2D MARINE SEISMIC

PROCESSING REPORT

OF

LITHOPROBE

FOR

ATLANTIC GEOSCIENCE CENTRE

BY

WESTERN GEOPHYSICAL, A DIVISION
OF WESTERN ATLAS CANADA LTD.

CALGARY DIGITAL CENTRE - MAY 1990

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INTRODUCTION

The processing of seismic data from offshore Nova Scotia was performed by Western Geophysical, A division of Western Atlas Canada Ltd. for the Atlantic Geoscience Centre as part of the Canadian Lithoprobe Project. Approximately 619 kilometers of deep seismic data (up to 23.6 second records) was collected in October,1989 by Haliburton Geophysical with the processing completed in the spring of 1990.

This report details the processing methods and parameters used as well as providing a summary of the testing that lead to the selection of this processing sequence. Also provided is a statement of the products generated and their final disposition, along with a list of the personnel involved in this project.

ACQUISITION PARAMETERS

ACQUISITION DATES:

Line 89-1	October 3, 1989
Line 89-1A	October 3, 1989
Line 89-1B	October 3, 1989
Line 89-1C	October 7, 1989
Line 89-1D	October 7, 1989
Line 89-1E	October 8, 1989
Line 89-1F	October 11, 1989
Line 89-1G	October 14, 1989
Line 89-2	October 15, 1989
Line 89-2A	October 16, 1989
Line 89-3	October 23, 1989
Line 89-3A	October 23, 1989
Line 89-4	October 24, 1989
Line 89-5	October 24, 1989

RECORD LENGTH:

Line 1	23.6 sec
Line 1A	22.6 sec
Line 1B	22.6 sec
Line 1C	22.6 sec
Line 1D	22.6 sec
Line 1E	21.5 sec
Line 1F	21.5 sec
Line 1G	21.5 sec
Line 2	21.5 sec
Line 2A	21.5 sec
Line 3	21.5 sec
Line 3A	22.5 sec
Line 4	23.6 sec
Line 5	22.5 sec

VESSEL: M/V F.J. AGNICH -Party 2995
SHOT BY: HALLIBURTON GEOPHYSICAL SERVICES

SOURCE:

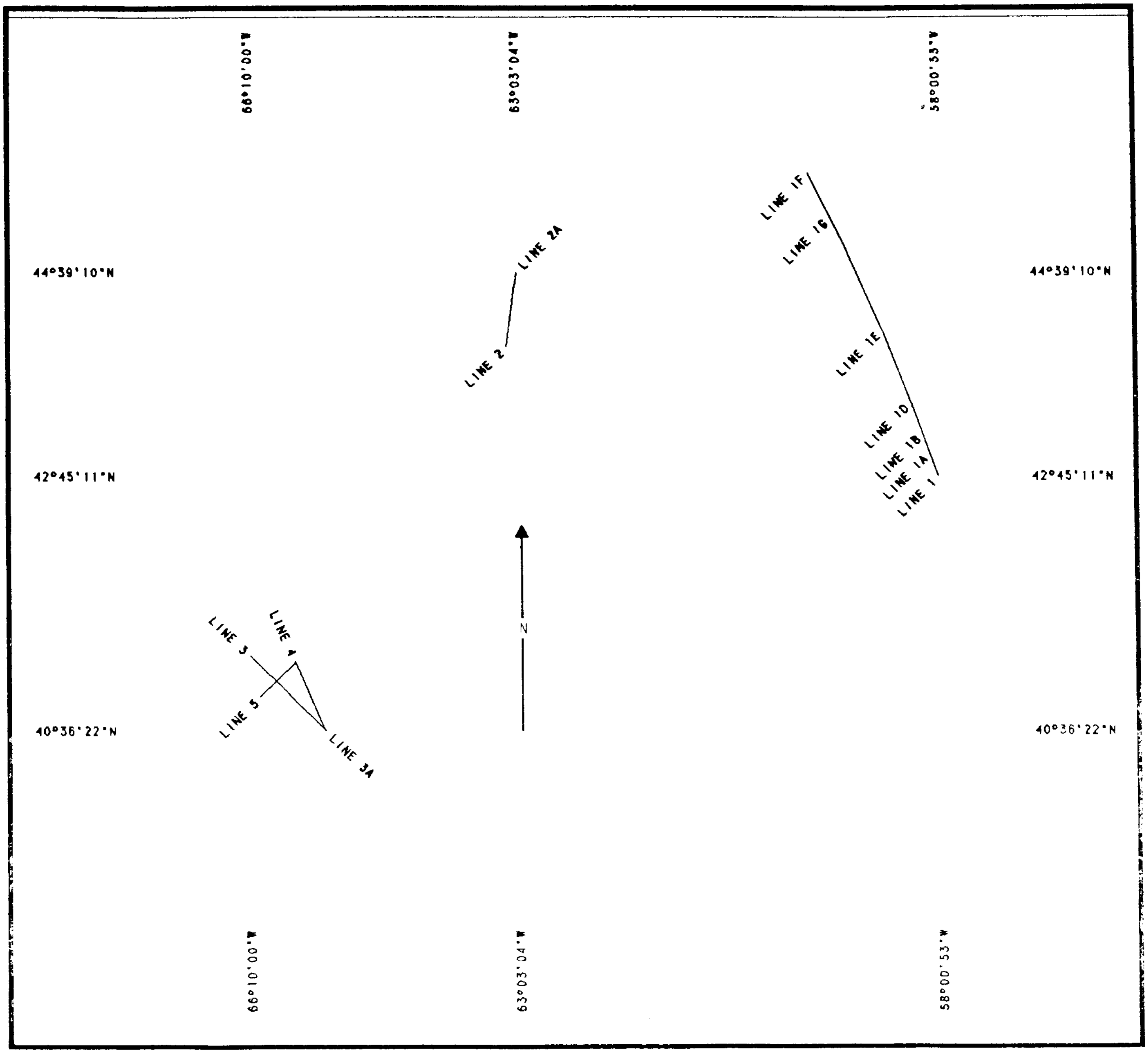
Energy Source	AIRGUN ARRAY
Gun Array Volume	7062 CU. IN.
Gun Pressure	1800 P.S.I.
Gun Depth	12 M
Shotpoint Interval	50 M
Antenna to Source	102.5 - 103.5
Centre Near Group to Centre Far Group .	2975 M
Cable Depth	14 M
Offset Centre Guns to Centre Near Group	260 M
Group Interval	25 M
Number of Groups Recorded	120

