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DATA PROCESSING REPORT

SURVEY:- BASS BASIN

TAS T14P

COMPANY:- CUE MINERALS N.L.

COMPANY ADDRESS:- 17, QUEENSBRIDGE STR.,
S. MELBOURNE.

BY

GEOPHYSICAL SERVICE INTERNATIONAL

UNIT D, 8 BYFIELD STREET,

NORTH RYDE. N.S.W. 2113

PARTY 6854

C. WILKINS

DATE: DECEMBER, 1981

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SECTION I.

INTRODUCTION

A seismic reflection survey was conducted by the M/V Eugene Mcdermott II in the Bass Basin off the North coast of Tasmania (see Plate I) between 10th February 1981 and 24th February 1981. The survey covered approximately 550Km using the following shooting parameters:-

- Streamer configuration - 2400m cable with 96 groups equally spaced.
- Group length - 25m (15 hydrophones at 1.67 spacing)
- Shot interval - 25m (48 fold)
- Record length - 5 secs
- Sample period - 2 ms
- Cable depth - 13m average
- Filter settings - High cut and slope 128hz @ 72db/oct
- Low cut and slope 8 hz @ 18db/oct
- Navigation - Maxiran by O.N.I.
Geonav by GSI
- Airguns - 2000 cu.in. operating at 2000 p.s.i.
(-51ms delay)
- Recording - DFS V, 9track, 96tr, 127 chnl, SEG B

Processing was carried out in G.S.I.'s Sydney office on TIMAP* 980 computers.

* Trademark of Texas Instruments.



SECTION II

EXPERIMENTAL WORK

Field data was received in March soon after which analytical work commenced. The standard suite of tests as listed below were conducted on Line BCS81-7, SP Range 175-225

PREPROCESSING TESTS:

- True Amplitude Recovery Test on 1 field record with 3 recovery rates 4,6,8,db/sec Sp 200
- F-K noise analysis on 1 record with TAR only applied
- " " + PDR applied
- " " + PDR + VEF applied
- " " + VEF applied
- Deconvolution pre stack test
Comparison over a 100 depthpoints between.
 - A. Signature VEF applied
 - B. signature no VEF applied
 - C. Whitening Deconvolution VEF applied
 - D. Gapped Deconvolution VEF applied
- Cable Configuration test
Not run. Decision based on results of OMQ cable test.
- Demult Test comparing stacked data with and without it.
Not run. Decision based on results of OMQ demult test.



POST PROCESSING TESTS

- Post Stack Deconvolution comparison over 100 Depthpoints
between
 - A. No deconvolution
 - B. Gapped deconvolution
 - C. Spiking deconvolution
- Filter Analyses over 50 depthpoints
- Scaling test with 3 sets of parameters over 100 depthpoints.
 - A. 500 ms gates 50% overlap
 - B. 1000 ms gates 50% overlap
 - C. 2000 ms gates 50% overlap
 - D. No Scaling



SECTION III

PRODUCTION PROCESSING

TAR	Inelastic attenuation parameter (exponential factor) T2 (cut off time for) = 3.5 secs.	6 db/sec
STATIC	- 51 ms airgun delay	
PDR	TDR (start time of ramp at offset zero) LDR (length of ramp at offset zero) VDR (velocity used in computation of ramp times with increasing offset) KPR (percentage offset factor for increasing ramp length)	-125 msec 86 msec 1190 m/sec 6%
CDP	Gather 96 trace 48 fold	
TVD	Pre stack gapped deconvolution start time of first gate No. of gates Velocity used to change start time with increasing offset (VDG) Gap length No. of filter points	=200 msec =2 =1250m/sec =24 msec =50
TVS	Gate length No gates	3000 msec 1



TVD Deconvolution Post Stack
 Start time of the first gate = 300 msec
 Maximum time of the last gate = 4800 msec
 Number of gates with 50% overlap = 3
 Operator = 26 points
 with 32 msec
 gap

TVF Time Variant Filtering
 All lines were filtered with the following passband

<u>Time(secs)</u>	<u>Passband(hz)</u>
0.5	15-60
0.8	12-60
1.2	10-55
2.2	10-55
4.0	10-40

TVS Time Variant Scaling
 The lines were scaled with 3 x 2000msec gates using
 50% overlap unity scalars.

