



DATA PROCESSING REPORT

1985B AMOCO BASS BASIN SURVEY

(TQH5 SURVEY)

T/14/18/22P

FOR

AMOCO AUSTRALIA PETROLEUM COMPANY

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NORTH SYDNEY,

N.S.W. 2060

BY

GEOPHYSICAL SERVICE INC

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SECTION 1

INTRODUCTION

A seismic reflection survey called the "1985B Amoco Bass Basin Survey" (line prefix TQH5-) was recorded for Amoco Australia Petroleum Company by the G.S.I. vessel Eugene McDermott II in the Bass Basin in October and November 1985. The survey consisted of 162 lines covering 5020 kms over permits T-14-P, T-18-P, and T-22-P, as shown in Figures 1 & 2.

Data quality was good throughout most of the area but deteriorated towards the western edge of the project where the occurrence of a strongly reflecting layer, varying between 1 and 2 seconds two-way-travel time, meant that little signal was returned from beneath this layer. In an attempt to improve resolution below this layer a number of lines in the western part were restacked with faster stacking velocities and then remigrated. In some cases this did improve the section but often the improvement was marginal. Both versions of the final stacks and migrations were sent to Amoco. A list of the lines which were restacked is included in appendix B.

The recording polarity was such that a positive pressure on the hydrophones was recorded as a positive number on tape. The recording polarity was maintained throughout the processing and display resulting in an increase in acoustic impedance being displayed as a dark peak on the final displays. This was done so that the data would match the "1984 Amoco Bass Basin Survey" TNK4 lines and the "1985A Amoco Bass Basin Survey" TP05 lines.

Processing was carried out in both GSI's Sydney and Singapore offices on IBM 3033 computers.



Data collection for the survey began on October 9th 1985 and was completed on 16th November. A further 8 lines were collected between November 23rd and 25th.

The first shipment of 1611 kms was offloaded at Devonport; Tasmania, on October 21st. This shipment contained 1148 kms from the priority area, permit T-14-P. To ensure that this data reached GSI's Sydney office without delay the processing party chief travelled to Devonport to escort the shipment to Sydney, and the data reached the office on October 22nd.

A further three shipments were made as follows: November 5th, 1750 km, including the remainder of the priority area; November 16th, 1448 km; and November 25th, 212 km.

Because of the urgency of this project GSI committed to delivering the final migrated stacks from T-14-P six weeks after receipt of either the first shipment of field data, or decisions enabling pre-processing to begin, whichever occurred last. The remainder of the data was to be delivered 10 weeks after receipt of the first shipment. To meet this commitment it was decided to process and display all of the third shipment of data on GSI's Singapore computer (IBM 3033): the data was demultiplexed in Sydney and the demultiplexed tapes shipped to Singapore. All further processing was run on the IBM in Singapore. The jobs were, however, input and QCed in Sydney. A member of the Sydney velocity picking crew travelled to Singapore to pick the velocities and QC the final displays which were also plotted in Singapore.

Because of the very tight deadlines on this project testing was commenced on two lines from previous surveys in the same area (TNK4-47 and TP05-7) and the decision enabling pre-processing to commence was made on October 29th.



The last section from T-14-P was delivered on December 18th and the last section for the whole survey on January 21st. Although these dates were slightly beyond the deadline dates the final size of the project (5021 km) was 500 km greater than had originally been forecast.

Final displays of stacks and migrations were plotted on film at two horizontal scales: 1:25000 and 1:75000, both with a vertical scale of 3.75 inches/second. Two film copies of these displays were made, one set each for Amoco's Houston and Sydney offices.

Amoco purchased copies of the raw stack and raw migrated data in SEG-Y format. These tapes were shipped to Amoco's Houston office. Unfortunately the decision to copy the migrated data was not made until May 21st, and because this was more than 30 days past the completion of the project some of this data was no longer available for copying. Further details can be found in appendix C.

A tape containing a listing of all the stacking velocities used was also produced and shipped to Amoco's Houston office.

On completion of the survey the original field tapes were shipped to Geophysical Magnetic Pty. Ltd., 45 Garema Crescent, Kingsgrove, NSW 2208 for storage.

Respectfully Submitted,

Michael Murphy

Michael Murphy

(Processing Party Chief)



SECTION II

DATA COLLECTION PARAMETERS

- o Data Shot By - G.S.I. Party 2931
M.V. Eugene McDermott II
- o Data Shot - October and November, 1985
- o Recording Instruments - Trace Sequential Recorder
- o Recording Filters/Slopes - High Cut Filter : 128 HZ
High Cut Slope : 72 dB/octave
Low Cut Filter : 8 HZ
Low Cut Slope : 18 dB/octave
- o Recording Polarity - A positive pressure at the hydrophone produces a positive number on tape and an upward deflection on the field monitor record.
- o Digital Tape Format - SEG D, 6250 B.P.I. phase encoded
- o Record Length/Sample Rate - 6.0 seconds at 2 milliseconds
- o Energy Source - 4075 cubic inch airgun array operating at 1800 P.S.I.
- o Gun Delay - 51.2 milliseconds
- o Source Depth - 10 metres average
- o Shotpoint Interval - 30 metres, 1 pop per shot
- o Streamer Type - G.S.I. Multiplexer Streamer
- o Streamer Length - 3600 metres, 240 groups
- o Group Interval - 15 metres
- o Streamer Depth - 12 metres average
- o Hydrophones - 40 per group
- o Coverage - 240 trace, 60 fold
- o Navigation - Primary - Argo
Secondary - Syledis



SECTION III

PRODUCTION PARAMETERS

The production processing parameters used were based on the results of the experimental work described in the next section.

All data was processed to 5.0 seconds at 4 milliseconds sample interval reduced from 240 trace/60 fold to 120 trace/60 fold by a 2 on 1 mix near the beginning of the processing sequence. This increased the common depthpoint interval from 7.5 metres to 15 metres.

The recording polarity was maintained throughout the processing and display.

- o Processing Record Length - 5.0 seconds
- o Resample - Minimum phase resample from 2 to 4 ms
- o Shot Static - A -51.2 ms shift was applied to compensate for the airgun delay.
- o Adjacent Trace Mix - A simple 2 on 1 mix was used to reduce coherent and random noise. This also reduced the data volume from 240 trace/60 fold to 120 trace/60 fold and increased the common depth point interval from 7.5 to 15 metres.
- o True Amplitude Recovery - To compensate for amplitude decay with time a gain increase of 4 dB/s was applied from 0 to 4 seconds and spherical divergence corrections were applied.
- o Pre Deconvolution Mute - Ramp length: 96 ms
offsets : 410, 480, 960, 3975 m
start time : 0, 400, 800, 2900 ms
- o Velocity Filtering (V6) - Using dips of +11, -3 ms/trace in the shot domain with full cosine ramping.
- o Signature (V6) - Using offset-dependent wavelet
Fmax: 125 Hz



- o Common Depth Point Gather - 60 fold, 15 m CDP interval
- o Velocity Analysis - Using 11 depth point velscan analyses every 2 km to determine demult velocity function
- o Demultiple - F-K domain multiple attenuation using primary/multiple moveout separation. Negative cut off velocity : 67056 m/s
- o Velocity Analysis - Using 11 depth point velscan analyses every 2 km to determine stacking velocity function.
- o Normal Moveout Correction
- o Static Correction - Static corrections averaging 12 ms were applied to correct for shot and streamer depth.
- o First Break Mute - Ramp length : 96 ms
Offset : 390,400,480,3975 m
Start time : 0,180,400,3200 ms
- o Inner Trace Mute - Ramp length : 96 ms
Offset : 400, 520,1290,1300 m
Start time : 800,1000,2900,5000 ms
- o Common Depth Point Stack - 60 fold, 15 m CDP interval
- o Time Variant Filtering - Freq (Hz) @ Time (ms)

10 - 70	0
10 - 60	900
8 - 50	1500
8 - 45	2000
8 - 40	2500
6 - 40	3000
6 - 35	3500
6 - 30	5000
- o Time Variant Scaling - Digital Gain Control Scaling
Gate length : 1000 ms
- o Wave Equation Migration - Input : raw stack data.
Kirchoff F-K domain migration.
Migration velocities derived from Spacevels routine: 100 % of stack velocities.



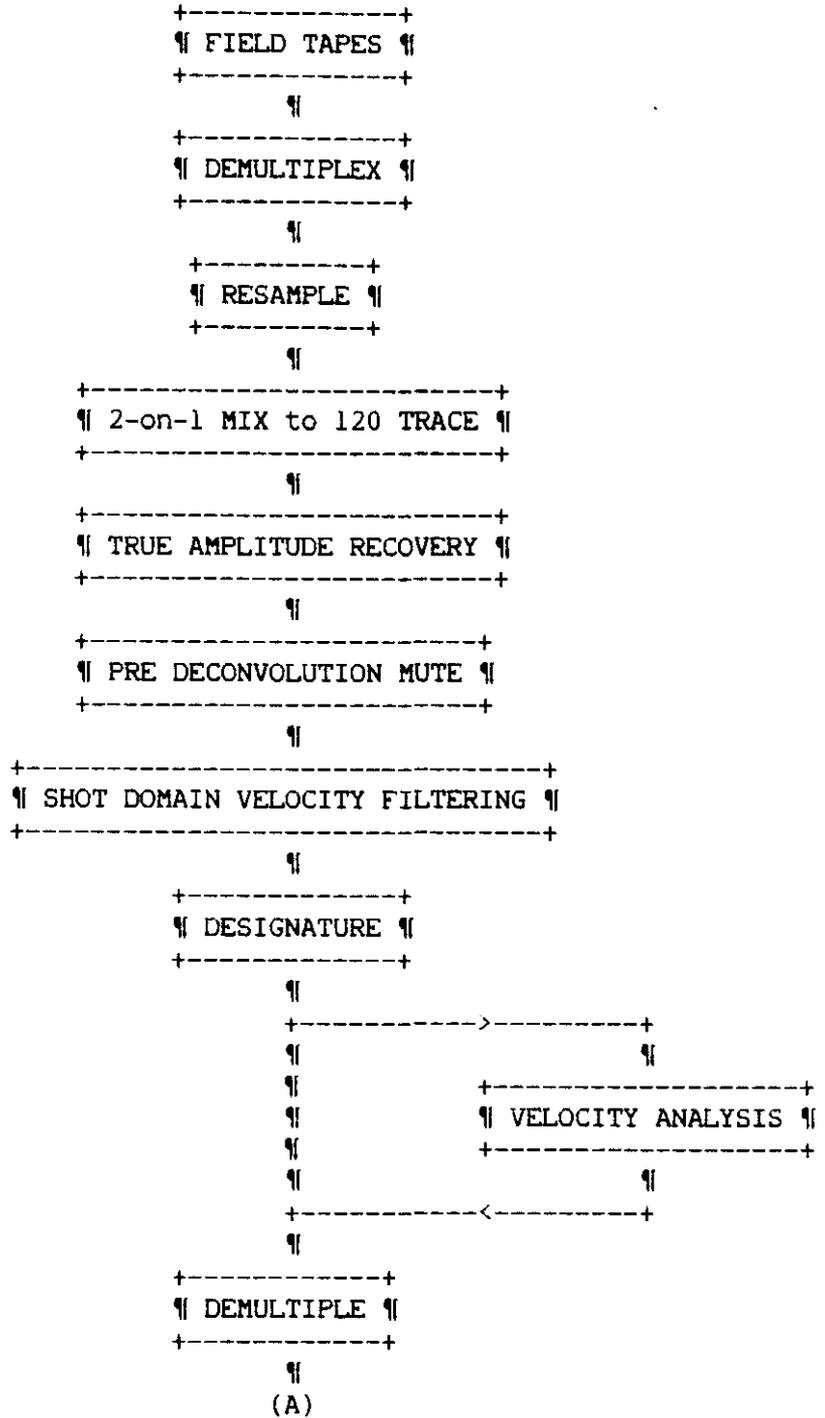
- o Dipcon - Dip angle: 30 degrees
Add back noise: low

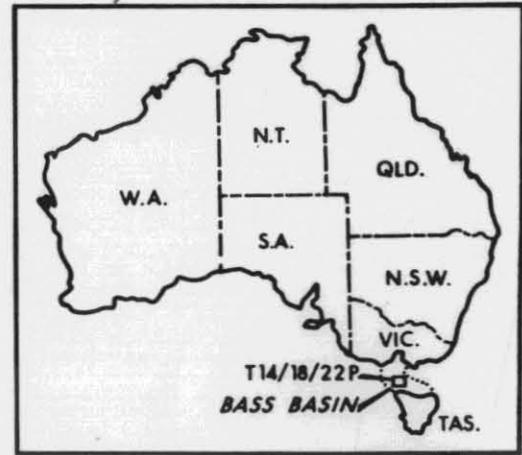
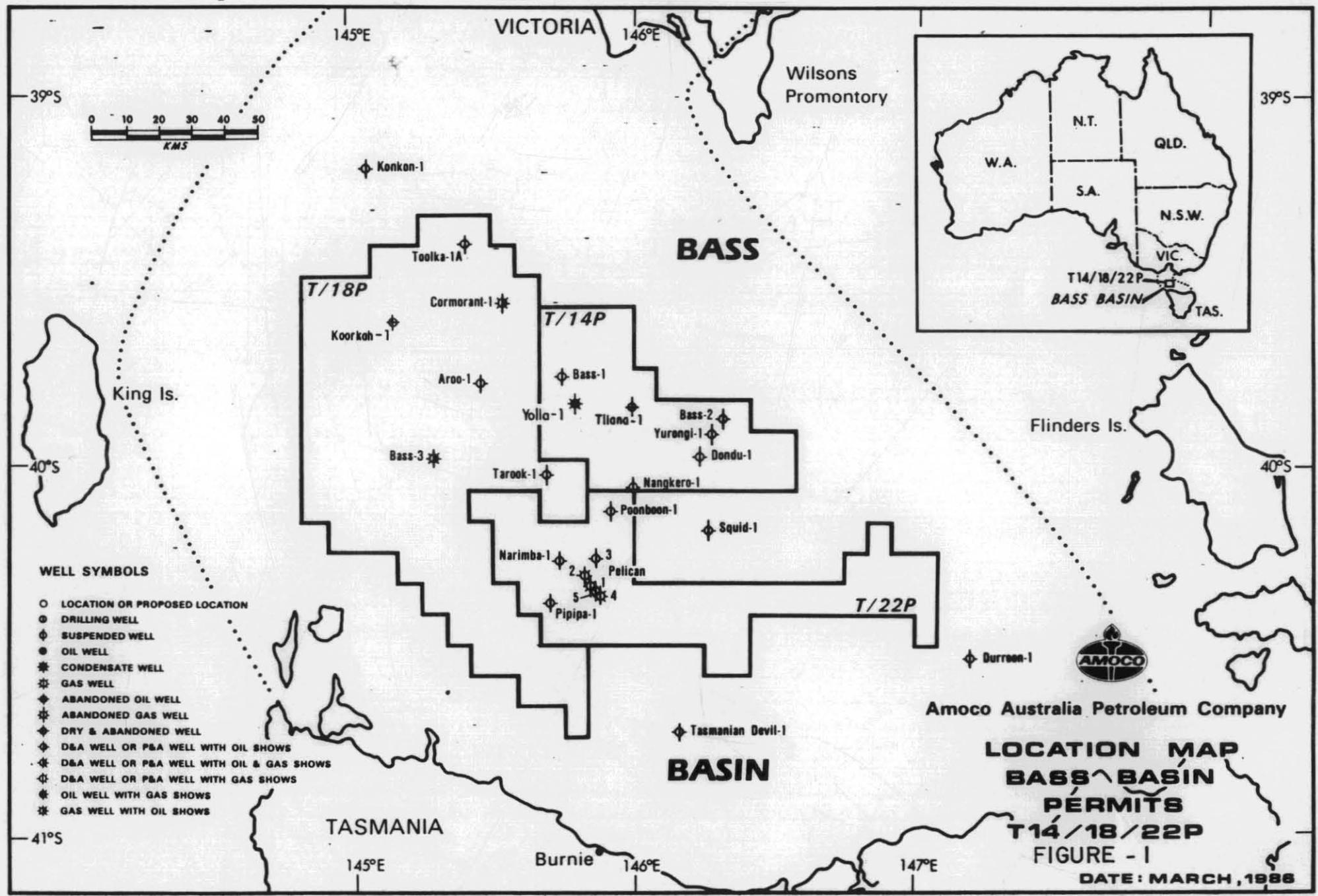
- o Time Variant Filtering - Freq (Hz) @ Time (ms)
 - 10 - 70 0
 - 10 - 60 900
 - 8 - 50 1500
 - 8 - 45 2000
 - 8 - 40 2500
 - 6 - 40 3000
 - 6 - 35 3500
 - 6 - 30 5000

- o Time Variant Scaling - Digital Gain Control Scaling
Gate length : 1000 ms



PROCESSING FLOW DIAGRAM





WELL SYMBOLS

- LOCATION OR PROPOSED LOCATION
- ⊙ DRILLING WELL
- ⊕ SUSPENDED WELL
- OIL WELL
- ✱ CONDENSATE WELL
- ✱ GAS WELL
- ⊕ ABANDONED OIL WELL
- ✱ ABANDONED GAS WELL
- ⊕ DRY & ABANDONED WELL
- ⊕ D&A WELL OR P&A WELL WITH OIL SHOWS
- ⊕ D&A WELL OR P&A WELL WITH OIL & GAS SHOWS
- ⊕ D&A WELL OR P&A WELL WITH GAS SHOWS
- OIL WELL WITH GAS SHOWS
- ✱ GAS WELL WITH OIL SHOWS

