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FINAL SUBSIDY REPORT  
OTWAY EU MARINE SEISMIC SURVEY  
PERMIT AREA SOUTH AUSTRALIA P. 8

by

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC

R.W. WIGGIN

J. BEIN

MARCH, 1969

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ABSTRACT

The EU offshore seismic survey was designed to map the nearshore portion of a large basement high known from previous gravity and magnetic surveys as the Beachport High.

The seismic traverses revealed the basement high is a horst block formed by early Lower Cretaceous faulting. The Lower Cretaceous Crayfish sandstone was deposited contemporaneously with the faulting and essentially filled the depressions in the broken basement surface. The sandstone onlaps the basement high and is absent on the crest.

INTRODUCTION

The Otway EU Marine Seismic Survey began on 16 November and finished 22 November. The work was conducted in the SA/P8 permit area wherein Esso has concluded a farm-in agreement with Alliance Petroleum Australian, N.L. General Exploration of Australia and Beach Petroleum N.L. Forty seven miles of 6 Fold CDP data were recorded in and around Rivoli Bay South Australia using an aquapulse sleeve exploder as energy source. Field work was done by Western Geophysical Co. and the data were digitally processed at G.S.I.'s Sydney center.

Many shoals and islands are found in the survey area and it was necessary to limit the cable length to 1140' for maximum manoeuvrability.

It was originally planned to tow a shipboard magnetometer during the survey but this was not used because of the navigational hazards.

INTERPRETATIONA. REGIONAL GEOLOGY

The survey area is in the North Western portion of the Otway basin near the boundary of the Crayfish Platform and the Gambier Sunlands . (see figure 1)

The Crayfish platform is essentially filled with Lower Cretaceous Otway group sediments consisting of the Crayfish sand and the Otway mudstone. The Crayfish sandstone was deposited during a period of basement block faulting and filled in the grabens created at that time. The Otway mudstones represent a much quieter period of deposition, there was little tectonic activity other than subsidence.

From the end of L. Cretaceous times the Crayfish platform has been relatively stable with a thin layer of U. Cretaceous sands of the Curdies Formation and a thicker sequence of silts of the Eocene Knight group onlapping the platform.

An extensive deposit of limestone of Oligocene-Miocene age known as the Gambier Limestone covers both the Crayfish platform and the Gambier Sunlands and reaches a thickness of about 1000 feet.

B. OBJECTIVES

The object of the EU seismic survey as set forth in the subsidy application was as follows:-

1. To tie offshore control as close as possible to the Beachport 1 well.
2. To prospect for a Crayfish sand stratigraphic trap against high basement,

These objectives were accomplished as will be seen in Figure 3 wherein the results are discussed.

C. EXISTING GEOPHYSICAL INFORMATION

Gravity coverage on shore in the vicinity of the survey area has been obtained by the South Australian Mines Department. In addition, land seismic traverses were recorded by the South Australian Mines Department, Alliance Oil Development Australia N.L. and Beach Petroleum N.L. An interpretation of this information together with the early Haematite seismic lines offshore is presented in the report "Geological Interpretation of Seismic Time Sections in the Gambier Embayment" by K. Rochow of the South Australian Department of Mines. In general, the onshore seismic data in the area of the EU survey are of very poor quality.

Additional offshore seismic coverage has been obtained in the area by Esso Exploration and Production Australia Ltd. and Haematite Exploration Pty Ltd. The results of the marine seismic work are found in the following subsidy reports:

1. "Cape Grim to Cape Jaffa Marine Seismic Survey, Haematite Explorations Pty. Ltd. 1965".

2. "Offshore Otway Basin Marine Seismic Survey, Esso Exploration and Production Australia, 1967".
3. "Offshore Otway Basin Marine Seismic and Magnetic Survey EP-67, Esso Exploration and Production Australia, 1968".

The Offshore Otway ER marine seismic and Magnetic survey was shot concurrently with the EU survey. The reader is referred to the ER subsidy report as the most recent compilation of offshore information in the area adjoining the EU survey.

#### D. HORIZONS MAPPED

The enclosed contour maps are on a scale of 1:100,000. Reflection time from sea level datum is contoured. Time vs depth curves from well surveys in Crayfish A-1 and Geltwood Beach are presented in Figure 2. These wells are 45 miles apart, see Figure 1, however their velocity distribution is similar. It is believed these curves given an adequate representation of the velocity in the area of the EU Survey.

The following maps are presented:

1. Plate I Structure on Economic Basement
2. Plate II Structure on Crayfish Sand
3. Plate III Structure on Base Tertiary
4. Plate IV Water Depth Map
5. Plate V Shot Point Map

This discussion gives details of reflection characteristics, data quality and pertinent geologic information relating to the mapped horizons.

#### 1. Structure on Economic Basement Plate I

Economic Basement in the EU survey area may be either granite or Palaeozoic metamorphics. A basement reflection can usually be recognized and often there are no deeper events or intra basement reflections. Line EU-1 is reproduced as Figure 3. The horizons Economic Basement, Top of Crayfish sand and Base Tertiary are marked. As seen on figure 3; the basement is involved in large block faults which may or may not cut the top of the Crayfish sand.

The basement as contoured on Plate I is taken as representing the base of the L. Cretaceous Crayfish sand and generally follows the deepest high amplitude event. The only well in the area that reached basement is Kalangadoo No. 1 and no direct seismic reflection ties have been made. A possible source of error on the presented basement interpretation could involve the presence of metamorphosed palaeozoic rocks which would represent true economic basement and overlie the mapped horizon. It is felt, however, that Plate I is a reasonable interpretation in light of the 5000 feet of Crayfish sand penetrated in the Crayfish well.

#### 2. Structure on Crayfish Sand Plate II

The reflection event is characterized by high amplitude and occasional truncation of underlying beds. Usually the overlying Otway mudstone is a low amplitude zone with few coherent reflections.

It is seen on Figure 3 that the thickness of the Crayfish sand varies abruptly on the flanks of the Beachport High. At the crest of the structure between shot points 280 and 315 the Crayfish sand onlaps basement and is absent. This area where Crayfish sand is missing has been projected on hypothetical contour onshore.

The map presented on Plate II is considered reliable in the area of offshore data, however the contours on land are highly speculative.

### 3. Structure on Base of Tertiary Plate III

The Base of Tertiary horizon, while easily recognized further south in the Otway Basin is somewhat confused in the EU survey area. The horizon mapped is believed to be correct however it seems anomalously shallow when compared to the time tie (estimated) at the Beachport well of about .520 sec.

The basement structure on the Beachport High is believed to have greatest relief in the vicinity of the Beachport well as evidenced on existing gravity and magnetic surveys. The unusually deep time value on the Base of Tertiary at Beachport can be related to the corresponding low off-shore values where the seismic lines cross the structural axis of the Beachport High.

### 4. Water Depth Map Plate IV

This map has been somewhat modified to include values taken from navigation charts as well as EU survey data. It is not meant to be an adequate guide to the many shoals and islands in the area.