INSTRUMENTS:

Recording System	DFS-V
Filter	LOW CUT 3.5 HZ, 18 db/oct HIGH CUT 90 HZ,72 db/oct
Sampling Interval	4 MS
Format	MULTIPLEXED SEG-B
Primary Nav. System	STARFIX
Secondary Nav. System	AIFF GPS

LIST OF LINES PROCESSED

LINE #	SHOTPOINT RANGE (ACQUIRED)	SHOTPOINT RANGE (PROCESSED)	SHOTPOINT INTERVAL (METERS)	LENGTH (KM)
89-1	101-630	101-599	50	29.950
89-1A	577-1061	600-999	50	20.000
89-1B	981-1625	1000-1599	50	30.00
89-1C	1593-1638	0	50	0.00
89-1D	1593-3128	1600-3114	50	75.750
89-1E	3097-5051	3115-5045	50	96.550
89-1F	6501-5471	6501-5542	50	48.000
89-1G	5541-4817	5541-5046	50	24.800
89-2	101-1339	101-1299	50	59.950
89-2A	1261-1566	1300-1566	50	13.350
89-3	101-1193	101-1174	50	53.700
89-3A	1157-2180	1175-2180	50	50.300
89-4	101-1564	101-1564	50	73.200
89-5	101-1068	101-1068	50	48.400


66°10'00"W
63°03'04"W
58°00'53"W
44°39'10"N
42°45'11"N
40°36'22"N
LINE 1F
LINE 1G
LINE 1E
LINE 1D
LINE 1B
LINE 1A
LINE 1
LINE 2A
LINE 2
N
LINE 3
LINE 4
LINE 5
LINE 3A

PROCESSING FLOWCHART

General Processing Flow
(For Lines 89-1E,1F,1G, 89-2/2A, 89-4, 89-5)

FORMAT CONVERSION/DEMULTIPLEX
|
EDIT/52 MSEC FIRING DELAY COMPENSATION
|
FK NOISE ATTENUATION
|
GEOMETRIC SPREADING COMPENSATION
|
PRESTACK DECONVOLUTION
|
TRACE BALANCE
|
VELOCITY ANALYSIS
|
FK DEMULTIPLE
|
STACK 3000%
|
WATER BOTTOM MUTE
|
ARRAY FORM
|
DECIMATION 2/1
|
REFLECTION STRENGTH GAIN
|
RMS GAIN
|
POST STACK DECONVOLUTION
|
TIME VARIANT FILTER
|
(SUBSAMPLE TO 6 MSEC-NOT APPLIED TO LINE 89-2/2A)
|
FINITE DIFFERENCE MIGRATION
|
TIME VARIANT FILTER
|
GAIN (RMS)
|
ARRAY FORMING
|
DECIMATION 2/1 (TO OBTAIN 1:100,000)
|
ADJACENT TRACE SUM (TO OBTAIN 1:200,000)