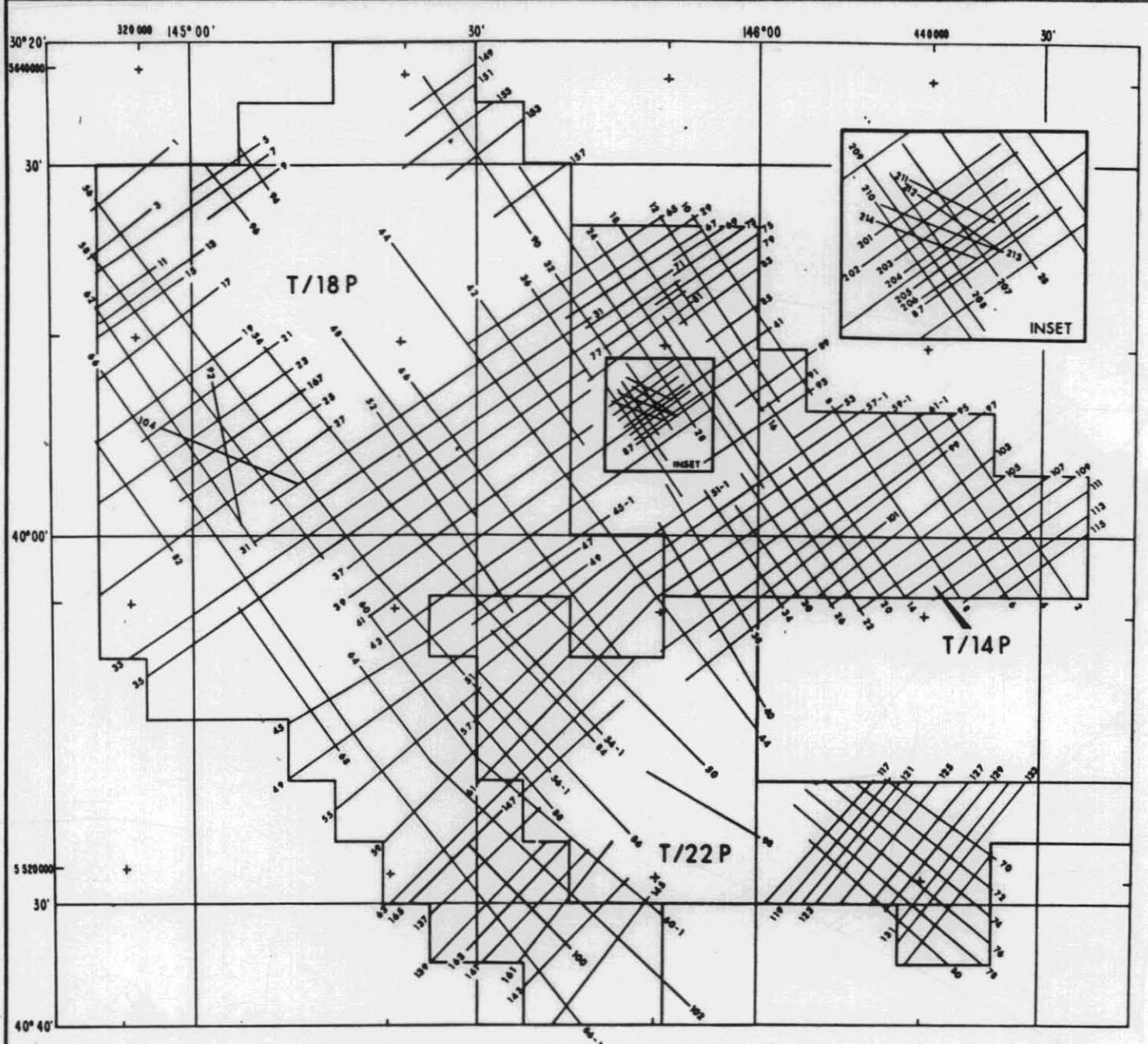


Amoco Australia Petroleum Company

LOCATION MAP
BASS BASIN
PERMITS
T14/18/22P
FIGURE - 1

DATE: MARCH, 1988

150013A



NOTE: All lines prefixed by - TQH5 -
e.g. TQH5 - 33

5 cm



FIGURE 2



Amoco Australia Petroleum Company

Offshore Tasmania
BASS BASIN

1985 B AMOCO
BASS BASIN SURVEY

LINE LOCATION MAP

SCALE: As shown	ENCLOSURE No.	
DATE: April 1986	AUTHOR: J.T.	Drwg. No. FU-226

APPENDIX ASECTION IV PROCESS DESCRIPTION AND PARAMETER SELECTIONTRUE AMPLITUDE RECOVERY (TAR)

The TAR process is applied to digital field records to produce output records on which relative amplitudes of reflections on each trace are approximately true and traces evenly modulated. This consists of removing the gain imposed on the field records by the TSR Binary Gain control system and then correcting for inelastic attenuation and spherical divergence losses.

Correction for inelastic attenuation is controlled by specifying a gain increase in dB/second to be applied to the trace amplitudes and a start and end time. The gain increase value is called the exponent or alpha value.

Spherical divergence is corrected for by a simple algorithm which scales trace amplitudes in proportion to their reflection time.

A TAR test was carried out on shotpoints 250 and 251 from line TP05-7. Exponent values of 3.0, 4.0, 5.0, 6.0, and 7.0 dB/s were tested. The start and end times were kept constant at 0 and 4000 milliseconds respectively and spherical divergence corrections were applied.

From this test an exponent value of 4.0 dB/s starting at 0 and ending at 4 seconds, with spherical divergence corrections applied, was chosen for production processing. This value was also used on all further test work.



PRE DECONVOLUTION RAMP (PDR)

A PDR is applied to remove unwanted noise, such as refractions or first breaks, from the front end of the shot records prior to the design of deconvolution or Signature filters.

The PDR is affected by the application of velocity filtering because the velocity filter will remove noise from the front end of the shots which may otherwise have to be ramped off. Therefore if velocity filtering is being applied a less severe PDR is often required. For this reason the PDR is often chosen in conjunction with the velocity filter by examining F-K contour displays with and without velocity filter.

The following shot and F-K contour plots were produced on shotpoint 250 from line TP05-7:

- a) TAR only
- b) TAR/VEF +4.5/-1.0 ms/trace
- c) TAR/VEF +5.5/-1.5 ms/trace
- d) TAR/VEF +6.0/-2.0 ms/trace

From these displays the following pre deconvolution ramp was chosen and applied to all further processing on line TP05-7 and TNK4-47:

ramp length	:	96	milliseconds
trace	:	236 , 233 , 198 , 1	
offset	:	390 , 435 , 960 , 3975	metres
ramp start time	:	0 , 400 , 800 , 2900	milliseconds

The PDR applied to the new survey was changed slightly to give a small increase in the fold of the shallow data and was:

ramp length	:	96	milliseconds
trace	:	235 , 230 , 198 , 1	
offset	:	410 , 480 , 960 , 3975	metres
ramp start time	:	0 , 400 , 800 , 2900	milliseconds



VELOCITY FILTERING (VEF) V6

Velocity filtering is a frequency-wavenumber domain operation that can be used to discriminate against specified horizontal velocities on pre-stacked data.

The data is transformed from the space time (X-T) domain to the frequency-wavenumber (F-K) domain where the filter is applied. After filter application the data is transformed back to the X-T domain for further conventional process applications.

A linear event in the X-T domain (implying constant velocity) appears as a linear event in the F-K domain where lines of constant velocity all pass through the origin. Thus, a multitude of noise events, with the same velocity, at various times on the input record join on the F-K plane into a single event. If the velocity of the noise is adequately separated from the primary signal velocities the noise will transform into a different part of the F-K plane than the signal. A window of primary dips can be specified and dips outside this window are rejected.

Examples of noise alignment that can be removed are direct arrivals, hard bottom refraction, mud roll and cable jerk. These types of noise alignments have a velocity slower than primary signal or have a dip opposite to the primary.

As well as removing certain types of coherent noise, velocity filtering also reduces random noise, since some this will be transformed into the part of the F-K plane that is zeroed.



Since "version 5", GSI's F-K domain velocity filter process has had the option of using "cosine" cut-off ramps, as opposed to the linear ramps of previous versions. The cosine ramps are also wider, and the net effect of these changes is to reduce the "edge effects" on the output records. These edge effects showed as energy alignments parallel to the cut-off dips used in the process. The result is a cleaner record in comparison to earlier versions.

Aliasing both in the frequency and wavenumber axes can be predicted from the time sampling period and the spatial sampling (or group interval) of the input data. Spatial sampling determines, to a large extent, the effectiveness of the process. Velocity filtering attenuates some portions of aliased events. However, when aliased noise overlays signal, velocity filtering loses its discriminating power.

Velocity filter testing started with a series of shot and F-K plots on shotpoint 250 of line TP05-7. The values tested were:

- a) TAR only
- b) TAR/PDR/VEF +4.5/-1.0 ms/trace
- c) TAR/PDR/VEF +5.5/-1.5 ms/trace
- d) TAR/PDR/vef +6.0/-2.0 ms/trace

and a value of +5.5/-1.5 ms/trace was chosen.



The tests on TP05 were carried out on a 240 trace record with 15 metre group interval. However, on the data from the Bass Basin 1985B survey, a 2-on-1 mix was performed on the shot records before velocity filter. This reduced the number of traces going in to VEF to 120, and doubled the group interval to 30 metres, thereby necessitating a doubling of the VEF cuts to $+11/-3$ ms/trace. To check these cuts the following shot and F-K plots were produced on shotpoint 100 of line TQH5-98 :

- a) TAR only
- b) TAR/PDR
- c) TAR/PDR/VEF $+11/-3$ ms/trace

These, which are reproduced in figures 3 to 5, served to check the TAR and PDR values chosen from the earlier test work.

Further testing of velocity filtering was carried out and is detailed in the section "Velocity Filter versus Deconvolution before Stack".

DESIGNATURE (DESIG V5*)

Designature is a generic name for processes which attempt to replace an arbitrary source wavelet convolved with the reflection sequence with a shorter wavelet of improved resolving capability.

DESIG V5 is the current designature program and provides an alternative to conventional pre-stack deconvolution (TVD). DESIG V5 is a multi-channel process, that can use the entire record to estimate the wavelet, whereas TVD is a single channel process that only uses a portion of a trace to design an operator. Because of this DESIG can better account for the source wavelet and source and receiver ghosts found in marine data than TVD can.

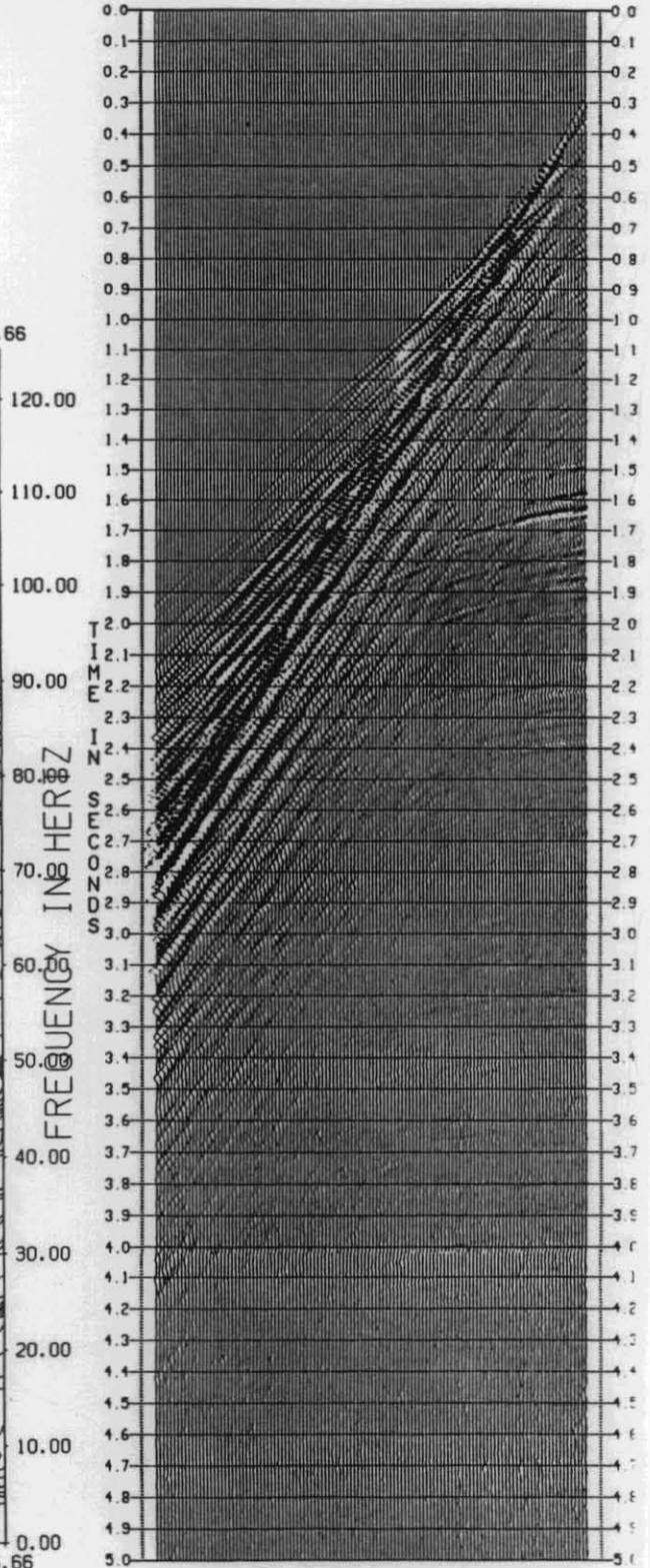
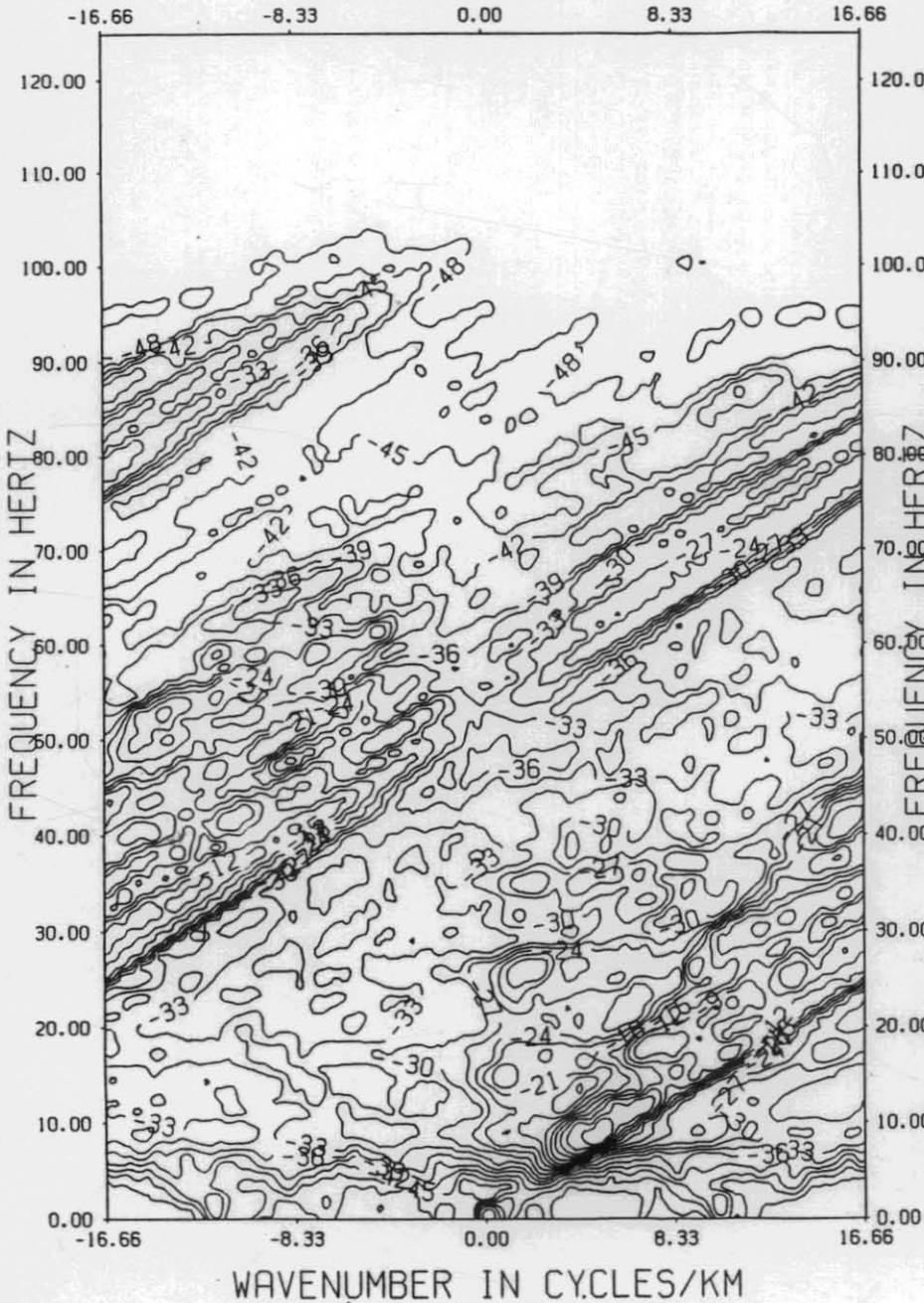
5 cm

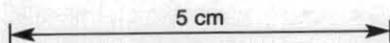
LINE TQH5-98
S.P. 100
SPN/FK CONTOUR DISPLAY
 AMOCO AUSTRALIA PETROLEUM COMPANY
 PERMIT T-14P
 1985B AMOCO BASS BASIN SURVEY
 24 OCT 1985 G.S.I.

PROCESSING:
TAR :ALPHA=4.0 DB/SECOND FROM 0 TO 4.0 SECONDS
SPHERICAL DIVERGENCE CORRECTIONS APPLIED.

