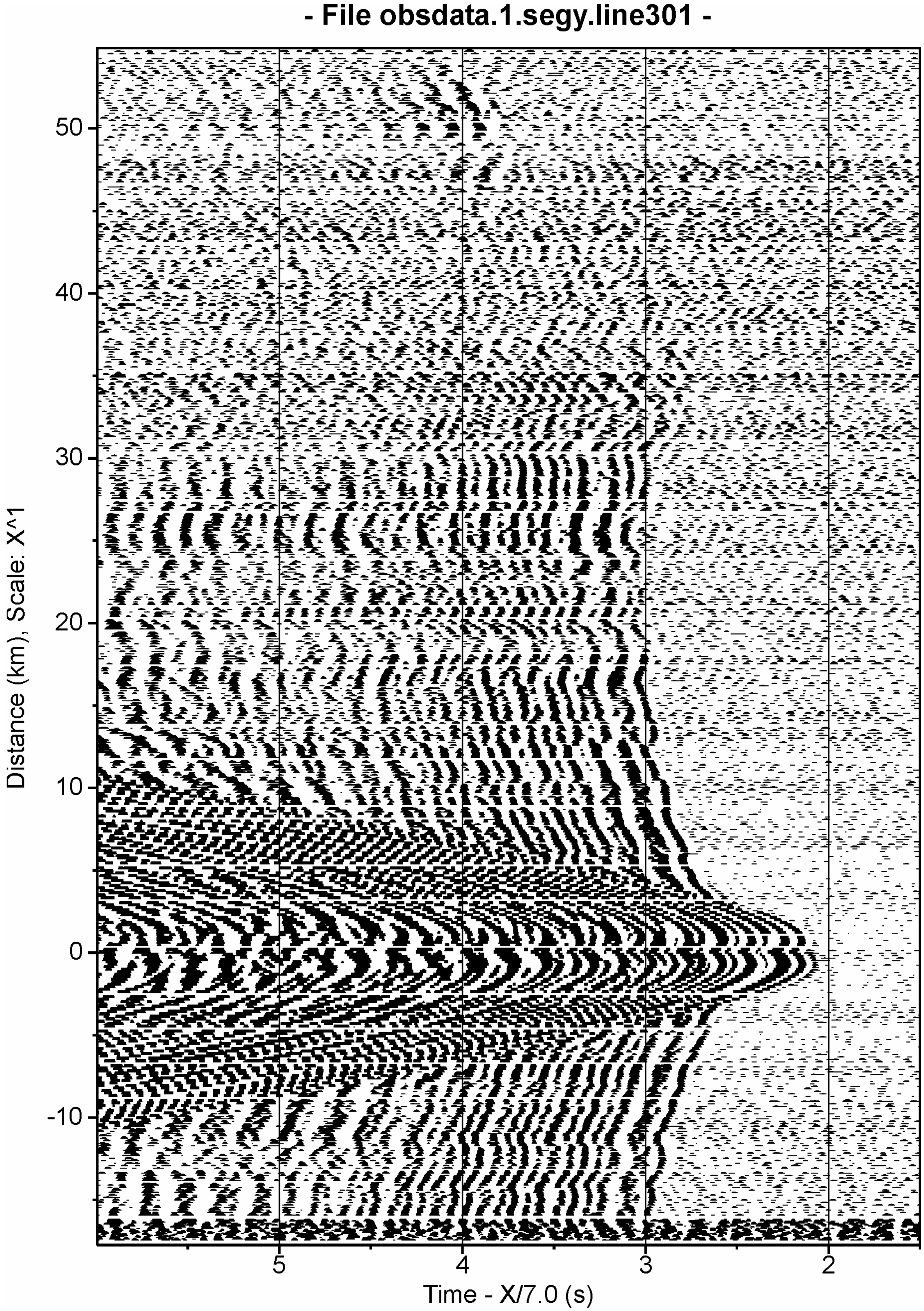

Hess Deep Line 205 WBSTACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500
600
700