DISPLAY Horiz. Scale 24 trace / inch (1:11811)
 Vert. Scale 5in/sec
 Mode VA/WT 20% Bias

TAPES Field tapes and raw stack tapes were shipped to
 Geomagnetics together with the observers logs.
 Paper field monitors were destroyed at client request.



IV COMMENTS

This survey was exploratory and thus the client decided against the use of Velocity Filtering. With the use of velocity filtering the signal to noise ratio would be improved giving rise to a better product.

Respectfully submitted.

Cherry Wilkins
Processing Party Chief



APPENDIX A
PROCESS DESCRIPTIONS

TRUE 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 record during recording and correcting for inelastic attenuation and spherical divergence losses.

VELOCITY FILTERING (VEF)

Velocity filtering is a multichannel process. Multichannel filtering is a two-dimensional frequency-wavenumber filtering operation that can be used to discriminate against specified velocities on pre-stacked data or against specified dips on stacked data.

Velocity filtering processes transform the data from the space time (X-T) domain to the frequency-wavenumber (F-K, where K = reciprocal of wavelength) domain where the filter is applied. After filter application the process transforms back to the X-T domain for further conventional process applications.

The apparent velocity of noise must be adequately separated from the primary signal for the process to be effective. Examples of noise alignment that can be removed are 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 from the primary.

A window of primary dip zones to keep is specified and dips outside this window are rejected.



A linear event in the X-T domain (implying constant velocity) appear as a linear event in the F-K domain where lines of constant velocity 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. In general seismic reflections (signal) have higher apparent velocities than noise propagating horizontally in a direct path from source to receiver; therefore, recorded signal appears in a different region of the F-K plane from the noise.

This provides the basis for signal-to-noise enhancement used in velocity filtering. The process is analogous to muting in X-T.

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 alaised events. However, when alaised noise overlays signal, velocity filtering loses its discriminating power.

DESIGNATURE (DESIG 1*)

Designature is a 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.

* Trademark of Texas Instruments Inc



DESIG 1 is the particular signature process in the current VELFILT program and provides an alternative to conventional pre-CDP stack deconvolution (TVD). DESIG 1 is a multichannel process, like VELFILT 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. While TVD is time and offset-variant DESIG 1 is not time-variant.

DESIG 1 can better account for the source and receiver ghosts found in marine data than TVD can.

Once the signal-to-noise ratio of the primary events is improved by velocity filtering, signature is applied in the common source point domain. Signature estimates the source wavelet from the seismic traces and attempts to collapse it to a zero phase pulse. The source domain is chosen since all traces originate from the same source.

PREDECONVOLUTION RAMP (PDR)

PDR is the process whereby first arrival unwanted noise at the front end of seismic records is removed. This is applied prior to deconvolution design.

VELOCITY ANALYSIS

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



DISCRETE (VELSCAN)

GSI's VELSCAN Velocity Module is a discrete Velocity Analysis mode making use of advanced picking logic to generate events as functions of time, amplitude, moveout and dip. The event picking proceeds in the following manner:

- . NMO corrections corresponding to a series of moveout functions are applied to a set of depth point traces. For each moveout function, the NMO-corrected traces are stacked. The resulting traces consist of amplitudes as functions of time and moveout.
- . Identical operations are applied to adjacent depth points, adding the dimension of space.
- . Dip is applied and for each value of dip, the traces are stacked across depth points. The result is a set of 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.



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 (or spread geometry) 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 times ramps are applied to zero out the early part of the traces where NMO is excessive and to phase in the NMO corrections gradually.

COMMON DEPTH POINT STACK (CDP)

The common depth-point stack is the summation of all the traces with 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 of the individual traces. If these corrections are appropriate then trace signals will reinforce whilst random noise will fail to reinforce. 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, if the fold of stack is 48 fold, then the improvement is approximately 7.



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 destructive interference to some degree.

In practice, the early live portion of the NMO output traces have more distortion than is acceptable. For this and possibly other reasons, a ramp function is applied to the input traces before summation. Each trace may have up to three ramps applied to it to accept or reject portions of the input trace as desired. Quite commonly short offset traces are rejected at depth to improve multiple attenuation.

To accommodate the varying summation, or fold, implicit in this ramping a recovery scaler is applied to normalise the energy output level to that of the full fold stack.