PROCESSING FLOWCHART
(FOR LINE 89-1/1A/1B/1D,89-4 & 89-5)
General Processing Flow
(PRE-STACK AGC GAIN VERSION)

FORMAT CONVERSION/DEMULTIPLEX
|
EDIT/52 MSEC FIRING DELAY COMPENSATION
|
FK NOISE ATTENUATION
|
GEOMETRIC SPREADING COMPENSATION
|
PRESTACK DECONVOLUTION
|
TRACE BALANCE
|
VELOCITY ANALYSIS
|
FK DEMULTIPLE
|
AGC GAIN
|
STACK 3000%
|
WATER BOTTOM MUTE
|
ARRAY FORM
|
DECIMATION 2/1
|
REFLECTION STRENGTH GAIN
|
RMS GAIN
|
POST STACK DECONVOLUTION
|
TIME VARIANT FILTER
|
(SUBSAMPLE TO 6 MSEC-NOT APPLIED TO LINE 89-2/2A)
|
FINITE DIFFERENCE MIGRATION
|
TIME VARIANT FILTER
|
GAIN (RMS)
|
ARRAY FORMING
|
DECIMATION 2/1 (TO OBTAIN 1:100,000)
|
ADJACENT TRACE SUM (TO OBTAIN 1:200,000)

PROCESSING FLOWCHART
(FOR LINE 89-4 & 89-5)

General Processing Flow

FORMAT CONVERSION/DEMULTIPLEX
|
EDIT/52 MSEC FIRING DELAY COMPENSATION
|
FK NOISE ATTENUATION
|
SUBSAMPLE TO 6 MSEC
|
ADJACENT TRACE SUM
|
AGC GAIN
|
VELOCITY ANALYSIS
|
STACK 3000%
|
WATER BOTTOM MUTE
|
REFLECTION STRENGTH GAIN
|
RMS GAIN
|
POST STACK DECONVOLUTION
|
AGC GAIN
|
TEMPORAL AND SPATIAL VARYING FILTER
|
(SUBSAMPLE TO 6 MSEC-NOT APPLIED TO LINE 89-2/2A)
|
FINITE DIFFERENCE MIGRATION
|
TIME VARIANT FILTER
|
GAIN (RMS)
|
ARRAY FORMING
|
DECIMATION 2/1
|
ADJACENT TRACE SUM (TO OBTAIN 1:200,000)

DATA PROCESSING DESCRIPTION

1. FORMAT CONVERSION/EDIT

The field tapes received in SEG-B multiplexed format were converted to Western's internal Code-4 format. The near trace of each shot record and every 60th shot record were displayed for quality control and subsequent parameter selection. Data was processed to a record length of up to 23.60 seconds.

2. FK DOMAIN NOISE FILTER (SHOT DOMAIN)

Dipping events that overlap in the TX domain can be separated in the FK domain. This separation enables us to filter out events with unwanted dips. First the shot records are transformed from the TX domain to the FK domain. Next, regions of the FK domain (see below) corresponding to unwanted dips are attenuated. Finally, the data are transformed back to the TX domain to obtain the filtered result.

FK Filter Zones

50m

Pass Zones from -8.7 to +8.7 msec/trace with 2.4 msec/trace tapers centered at these boundaries and -.125 to +.125 (times nyquist) wave number with .05 wavenumber tapers centered at these boundaries.

FK filtering was performed on all lines.

3. WAVE EQUATION MULTIPLE ATTENUATION (W.E.M.A.)

In this method, the wave equation is used to extrapolate the record wave field from the water surface back to the water-bottom. The influence of the water-bottom shape is properly taken into account. Each repeat of the multiple series is predicted from the previous repeat and is subtracted from the total data. W.E.M.A. was perfomred on shot records that had been subsampled to 6 ms and had the amount of traces reduced to 60 with an adjacent trace sum.

Performed on Line 89-1/1A/1B/1D (SP 101-3014) and Line 89-3/3A (SP 1-600).

4. GAIN COMPENSATION FOR SPHERICAL SPREADING

This time and offset variant, non data amplitude dependent trace scaling compensated for amplitude loss resulting from the increasing area of the propagating wavefront. The gain correction based on the radius of the expanding wavefront, was calculated as a function of offset and time dependent velocities.