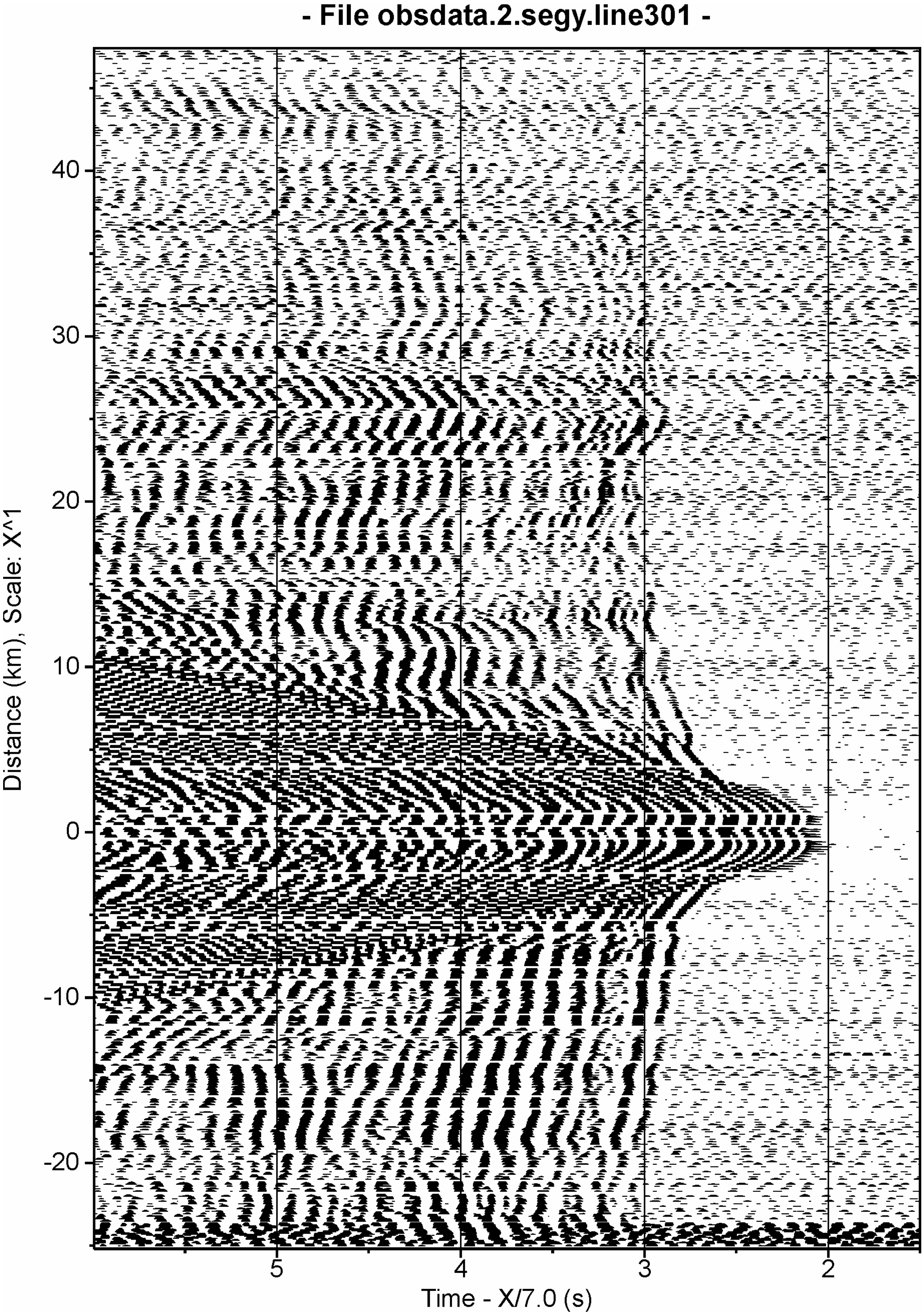

Hess Deep Line 206 WBSTACK
2.0
3.0
4.0
5.0
6.0
100
200
300
400
500

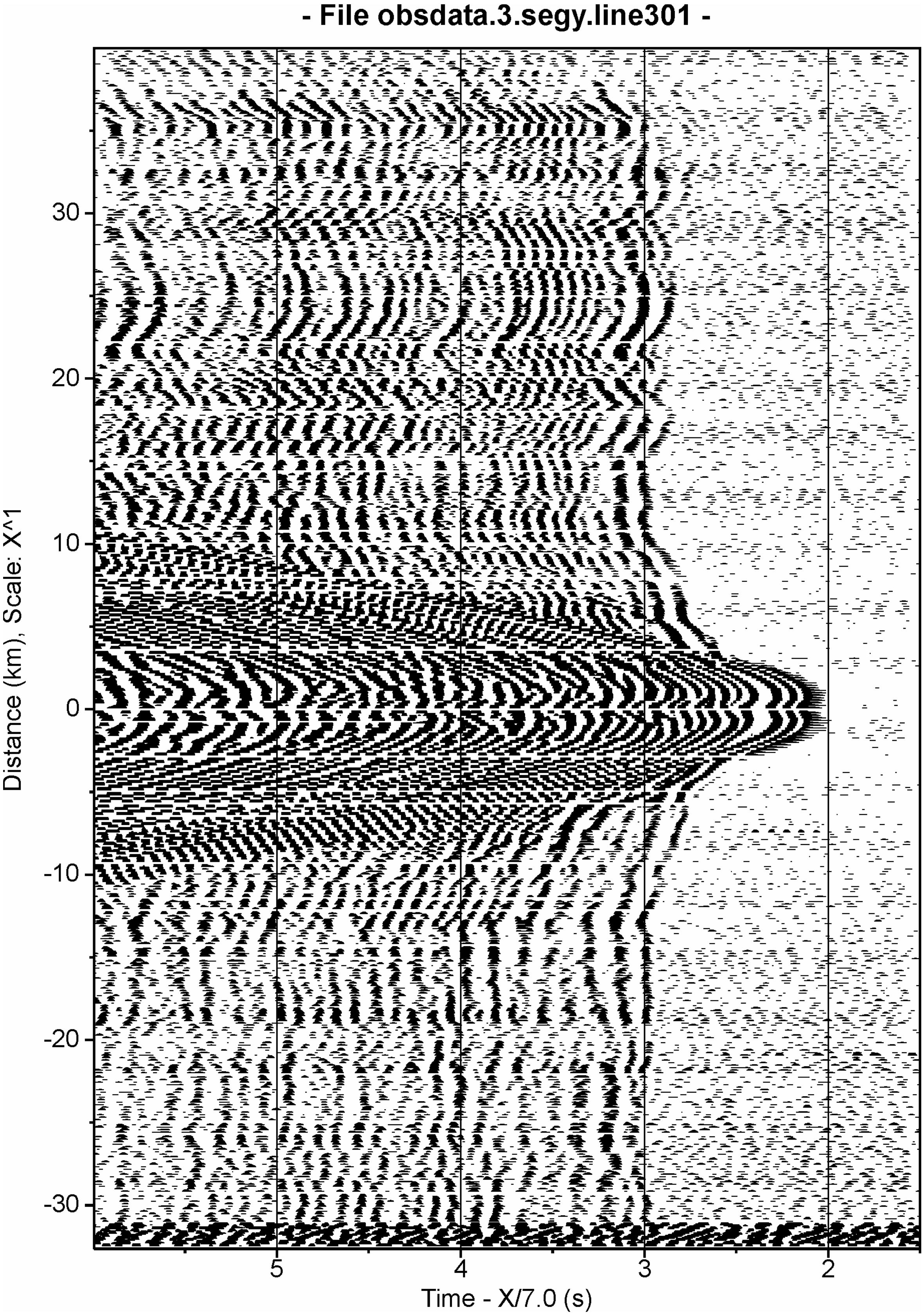

Hess Deep Line 207 WBSTACK
100
200
300
400
500
600
700
800
900
1000
1100
1200
2.0
3.0
4.0
5.0
6.0
7.0
8.0