### 5. Shot Point Map

This map is a compilation of all Esso and other company shooting including South Australian Mines Department.

## E. RESULTS

The EU seismic survey was successful in defining the offshore portion of the Beachport High. A potential reservoir, the Crayfish sand was mapped and found to have some 1200 feet of reversal (from reflection time of 1.250 to 1.450) across the south west flank. In addition it was interpreted that the Crayfish sand is absent on the crest of the anomaly. These sands pinch out against the old basement high.

Furthermore, it was demonstrated that any U. Cretaceous or Tertiary sands in the section are probably in a structurally low position on the crest of the Beachport High and hence are not prospective in the area.

The objectives of the survey were achieved and significant new structural and stratigraphic information was obtained on this very interesting feature.

### PLAYBACK

The digitally recorded field tapes were processed at G.S.I's playback center in Sydney. Three aquapulse pops were summed before spread correction. After dynamic corrections a 6 fold stack was used. A time-varying filter was applied as follows:

<u>Frequency</u>	<u>Record Time</u>
20-60	.5
15-55	.6
10-50	.7
10-40	1.0
10-30	1.4
10-20	2.0

Time varying deconvolution was used.

Velocity curves for spread correction are designated EP 1 B-2 and EP 7A. These curves were not derived from EU survey data in-as-much the spread lengths used in the EU survey were too short for effective velocity analysis. The velocity curves were developed for the area from other nearby marine surveys using long spreads. These curves are very similar to the two well Time-Depth curves shown in figure 2.

Static corrections were applied to the seismic sections to correct for the delay involved in water travel. A correction of 1 ms. for each 10' of water was subtracted.

FIELD OPERATIONS AND STATISTICAL REPORT

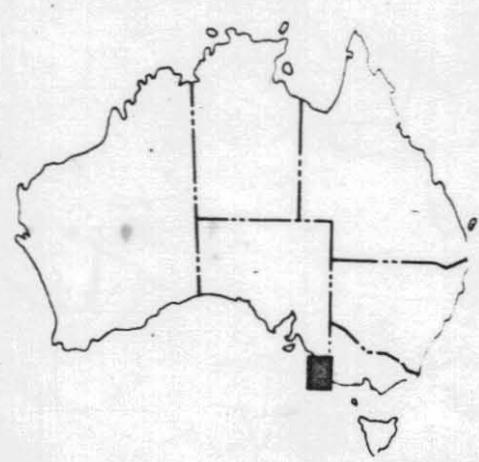
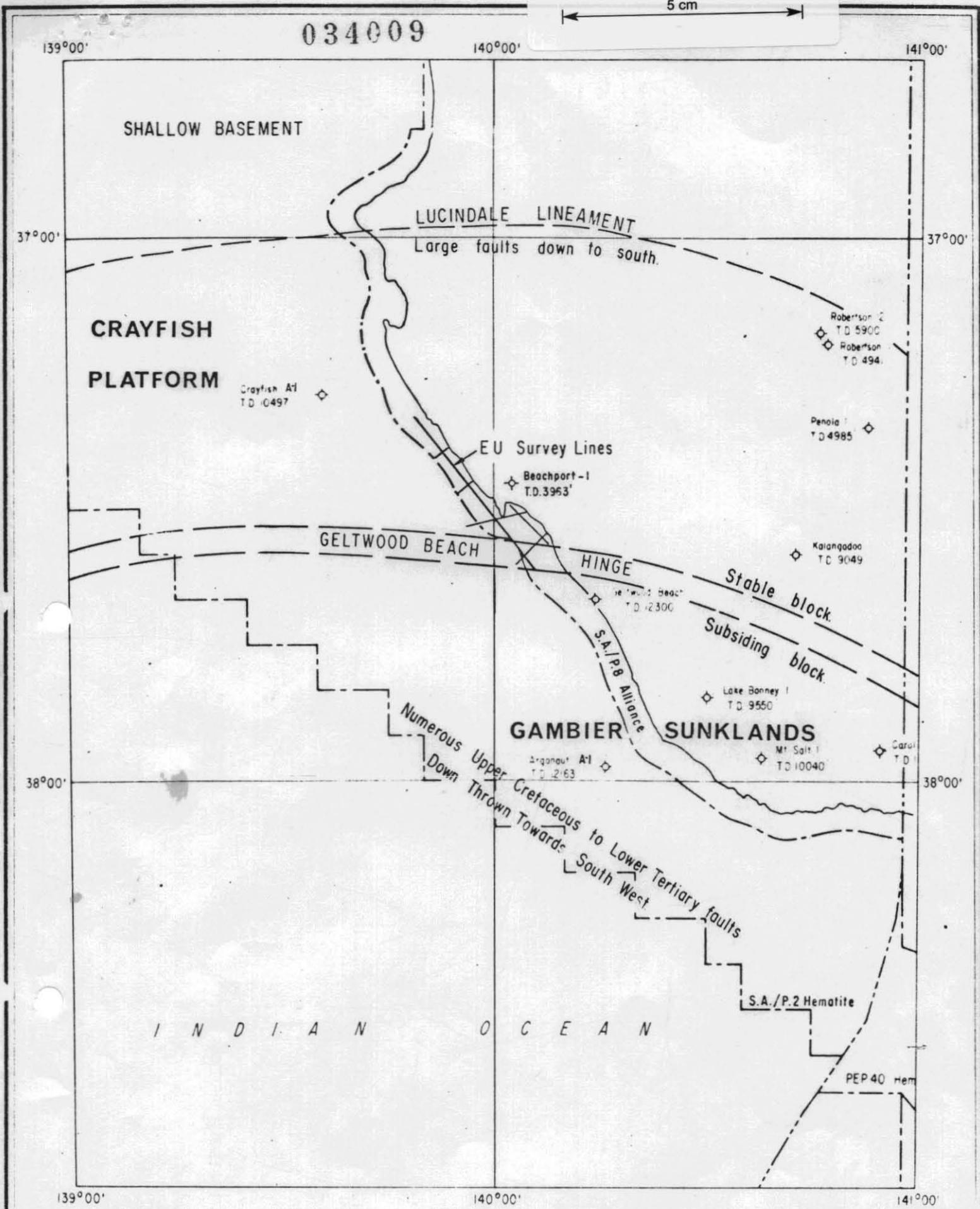
Western Geophysical Co. has prepared a report on the field operations which is attached as an appendix to this report and will be found in the pocket.