Note: In cases where wave equation multiple attenuation (W.E.M.A.) was performed, this process was done post W.E.M.A. (i.e. Lines 89-1/1A/1B/1D (SP 101-3014), 89-3/3A.

5. PRESTACK DECONVOLUTION

Minimum phase predictive deconvolution was applied in the time domain using the Weiner-Levinson algorithm. The design parameters and windowing for autocorrelation determination were as follows:

Minimum Prediction Distance .... 12 ms (line 89-2/2A)
Minimum Prediction Distance .... 60 ms (all other lines)
Maximum Prediction Distance .... 300 ms

Percent White Noise 0.1%
Number of Channels 1

Autocorrelation Windowing

89-1/1A/1B/1D	1 window	start:	deepest of water bottom or 500 ms
89-3/3A		:	length 3000 ms
89-1E/1F/1G	2 windows	start:	500 ms
		stop:	15,000 ms
		overlap:	500 ms centered at 3250 ms
89-4	1 window	start:	water bottom
		stop:	water bottom multiple

6. TRACE BALANCE

Each trace was scaled to a fixed root mean square value (2000) to remove source and receiver induced amplitude differences between traces.

7. VELOCITY ANALYSIS

The velocities for FK multiple Attenuation had an interval of 6 km, while stacking velocities were at a 3 km interval. Five adjacent common midpoint gathers with common offset traces summed together provided the input. A cross-correlation based technique was used to determine stacking velocities by searching for coherence (semblance) along hyperbolic trajectories.

Conventional gained and filtered stacked sections were produced for subsequent velocity residualizing.

8. FK DOMAIN MULTIPLE ATTENUATION

The velocity analysis (step 7) provided the multiple velocities with sufficient accuracy to determine intermediate velocity functions with which to temporarily NMO correct the data. These gathers with over-corrected primary (negative dip) and under-corrected multiple (positive dip) were then transformed into the FK domain where all positive dips were removed. An inverse FK transform was then applied and the temporary velocity correction removed.

F-K demultiple was performed on all lines.

9. AUTOMATIC GAIN CONTROL (A.G.C.)

Multipliers, defined by the average absolute amplitude over a 60 ms window, were applied to the data. The multipliers are applied at the center of the window and the window is shifted one sample at a time. This normalization routine tends to reduce the ratio of the high amplitude multiple to the time concurrent primary.

AGC gain was applied to Lines 89-1/1A/1B/1D, 89-4, 89-5 only for the separate pre-stack AGC-gain version.

10. NORMAL MOVEOUT CORRECTION, MUTE AND STACK

Based on the velocity analysis performed earlier, the component of arrival time associated with shot to receiver offset for each trace sample was removed (NMO). The resulting traces within a common midpoint were summed together to produce a single (zero-offset simulated) stacked trace at each common midpoint location. As is normal, two applications of normal moveout, mute and stack were performed. The preliminary stack was used to generate a stacking monitor. After residualizing the velocities using this monitor, the velocity analysis, and the preliminary stack section; a second and final stack was produced.

a.) Optimum Trace Weighting

Offset dependent weights were designed to aid in multiple suppression by weighting down the near offsets where the multiple exhibited little residual moveout after correction with the primary velocity. The weights were designed using the velocities of primary and multiple reflections at specific times.
Optimum trace weighting was performed on Lines 89-1/1A/1B/1D, 89-3/3A,89-4, and 89-5 where the water bottom multiple was greater than one second.

11. ARRAY FORM

An adjacent trace sum (1:1) and 2:1 trace decimation was performed on those lines that had not already had their shot records reduced to 60 traces.

12. REFLECTION STRENGTH GAIN

This gain locally provided an AGC type sample by sample gain to suppress 'gain shadows' while globally preserving the amplitude envelope of the trace, normalizing the output trace RMS to 2000.

13. RMS GAIN

Each trace was divided into non-overlapping zones beginning with a length of 128 msec and doubling to a maximum of 4096 or 512 msec depending on the water depth of the line (see below)

Line	Maximum Zone
89-1E/1F/1G	4096
89-1D(SP 3080)	4096
(SP 2740)	512
89-1/1A/1B	512
89-2/2A	4096
89-3/3A	512
89-4	512
89-5	512

14. DECONVOLUTION AFTER STACK

Minimum phase predictive deconvolution was applied using the Wiener Levinson algorithm. The design parameters and windowing for autocorrelation determination were as follows:

Operator Length	300 MSEC
Prediction Distance	60 MSEC
Number of Channels	101
Percent of White Noise	0.1%

Autocorrelation Windowing

89-1/1A/1B/1D 89-3/3A	1 window	Start: Stop:	water bottom 100 ms. before multiple or 6sec whichever occurred deeper
89-4,89-5	1 window	Start: Stop:	water bottom 100 ms before multiple
89-1E/1F/1G 89-2/2A	2 windows	Start: Stop: Overlap:	50 ms 21,500 ms 1000 ms centered at 5500 ms

15. TIME VARIANT FILTER

The data was filtered with zero phase bandpass filters having time variant passbands. The filters used are listed below. For intermediate times or shot points a weighted average was taken of the trace filtered with the earlier and later filter separately. The cutoff frequency is specified at -3db.