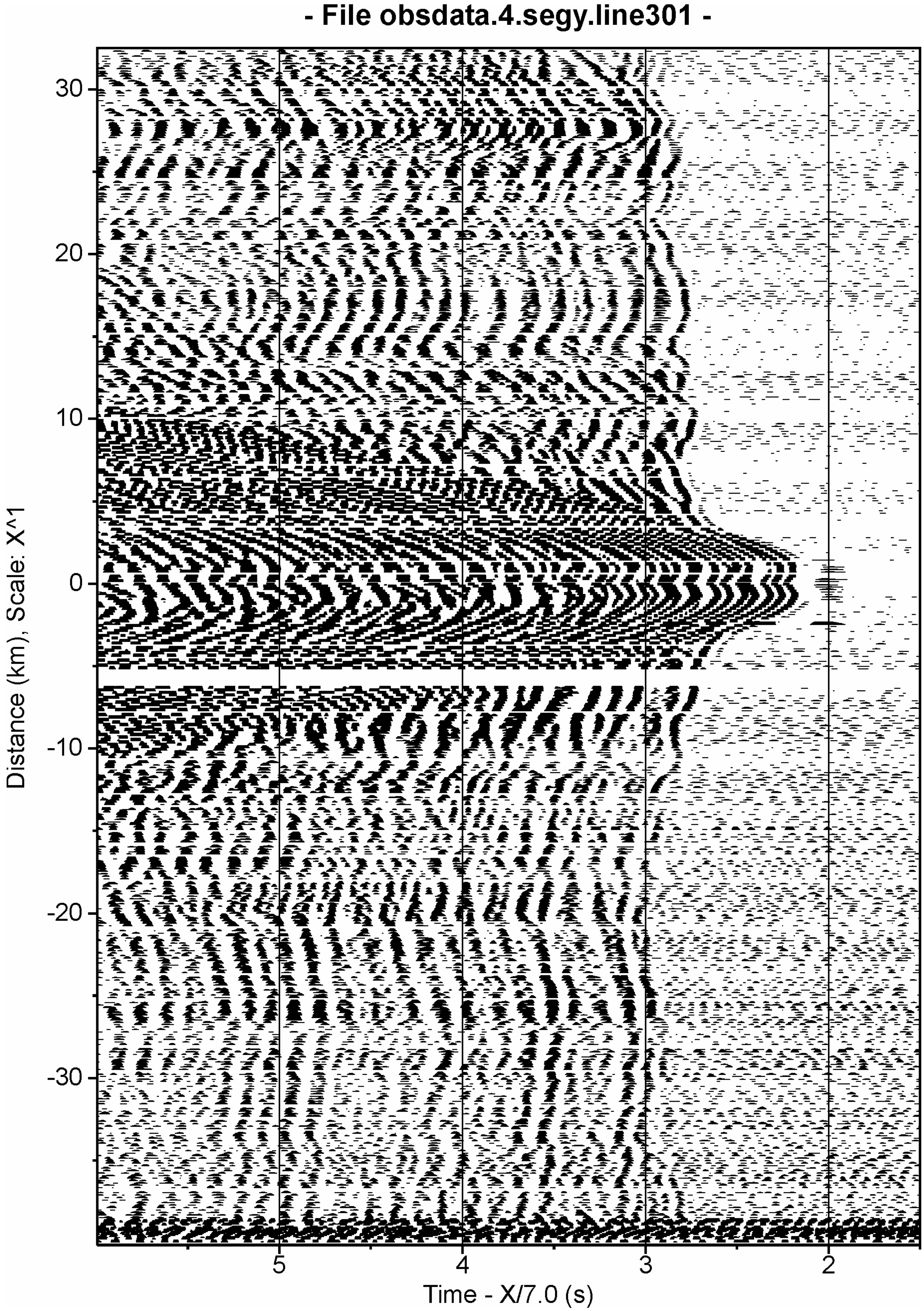
OBS Record Sections

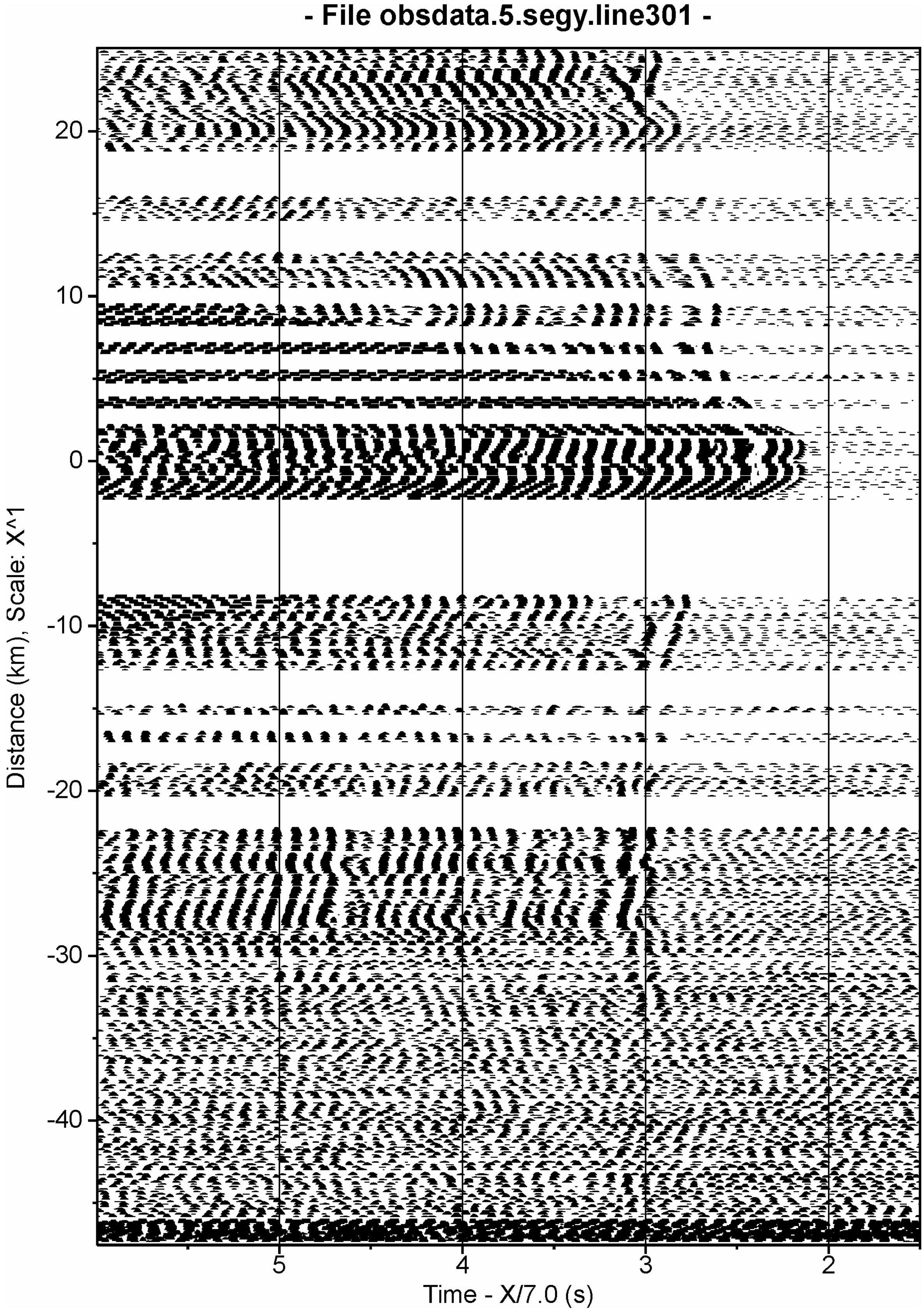
Record sections are shown for lines 301, 311, and 315 (the 3 profiles shot at OBS shot spacing). Line 301 had a shot interval of 200 m, and lines 311 and 315 had a shot interval of 150 m. All record sections are plotted with a reduction velocity of 7 km/s, and have been bandpass filtered with a low cut of 3 Hz, high cut of 15 Hz, and 48 dB/octave rolloff.