The following is a list of Line Nos. and shot points included in EU Survey:

<u>Line</u>	<u>From</u>	<u>To</u>
EU-1	1	534
EU-2	780	819
EU-3A	1074	995
EU-4A	1186	1076
EU-5	994	820
EU-6	640	666

*A.M. Wiggins*

*Jay Kern*



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ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

**OTWAY BASIN  
SOUTH AUSTRALIA**

**MAJOR STRUCTURAL FEATURES  
& LOCATION OF EU-68 MARINE  
SEISMIC SURVEY**

TO ACCOMPANY: FINAL SUBSIDY REPORT, EU - 68

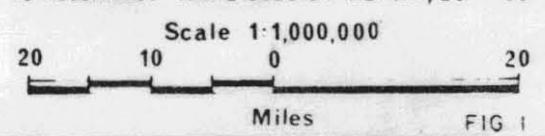
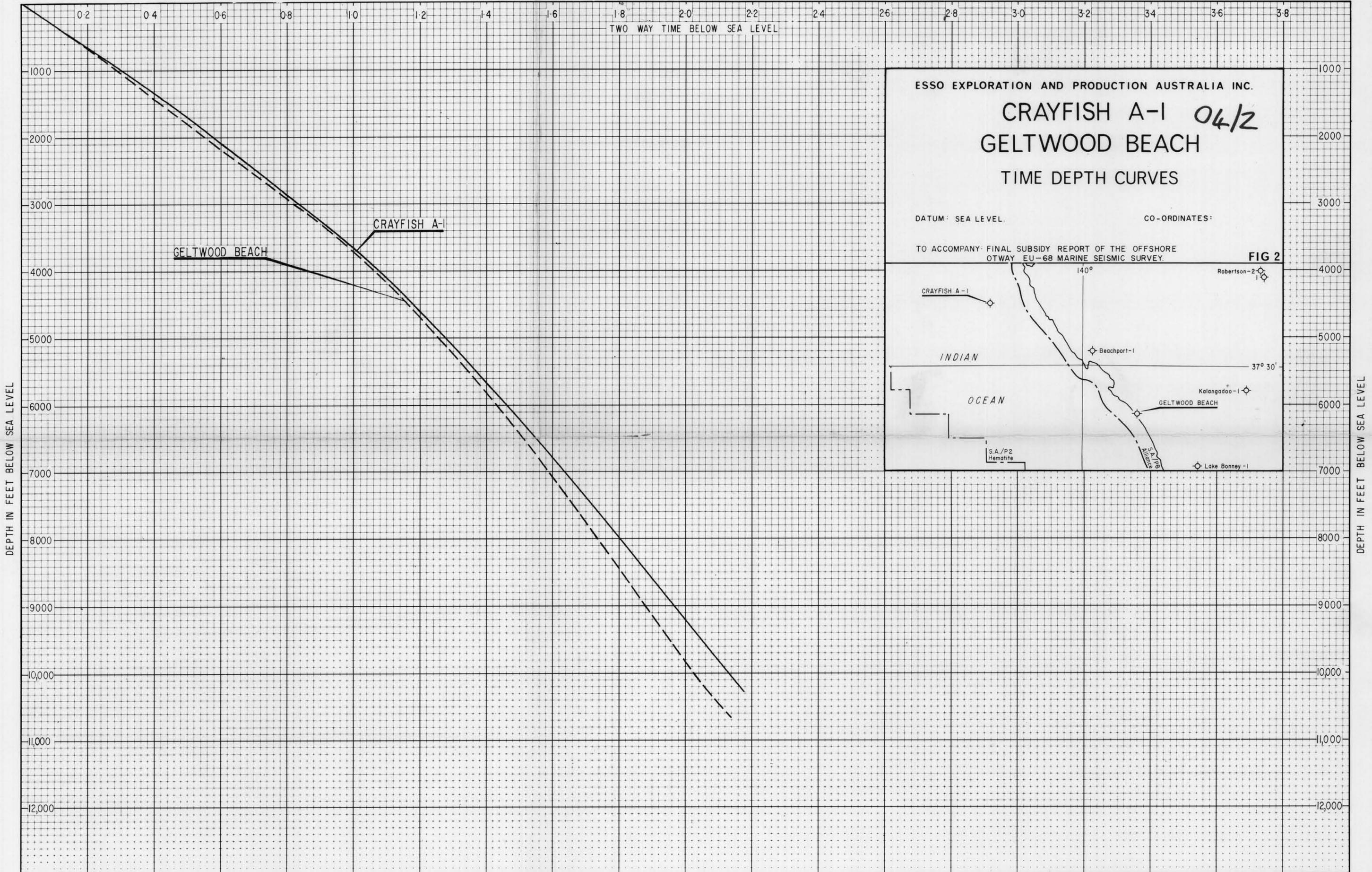


FIG 1

5 cm

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ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

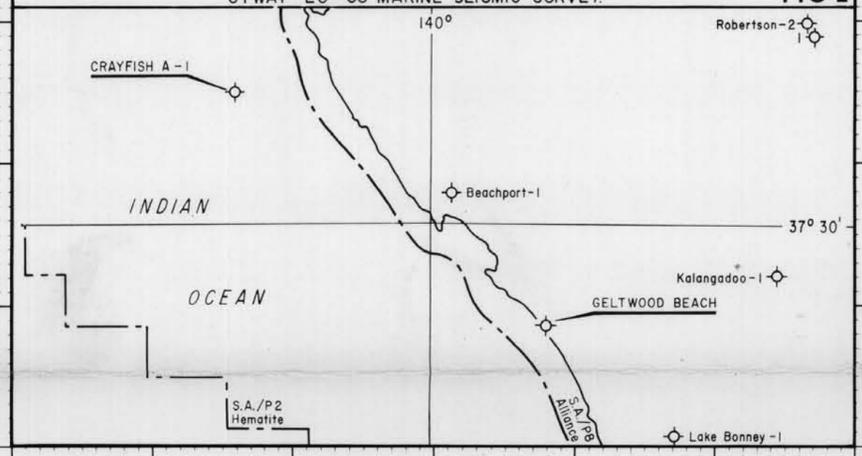
# CRAYFISH A-1 04/2 GELTWOOD BEACH TIME DEPTH CURVES

DATUM: SEA LEVEL.

CO-ORDINATES:

TO ACCOMPANY: FINAL SUBSIDY REPORT OF THE OFFSHORE  
OTWAY EU-68 MARINE SEISMIC SURVEY.