Line Number	Time (MSEC)	Low Cut (HZ)	Roll Off	High Cut (HZ)	Roll Off (db/OCT)
89-1/1A 1B/1D	**Shotpoint 101:**				
	5100	8	18	50	64
	8000	8	18	45	52
	9000	8	18	40	48
	10000	8	18	35	42
	11000	8	18	30	36
	12000	8	18	25	28

Shotpoint 2350:

	3200	8	18	50	64
	7000	8	18	45	52
	9000	8	18	40	48
	10000	8	18	35	42
	11000	8	18	30	36
	21000	8	18	25	28
	Shotpoint 3080:				
	3200	8	18	50	64
	5000	8	18	45	52
	6500	8	18	40	48
	8000	8	18	35	42
	10000	8	18	35	28
	21000	8	18	20	24
89-1E/1F/1G					
	WB	8	18	50	64
	8000	8	18	45	52
	9000	8	18	40	48
	10000	8	18	35	42
	11000	8	18	25	28
	21000	8	18	20	24
89-2/2A					
	WB	8	18	50	64
	8000	8	18	45	52
	9000	8	18	40	48
	10000	8	18	35	42
	11000	8	18	30	36
	21000	8	18	25	28
89-3/3A	**Shotpoint 103:**				
	1500	8	18	50	64
	4000	8	18	45	52
	7000	8	18	40	48
	9000	8	18	35	42
	11000	8	18	30	36
	21000	8	18	25	28
	Shotpoint 525:				
	3000	8	18	50	64
	7000	8	18	45	52
	9000	8	18	40	48
	10000	8	18	35	42
	11000	8	18	30	36
	21000	8	18	25	28

	Shotpoint 2174:				
	5100	8	18	50	64
	8000	8	18	45	52
	9000	8	18	40	48
	10000	8	18	35	42
	11000	8	18	25	28
	21000	8	18	20	24
89-4					
	WB	8	18	50	64
	8000	8	18	45	52
	9000	8	18	40	48
	10000	8	18	35	42
	11000	8	18	30	36
	21000	8	18	20	28
89-5					
	WB	8	18	50	64
	8000	8	18	45	52
	9000	8	18	40	48
	10000	8	18	35	42
	11000	8	18	30	36
	21000	8	18	25	28

16. SUBSAMPLE

Lines 89-4 and 89-5 were subsampled from 4 to 6 ms. using a zero phase filter with a roll off of 36 db/oct at 62.5 Hz to suppress aliasing.

17. MIGRATION

All data was migrated using the 'Finite Difference Solution' to the scaler wave equation. This migration is internally cascaded up to 5 times by the program to more accurately image steeply dipping features. Smoothed stacking velocities were used for the migration velocity field.

18. TIME VARIANT FILTER

Step 15 was repeated.

19. **RMS GAIN**

Each trace was divided into non-overlapping zones beginning with a length of 128 msec and doubling to a maximum of 4096 or 512 msec depending on the water depth of the line (see below)

Line	Maximum Zone
89-1E/1F/1G	4096
89-1D(SP 3080)	4096
(SP 2740)	512
89-1/1A/1B	512
89-2/2A	4096
89-3/3A	512
89-4	512
89-5	512

20. **ARRAY FORMING**

All lines were array formed with a 1:4:6:4:1 trace mix.

21. **DECIMATION**

A 2:1 trace decimation was performed on all lines to create a horizontal scale of 1:100,000.

22. **SUM**

An adjacent trace sum (1:1) was used to reduce horizontal scale to 1:200,000

PROCESSING TESTS

This section lists the main tests that were performed to obtain the processing parameters for this survey. The coded name before each test corresponds to the label of the test plots provided (separate shipment).