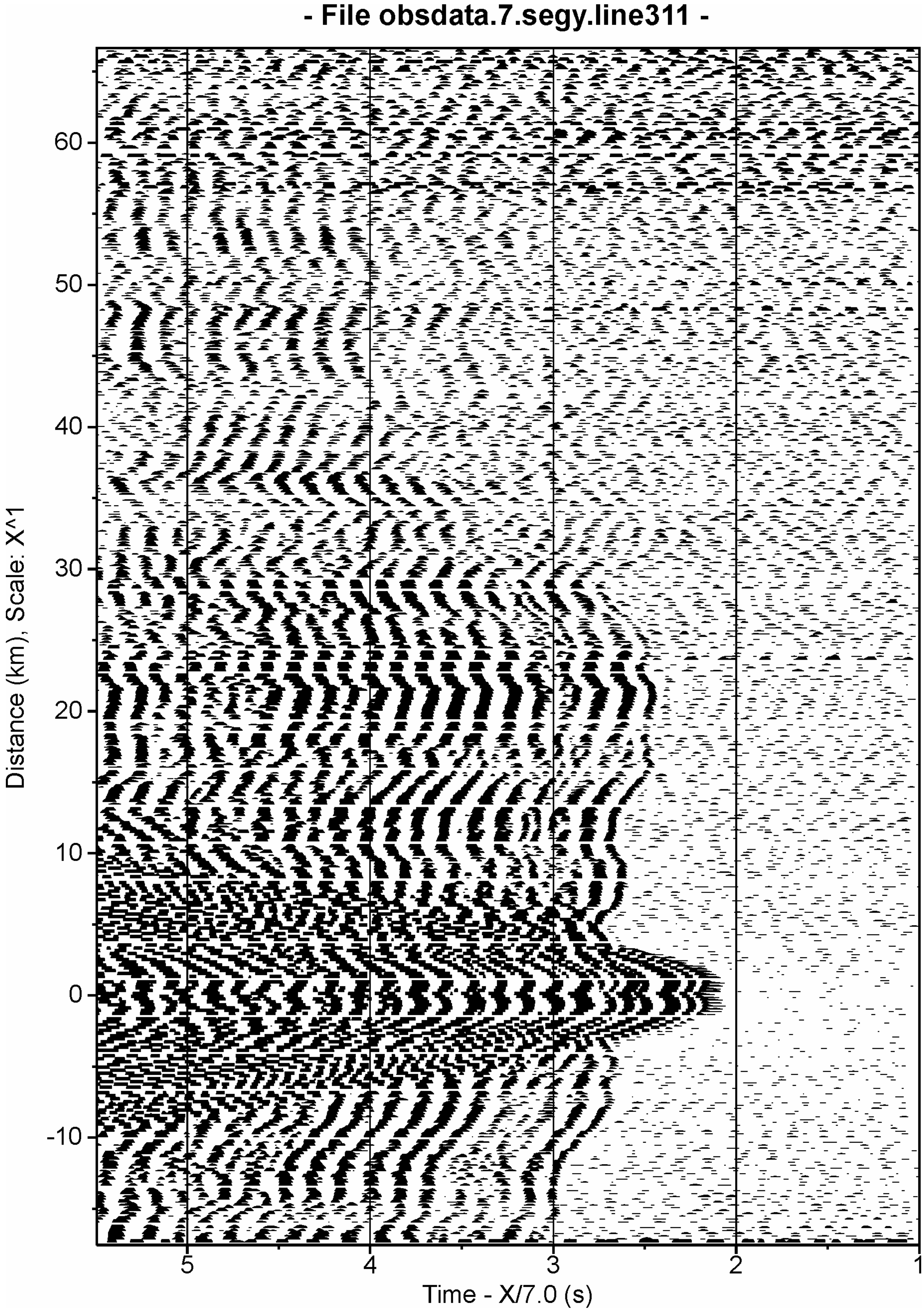

- File obsdata.1.segy.line301 -
Distance (km), Scale: X^1
50
40
30
20
10
0
-10
5
4
3
2
Time - X/7.0 (s)

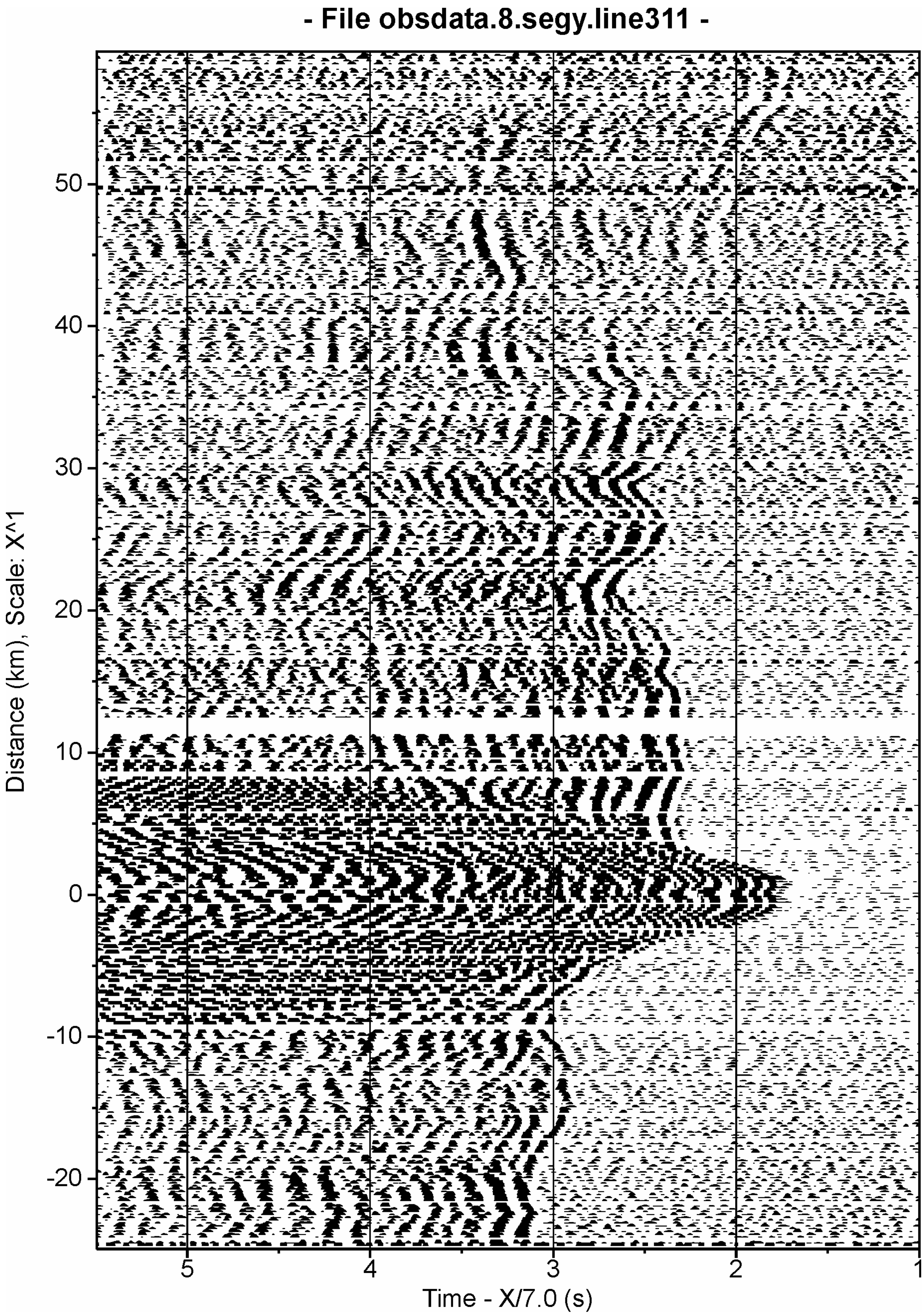

- File obsdata.2.segy.line301 -
Distance (km), Scale: X^1
40
30
20
10
0
-10
-20
5
4
3
2
Time - X/7.0 (s)