FIG 2









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ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

FIGURE 5b

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NEG

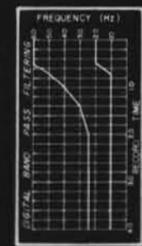
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AUSTRALIA</small> CHANNELS 4    2    4    8    16    32    64    128    256    512    1024    2048    4096    8192    16384    32768    65536    131072    262144    524288    1048576    2097152    4194304    8388608    16777216    33554432    67108864    134217728    268435456    536870912    1073741824    2147483648    4294967296    8589934592    17179869184    34359738368    68719476736    137438953472    274877906944    549755813888    1099511627776    2199023255552    4398046511104    8796093022208    17592186044416    35184372088832    70368744177664    140737488355328    281474976710656    562949953421312    1125899906842624    2251799813685248    4503599627370496    9007199254740992    18014398509481984    36028797018963968    72057594037927936    144115188075855872    288230376151711744    576460752303423488    1152921504606846976    2305843009213693952    4611686018427387904    9223372036854775808    18446744073709551616    36893488147419103232    73786976294838206464    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OR-056

FIGURE 5c

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

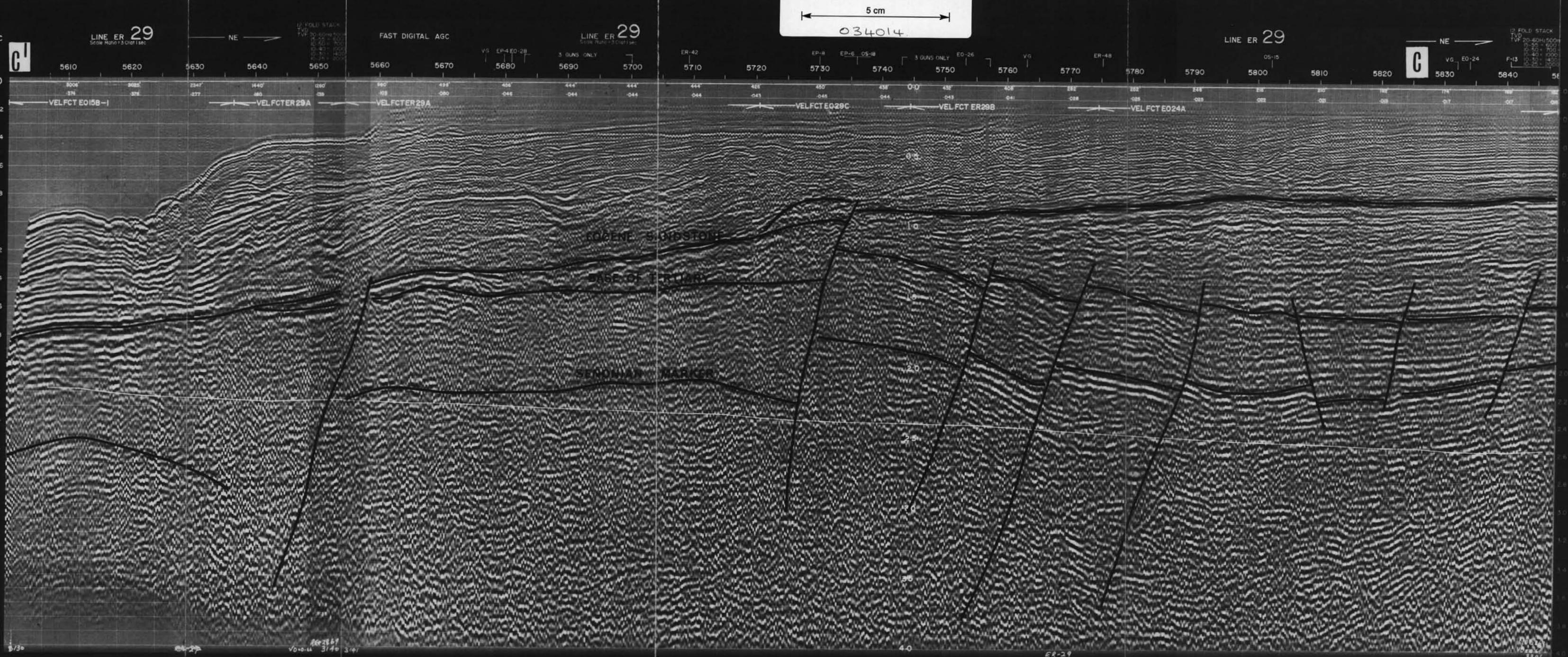
Dwg 1122 G 7



GSI DIGITAL PROCESSING CENTRE  
 1. SAMPLE PERIOD 4 ms 2. TAPER 10 3. 2.5 4. 4000  
 5. NMO 2000 3000 4000  
 6. SECTION 64 4 200 4000  
 7. DIGITAL FILTER 35 4  
 8. PLOT 100 5  
 9. WGS 2869 851  
 10. TVF1503 12  
 11. DEC'68

ER-29  
 OTWAY 8  
 AQUAPULSE 15 50 20  
 7590 660  
 100 5  
 64 DEC'68

FAST DIGITAL AGC  
 LINE ER 29  
 Scale Ratio 3.0 (1 sec)  
 MAGNETOMETER PLOT  
 61500 gammas  
 61500 gammas  
 61400 gammas  
 61300 gammas  
 61200 gammas  
 61100 gammas  
 61000 gammas  
 60900 gammas  
 60800 gammas



NEG

12 FOLD STACK  
 TVF 20-60Hz 500  
 10-55 600  
 10-50 700  
 10-40 800  
 10-30 900  
 10-20 1000  
 10-10 1100  
 10-05 1200