TIME VARIANT FILTERING (TVF)

Filtering is commonly applied in a time variant manner to take account of the higher frequency content of the shallow seismic signal and the lower frequency content at depth when rejecting unwanted frequencies, or noise.

By appropriate filter design, unwanted frequencies may be attenuated, or removed, the most common application is the band-pass filter which discriminates against the high and low frequency spectrum of the input trace where no significant signal energy is present.



TIME VARIANT SCALING (TVS)

Time Variant Scaling (TVS) produces amplitude equalisation in a time variant manner down the seismic trace as well as from trace to trace. Up to twenty time gates with variable overlap can be used to compute time variant scalers for each gate to raise all gates to the same energy level.

Scalers computed for each gate are applied at the gate centre, with linear interpolation between gate centres.

Gate amplitudes are measured for a set of continuous gates on each trace and scalers are computed for each gate to make the amplitude constant or proportional to the amplitudes. The scalers are applied in a continuously time-variant manner.

TIME VARIANT DECONVOLUTION (TVD)

The purpose of TVD is to take reverberating series of wavelets and reduce them to the time domain spike and this implies normalising the frequency spectrum. At the same time TVD is desirable to collapse and stabilise wavelet shapes from broad or variable input wavelets.

TVD is accomplished by the application of one or more filters designed from individual data trace autocorrelation functions.

Gapped TVD is the process of deconvolution without total spectral whitening. This differs from Spike TVD which gives total spectral whitening. This means the frequency spectrum in gapped deconvolution will show that the high frequency noise area is not amplified



MIXING

This involves combining energy from adjacent trace of the same record. In a 2 on 1 MIX, traces are summed as follows:-

<u>Input trace</u>	<u>Output trace</u>
1	
2	1
3	
4	2
etc.	etc.

Some noise cancellation is achieved by mixing.