FIGURE 3

SPC 100 TRACES 1 TO 120

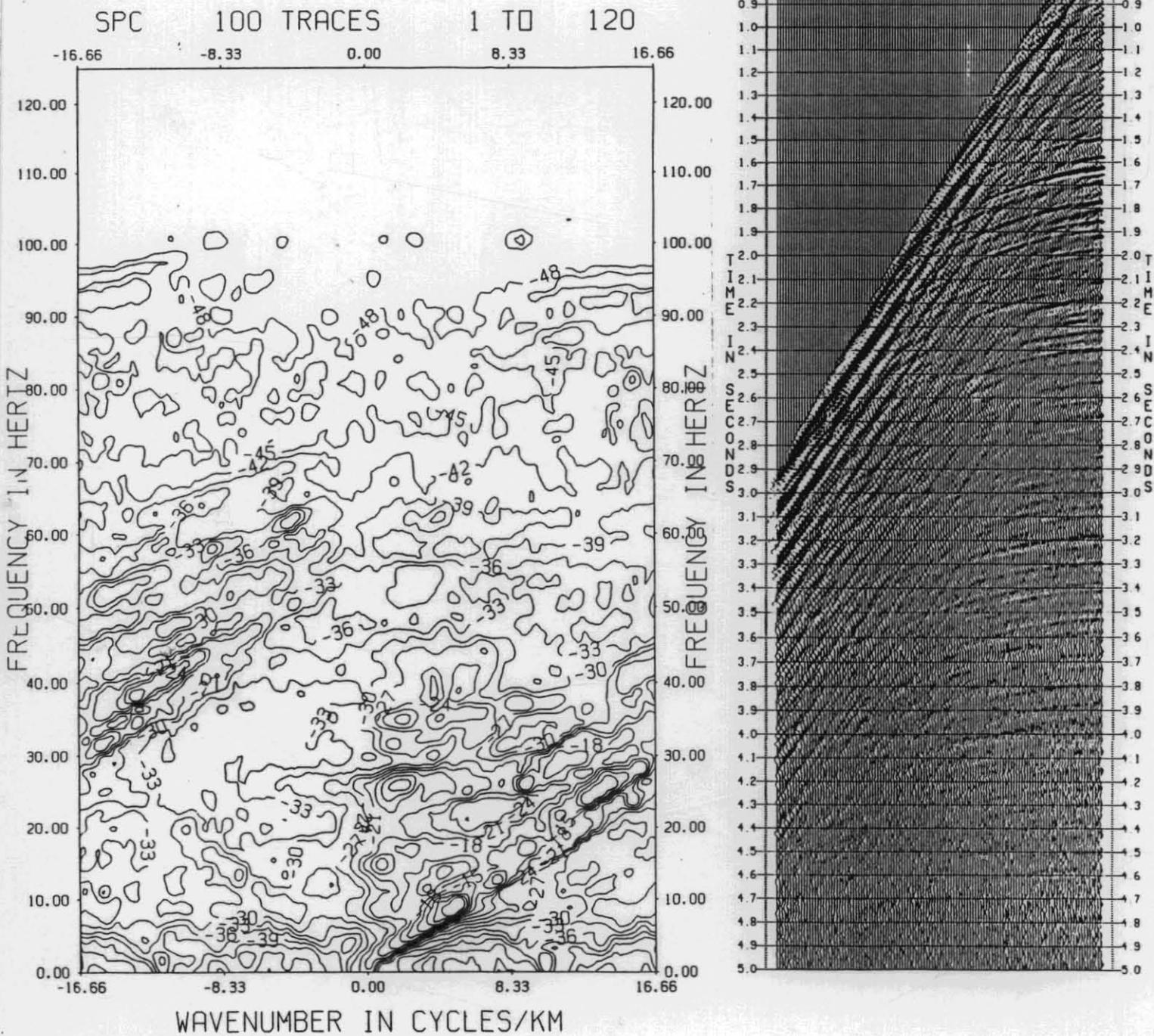





LINE TQH5-98
S.P. 100
SP/FK CONTOUR DISPLAY
 AMOCO AUSTRALIA PETROLEUM COMPANY
 PERMIT T-14P
 1985B AMOCO BASS BASIN SURVEY
 24 OCT 1985 G.S.I.

PROCESSING:
 TAR : ALPHA=4.0 DB/SECOND FROM 0 TO 4.0 SECONDS
 SPHERICAL DIVERGENCE CORRECTIONS APPLIED.
 PDR : OFFSETS(METRES) : 110, 180, 960, 3975
 START TIME(MSEC) : 0, 100, 800, 2900
 RAMP LENGTH(MSEC) : 96
 DATUM : SURFACE

FIGURE 4



5 cm

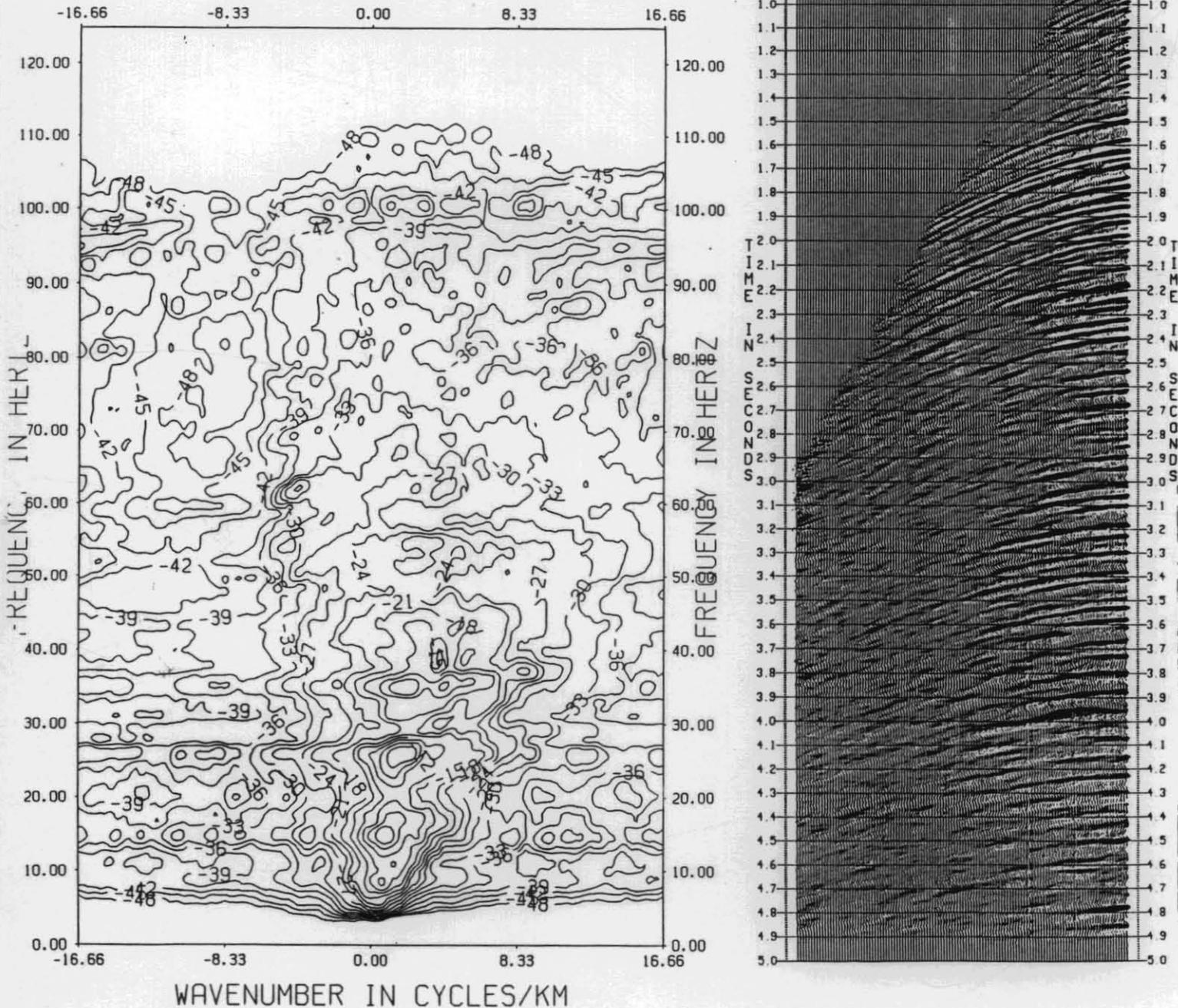
150021A


LINE TQH5-98
S.P. 100
SP/TK CONTOUR DISPLAY
 AMOCO AUSTRALIA PETROLEUM COMPANY
 PERMIT T-14P
 1985B AMOCO BASS BASIN SURVEY
 24 OCT 1985 G.S.I.

PROCESSING:
 TAR : ALPHA=4.0 DB/SECOND FROM 0 TO 4.0 SECONDS
 SPHERICAL DIVERGENCE CORRECTIONS APPLIED.
 PDR : OFFSETS(METRES) : 410. 480. 960. 3975
 START TIME(MSEC) : 0. 400. 800. 2900
 RAMP LENGTH(MSEC) : 96
 DATUM : SURFACE
 VELFILT : VERSION 6:
 USING DIPS OF +11. -3 MSEC/TRACE APPLIED
 IN THE SHOT RECORD DOMAIN. FMAX=125HZ

FIGURE 5

SPC 100 TRACES 1 TO 120





While TVD is time and offset-variant DESIG V5 is not time-variant. It can, however, be offset-variant by specifying the OFFSET-DEPENDENT DESIG option. In this case the shot record is divided into four sets of traces. Designature is applied separately to each set of traces as though they were separate shot records. In areas where streamer depth and/or water depths vary along the streamer gradual and progressive variations in the receiver ghost period and reverberation period occur. OFFSET-DEPENDENT DESIG is better able to compensate for these variations than STANDARD DESIG, which operates on the entire record.

To compare Standard and Offset-dependent Desig brute stacks were produced over shotpoints 200 to 300 of line TP05-7. The processing applied was:

- a) TAR/PDR/VEF (+5.5,-1.5 ms/trace)/Stack/Filter/Scale
- b) TAR/PDR/VEF/OD DSG/Stack/Filter/Scale
- c) TAR/PDR/VEF/STD DSG/Stack/Filter/Scale

From these tests it was concluded that OFFSET DEPENDENT DESIGNATURE was better able to deconvolve the shot wavelet and produced a sharper wavelet than STANDARD DESIG.



DEMULATE (DEMULT)

Demultiple is an F-K domain filtering technique to attenuate water-layer, pegleg and interbed multiples. It is based on the difference in normal moveout between primaries and the slower multiples.

The Demult filter is applied independently to each CDP set of traces and consists of 5 main steps:

- . Normal moveout correction (NMO) is applied to the CDP gather using the velocity function of the multiples to be attenuated. In the normal case where multiples have a slower velocity than the primaries, the chosen multiples will be flattened across the CDP and the primary will be overcorrected.
- . The NMO corrected gather is then transformed into the F-K domain and a velocity filter is applied. Since the chosen multiple energy has been flattened by the NMO correction and thus has zero dip it will be concentrated along the $K=0$ axis: any slower multiples will be undercorrected and will transform into the positive side. The primary energy, and any faster multiples will be overcorrected and will transform into the negative side of the plane.
- . A velocity filter is then applied in the F-K domain. The filter is specified as a negative velocity called the cut-off velocity and is chosen to fall between the primary and multiple energy. Any energy at the cut-off velocity or slower is zeroed. Any energy with a faster velocity will be kept. This includes the primary energy and any faster multiples.
- . The final two steps consist of transforming the data back into the time-distance domain, and then applying a reverse NMO correction. The result is a CDP gather record that has no NMO correction applied and on which the multiples are strongly attenuated.



A sideeffect of DEMULT is that some attenuation of the primary cannot be avoided. This is because on the shorter offset traces there is little moveout difference between the primaries and multiples. As a result the primary energy on these traces transforms into that part of the F-K plane that is zeroed.

Not only is this energy attenuated, but a false event, or "artifact" can be introduced where the primary energy has been attenuated. This is because the shorter offset end of the remaining primary is or smeared out across the shorter offset traces as a linear event parallel to the velocity cut-off slope. This results in it appearing at a later time than the original true primary. After the reverse NMO correction is applied, the artifact becomes a curved extension of the real primary and can "roll over" to have reverse dip on the shortest offset traces.

The roll-over artifacts can make the velocities of the primary events appear too fast and can also distort the signal on the stacked traces. Therefore they are usually removed by an inside trace mute before the CDP gather traces are input to any other process.

The success of the DEMULT technique depends on the accuracy of the multiple function used: if the function is too slow the multiples will be overcorrected and not zeroed, but if the function is too fast primary energy will be flattened and rejected by the filter. This is also linked to the cut-off velocity: As the multiple function becomes faster (closer to the primary function) so the primaries are less overcorrected and transformed closer to the $K=0$ axis. Therefore a cut-off velocity closer to the axis (higher velocity) must be chosen to avoid attenuation of the primary. A higher cut-off velocity has the advantage of reducing the number of traces affected by the "roll-over" effect, but it has the disadvantage of reducing the margin for velocity errors; and a multiple can be easily missed, or a primary attenuated.



The final choice between these is therefore a compromise, whereby a certain amount of primary attenuation is accepted in order to attenuate the faster multiples while still using a fairly low cut-off velocity. The method used by G.S.I to derive the multiple velocity function is to produce a set of velocity analyses on each line and interpret a primary velocity function. The multiple function is then derived by specifying an acceptable inside trace ramp and cut off velocity and calculating the multiple function.

To test the effect of DEMULT brute stacks and velocity analyses were produced over shotpoints 1 to 500 on line TP05-7 and TNK4-47 using the following sequence:

TAR/PDR/VEF/OD DSG/Scaling/Stack

The velocity analyses were interpreted and a demultiple velocity function calculated using a cut-off velocity of -67056 m/s and a primary attenuation of 25%, ie at any given time the near 25% of the traces remaining after application of the stack ramp would need to be ramped off by the inside trace mute. To preserve fold the ramp applied is actually gentler than this on the shallow data.

Each line was then restacked using the same parameters and stacking velocities as the brute stack, but with DEMULT applied, thereby enabling a direct comparison of the effect of DEMULT to be made. The sequence used was:

TAR/PDR/VEF/OD DSG/DEMULT/Scaling/Stack.

The brute stacks with DEMULT applied showed a strong attenuation of multiples and it was decided to use DEMULT in the production processing of the 1985B survey.

A further opportunity to check the benefits of DEMULT arose during testing to compare velocity filter/signature with deconvolution, as described in the next section.



Velocity Filter/Designature versus Deconvolution Before Stack

From the previous testing, done mainly on lines TNK4-47 and TP05-7, a set of pre-processing parameters were derived to use in processing the newly collected 1985B survey. Because of the very tight turnaround requirements for this survey it had originally been planned that no pre-processing testing would be carried out on the new data, thus enabling production to start as soon as the data was received. However shortly after the data was received it was decided to compare velocity filter/designature with deconvolution-before-stack.

The tests were run over the following data:

- a) Line TQH5-98 , shotpoints 1-698 (reproduced in figures 6 & 7)
- b) Line TQH5-61-1 , shotpoints 1-900
- c) Line TQH5-65 , shotpoints 601-1232

Each line was preprocessed and velocity analyses produced using the following sequence:

- a) Resample/2:1 smash/TAR/PDR/VEF/DSG/Velocity analysis.
The velocity filter cuts were: +11/-3 ms/trace.
Offset dependent designature was used.

This was the production sequence that had been decided upon from the testing carried out on TP05-7 and TNK-47.

- b) Resample/2:1 smash/TAR/PDR/DBS/Velocity analysis.
Whitening (spiking) deconvolution with a filter length of 240 ms was applied.



The velocity analyses were interpreted and demultiple functions calculated for each line. This was then used to apply demultiple to both the velocity filtered and deconvolved data. Velocity analyses were produced on the demultiplied data and these were then interpreted to provide stacking velocities. Final stacks were then produced on both sets of data. The same velocity function was used on both sets of data for each line.

As can be seen in figures 6 and 7. These tests confirmed that the VEF/DSG sequence was preferable to deconvolution. Velocity filter resulted in greater attenuation of coherent and random noise, and Designature produced a sharper wavelet with less reverberations than the deconvolution. This was seen on both the stack sections and the velocity analyses. It was considerably easier to pick a primary function on the velocity analyses which had VEF applied because the reduced noise enabled the primaries to be more easily seen.

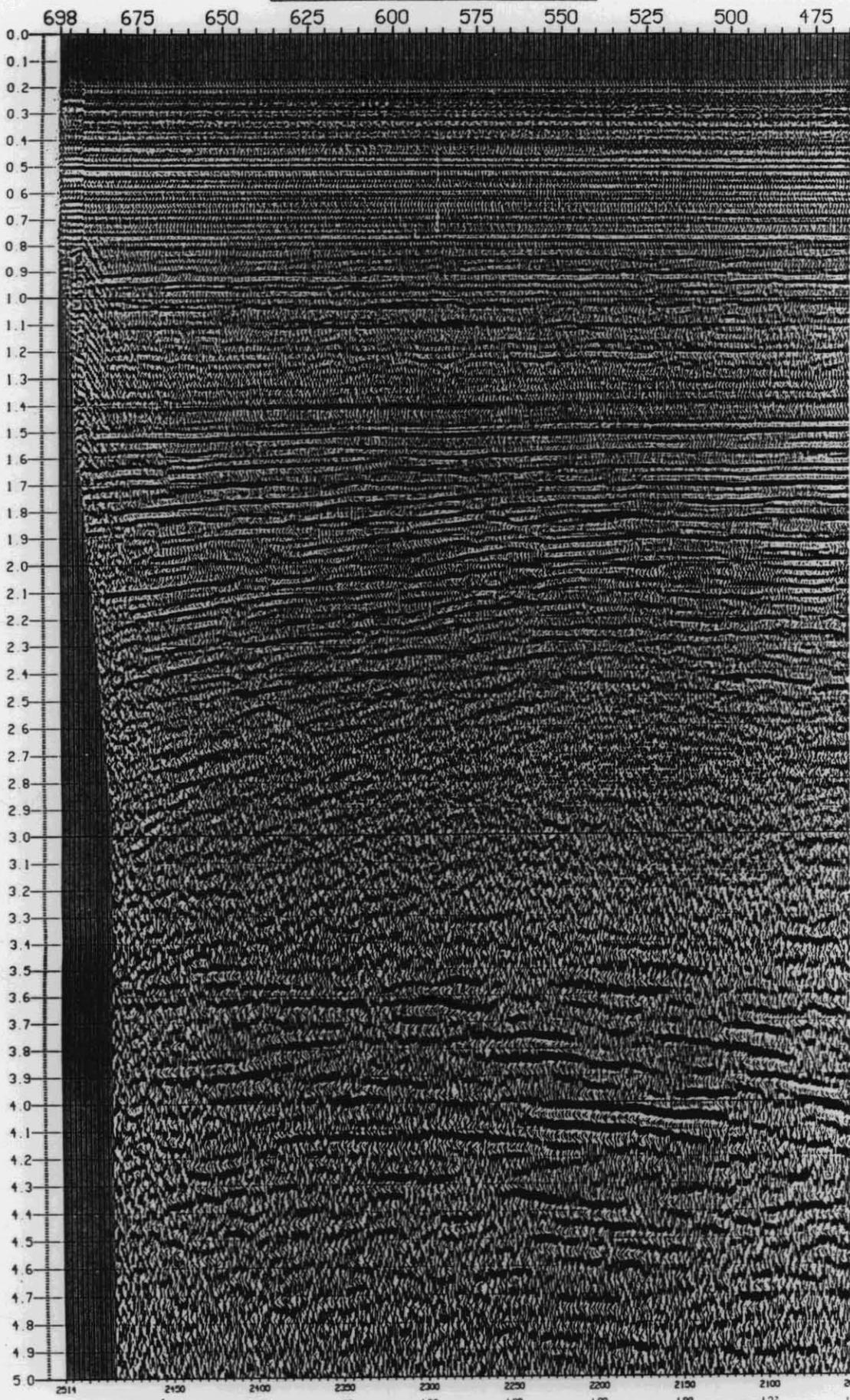
This test also confirmed the value of demultiple on this data since a far more accurate primary function could be derived from the analyses with DEMULT applied. The attenuation of the multiples enabled the primaries to be more clearly discerned and often allowed primaries to be seen that had been masked by the multiples.