034016

02-086

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

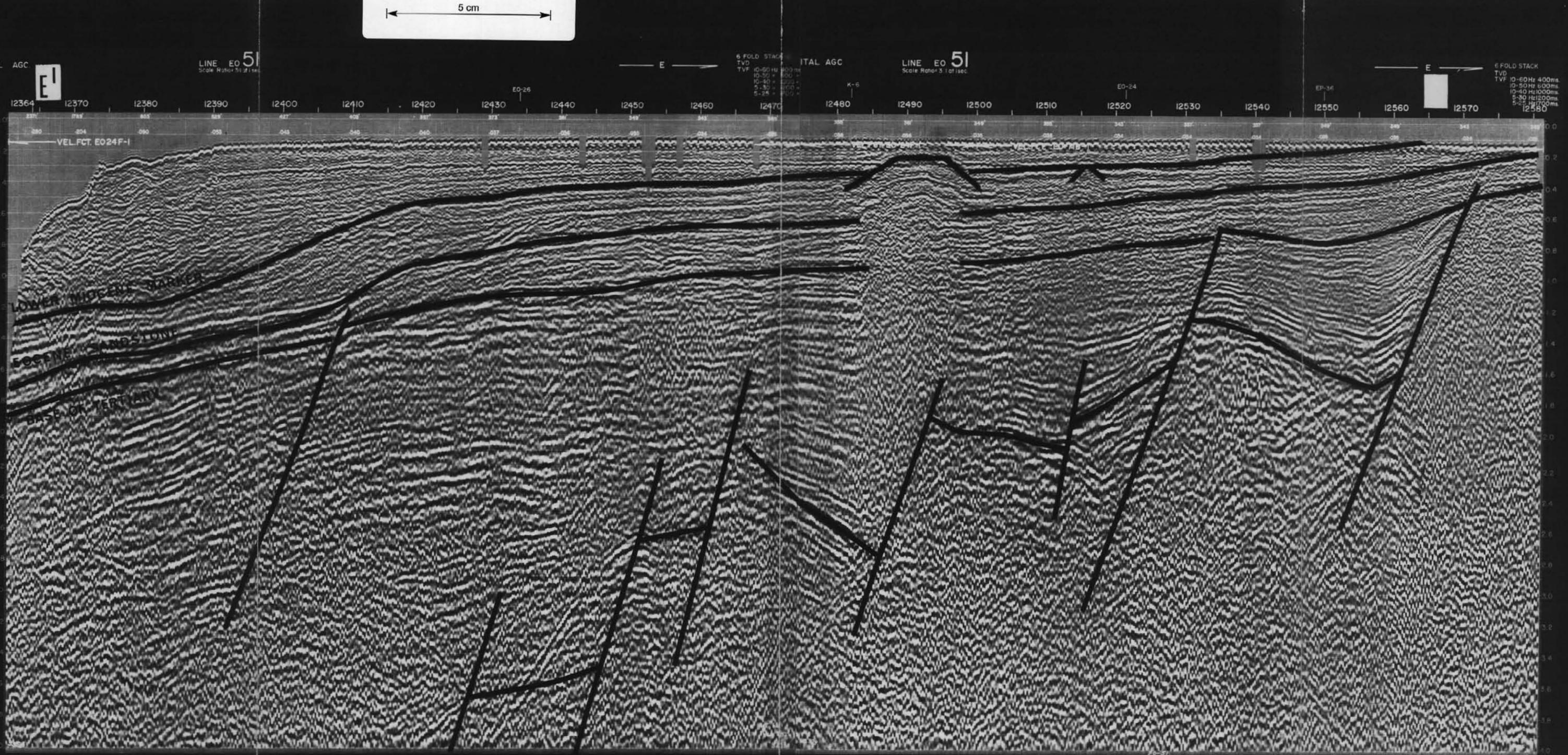
FIGURE 5e

Dwg 1122 G 9

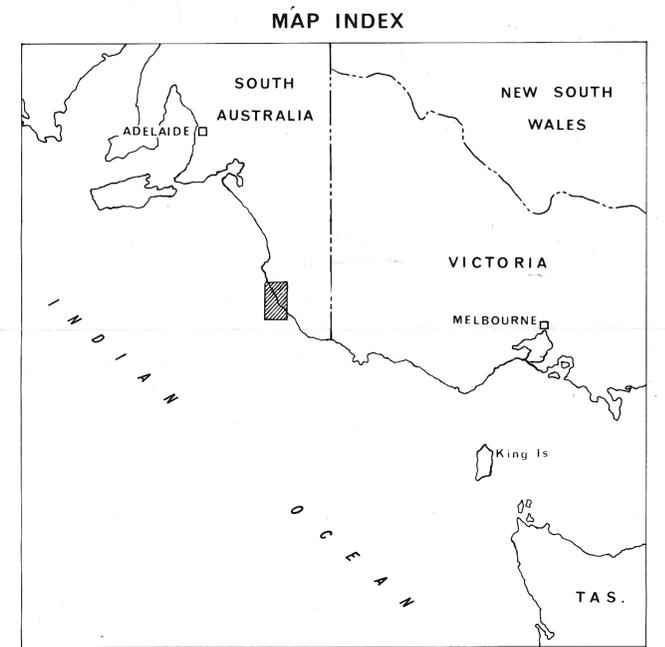
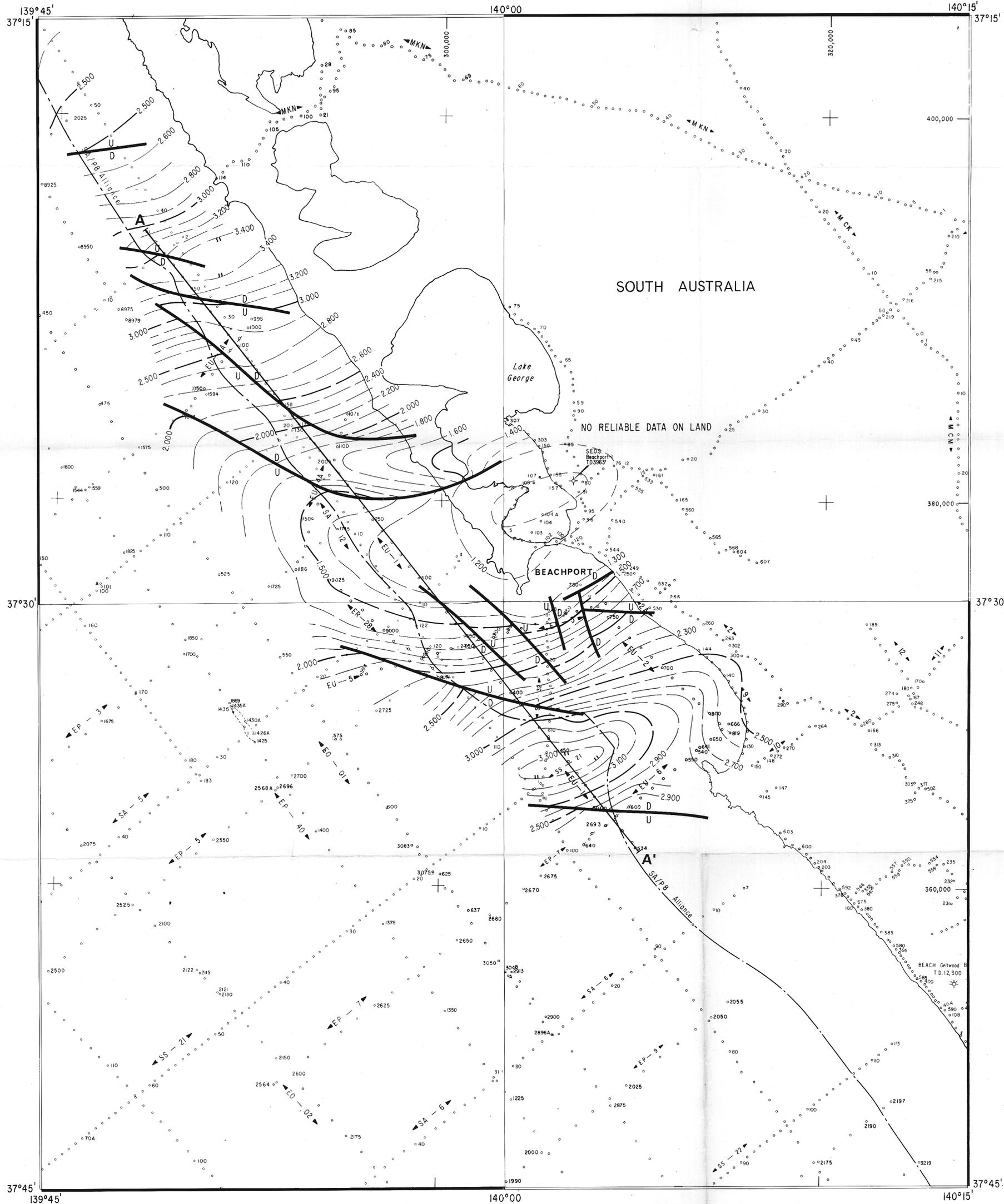
STONEY, S.S.A., AUSTRALIA  
 AREA OTWAY  
 RECORDING PARAMETERS Line EO-51  
 S.P. Int. up 185  
 Source POWDER  
 Charge Size 100 lbs  
 Fill Time 100.00  
 Cable Length 7544 ft  
 S.P. Interval 328 ft  
 S.P. Interval 656 ft  
 Pops/Vertical Sam. Processed 6  
 Recording Filter 75 - 8 Hz  
 GSI Input Crew 581 Date SEPT 68