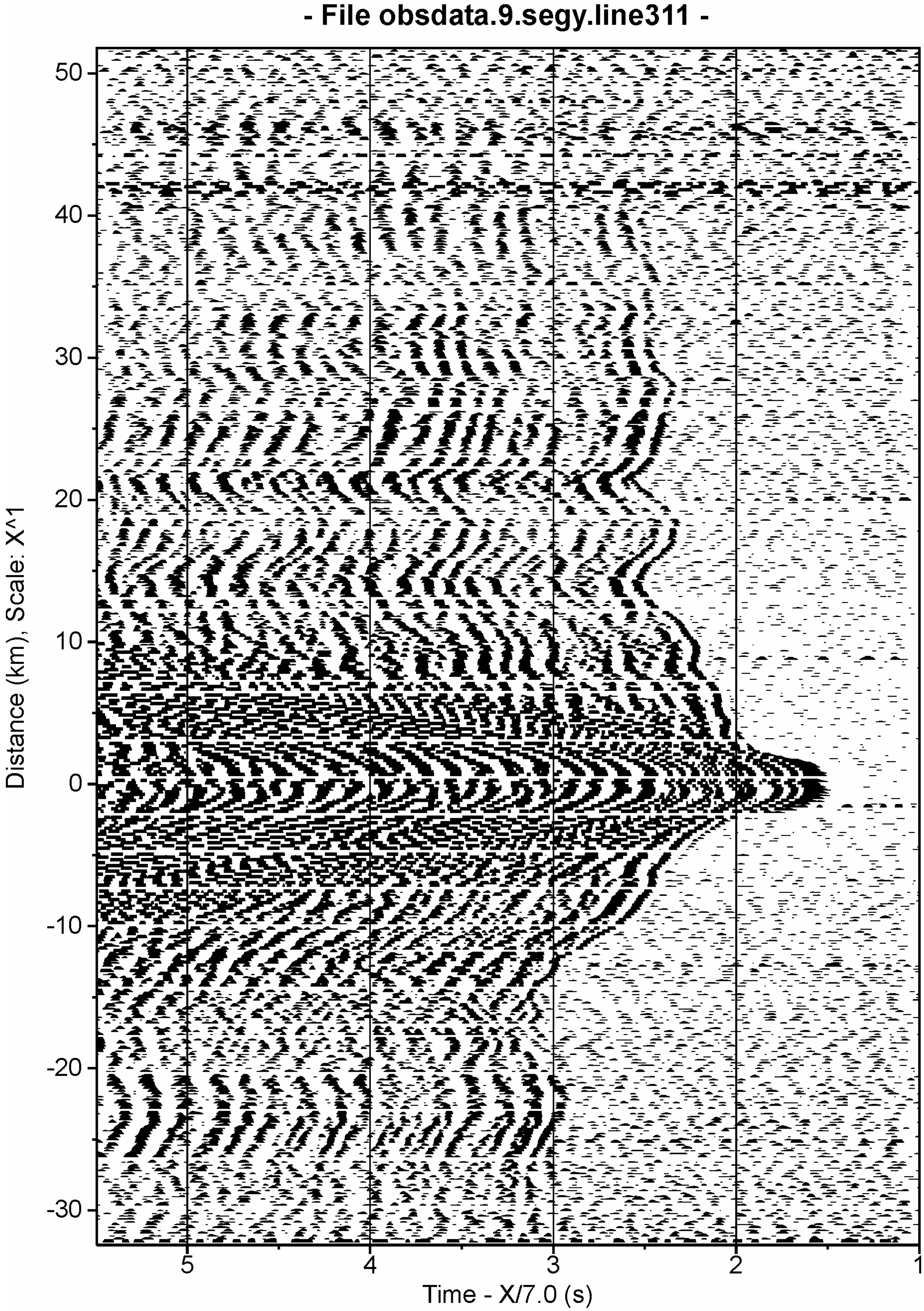

- File obsdata.3.segy.line301 -
Distance (km), Scale: X^1
30
20
10
0
-10
-20
-30
5
4
3
2
Time - X/7.0 (s)

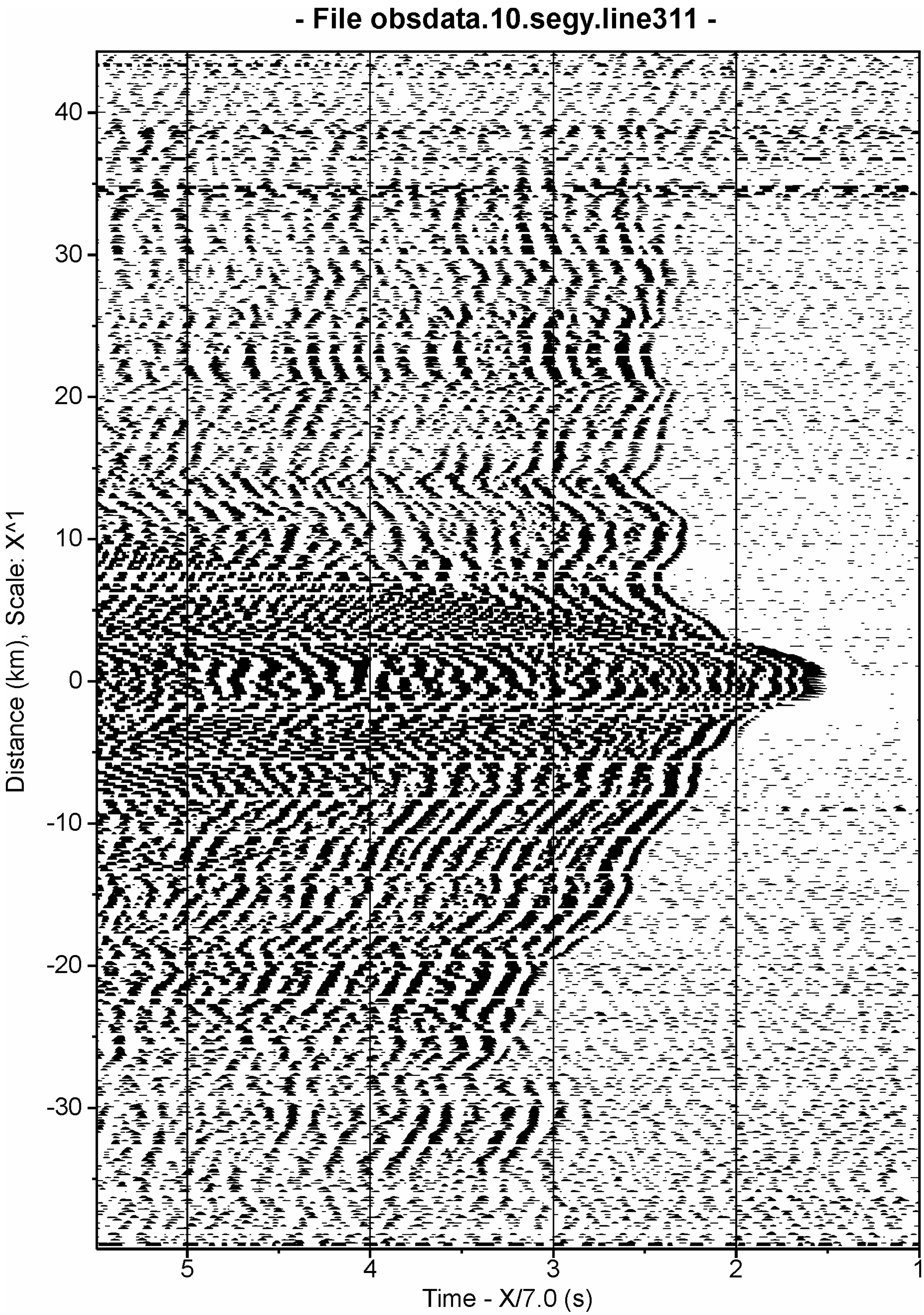

- File obsdata.4.segy.line301 -
Distance (km), Scale: X^1
30
20
10
0
-10
-20
-30
5
4
3
2
Time - X/7.0 (s)