150028A

FIGURE 6

LINE TQH5-98
S.P. 1 TO 698
OBS/DPLT/SIK/TVF/TVS
AMOCO AUSTRALIA PETROLEUM COMPANY
PERMIT T-22-P
1985B AMOCO BASS BASIN SURVEY
02 NOV 1985 118 120 122 0 9 1

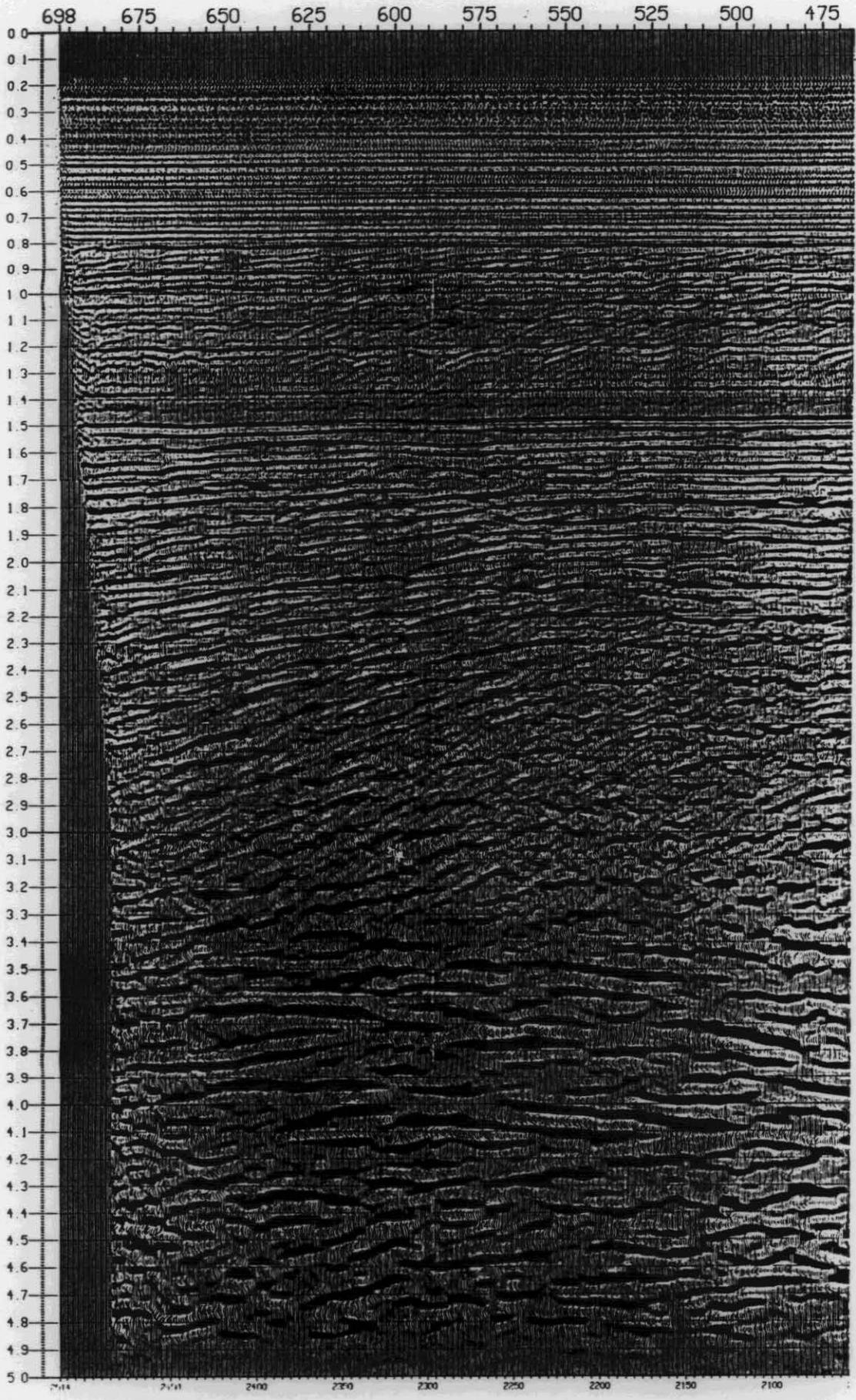
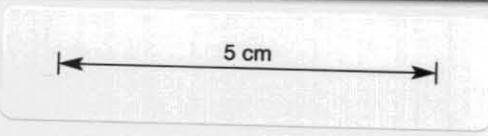
5 cm



150029A

FIGURE 7

LINE TQH5-98
S.P. 1 TO 698
VEF/DSC/DMLT/STK/TVF/TVS
AMOCO AUSTRALIA PETROLEUM COMPANY
PERMIT T-22-P
1985B AMOCO BASS BASIN SURVEY
02 NOV 1985 118 SECONDS G.S.I.





VELOCITY ANALYSIS

GSI's VELSCAN Velocity Module is a high technology program designed to enable stacking velocities to be picked on the basis of the stack response of individual event wavelets. It makes use of advanced picking logic to pick events as functions of time, amplitude, moveout and dip. These attributes are plotted on a scattergram display with a listing of the attribute values and a display of the associated trace data. The latter comprises a suite of stacked traces, and a CDP gather with different NMO corrections applied. The CDP gather displayed is the central gather of the set of stacked traces.

The event picking proceeds in the following manner:

- . NMO corrections corresponding to a series of moveout functions are applied to each set of CDP traces. For each moveout function, the NMO-corrected traces are stacked. The set of moveout functions is automatically computed such that there is only a small difference in stack response between adjacent functions. Therefore the stack response will increase gradually toward the correct moveout for stack and then die off gradually as the moveout becomes excessive. This enables the program to interpolate maximum stack amplitude for each event versus moveout, and arrive at the optimum velocity for the event.
- . The next step is to apply a dip scan to the suite of stacked traces to further improve the signal to noise ratio and determine a localized dip value of the event. Small increments of dip are used, as were small moveout increments in the moveout scan described above. A maximum amplitude for the event should be found when the correct dip is applied. Dips either side of the correct dip will give a reduced amplitude.



- . The result of the moveout and dip scan processes is a set of event amplitudes as functions of time, moveout and dip. An event is located by searching for an amplitude extremum in the time, moveout and dip domains. An extremum may be either a maximum or minimum; that is, both peaks and troughs are picked. The event attributes of time, amplitude moveout and dip are assigned to the centre depth point.
- . The picked events are then plotted on a scattergram, with different symbols being used to classify the amplitudes of the events. The highest amplitude symbol in each 50 ms is circled to distinguish it. The velocity, amplitude and dip attributes of each circled event are also listed with the scattergram. The scattergram and event listing is usually displayed with trace data in the form of CDP gathers and stacks with moveout correction using the different velocity functions.

As part of the velocity analysis routine, static corrections to compensate for shot and cable depth, and multiplexor delays are applied.

The testing involved with velocity analysis consists mainly of obtaining a suitable centre velocity function for the trace data displays. With information about the dominant data frequency, stack fold and trace offsets, the program will compute functions for a range above and below the central function such that there is a constant small difference in stack response between the functions so that the optimum function is easily recognized on the stack trace displays.

Two passes of velocity analyses were run on this project: one on the preprocessed data before demultiple was applied and one on the data after DEMULT.



For the first pass (non-demult) analyses the central velocity function was derived from checkshot velocity survey information supplied by Amoco. The function used was:

TIME (ms)	VELOCITY (m/s)
0	1480
100	1480
500	2000
700	2150
1200	2400
1500	2500
3000	3600
4000	4700

For the second pass (DEMULT) velscans the central function used was the primary function picked from the first pass since this provides a more accurate central function.

Interpretation of both passes of velscans was done by G.S.I.'s Sydney office. The interpretation process consists of selecting those events thought to be primaries based on their velocity, dip and amplitude behaviour. It is generally assumed that the longest segments are the most reliable since they display lateral continuity. Normally a long high amplitude circled segment is given the highest weight in picking the scattergram.

Towards the western part of the prospect a strong shallow event occurs between 1.0 and 2.0 seconds two way reflection time. Little coherent signal was returned from beneath this layer and in an attempt to improve the resolution below this layer a number of lines were restacked with faster stacking velocities and then remigrated. In some cases this did result in an improvement, but often this was marginal. Both versions of the final stacks and migrations were sent to Amoco. A list of the restacked lines is given in Appendix B.



NORMAL MOVEOUT CORRECTIONS (NMO)

Reflection arrival times at the surface, from a horizontal reflecting interface, increase with offset from seismic source in a predictable manner known as the normal moveout effect. NMO at a given location is a function of offset, depth to the reflector and the velocity of the medium between the reflector and the surface.

NMO corrections remove the NMO increase in reflection times with offset and reduce all reflection times to the value they would have if source and receiver were coincident.

NMO corrections involve some stretching of the data. This is greatest at early record times but decreases with increasing record time. In order to avoid gross distortion at early record time, ramps are applied to zero out the early part of the traces where NMO is excessive and to phase in the NMO corrections gradually.

In conjunction with the NMO process, static corrections to compensate for shot and cable depth are applied. These averaged about 12 milliseconds.

COMMON DEPTH POINT STACK (CDP STACK)

The common depth-point stack is the summation of all the traces of a common depth point into one stacked output trace for each depth point. This summation is performed after the application of NMO and static corrections to each individual traces. If these corrections are appropriate then trace signals will reinforce whilst random noise will tend to cancel out. The improvement in signal-to-noise (S/N) ratio of a stacked trace compared to the input traces is theoretically equal to the square root of N, where N is the number of traces summed together. Thus a stack fold of 60 fold would give an improvement of approximately 8.



In addition to improving the S/N ratio, stacking can also attenuate or suppress undesired reflection events such as multiple reflections. This is because an appropriately applied NMO correction will only partially correct multiple reflections so that they will not reinforce when summed but will suffer some degree of destructive interference.

A ramp is applied to the input traces before summation to remove the stretched data, as described in the previous section on NMO, and any first break noise not removed by the pre-deconvolution ramp or velocity filter. The ramp applied was:

Ramp Length : 96 ms
 Start Time : 0 , 180 , 400 , 3200 ms
 Offset : 390 , 400 , 480 , 3975 m
 Trace : 240 , 240 , 234 , 1

When Demult is applied to the data an inside trace ramp is also applied before summation, as explained in the section on Demult. The inside trace ramp applied was:

Ramp Length : 96 ms
 Start Time : -100 , -100 , -100 , -100 ms
 End Time : 800 , 1000 , 2900 , 5000 ms
 Offset : 400 , 520 , 1290 , 1300 m
 Trace : 240 , 230 , 180 , 1

Because of the application of these ramps there will be time-variant changes in the number of traces being summed to form the stacked trace. As a result the sums will have different amplitude values as a function of the number of live contributors so they must be normalized before output, a process known as Recovery Scaling. The number of contributing traces vs time is counted and the scaler computed as follows:

$$RSc(t) = 1 / N(t)$$

where $RSc(t)$ is the recovery scaler at time t

$N(t)$ is the number of contributing traces at time t



Deconvolution and Transmission Compensation (TCOMP)

The aim of post stack deconvolution is to shorten the reflection wavelet to increase resolution and to attenuate short period reverberations. G.S.I offers both time and frequency domain deconvolution, the later being called TCOMP. Both are time variant.

Tcomp

Tcomp is a post-stack, time-variant, frequency domain deconvolution. It is designed to remove short period minimum phase reverberation and transmission effects. These effects, caused by interbed and short period multiples, act as a time-variant high-cut filter. Ideally, the input data will have been processed through DESIG which will have collapsed the time-invariant, geology independent shot wavelet to a zero phase band-limited pulse.

The operation of TCOMP is as follows:

One or more time gates are picked on the section. The gates may overlap.

The power spectrum of each trace in each gate is obtained. The power spectra for a span of traces are laterally averaged and the average spectrum is assigned to the centre trace of the span. This is done to improve statistics and the assumption that the primary spectrum is white.

The averaged power spectrum for each gate of each trace is then divided by a model spectrum (a flat, or "white", spectrum in this case) to give the power spectrum of the transmission filter for that gate.



The TCOMP filter is then transformed into the quefrequency (cepstral) domain in which the data is displayed as power versus quefrequency. The advantage of this power cepstrum display is that multiple energy will appear as a peaks at quefrequency values equal to the multiple periods.

The cepstrum is then windowed so that the desired range of multiple periods fall within the window (the window is controlled by the Taumin and Taumax parameters). This window is then transformed to the frequency domain where it gives the power spectrum of the multiple energy.

The amplitude spectrum of the multiple reflection sequence is then derived and since the multiple sequence has minimum phase characteristics, its phase spectrum can be derived from its amplitude spectrum. Given both spectra the appropriate inverse filters can be designed and applied to the trace.

Post stack deconvolution tests were run on line TQH5-61-1, shotpoints 600-700

Values Tested were : a) Gapped deconvolution. Number of filters: 2.
Total filter length: 224 ms.
Start/end time of filter design: 400/4000 ms

- i) Gap: 24 ms
- ii) Gap: 32 ms
- iii) Gap: 40 ms
- iv) Gap: 48 ms



- b) Gapped deconvolution. Number of filters: 2.
Total filter length: 1.2 x two-way water
bottom time.
Start/end time of filter design: 400/4000 ms
Gap: 0.9 x two-way water bottom time.
- c) Transcomp. Tcomp option
Smash: 11, noise: 5, number of gates: 3,
gate length: 1200 ms
gate start times: 400, 1300 and 2500 ms
- i) Taumin/Taumax: 0/100 ms
 - ii) Taumin/Taumax: 30/130 ms
 - iii) Taumin/Taumax: 50/150 ms

It was decided that no post-stack deconvolution would be applied to the data.

TIME VARIANT FILTERING (TVF)

Bandpass filtering is applied to limit the data displayed to the range of frequencies with a good signal-to-noise ratio. This usually results in the application of a time-variant filter because the earth's filtering effect results in a progressive loss of the higher frequencies with depth. Therefore any high frequencies present on the data at depth are usually noise and not signal.



Filter tests were run on lines TQH5-98 (shotpoints 540 to 620), which is reproduced in figure 8, TQH5-61-1 (shotpoints 601 to 701).