3. NMO Equalization gain 1200 to 2500 ms  
 4. DECEN 64 pts 4 ms dec, Design gain 200 to 4000 ms  
 No. of gates/move 2 Gate shift ms/trace from 0  
 5. DIGITAL FILTER 35 pts 4 ms dec  
 6. OPS 1, OWBS 0, TVO 1, DCA 0, AR2 0, DRP 0, TVP 1, N-4 0  
 7. TAC Pres 2025 8 Head Code 631 9. P/B Gain 10 db  
 GSI Input Crew 581 Date SEPT 68

STONEY, S.S.A., AUSTRALIA  
 AREA OTWAY  
 RECORDING PARAMETERS Line EO-51  
 S.P. Int. up 185  
 Source POWDER  
 Charge Size 100 lbs  
 Fill Time 100.00  
 Cable Length 7544 ft  
 S.P. Interval 328 ft  
 S.P. Interval 656 ft  
 Pops/Vertical Sam. Processed 6  
 Recording Filter 75 - 8 Hz  
 GSI Input Crew 581 Date SEPT 68





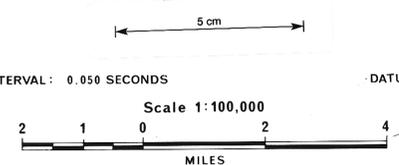


- LEGEND**
- Dry and abandoned well with show of gas
  - Dry and abandoned well
  - Seismic shot point
  - Fault, "D" downthrown side
  - Structure contour in seconds
  - Line of seismic cross-section
  - Petroleum Tenement Boundary
  - Igneous intrusion, reflector pierced
  - Igneous intrusion, reflector not pierced

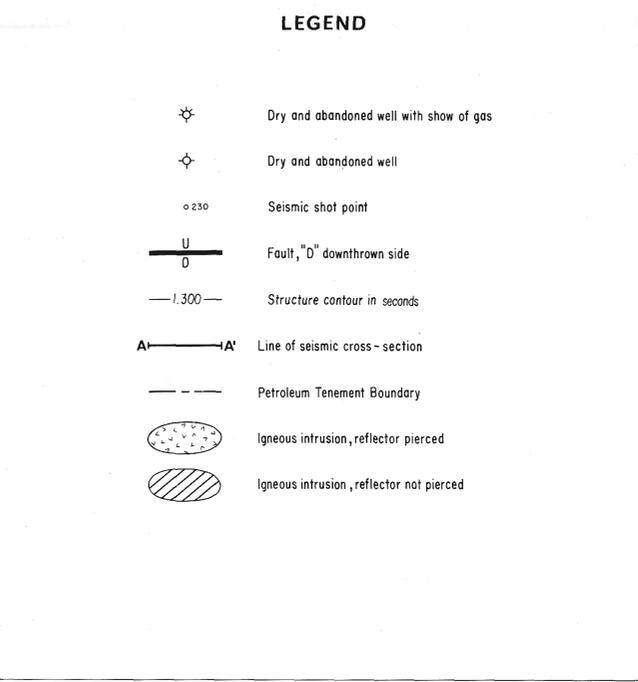
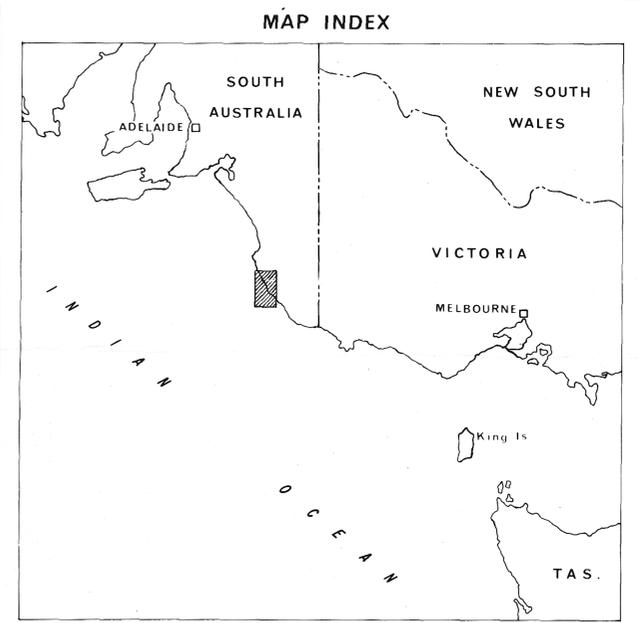
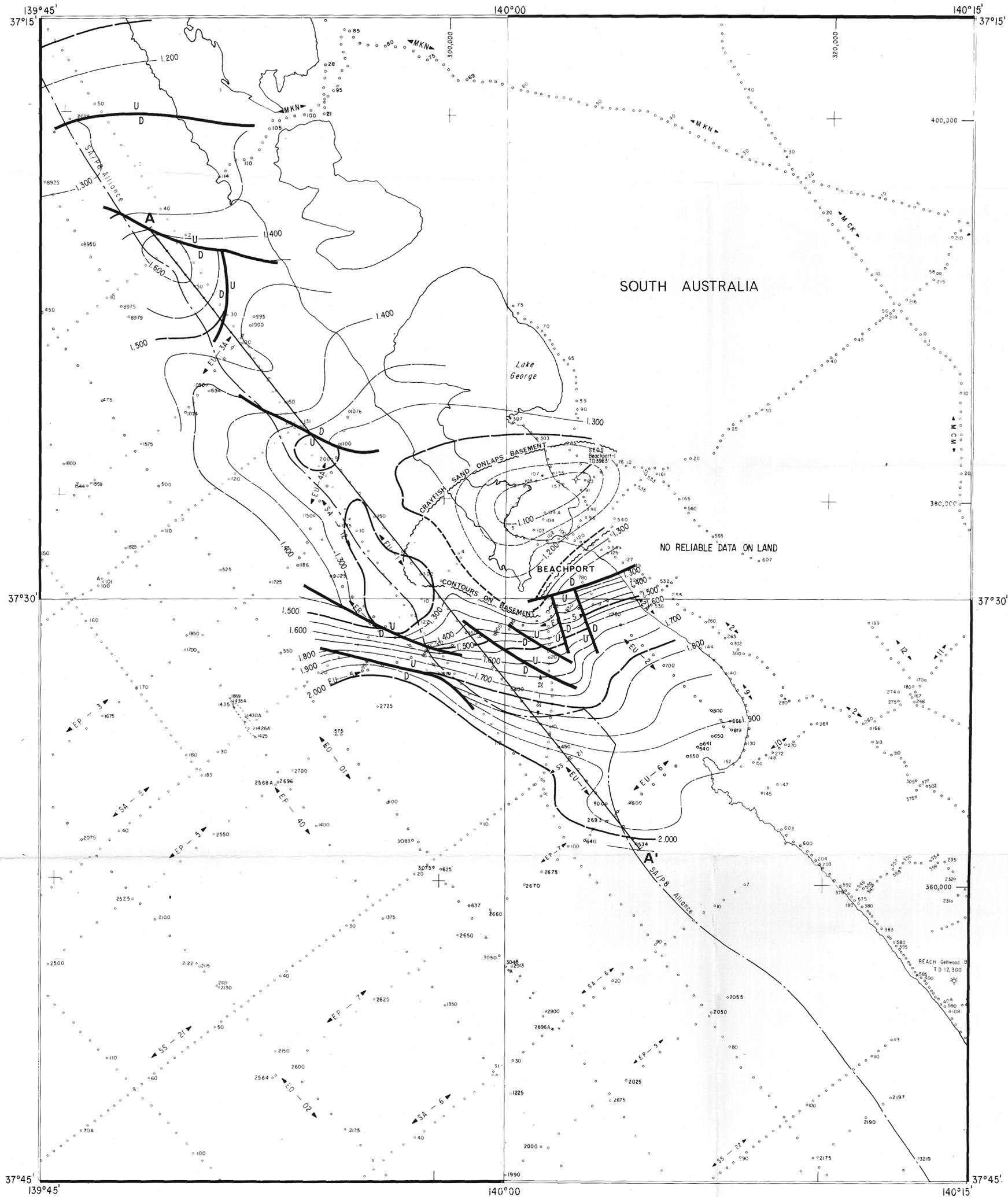
ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.  
**THE OTWAY BASIN**  
 SOUTH AUSTRALIA