FK Noise Tests

Shot records and color spectrums before and after FKN

- shot record displayed over entire Tr length
- color spectrum over specific time zone

F1A: shot record Line 3, S.P. 402, before FKN
F1B: shot record line 3, S.P. 402, after FKN
F1C: color spectrum line 3, S.P. 402, Time 12000-20000 msec, before FKN
F1D: color spectrum line 3, S.P. 402, Time 12000-20000 msec, after FKN
F2A: shot record line 2, S.P. 1123, before FKN
F2B: shot record line 2, S.P. 1123, after FKN
F2C: color spectrum line 2, S.P.1123, Time 13000-20000 msec, before FKN
F2D: color spectrum line 2, S.P.1123, Time 13000-20000 msec, after FKN1
F3A: shot record line 2A, S.P. 1322, before FKN
F3B: shot record line 2A, S.P. 1322, after FKN
F3C: color spectrum line 2A, S.P.1322, Time TR 120:500 - 7000 msec, TR 1: 3000-7000 msec before FKN
F3D: color spectrum line 2A, S.P.1322, Time TR 120:500 - 7000 msec, TR 1:3000-7000 msec after FKN
F4A: shot record line 1E, S.P. 3291, before FKN
F4B: shot record line 1E, S.P. 3291, after FKN
F4C: color spectrum line 1E, S.P.3291, Time TR 1:3000 TR 120:500-5000 msec, before FKN
F4D: color spectrum line 1E, S.P.3291, Time TR 1:3000 - 5000 TR 120: 500-5000 msec after FKN
F4E: color spectrum line 1E, S.P.3291, Time 14000-20000 msec, before FKN
F4F: color spectrum line 1E, S.P.3291, Time 14000-20000 msec, after FKN
F5A: shot record line 1, S.P. 101, before FKN
F5B: shot record line 1, S.P. 101, after FKN
F5C: color spectrum line 1, S.P.101, Time 17000-23000 msec, before FKN
F5D: color spectrum line 1, S.P.101, Time 17000-23000 msec, after FKN

FK Noise filter applied is as follows: ± 8.7 msec/tr, taper of 2.4 msec/tr
55 Hz highcut, taper of 6 Hz
± .125 nyquist wavenumber keep,
taper of .05% nyquist

WEMA TESTS

All tests performed on Line 1, S.P. 564

W1 S.P. 564 & 3003 with 120 tr and sample interval of 4 msec
W2 S.P. 564 & 3003 with 60 tr and sample interval of 6 msec
W3 S.P. 564, operator length 650 ms, 120 tr, sample interval 4 msec
W4 S.P. 564, operator length 1700 ms, 60 tr, sample interval 6 msec

NOTE: To increase operator length to 1700 ms the amount of traces had to be reduced to 60 and the sample interval increased to 6 ms.

The WEMA used had a 1700 ms operator length applied to data with 60 Tr/shot and a sample interval of 6 msec.