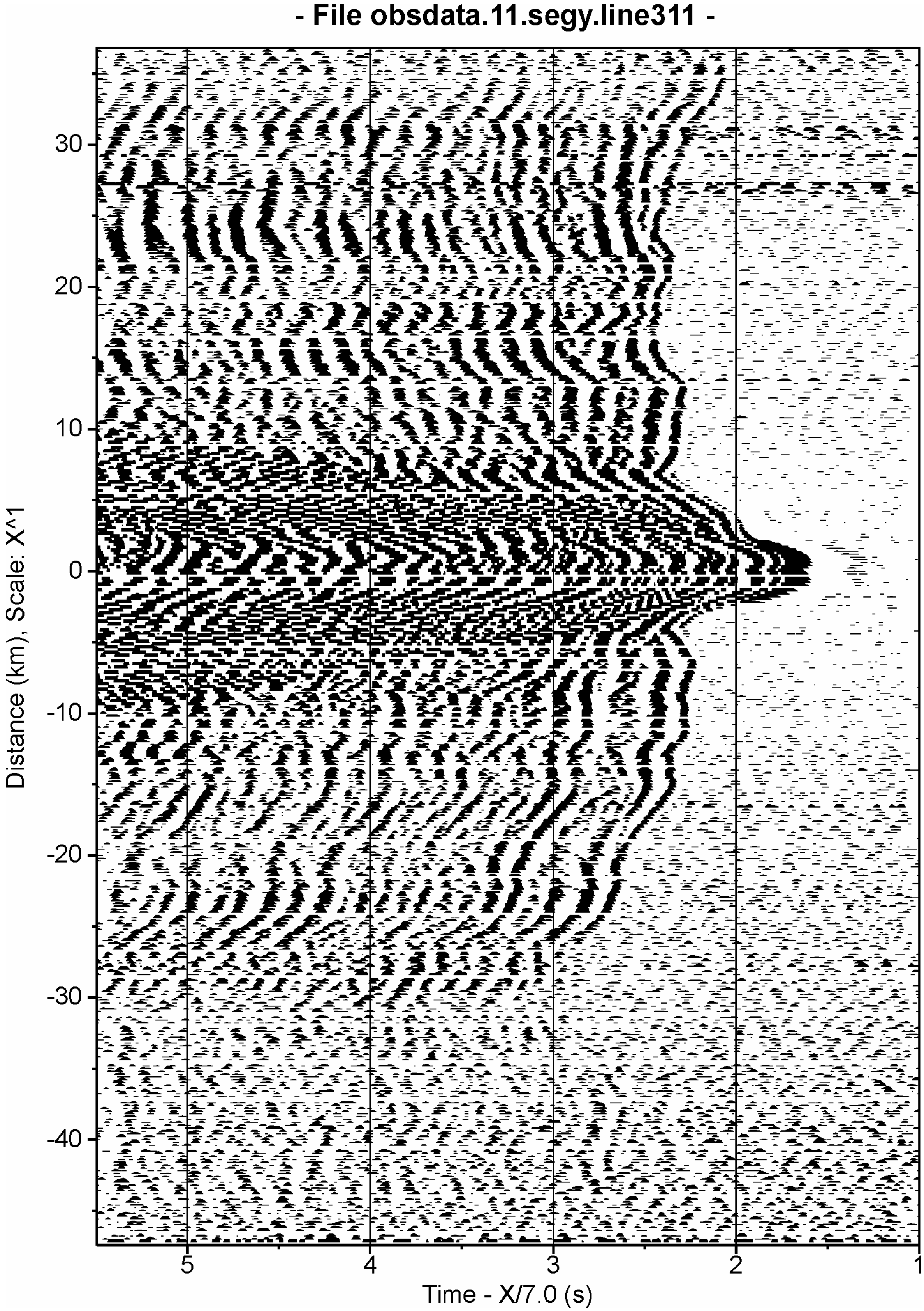

- File obsdata.5.segy.line301 -
20
10
0
-10
-20
-30
-40
Distance (km), Scale: X^1
5
4
3
2
Time - X/7.0 (s)


- File obsdata.7.segy.line311 -
Distance (km), Scale: X^1
60
50
40
30
20
10
0
-10
5
4
3
2
1
Time - X/7.0 (s)