**STRUCTURE MAP ON**  
**TOP OF ECONOMIC BASEMENT**

04/13



034018  
 CONTOUR INTERVAL: 0.050 SECONDS      DATUM: SEA LEVEL  
 AUTHOR: R.W. WIGGIN and J. BEIN      DRAFTED BY: P.L. SPINNER  
 TO ACCOMPANY: FINAL SUBSIDY REPORT OF THE OFFSHORE OTWAY EU-68 MARINE SEISMIC SURVEY      DATE: MARCH 1969  
**PLATE I**  
 CR-086



ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

# THE OTWAY BASIN

SOUTH AUSTRALIA

**STRUCTURE MAP ON TOP OF CRAYFISH SAND** 06/4

5 cm

034019

CONTOUR INTERVAL: 0.050 SECONDS DATUM: SEA LEVEL

Scale 1:100,000

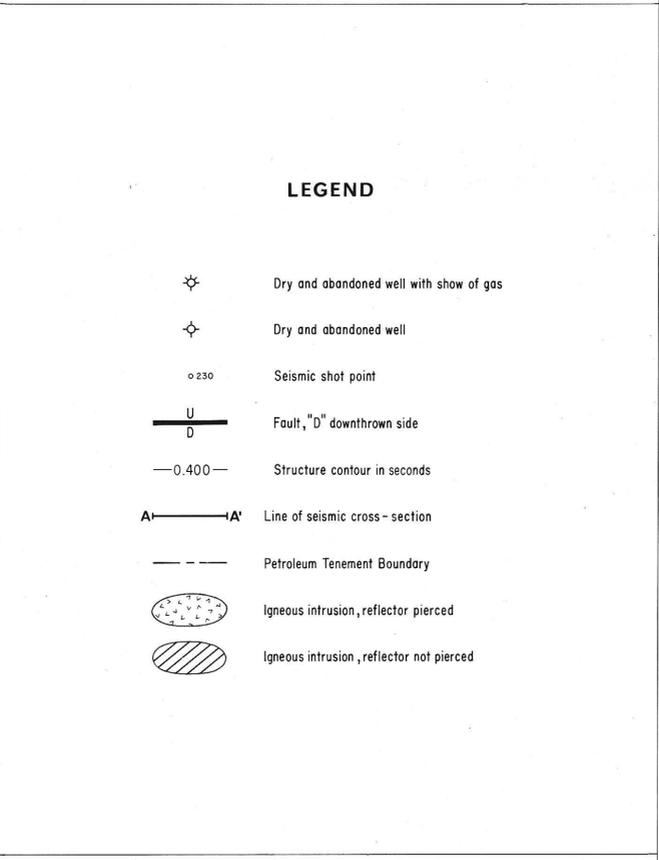
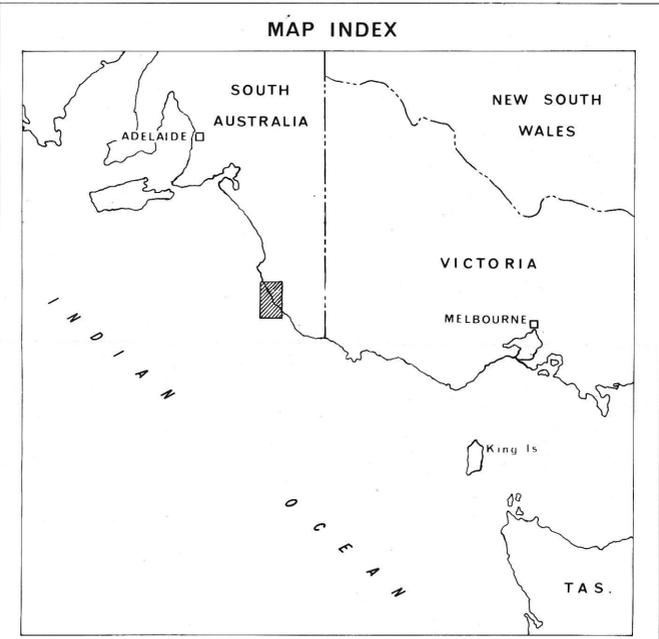
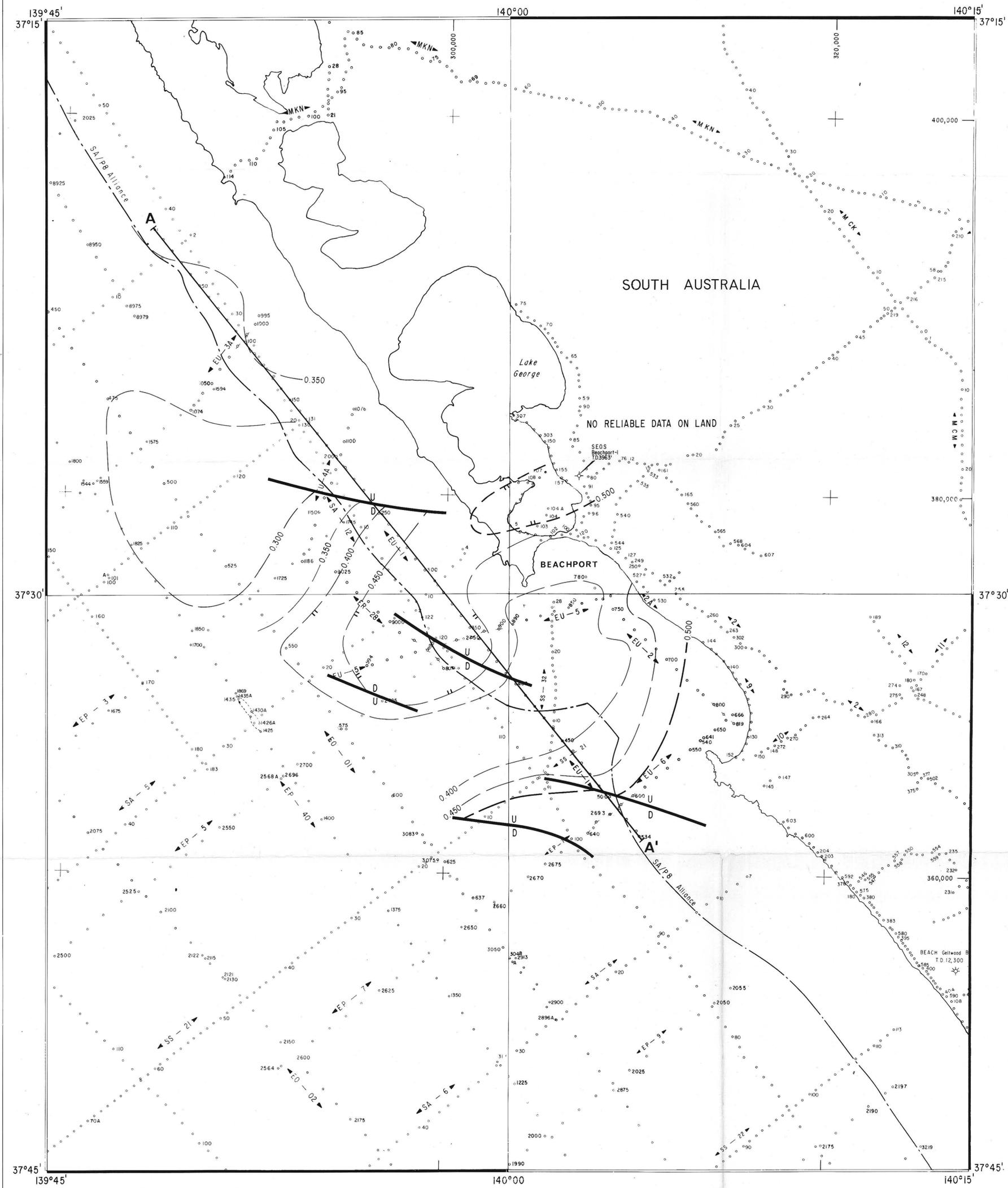
2 1 0 2 4  
MILES