DBS TESTS

DBS tests had a FKN before followed by a STK and TVF (4-60, 4-20) with RMSG (128 - 4096). All tests also have GSTV and BALN

```
Line 1E S.P. 4000 - 4200
DE1 Line 1E Gap= 12 OP=300 WL.=.1  windows =1 start: 500   stop: 5000
DE2 Line 1E Gap= 32 OP=300 WL.=.1  windows =1 start: 500   stop: 5000
DE3 Line 1E Gap= 60 OP=300 WL.=.1  windows =1 start: 500   stop: 5000
DE4 Line 1E No DBS  OP=300 WL.=.1  windows =1 start: 500   stop: 5000

Line 1G S.P. 5270 - 5470
DG1 Line 1G Gap= 12 OP=300 WL.=.1  windows =1 start: 500    stop: 5000
DG2 Line 1G Gap= 32 OP=300 WL.=.1  windows =1 start: 500    stop: 5000
DG3 Line 1G Gap= 60 OP=300 WL.=.1  windows =1 start: 500    stop: 5000
DG4 Line 1G No DBS  OP=300 WL.=.1  windows =1 start: 500    stop: 5000
DG5 Line 1G Gap= 12 OP=300 WL.=.1  windows =1 start: 500    stop: 5000
coupled withGap= 12 OP=300 WL.=.1  windows =3 start: 3000   stop:13000
                                              start: 11000  stop:21000
DG6  Line 1G Gap= 12 OP=300 WL.=.1  windows =2 start: 500   stop: 5000
             Gap= 12 OP=300 WL.=.1  windows =2 start: 3000  stop:13000

DG7  Line 1G Gap= 60 OP=300 WL.=.1  windows =2 start: 500   stop: 5000
             Gap= 60 OP=300 WL.=.1  windows =2 start: 3000  stop:13000
DAS applied to DG6

DG8 101 tr avg Gap= 12 OP=300 WL.=.1  windows =3 start: 450   stop: 4000
DG8 101 tr avg Gap= 12 OP=300 WL.=.1  windows =3 start: 3500  stop:12000
DG8 101 tr avg Gap= 12 OP=300 WL.=.1  windows =3 start: 11000 stop:21000

DG9 101 tr avg Gap= 60 OP=300 WL.=.1  windows =3 start: 450   stop: 4000
DG9 101 tr avg Gap= 60 OP=300 WL.=.1  windows =3 start: 3500  stop:12000
DG9 101 tr avg Gap= 60 OP=300 WL.=.1  windows =3 start: 11000 stop:21000
DAS applied to DG7

DG10 101 tr avg Gap= 12 OP=300 WL.=.1  windows =3 start: 450   stop: 4000
DG10 101 tr avg Gap= 12 OP=300 WL.=.1  windows =3 start: 3500  stop:12000
DG10 101 tr avg Gap= 12 OP=300 WL.=.1  windows =3 start: 11000 stop:21000

DG11 101 tr avg Gap= 60 OP=300 WL.=.1  windows =3 start: 450   stop: 4000
DG11 101 tr avg Gap= 60 OP=300 WL.=.1  windows =3 start: 3500  stop:12000
DG11 101 tr avg Gap= 60 OP=300 WL.=.1  windows =3 start: 11000 stop:21000

Line 2A  S.P. 1300-1498

DA1 Line 2A Gap= 12 OP=300 WL.=.1  windows =1 start: 500    stop: 6000
DA2 Line 2A Gap= 32 OP=300 WL.=.1  windows =1 start: 500    stop: 6000
DA3 Line 2A Gap= 60 OP=300 WL.=.1  windows =1 start: 500    stop: 6000
DA4 Line 2A No DBS  OP=300 WL.=.1  windows =1 start: 500    stop: 6000
DA5 Line 2A Gap= 12 OP=300 WL.=.1  windows =2 start: 500    stop: 65
                                              start: 5500   stop: 13000
TVSW applied to DA1
DA6 frequency range 4-60 filters 5 WL=.1 gain window 400
```

VELOCITY TESTS

After a geologic velocity model had been chosen by A.G.C., portions of lines 1E/1F/1G and 2/2A were each stacked five (5) times using the following multipliers applied to the geologic velocity model.

S1A: portion line 1E stacked with velocity model multiplied by .7
S1B: portion line 1E stacked with velocity model multiplied by .85
S1C: portion line 1E stacked with velocity model multiplied by 1.00
S1D: portion line 1E stacked with velocity model multiplied by 1.15
S1E: portion line 1E stacked with velocity model multiplied by 1.30

S2A: portion line 1F/1G stacked with velocity model multiplied by .7
S2B: portion line 1F/1G stacked with velocity model multiplied by .85
S2C: portion line 1F/1G stacked with velocity model multiplied by 1.00
S2D: portion line 1F/1G stacked with velocity model multiplied by 1.15
S2E: portion line 1F/1G stacked with velocity model multiplied by 1.30

S3A: portion line 2/2A stacked with velocity model multiplied by .7
S3B: portion line 2/2A stacked with velocity model multiplied by .85
S3C: portion line 2/2A stacked with velocity model multiplied by 1.00
S3D: portion line 2/2A stacked with velocity model multiplied by 1.15
S3E: portion line 2/2A stacked with velocity model multiplied by 1.30

A multiplier of 1.15 was chosen for all test areas.

LINE 4 & 5 MULTIPLE ATTENUATION TESTS

All tests performed on Line 5 (SP 101-201) with the final display being a filtered and gained STK.

M1A: STK without weights
M1B: STK with weights*
M2A: FKM --> STK (weights)
M2B: FKM -->AGC (60 msec) -->STK (weights)*
M2C: WEMA -->FKM -->STK (weights)
M2D: WEMA --> STK (weights)
M2E: WEMA --> STK (median)
M3A: FKM--> AGC (60 msec) STK (weights) --> 1-2-1 array **
 - compared against M2B

* Indicates which processes chosen within each comparison group

** Although this test shows the need for an array the exact specifications of the array were chosen later, with the test results listed under "migration and array tests".

DECONVOLUTION AFTER STACK TESTS

Filtered and gained stacks were generated over those portions of specific lines that were deemed appropriate for deconvolution testing. The autocorrelation windowing for these tests had already been determined from previous deconvolution before stack tests.