Values tested were:

OUT-OUT , 0- 10 , 7- 14 , 10-20
15- 30 , 20- 40 , 25- 50 , 30-60
35- 70 , 40- 80 , 45- 90 , 50-100
55-110 , 60-120 , 65-125 , 70-125
75-125 , 80-125 , 6- 55 , 8-55
10- 55 , 12- 55 , 15- 55 , 20-55

From these tests the following filter was picked and applied to the production final stack and migration data:

Frequency Hz	Time ms
10 - 70	0
10 - 60	900
8 - 50	1500
8 - 45	2000
8 - 40	2500
6 - 40	3000
6 - 35	3500
6 - 30	5000

150039A

1 AMCO AUSTRALIA PETROLEUM COMPANY
LINE 1045-98
S P 601 TO 675
CORNER FREQUENCIES 0 0 8 12 KNEE 0 TIMES

2 AMCO AUSTRALIA PETROLEUM COMPANY
LINE 1045-98
S P 601 TO 675
CORNER FREQUENCIES 5 9 13 17 KNEE 0 TIMES

3 AMCO AUSTRALIA PETROLEUM COMPANY
LINE 1045-98
S P 601 TO 675
CORNER FREQUENCIES 7 13 17 23 KNEE 0 TIMES

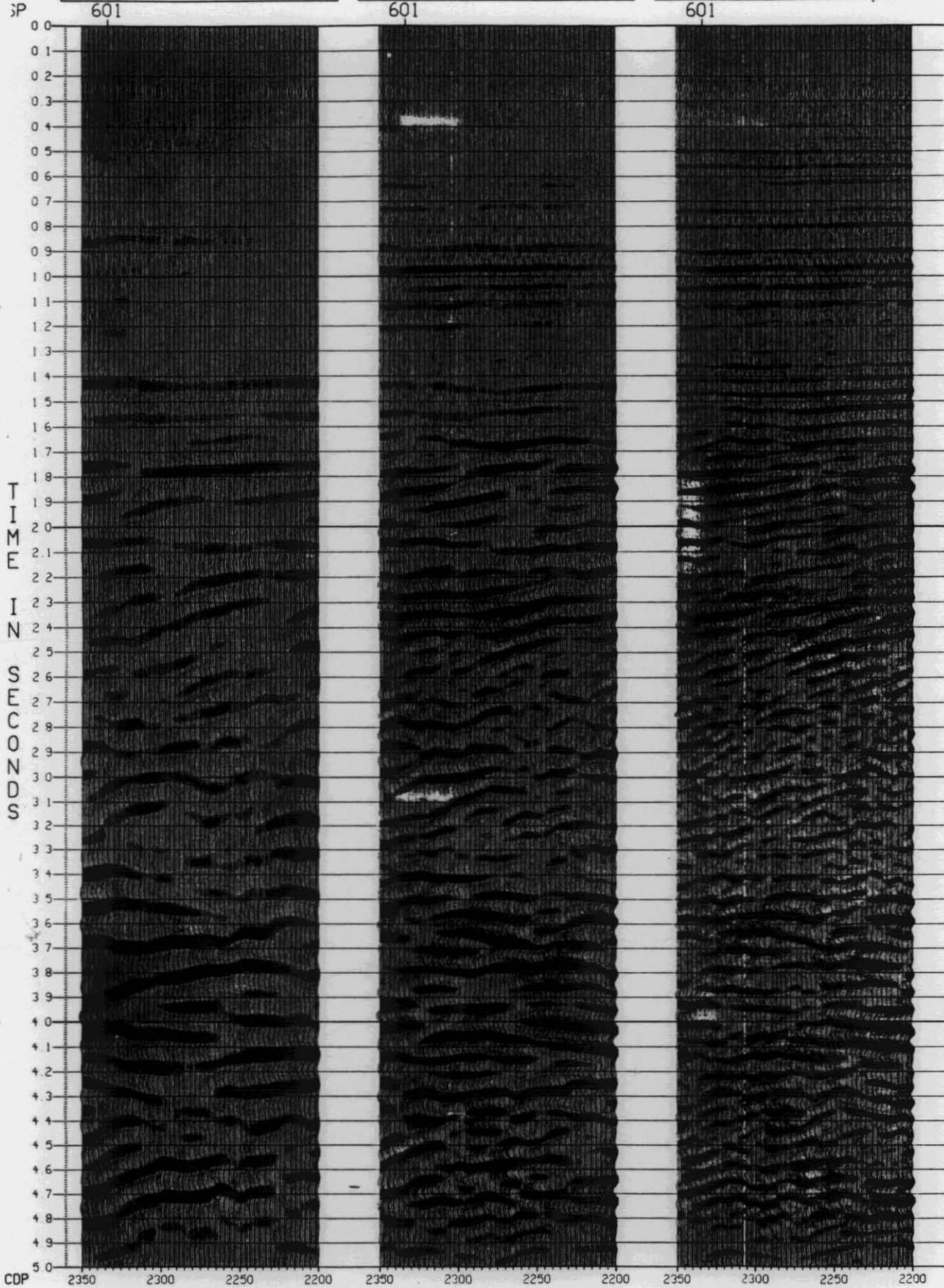
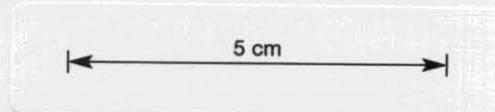


FIGURE 8

-A26-

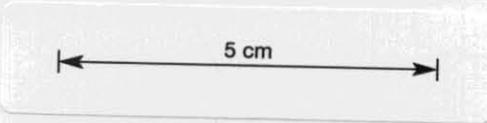
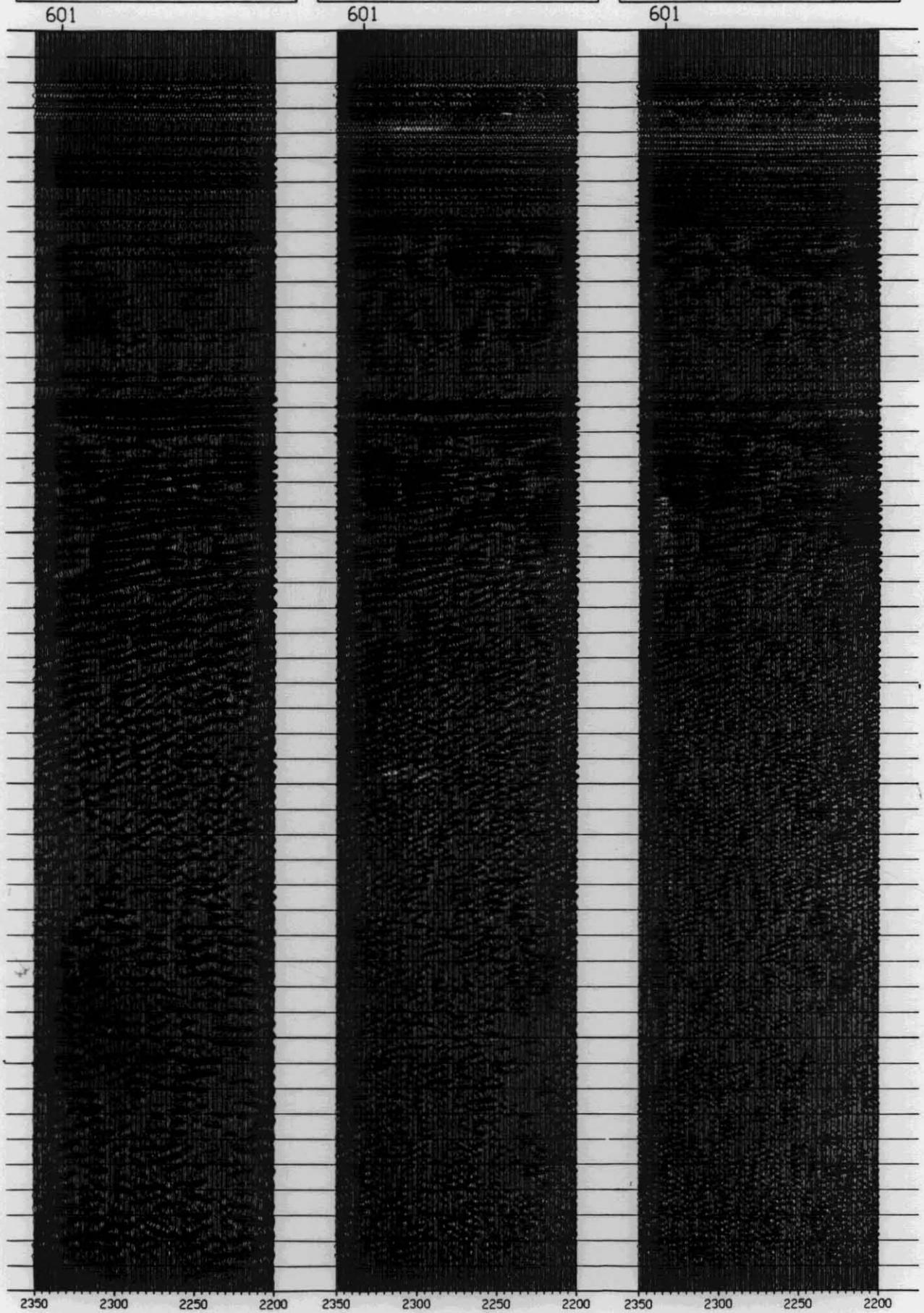


150040A

T LINE QHS 38
S P 601 TO 675
CORNER FREQUENCIES KNEE TIMES
12.18.27.33 0

U LINE QHS 38
S P 601 TO 675
CORNER FREQUENCIES KNEE TIMES
15.25.35.45 0

O LINE QHS 38
S P 601 TO 675
CORNER FREQUENCIES KNEE TIMES
20.30.45.55 0



150041A

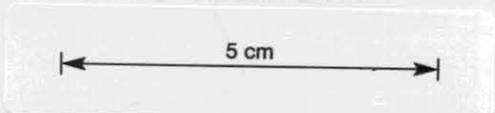
7 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TDH5-98
S.P. 601 TO 675
CORNER FREQUENCIES KNEE TIMES
25.35.55.65 0

8 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TDH5-98
S.P. 601 TO 675
CORNER FREQUENCIES KNEE TIMES
30.40.65.75 0

9 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TDH5-98
S.P. 601 TO 675
CORNER FREQUENCIES KNEE TIMES
35.45.75.85 0



-A28-

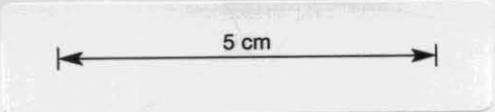
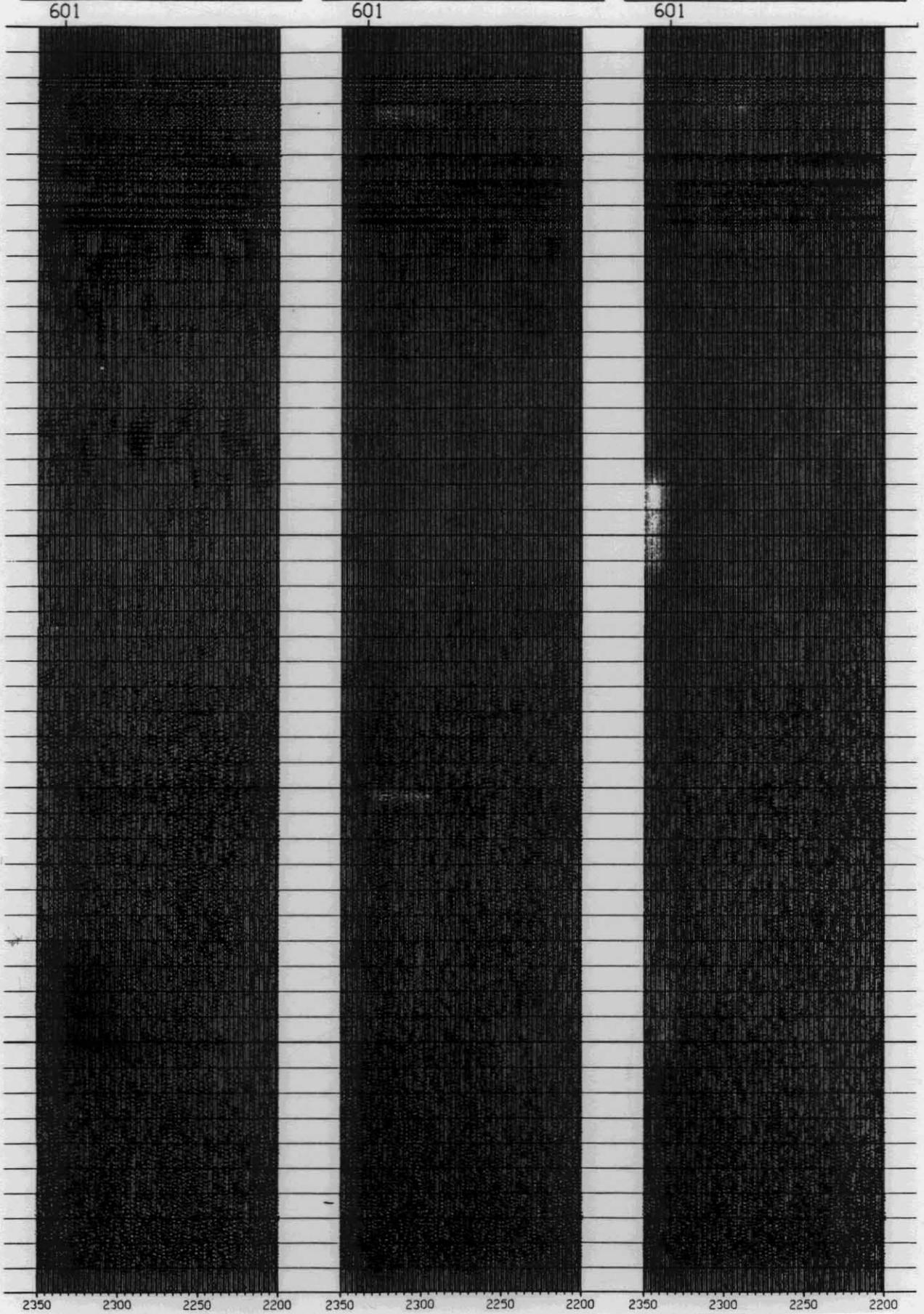


150042A

10 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TOHS-38
S P 601 TO 675
CORNER FREQUENCIES KNEE TIMES
40.50.85.95 0

11 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TOHS-38
S P 601 TO 675
CORNER FREQUENCIES KNEE TIMES
45.55.95.105 0

12 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TOHS-38
S P 601 TO 675
CORNER FREQUENCIES KNEE TIMES
50.60.105.115 0

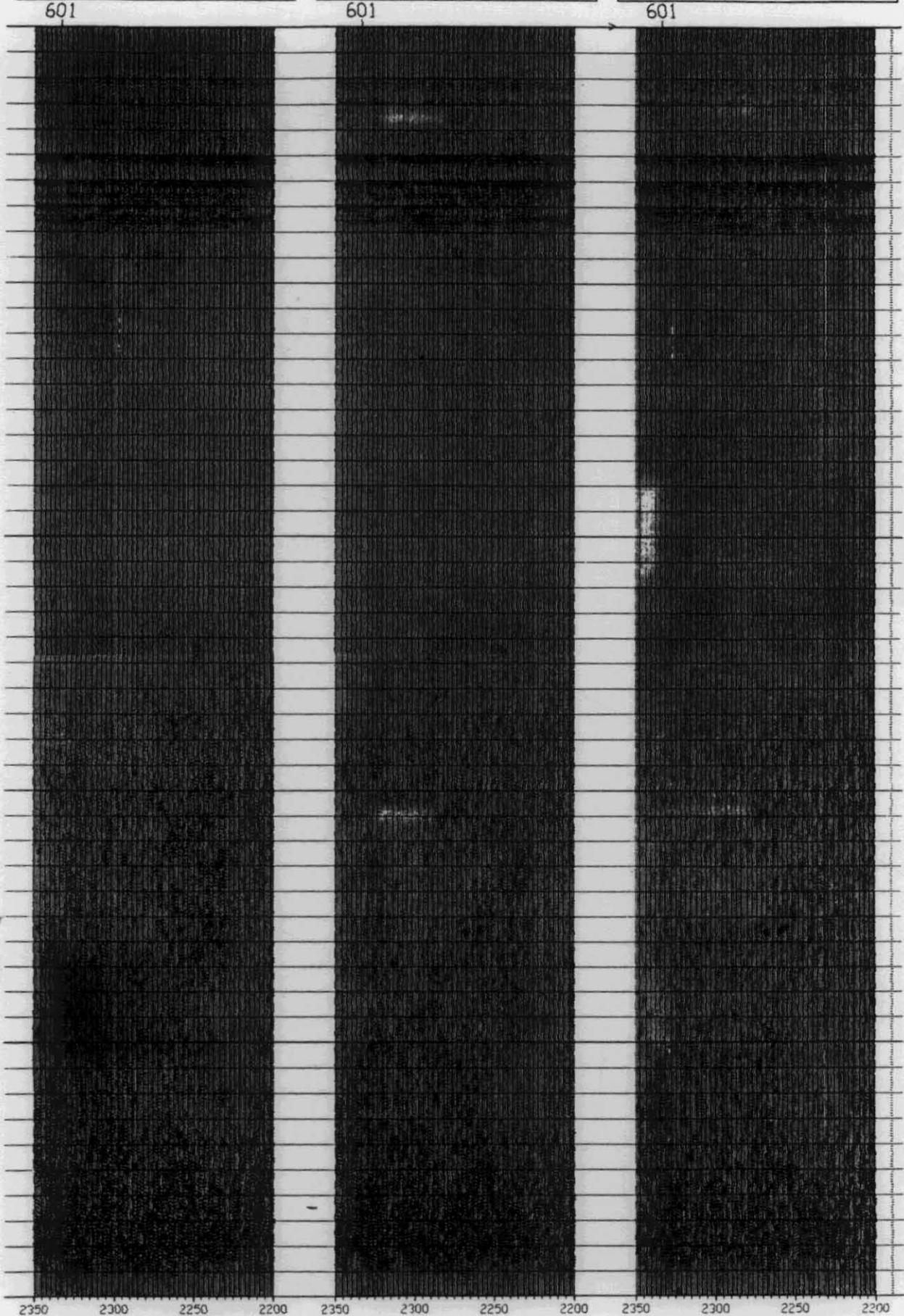


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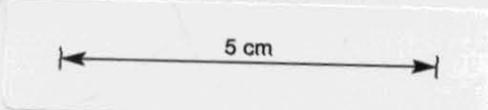
13 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TQHS-38
S P 601 TO 675
CORNER FREQUENCIES KNEE TIMES
55.65.115.125 0

14 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TQHS-38
S P 601 TO 675
CORNER FREQUENCIES KNEE TIMES
60.70.125.125 0

15 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TQHS-38
S P 601 TO 675
CORNER FREQUENCIES KNEE TIMES
65.75.125.125 0