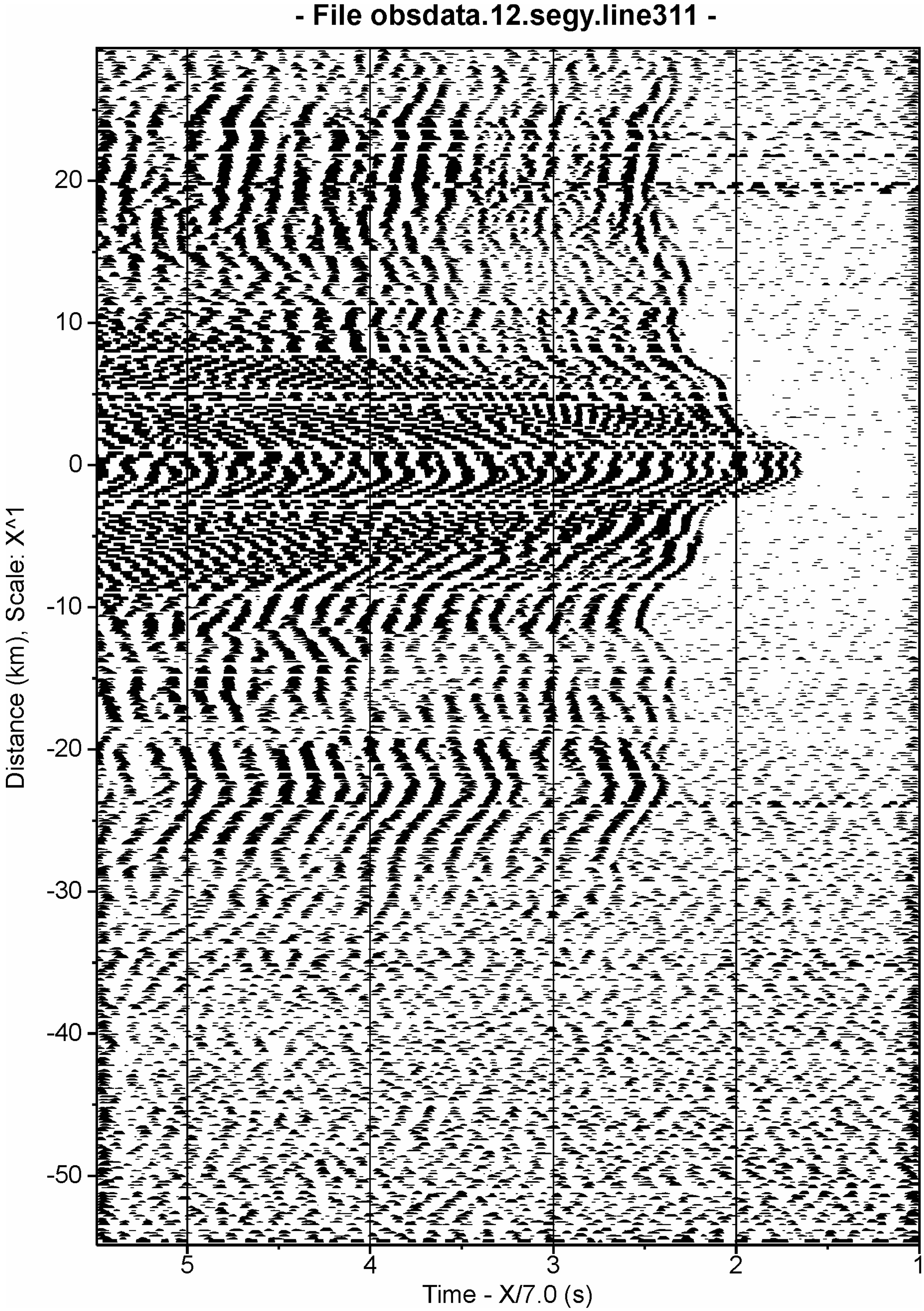

- File obsdata.8.segy.line311 -
Distance (km), Scale: X^1
Time - X/7.0 (s)
50
40
30
20
10
0
-10
-20
5
4
3
2
1


- File obsdata.9.segy.line311 -
Distance (km), Scale: X^1
Time - X/7.0 (s)
50
40
30
20
10
0
-10
-20
-30
5
4
3
2
1

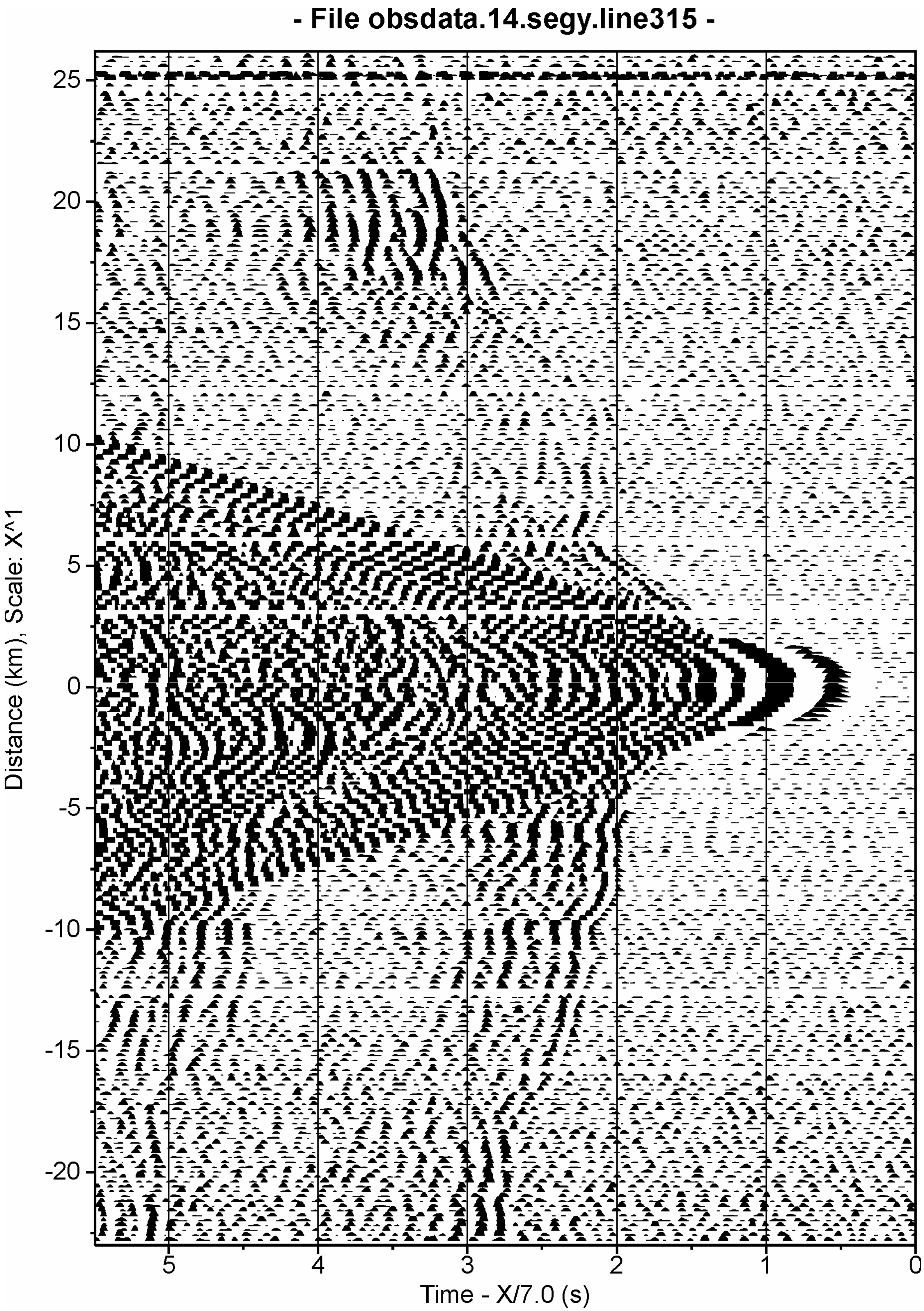

- File obsdata.10.segy.line311 -
Distance (km), Scale: X^1
40
30
20
10
0
-10
-20
-30
Time - X/7.0 (s)
5
4
3
2
1