G1A:	Line 1-1D, SP 101-550	No deconvolution
G1B:	Line 1-1D, SP 101-550	60 ms prediction distance
G1C:	Line 1-1D, SP 101-550	32 ms prediction distance *
G1D:	Line 1-1D, SP 101-550	12 ms prediction distance
G2A:	Line 1E, SP 3962-4203	No deconvolution
G2B:	Line 1E, SP 3962-4203	60 ms prediction distance
G2C:	Line 1E, SP 3962-4203	32 ms prediction distance *
G2D:	Line 1E, SP 3962-4203	12 ms prediction distance
G3A:	Line 1F-G, SP 5076-5305	No deconvolution
G3B:	Line 1F-G, SP 5076-5305	60 ms prediction distance
G3C:	Line 1F-G, SP 5076-5305	32 ms prediction distance *
G3D:	Line 1F-G, SP 5076-5305	12 ms prediction distance
G4A:	Line 2-2A, SP 1265-1500	No deconvolution
G4B:	Line 2-2A, SP 1265-1500	60 ms prediction distance
G4C:	Line 2-2A, SP 1265-1500	32 ms prediction distance *
G4D:	Line 2-2A, SP 1265-1500	12 ms prediction distance
G5A:	Line 3-3A, SP 1734-2174	No deconvolution
G5B:	Line 3-3A, SP 1734-2174	60 ms prediction distance
G5C:	Line 3-3A, SP 1734-2174	32 ms prediction distance *
G5D:	Line 3-3A, SP 1734-2174	12 ms prediction distance

* Indicates what prediction distance chosen for each line.

FILTER TESTS

Filter panels were generated over those portions of specific lines that represented the frequency spectrum for this survey. These panels were applied to data that had gone through post stack deconvolution, except for P5 which had filter panels after the data was migrated. Below is a list of low and high frequencies that made up the 18 filter panels run on the various areas:

Low Cut (Hz)	Roll Off (db/oct)	High Cut (Hz)	Roll Off (db/oct)
Open		Open	
0	0	3	18
0	0	5	18
0	0	7	18
0	0	10	18
5	12	15	22
10	14	20	24
15	16	25	32
20	18	30	36
25	22	35	42
30	24	40	48
35	32	45	52
40	36	50	64
45	42	55	68
50	48	60	72
55	52	65	76
60	58	70	80
65	64	75	84

P1 Line 1-1D SP 576-700
P2 Line 1-1D SP 2990-3110
P3 Line 1F-1G SP 5695-5745
P4 Line 2-2A SP 1415-1465
P5 Line 1-1D SP 576-700 (migrated)

MIGRATION AND ARRAY TESTS

All tests were performed on line 1-1D and although the amount of data varied, SP 101 through 1330 were included in all displays.

A1 No array after migration and filter
A2 1-2-1 array after migration and filter
A3 1-4-6-4-1 array *

A4 filter before migration and filter *
A5 no filter before migration and filter

A3 finite difference migration with 1 cascade
A5 finite difference migration with 5 cascades *

* indicates which process chosen within each comparison group

Filter Before Migration

Time	**Low Cut**	**High Cut**
5100	8/18	50/64
8000	8/18	45/52
9000	8/18	40/48
10000	8/18	35/42
11000	8/18	30/36
21000	8/18	25/28

Filter After Migration

5100	4/18	50/64
8000	4/18	45/52
9000	4/18	40/48
10000	4/18	35/42
11000	4/18	30/36
21000	4/18	25/28

FINAL PRESENTATIONS

Film and Print Displays

1 Film and 2 prints were supplied for the following lines: 89-1A/1B/1C/1D, 89-1E/1F/1G, 89-2/2A, 89-3/3A, 89-4/4A and 89-5.

Migrations

1. Gained migration film and prints at 20 tr/cm and 2.5 cm/sec at scale of 1:100,000, normal polarity.

2. Gained migration (prestack AGC version also) film and prints at 20 tr/cm and 2.5 cm/sec at scale of 1:200,000, normal polarity.

3. Gained migration (prestack AGC verson also) film and prints at 10 tr/cm and 2.5 cm/sec at scale of 1:50,000, normal polarity.

4. Gained migration film and prints at 10 tr/cm and 2.5 cm/sec at scale of 1:200,000, normal polarity.

Stacks

1. Gained stack film and prints at 20 tr/cm and 2.5 cm/sec at scale of 1:100,000, normal polarity.

STAFFING OF PROJECT

All of the seismic processing was performed in Western Geophysical's Calgary Processing Centre.

Personnel:

Atlantic Geoscience Centre

Client Representative: Mr. Bernie MacLean

Western Geophysical, A Division of Western Atlas Canada Ltd.

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This report prepared by Wayne Smith.