-A30-

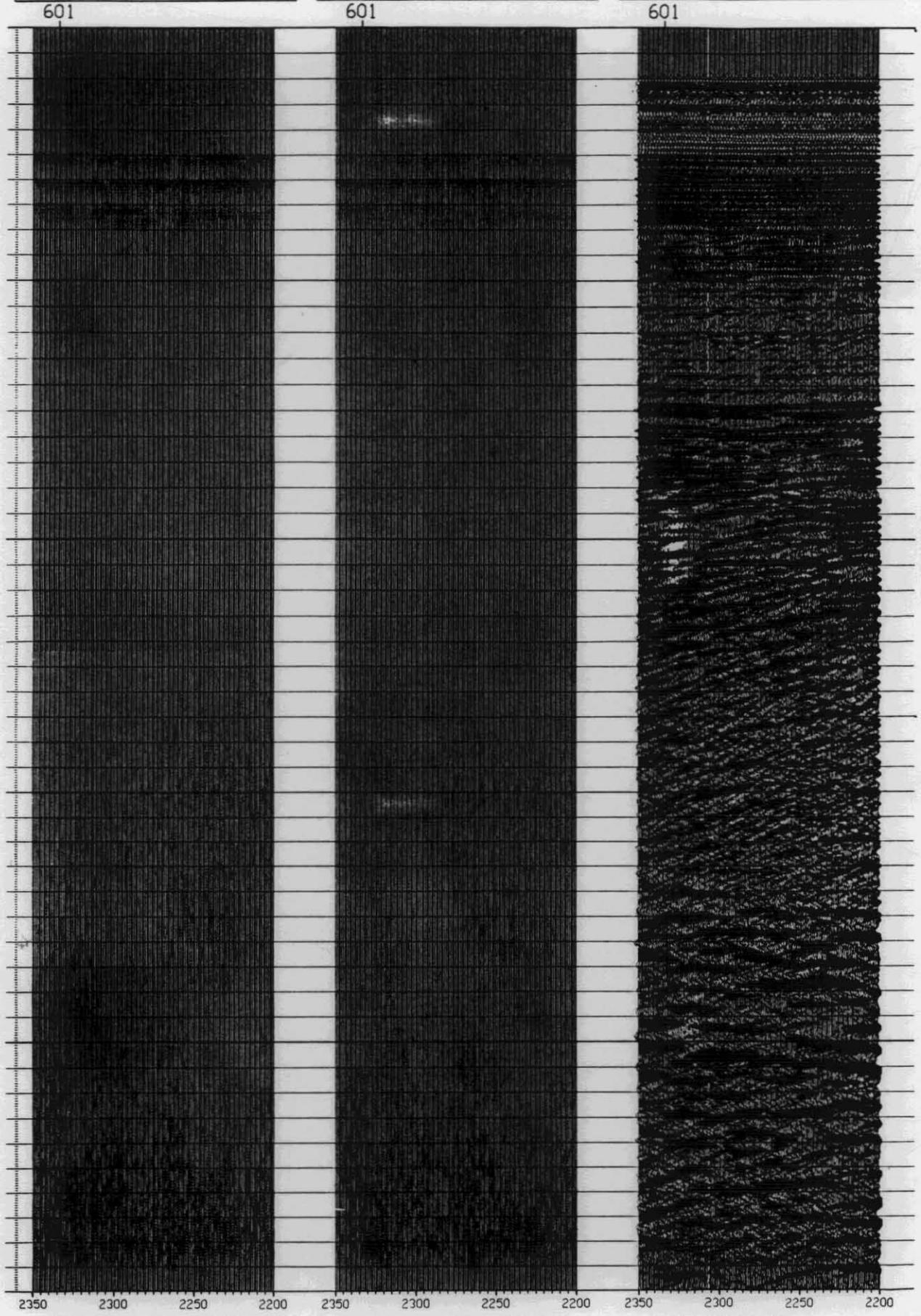


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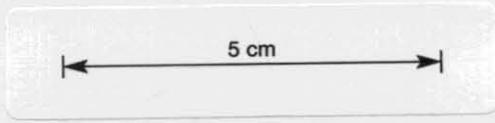
1 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TOHS-98
S P 601 TO 675
CORNER FREQUENCIES 70 80 125 125 KNEE 0 TIMES

2 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TOHS-98
S P 601 TO 675
CORNER FREQUENCIES 75 85 125 125 KNEE 0 TIMES

3 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TOHS-98
S P 601 TO 675
CORNER FREQUENCIES 2 10 50 60 KNEE 0 TIMES



-A31-

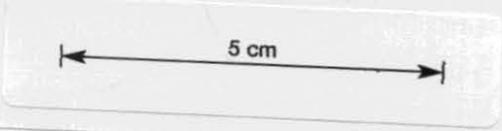
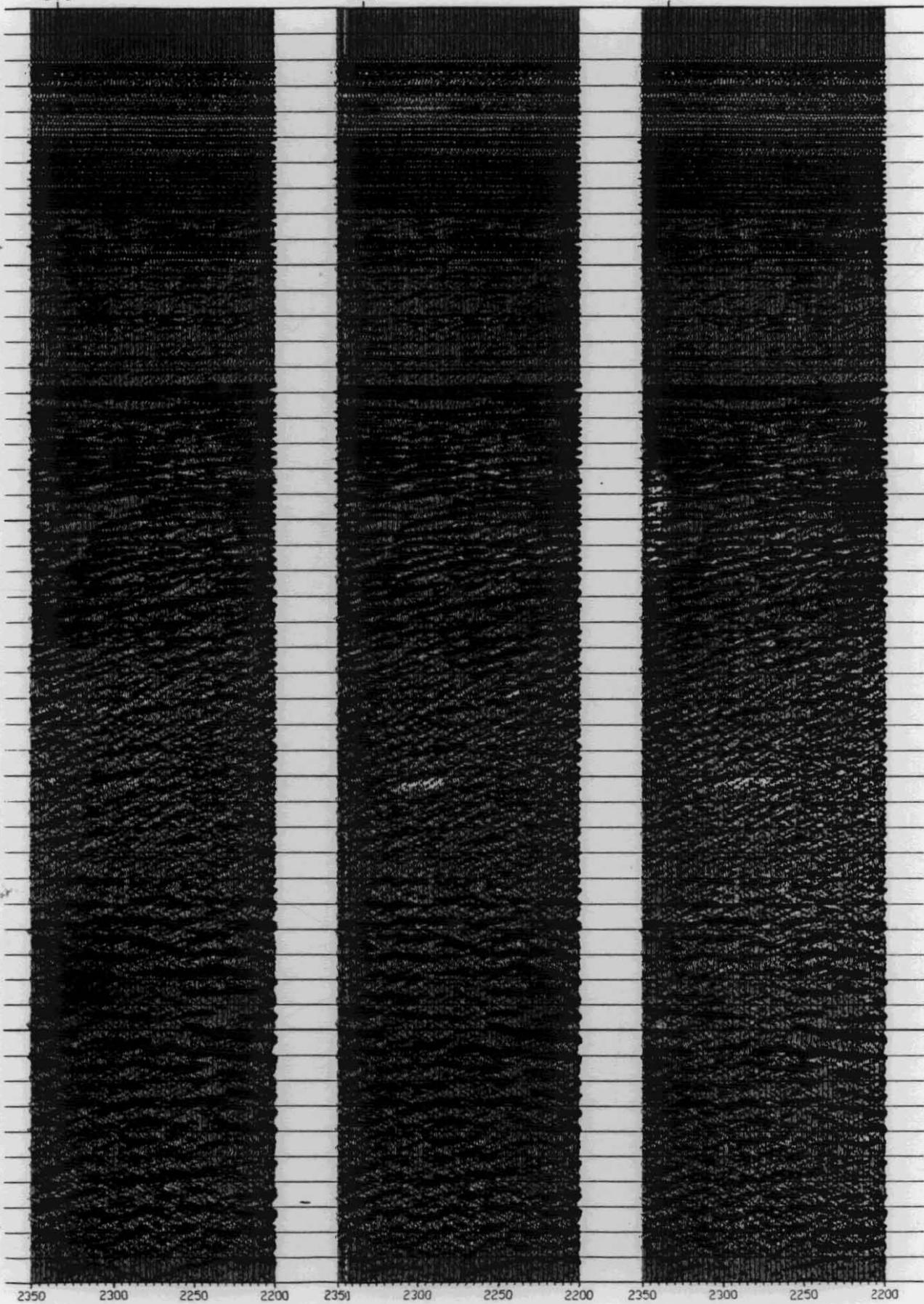


150045A

4 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TOHS-98
S P 601 TO 675
CORNER FREQUENCIES KNEE TIMES
3.13.50.60 0

5 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TOHS-98
S P 601 TO 675
CORNER FREQUENCIES KNEE TIMES
5.15.50.60 0

6 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TOHS-98
S P 601 TO 675
CORNER FREQUENCIES KNEE TIMES
7.17.50.60 0

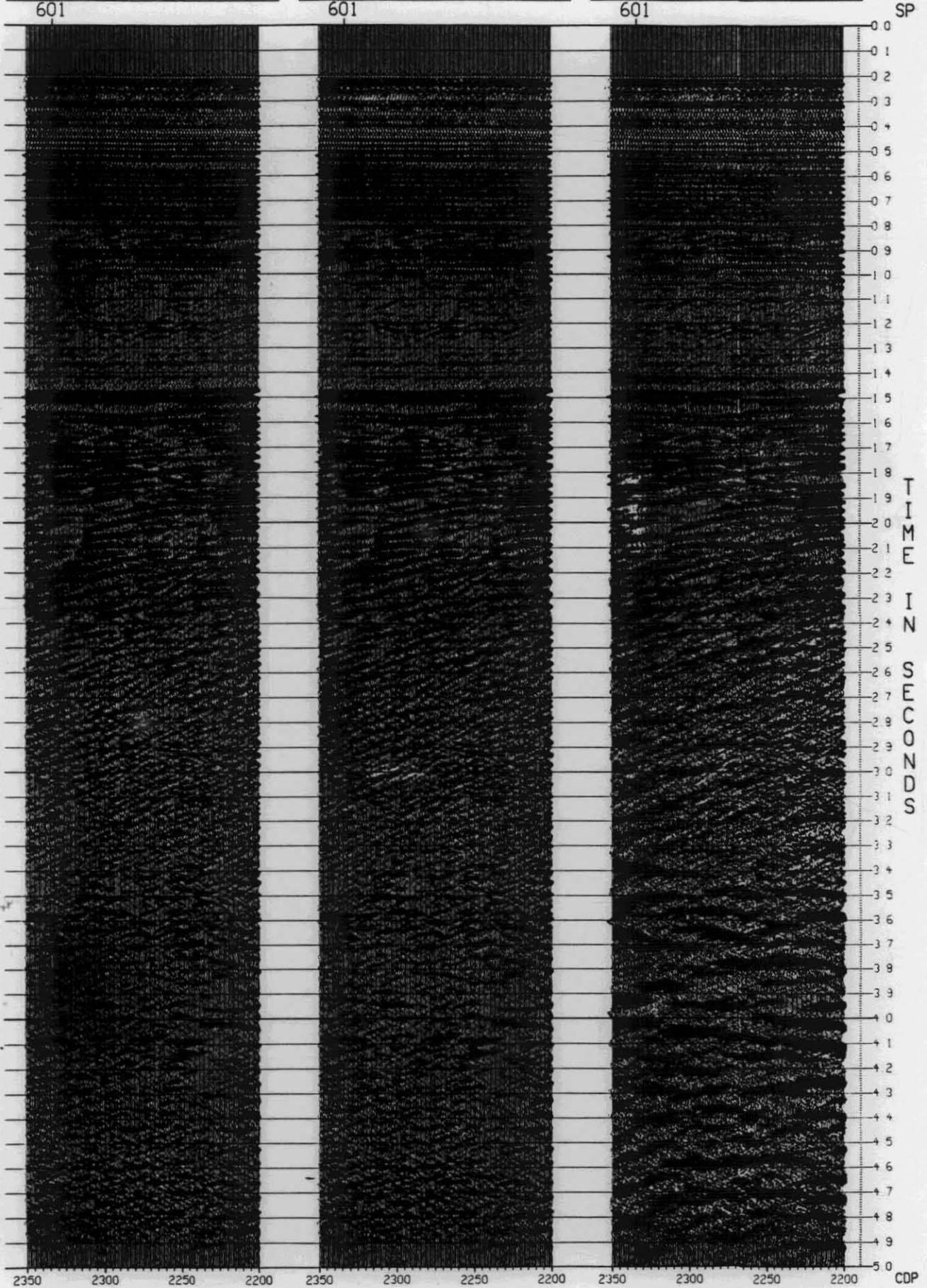


150046A

7 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TOHS-98
S P 601 TO 675
CORNER FREQUENCIES 10.20.50.60 KNEE 0 TIMES

8 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TOHS-98
S P 601 TO 675
CORNER FREQUENCIES 10.20.50.60 KNEE 0 TIMES

9 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TOHS-98
S P 601 TO 675
CORNER FREQUENCIES 0.0.125.125 KNEE 0 TIMES



-A33-

5 cm



TIME VARIANT SCALING

Time variant scaling is the last process and is applied because of inability of conventional displays to adequately show the large amplitude differences that can occur between reflection events. The solution to this is to apply TVS to the data to reduce the range of reflection amplitudes enough to be displayed adequately. The high amplitude events are scaled down and the low amplitude events are scaled up.

GSI has a number of different scaling routines and these were tested on line TQH5-61-1, shotpoints 601 to 701. The tests were run on the stacked data with the production TVF applied. The following values were tested:

a) No scaling

b) FLATTVS (regular scalers).

Start time: 100 ms below waterbottom.

Gate lengths :

i) 20 x 250 ms

ii) 10 x 500 ms

iii) 5 x 1000 ms

iv) 3 x 1500 ms

c) FITLNTVS (Logarithmic scalers)

Start time: 100 ms below waterbottom.

Gate lengths :

i) 20 x 250 ms

ii) 10 x 500 ms

iii) 5 x 1000 ms



d) DGCS (Digital Gain Scaler)

Start time: Surface

Gate lengths :

- i) 500 ms
- ii) 1000 ms

From these tests it was decided to apply DGCS with 1000 ms gates to the production data.

DGCS scaling produces amplitude equalisation in a time variant manner down the seismic trace as well as from trace to trace. A "sliding" time gate is used to compute time variant scalers for each trace.

i) Scaler Derivation

A scaling gate length and initial gate start time are specified and the program goes through the following sequence:

Amplitudes at all samples in the first gate (i.e. beginning at gate start time, finishing gate length msec later) are examined and their RMS value determined. A predetermined number (representing typically half system dynamic range) is then divided by the RMS value to give the scaler for the first gate. The second gate starts and finishes one sample later than the first, the third and fourth gates etc overlap earlier gates sliding down the trace similarly one sample at a time. Scalers for these gates are derived in the same manner as described earlier for gate one.

ii) Scaler Application

Scalers derived for each gate are applied only to the sample at the gate centre time. For all times prior to the first gate centre and after the last gate centre the scaler derived for the first gate and the scaler derived for the last gate respectively are used. The scaling operation is simply a multiplication of amplitude values on tape with the appropriate scaler value.

1 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE 10H5-61-1
S.P. 601 TO 701
POST-STACK SCALE FLATTVS
POST-STACK GATE LENGTH(S)
250

2 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE 10H5-61-1
S.P. 601 TO 701
POST-STACK SCALE FLATTVS
POST-STACK GATE LENGTH(S)
500

150049A

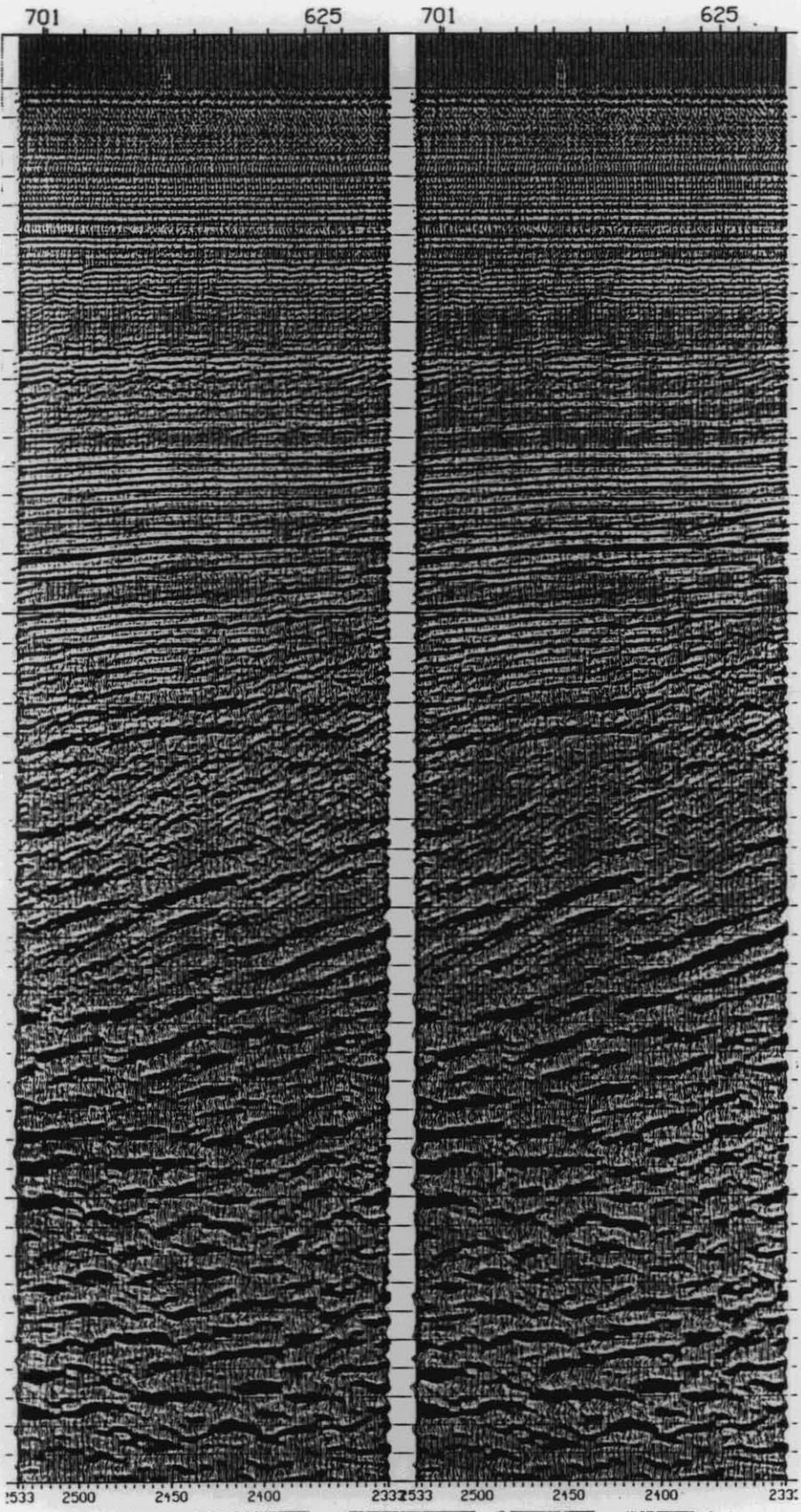
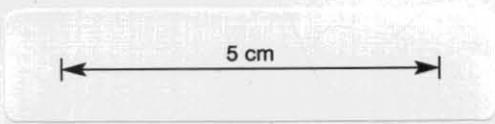