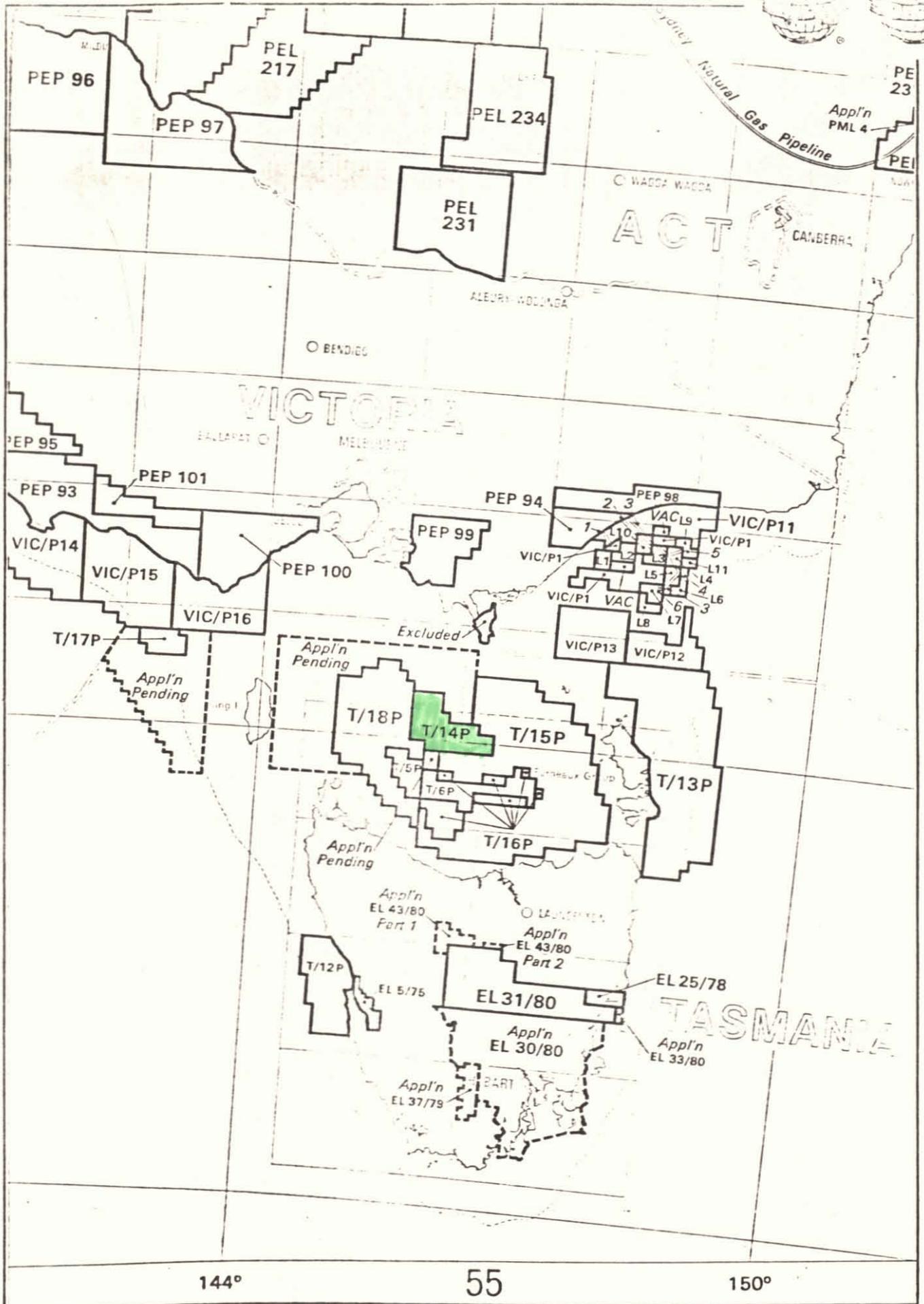
RESAMPLE

This process changes the input field sample period to a larger sample period, say 2ms to 4ms, for processing. Anti-alias filters are applied prior to the resampling.

APPENDIX B

RAW STACK TAPE LOG FOR BASS BASIN TAS T14P (prsn 21020)

<u>LINE</u>	<u>BCS81-</u>	<u>SP RANGE</u>	<u>TAPE</u>
01		1-2000	620
02		1-1856	2566
03		1-2398	2045
04		1-3016	42
05		1-2836	4205
06		1-536	522
07		1-3816	2874
08		1-5316	3664
09		1-3888	4196
		3880-5816	2856
10		1-3814	1377
11		1-1334	1030
11A		1-1792	556
12		1-3944	1829
		3892-4514	3700
13		1-1036	605
14		1-2538	899
16		1-1532	648



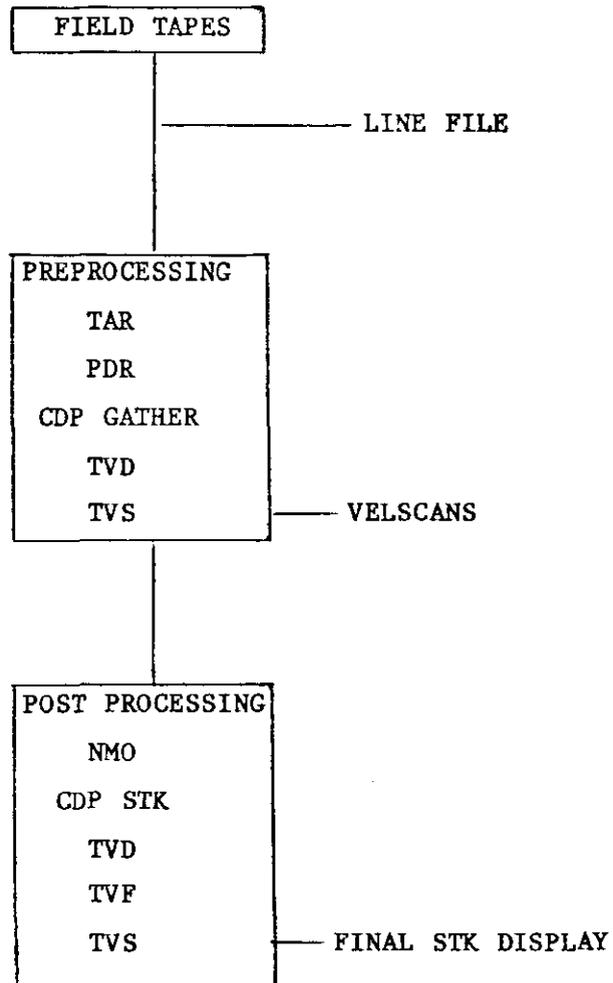
PROCESSING FLOW DIAGRAM

PLATE II