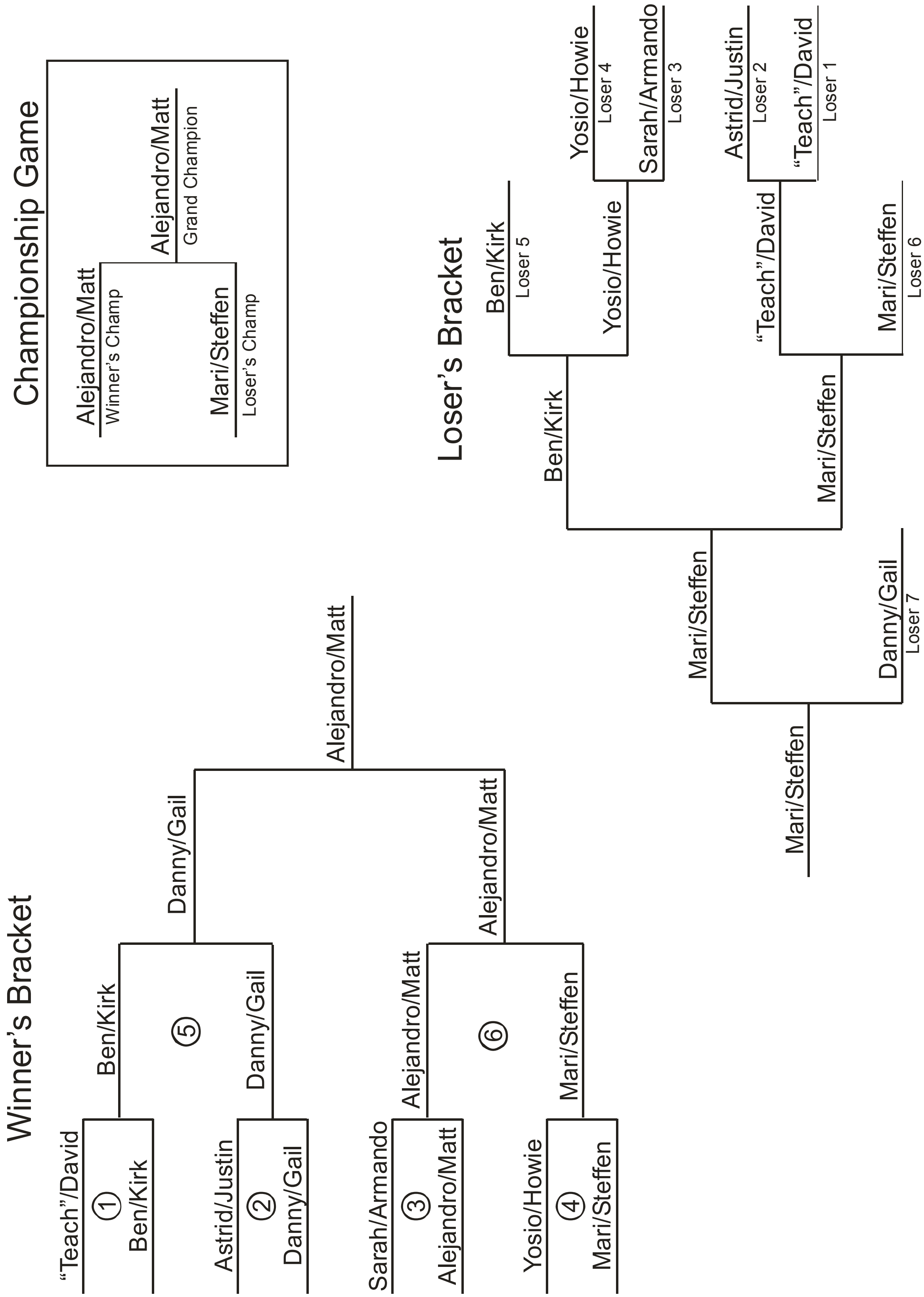
- File obsdata.11.segy.line311 -
Distance (km), Scale: X^1
30
20
10
0
-10
-20
-30
-40
5
4
3
2
1
Time - X/7.0 (s)



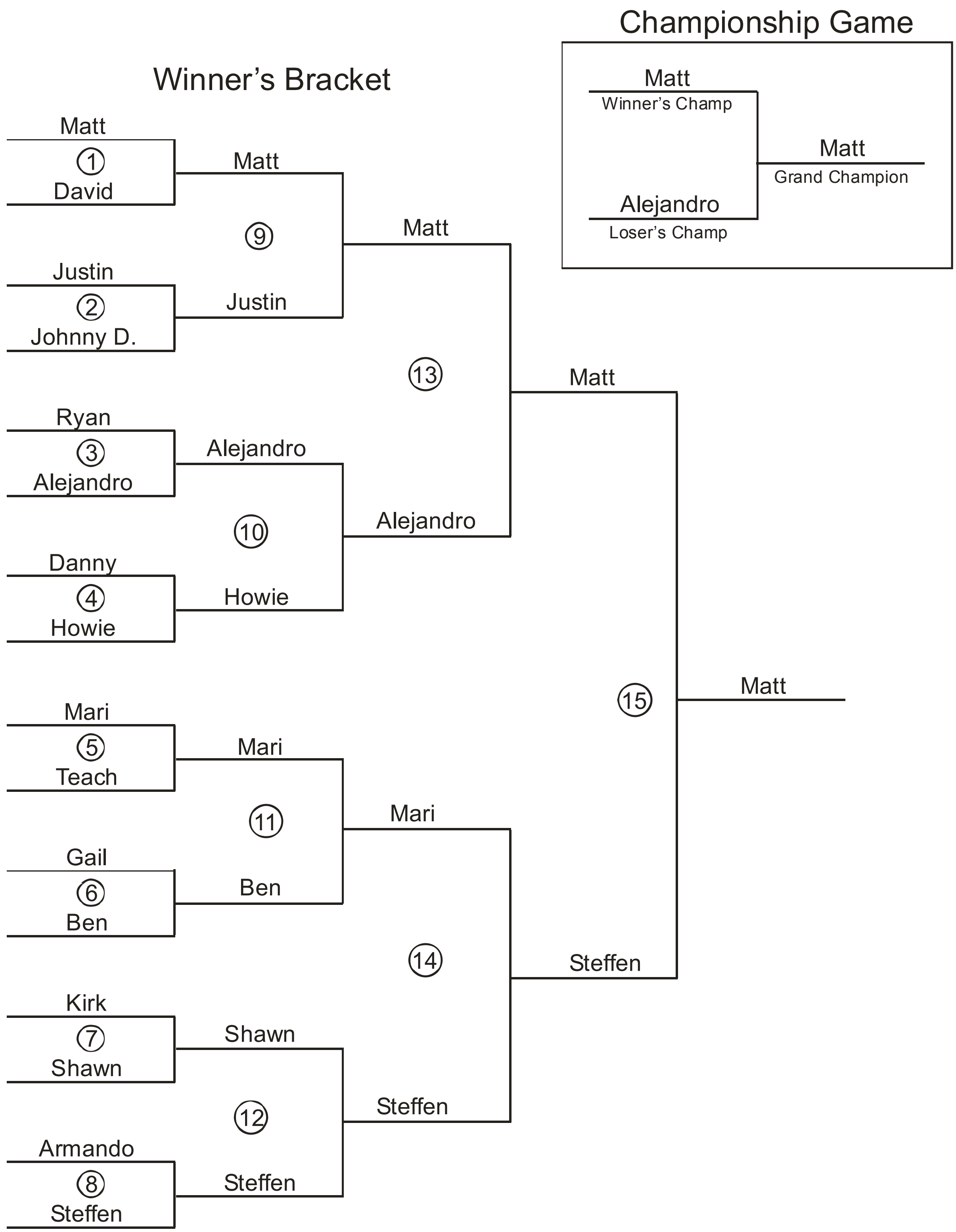
- File obsdata.12.segy.line311 -
Distance (km), Scale: X^1
20
10
0
-10
-20
-30
-40
-50
5
4
3
2
1
Time - X/7.0 (s)


- File obsdata.14.segy.line315 -
25
20
15
10
5
0
-5
-10
-15
-20
Distance (km), Scale: X^1
5
4
3
2
1
0
Time - X/7.0 (s)

Hess Deep Mid-Pacific Doubles Ping Pong Tournament



Hess Deep Mid-Pacific Singles Ping Pong Tournament



Hess Deep Mid-Pacific Single's Ping Pong Championship

Loser's Bracket