FIGURE 9

-A36-



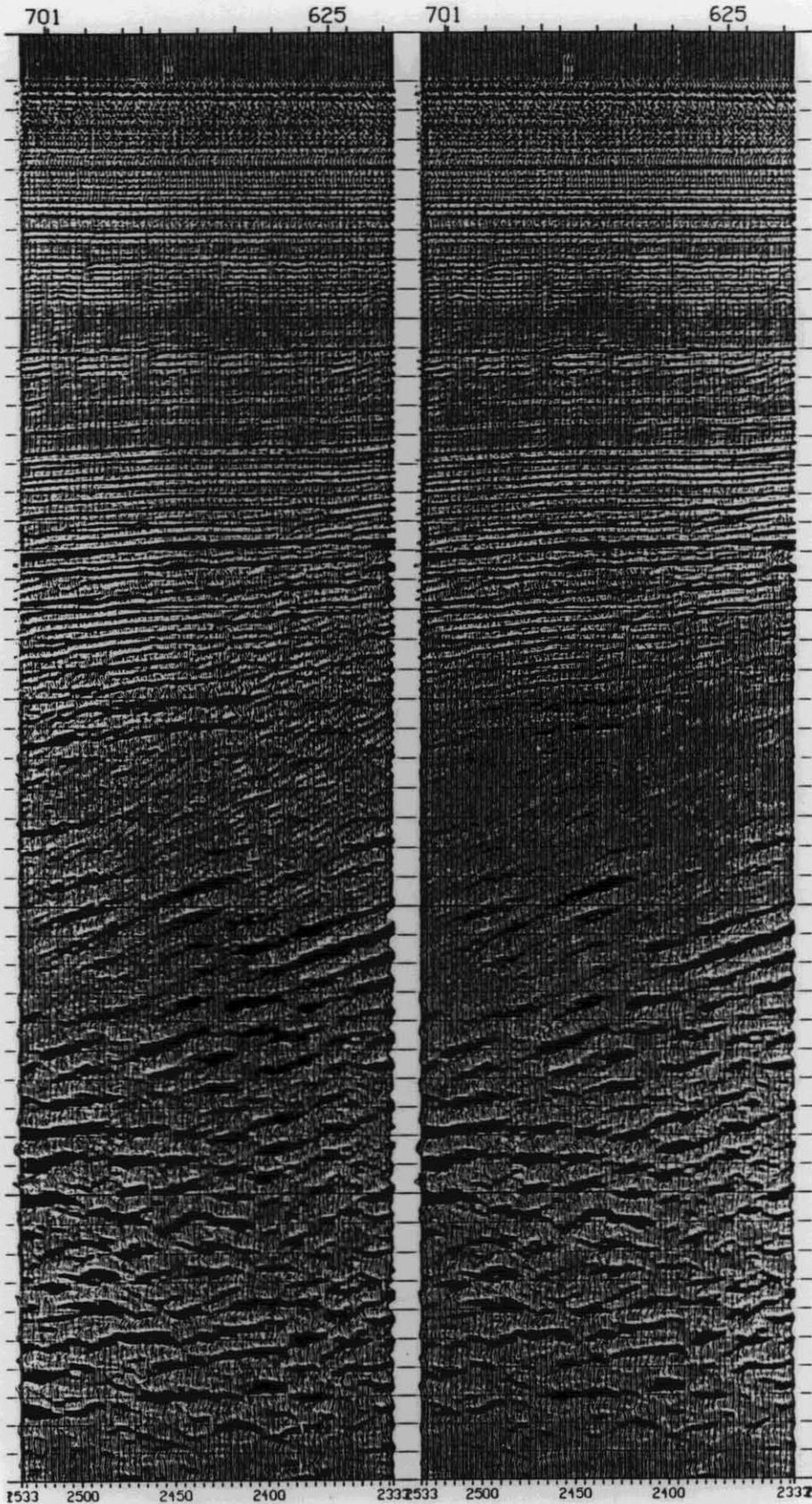
3 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TOB-61-1
S.P. 601 TO 701

POST-STACK SCALE FLATTVS
POST-STACK GATE LENGTH(S)
1000

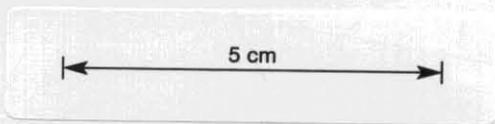
4 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE TOB-61-1
S.P. 601 TO 701

POST-STACK SCALE FLATTVS
POST-STACK GATE LENGTH(S)
1500

150050A



-A37-



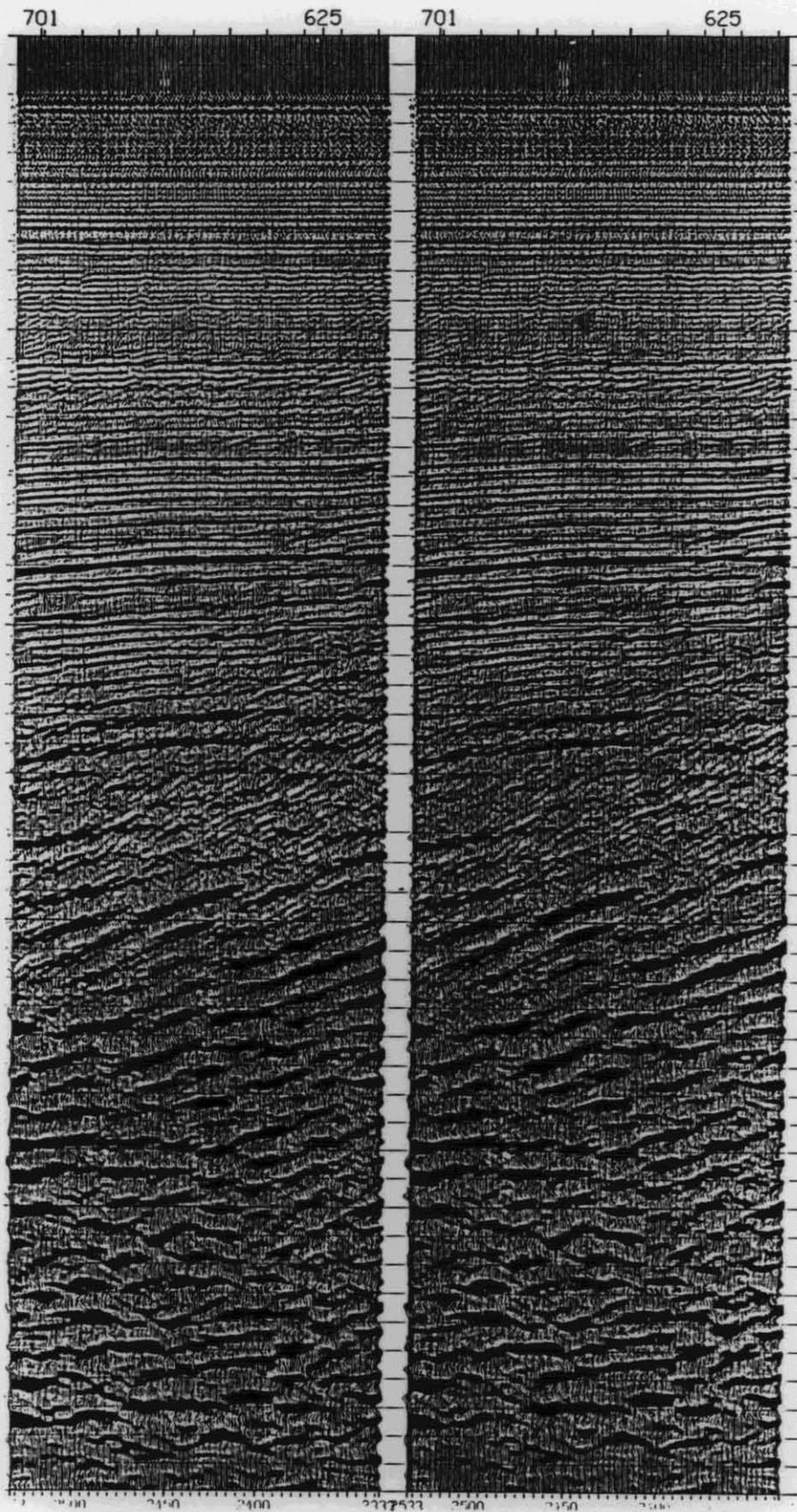
5 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE 1045-61-1
S.P. 601 TO 701

POST-STACK SCALE DGCS500
POST-STACK GATE LENGTH(S)
500

6 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE 1045-61-1
S.P. 601 TO 701

POST-STACK SCALE DGCS1000
POST-STACK GATE LENGTH(S)
1000

150051A



-A38-

5 cm

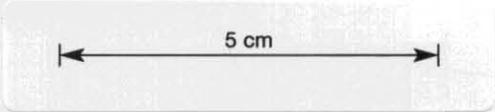
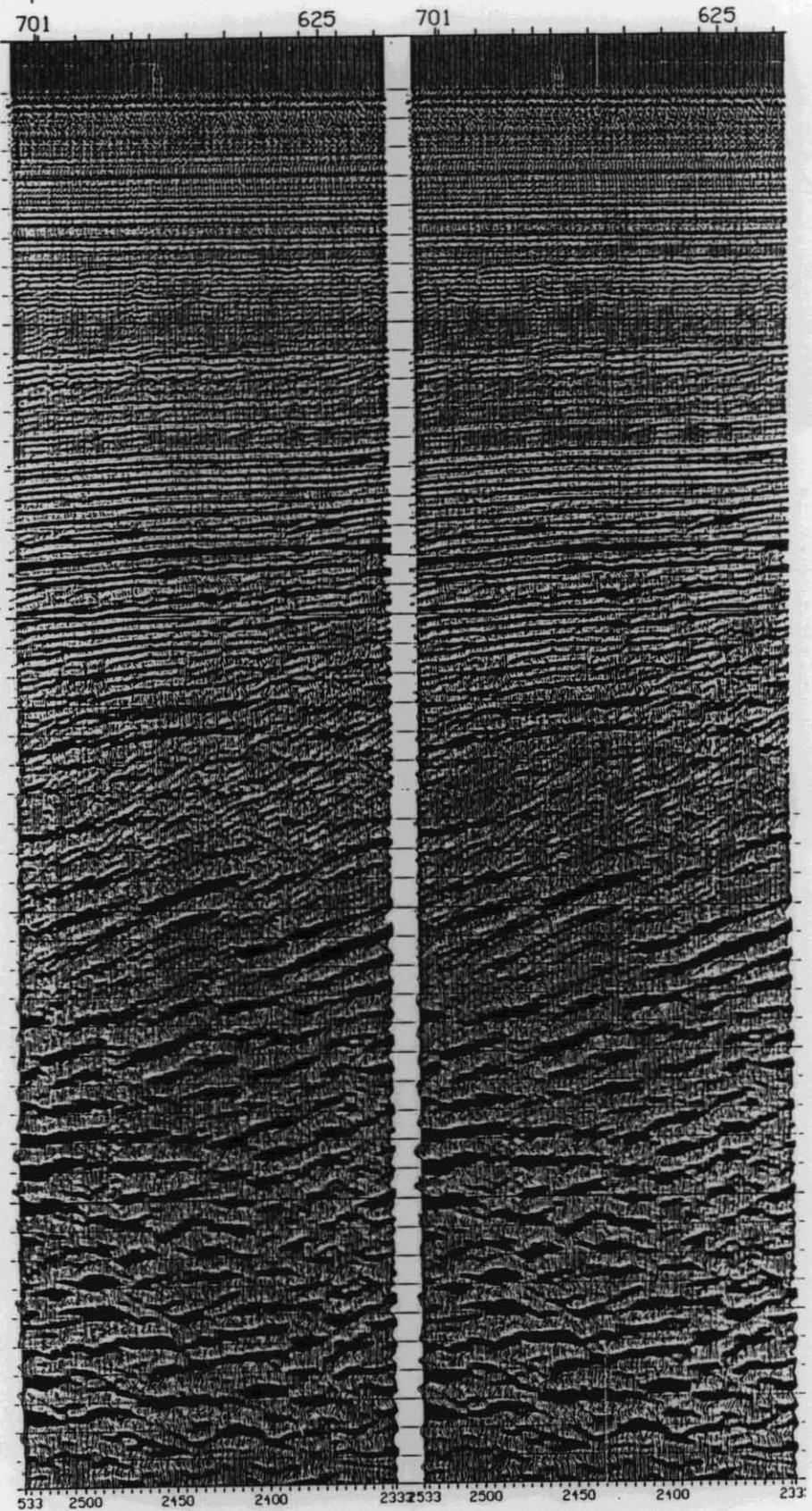
7 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE 10-B-61-1
S.P. 601 TO 701

POST-STACK SCALE FITTINGS
POST-STACK GATE LENGTH(S)
250

8 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE 10-B-61-1
S.P. 601 TO 701

POST-STACK SCALE FITTINGS
POST-STACK GATE LENGTH(S)
500

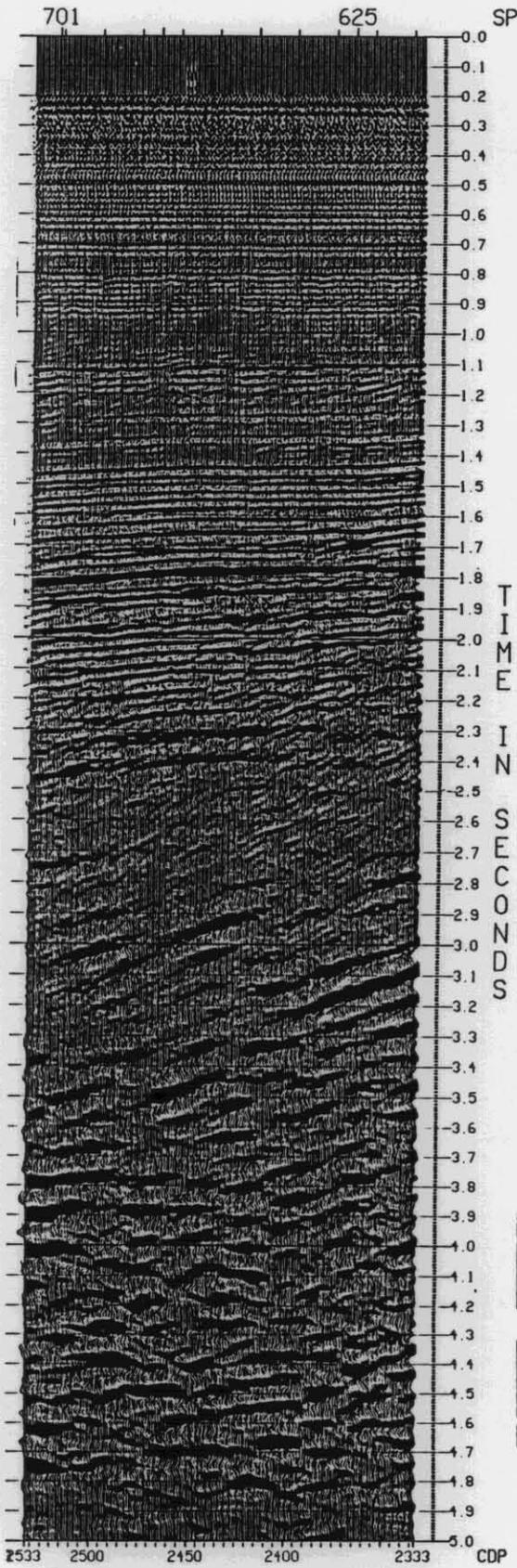
150052A



9 AMOCO AUSTRALIA PETROLEUM COMPANY
LINE 1015-61-1
S.P. 601 TO 701

150053A

POST-STACK SCALE FITLNTVS
POST-STACK GATE LENGTH(S)
1000



-A40-

5 cm



MSTACK

GSI's F-K domain migration routine uses the Kirchoff integral solution to the scalar wave equation. This method will migrate data more accurately in the presence of a laterally variant velocity field than many other techniques. It has a practical dip limit approaching 90 degrees. On sections with events with 'true' structural dips less than this it is recommended to follow MSTACK with DIPCON. This helps to prevent excessive wave front noise on low S/N ratio data.

Migration velocities are obtained from the SPACEVELS process.

SPACEVELS

SPACEVELS is the velocity modelling program used to derive migration velocities. Stacking velocity functions and unmigrated horizon times are input and SPACEVELS then uses an inverse ray tracing technique to build a migrated depth-interval velocity model. This model is then smoothed and the RMS velocity calculated. In the 2D mode SPACEVELS is run seperately on each line.

The horizon times are selected to define the horizons at which there are major changes in the slope of the stacking velocity function, and the regional geologic dips present in the survey area, and therefore do not necessarily represent either a structural or geologic interpretation of specific reflectors.

SPACEVELS has the option to scale the interval velocity model which results in a scaling of the calculated RMS velocities used for migration. This option was tested on line TQH5-115. The whole line (shotpoints 1 to 643) was migrated 3 times with scaling factors of 80%, 90% and 100% (no scaling) applied to the spacevels model. It was felt that the no scaling option gave the best result, the other sections appearing undermigrated.



DIPCON

DIPCON is a frequency-wavelength (F-K) filtering process designed to be applied after migration to attenuate the wavefront artifacts often generated by wide-angle migration where discontinuous events are present. DIPCON suppresses these spurious wavefronts by attenuating them with a dip-dependent amplitude scaling algorithm. This allows the more accurate event mapping inherent in wide-angle F-K migration to be used while at the same time producing a section which has the cosmetic advantages of finite-difference (F-D) migration.

Dip values of 30, 35, and 40 degrees were tested on the migrated stack of line TQH5-115. A value of 35 was chosen for production .



MSTACK

GSI's F-K domain migration routine uses the Kirchoff integral solution to the scalar wave equation. This method will migrate data more accurately in the presence of a laterally variant velocity field than many other techniques. It has a practical dip limit approaching 90 degrees. On sections with events with 'true' structural dips less than this it is recommended to follow MSTACK with DIPCON. This helps to prevent excessive wave front noise on low S/N ratio data.

Migration velocities are obtained from the SPACEVELS process.

SPACEVELS

SPACEVELS is the velocity modelling program used to derive migration velocities. Stacking velocity functions and unmigrated horizon times are input and SPACEVELS then uses an inverse ray tracing technique to build a migrated depth-interval velocity model. This model is then smoothed and the RMS velocity calculated. In the 2D mode SPACEVELS is run seperately on each line.

The horizon times are selected to define the horizons at which there are major changes in the slope of the stacking velocity function, and the regional geologic dips present in the survey area, and therefore do not neccesarilly represent either a structural or geologic interpretation of specific reflectors.

SPACEVELS has the option to scale the interval velocity model which results in a scaling of the calculated RMS velocities used for migration. This option was tested on line TQH5-115. The whole line (shotpoints 1 to 643) was migrated 3 times with scaling factors of 80%, 90% and 100% (no scaling) applied to the spacevels model. It was felt that the no scaling option gave the best result, the other sections appearing undermigrated.



DIPCON

DIPCON is a frequency-wavelength (F-K) filtering process designed to be applied after migration to attenuate the wavefront artifacts often generated by wide-angle migration where discontinuous events are present. DIPCON suppresses these spurious wavefronts by attenuating them with a dip-dependent amplitude scaling algorithm. This allows the more accurate event mapping inherent in wide-angle F-K migration to be used while at the same time producing a section which has the cosmetic advantages of finite-difference (F-D) migration.

Dip values of 30, 35, and 40 degrees were tested on the migrated stack of line TQH5-115. A value of 35 was chosen for production .

APPENDIX BLIST OF LINES RESTACKED WITH FASTER VELOCITIES

The following lines from the western part of the project were restacked and remigrated using faster velocities than had originally been picked. Both versions of the final stack and migration were supplied to Amoco.

<u>LINE</u>	<u>SHOTPOINTS</u>
TQH5-5	1 - 493
TQH5-9	1 - 512
TQH5-11	1 - 452
TQH5-17A	101 - 843
TQH5-19A	1 - 662
TQH5-21	1 - 922
TQH5-23	1 - 1273
TQH5-29A	1 - 2369
TQH5-31	1 - 2115
TQH5-33	1 - 3431
TQH5-56-1A	1 - 1506
TQH5-61	1 - 1419
TQH5-64	1 - 672
TQH5-66	1751 - 4162
TQH5-82	1 - 753
TQH5-92	1 - 882
TQH5-143	1 - 843
TQH5-145	1 - 884



APPENDIX C

RAW STACK TAPE INVENTORY

The following tapes are standard SEG-Y format. The header contains a sequential trace counter for each line with the first trace numbered 1 incrementing by 1 to the end of the line and starting over with the next line, as requested by Amoco.

An earlier shipment of raw stack tapes numbered 800020 to 800037 was made but these tapes did not contain the required header information.

<u>LINE NUMBER</u>	<u>SHOTPOINTS</u>	<u>RECORDS (CDP NUMBERS)</u>	<u>TAPE NUMBER</u>
TQH5-1	1 - 583	1001 - 2284	800086
TQH5-2	1 - 1183	1001 - 3484	"
TQH5-3	1 - 483	1001 - 2084	"
TQH5-4	1 - 1203	1001 - 3524	"
TQH5-5	1 - 493	1001 - 2104	"
TQH5-6	1 - 1202	1001 - 3522	"
TQH5-7	1 - 1133	1001 - 3384	"
TQH5-8	1 - 1273	1001 - 3664	"
TQH5-9	1 - 512	1001 - 2142	"
TQH5-10	1 - 1162	1001 - 3442	800087
TQH5-11	1 - 452	1001 - 2022	"
TQH5-12	4 - 1193	1001 - 3498	"
TQH5-13	1 - 712	1001 - 2542	"
TQH5-14A	1 - 1293	1001 - 3707	"
TQH5-15	1 - 613	1001 - 2344	"
TQH5-16A	1 - 874	1001 - 2866	"
TQH5-17A	101 - 843	1001 - 2604	"
TQH5-18	1 - 673	1001 - 2464	"



<u>LINE NUMBER</u>	<u>SHOTPOINTS</u>	<u>RECORDS (CDP NUMBERS)</u>	<u>TAPE NUMBER</u>
TQH5-19	1 - 439	1001 - 1996	800088
TQH5-20	1 - 882	1001 - 2882	"
TQH5-21	1 - 922	1001 - 2962	"
TQH5-22	1 - 1874	1001 - 4866	"
TQH5-23	1 - 1273	1001 - 3664	"
TQH5-24A	1 - 1281	1001 - 3680	"
TQH5-25	1 - 923	1001 - 2964	"
TQH5-26	1 - 903	1001 - 2924	"
TQH5-27	1 - 1544	1001 - 4206	800089
TQH5-28	1 - 1663	1001 - 4494	"
TQH5-29A	1 - 2639	1001 - 6396	"
TQH5-30	1 - 633	1001 - 2384	"
TQH5-31	1 - 2115	1001 - 5348	"
TQH5-32	1 - 574	1001 - 2266	800090
TQH5-33	1 - 3431	1001 - 7980	"
TQH5-34	1 - 794	1001 - 2706	"
TQH5-35	1 - 2766	1001 - 6650	"
TQH5-36	1 - 623	1001 - 2364	"
TQH5-37	1 - 1593	1001 - 4304	800091
TQH5-38	1 - 943	1001 - 3004	"
TQH5-39	1 - 1583	1001 - 4284	"
TQH5-40	1 - 1154	1001 - 3426	"
TQH5-41	1 - 2553	1001 - 6224	"
TQH5-42	1 - 972	1001 - 3062	"



<u>LINE NUMBER</u>	<u>SHOTPOINTS</u>	<u>RECORDS (CDP NUMBERS)</u>	<u>TAPE NUMBER</u>
TQH5-43	1 - 2087	1001 - 5292	800092
TQH5-44	1 - 3144	1001 - 7406	"
TQH5-45	1 - 923	1001 - 2964	"
TQH5-46	2 - 1816	1001 - 4778	"
TQH5-47	1 - 763	1001 - 2644	"
TQH5-48	1 - 1214	1001 - 3546	800093
TQH5-49	1 - 1932	1001 - 4982	"
TQH5-50	1 - 1265	1001 - 3648	"
TQH5-51	1 - 948	1001 - 3014	"
TQH5-52	2 - 1303	1001 - 3722	"
TQH5-53	1 - 372	1001 - 1862	"
TQH5-54	1 - 1136	1001 - 3390	"
TQH5-55	1 - 1033	1001 - 3184	800094
TQH5-56	1 - 2447	1001 - 6012	"
TQH5-57	1 - 1229	1001 - 3576	"
TQH5-58	1 - 2012	1001 - 5142	"
TQH5-59	1 - 1924	1001 - 4966	"
TQH5-60	1 - 1026	1001 - 3170	800095
TQH5-61	1 - 1419	1001 - 3956	"
TQH5-62	1 - 1512	1001 - 4142	"
TQH5-63	1 - 1813	1001 - 4744	"
TQH5-64	1 - 672	1001 - 2462	"
TQH5-65	1 - 1262	1001 - 3642	"
TQH5-67	1 - 912	1001 - 2942	"



<u>LINE NUMBER</u>	<u>SHOTPOINTS</u>	<u>RECORDS (CDP NUMBERS)</u>	<u>TAPE NUMBER</u>
TQH5-68	1 - 953	1001 - 3024	800096
TQH5-69	1 - 393	1001 - 1904	"
TQH5-70	1 - 743	1001 - 2604	"
TQH5-71	1 - 602	1001 - 2322	"
TQH5-72A	25 - 962	1001 - 2994	"
TQH5-73	1 - 523	1001 - 2164	"
TQH5-74	1 - 1152	1001 - 3422	"
TQH5-75	1 - 723	1001 - 2564	"
TQH5-76	1 - 1303	1001 - 3724	"
TQH5-77	1 - 583	1001 - 2284	"
TQH5-78	1 - 1333	1001 - 3784	"
TQH5-79	1 - 532	1001 - 2182	800097
TQH5-80	1 - 1033	1001 - 3184	"
TQH5-81	1 - 733	1001 - 2584	"
TQH5-82	1 - 753	1001 - 2624	"
TQH5-83	1 - 582	1001 - 2282	"
TQH5-84	1 - 862	1001 - 2842	"
TQH5-85	1 - 412	1001 - 1942	"
TQH5-86	1 - 1213	1001 - 3544	"
TQH5-87	1 - 833	1001 - 2784	"
TQH5-88	1 - 792	1001 - 2702	"
TQH5-89	1 - 573	1001 - 2264	"



<u>LINE NUMBER</u>	<u>SHOTPOINTS</u>	<u>RECORDS (CDP NUMBERS)</u>	<u>TAPE NUMBER</u>
TQH5-90A	1 - 1002	1001 - 3122	800098
TQH5-91	1 - 363	1001 - 1844	"
TQH5-92	1 - 832	1001 - 2782	"
TQH5-93	1 - 753	1001 - 2624	"
TQH5-94	1 - 332	1001 - 1782	"
TQH5-95	1 - 1692	1001 - 4502	"
TQH5-96	1 - 433	1001 - 1984	"
TQH5-97	1 - 2083	1001 - 5284	"
TQH5-98	1 - 698	1001 - 2514	"
TQH5-99	1 - 1592	1001 - 4202	800099
TQH5-100	1 - 836	1001 - 2790	"
TQH5-101	1 - 1363	1001 - 3844	"
TQH5-102	1 - 1744	1001 - 4606	"
TQH5-103	1 - 1223	1001 - 3564	"
TQH5-104	1 - 872	1001 - 2862	"
TQH5-105	1 - 1173	1001 - 3464	"
TQH5-107	1 - 1253	1001 - 3624	800100
TQH5-109B	1 - 1132	1001 - 3382	"
TQH5-111	1 - 1034	1001 - 3186	"
TQH5-113	1 - 843	1001 - 2804	"
TQH5-115	1 - 643	1001 - 2404	"
TQH5-117	1 - 902	1001 - 2922	"
TQH5-119	1 - 902	1001 - 2922	"
TQH5-121	1 - 873	1001 - 2864	"
TQH5-123	1 - 573	1001 - 2864	"



<u>LINE NUMBER</u>	<u>SHOTPOINTS</u>	<u>RECORDS (CDP NUMBERS)</u>	<u>TAPE NUMBER</u>
TQH5-125	1 - 862	1001 - 2842	800101
TQH5-127	1 - 862	1001 - 2842	"
TQH5-129	1 - 932	1001 - 2982	"
TQH5-131	1 - 993	1001 - 3104	"
TQH5-133	1 - 1122	1001 - 3362	"
TQH5-135	1 - 802	1001 - 2722	"
TQH5-137A	1 - 853	1001 - 2824	"
TQH5-139	1 - 932	1001 - 2982	"
TQH5-141A	1 - 872	1001 - 2862	"
TQH5-143	1 - 843	1001 - 2804	800102
TQH5-145	1 - 884	1001 - 2886	"
TQH5-147	1 - 803	1001 - 2724	"
TQH5-149	1 - 483	1001 - 2084	"
TQH5-151	1 - 523	1001 - 2164	"
TQH5-153A	1 - 643	1001 - 2404	"
TQH5-155	1 - 583	1001 - 2284	"
TQH5-157	1 - 532	1001 - 2182	"
TQH5-161	2 - 833	1001 - 2782	"
TQH5-163A	1 - 939	1001 - 2996	"
TQH5-165	1 - 859	1001 - 2836	"



<u>LINE NUMBER</u>	<u>SHOTPOINTS</u>	<u>RECORDS (CDP NUMBERS)</u>	<u>TAPE NUMBER</u>
TQH5-167	1 - 972	1001 - 3062	800103
TQH5-201	1 - 523	1001 - 2164	"
TQH5-202A	1 - 523	1001 - 2164	"
TQH5-203	1 - 453	1001 - 2024	"
TQH5-204	1 - 453	1001 - 2024	"
TQH5-205	1 - 453	1001 - 2024	"
TQH5-206	1 - 513	1001 - 2104	"
TQH5-207	1 - 493	1001 - 2836	"
TQH5-208	1 - 412	1001 - 1942	"
TQH5-209A	1 - 533	1001 - 2184	"
TQH5-210	2 - 733	1001 - 2582	"
TQH5-211	1 - 323	1001 - 1764	"
TQH5-212	1 - 343	1001 - 1804	"
TQH5-213	1 - 393	1001 - 1904	"
TQH5-214	1 - 373	1001 - 1864	"



APPENDIX D

RAW MIGRATION TAPE INVENTORY

The following tapes are standard SEG-Y format. The header contains a sequential trace counter for each line with the first trace numbered 1 incrementing by 1 to the end of the line and starting over with the next line, as requested by Amoco.

Initially raw migration tape copies were not required by Amoco, and by the time these were requested some of the migrated data was no longer available. The list below contains details of all lines for which migration tapes were provided.

<u>LINE NUMBER</u>	<u>SHOTPOINTS</u>	<u>RECORDS (CDP NUMBERS)</u>	<u>TAPE NUMBER</u>
TQH5-8	1 - 1273	1001 - 3664	700064
TQH5-22	1 - 1874	1001 - 4866	"
TQH5-23	1 - 1273	1001 - 3664	"
TQH5-24A	1 - 1281	1001 - 3680	"
TQH5-25	1 - 923	1001 - 2964	"
TQH5-27	1 - 1544	1001 - 4206	700066
TQH5-28	1 - 1663	1001 - 4494	"
TQH5-30	1 - 633	1001 - 2384	"
TQH5-32	1 - 574	1001 - 2266	"
TQH5-33	1 - 3431	1001 - 7980	700068
TQH5-34	1 - 794	1001 - 2706	"
TQH5-36	1 - 623	1001 - 2364	"
TQH5-40	1 - 1154	1001 - 3426	700072
TQH5-44	1 - 3144	1001 - 7406	"
TQH5-45	1 - 923	1001 - 2964	"
TQH5-45-1	1 - 1260	1001 - 3638	"



<u>LINE NUMBER</u>	<u>SHOTPOINTS</u>	<u>RECORDS (CDP NUMBERS)</u>	<u>TAPE NUMBER</u>
TQH5-47	1 - 763	1001 - 2644	700073
TQH5-48	1 - 1214	1001 - 3546	"
TQH5-49	1 - 1932	1001 - 4982	"
TQH5-51	1 - 948	1001 - 3014	"
TQHR-51-1	1 - 785	1001 - 2688	"
TQH5-52	2 - 1303	1001 - 3722	700074
TQH5-53	1 - 372	1001 - 1862	"
TQH5-54	1 - 1136	1001 - 3390	"
TQH5-54-1	1 - 1726	1001 - 4570	"
TQH5-55	1 - 1033	1001 - 3184	"
TQH5-56	1 - 2447	1001 - 6012	700077
TQH5-56-1	1 - 1506	1001 - 4130	"
TQH5-57	1 - 1229	1001 - 3576	"
TQH5-57-1	1 - 1517	1001 - 4152	"
TQH5-58	1 - 2012	1001 - 5142	700078
TQH5-59	1 - 1924	1001 - 4966	"
TQH5-59-1	1 - 1633	1001 - 4384	"
TQH5-60-1	1 - 1373	1001 - 3864	"
TQH5-61	1 - 1419	1001 - 3956	"
TQH5-62	1 - 1512	1001 - 4142	700079
TQH5-63	1 - 1813	1001 - 4744	"
TQH5-64	1 - 672	1001 - 2462	"
TQH5-65	1 - 1262	1001 - 3642	"
TQH5-66	1 - 2551	1001 - 6220	"



<u>LINE NUMBER</u>	<u>SHOTPOINTS</u>	<u>RECORDS (CDP NUMBERS)</u>	<u>TAPE NUMBER</u>
TQH5-69	1 - 393	1001 - 1904	70081
TQH5-71	1 - 602	1001 - 2322	"
TQH5-77	1 - 583	1001 - 2284	"
TQH5-83	1 - 582	1001 - 2282	"
TQH5-84	1 - 862	1001 - 2842	"
TQH5-85	1 - 412	1001 - 1942	"
TQH5-86	1 - 1213	1001 - 3544	"
TQH5-88	1 - 792	1001 - 2702	"
TQH5-89	1 - 573	1001 - 2264	"
TQH5-98	1 - 698	1001 - 2514	70082
TQH5-103	1 - 1223	1001 - 3564	"
TQH5-105	1 - 1173	1001 - 3464	"
TQH5-109B	1 - 1132	1001 - 3382	"
TQH5-111	1 - 1034	1001 - 3186	"
TQH5-113	1 - 843	1001 - 2804	"
TQH5-115	1 - 643	1001 - 2404	"
TQH5-149	1 - 483	1001 - 2084	70084
TQH5-151	1 - 523	1001 - 2164	"
TQH5-153A	1 - 643	1001 - 2404	"
TQH5-155	1 - 583	1001 - 2284	"
TQH5-157	1 - 532	1001 - 2182	"



<u>LINE NUMBER</u>	<u>SHOTPOINTS</u>	<u>RECORDS (CDP NUMBERS)</u>	<u>TAPE NUMBER</u>
TQH5-201	1 - 523	1001 - 2164	800106
TQH5-202A	1 - 523	1001 - 2164	"
TQH5-203	1 - 453	1001 - 2024	"
TQH5-204	1 - 453	1001 - 2024	"
TQH5-205	1 - 453	1001 - 2024	"
TQH5-206	1 - 513	1001 - 2104	"
TQH5-207	1 - 493	1001 - 2836	"
TQH5-208	1 - 412	1001 - 1942	"
TQH5-209A	1 - 533	1001 - 2184	"
TQH5-210	2 - 733	1001 - 2582	"
TQH5-211	1 - 323	1001 - 1764	"
TQH5-212	1 - 343	1001 - 1804	"
TQH5-213	1 - 393	1001 - 1904	"
TQH5-214	1 - 373	1001 - 1864	"