AUTHOR: R.W. WIGGIN DRAFTED BY: P. RIECK

TO ACCOMPANY FINAL SUBSIDY REPORT OF THE OFFSHORE OTWAY EU-68 MARINE SEISMIC SURVEY DATE: MARCH 1969

PLATE II CR-086

Dwg. 1123/G/5



ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

# THE OTWAY BASIN

SOUTH AUSTRALIA

STRUCTURE MAP ON  
BASE OF TERTIARY **04/5**

5 cm

034020

CONTOUR INTERVAL: 0.050 SECONDS      DATUM: SEA LEVEL

Scale 1:100,000

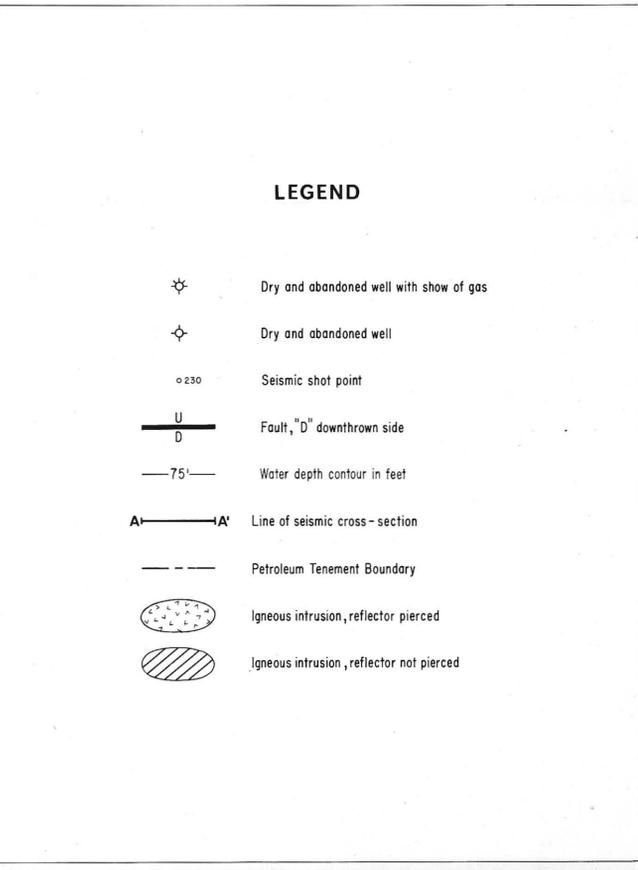
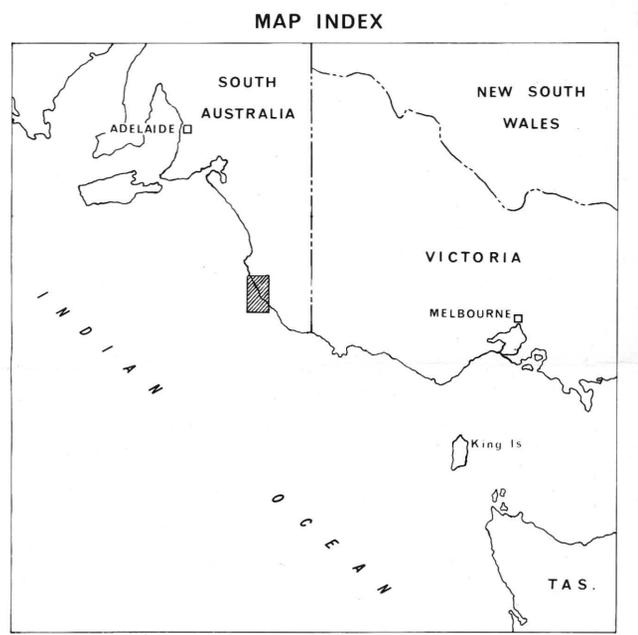
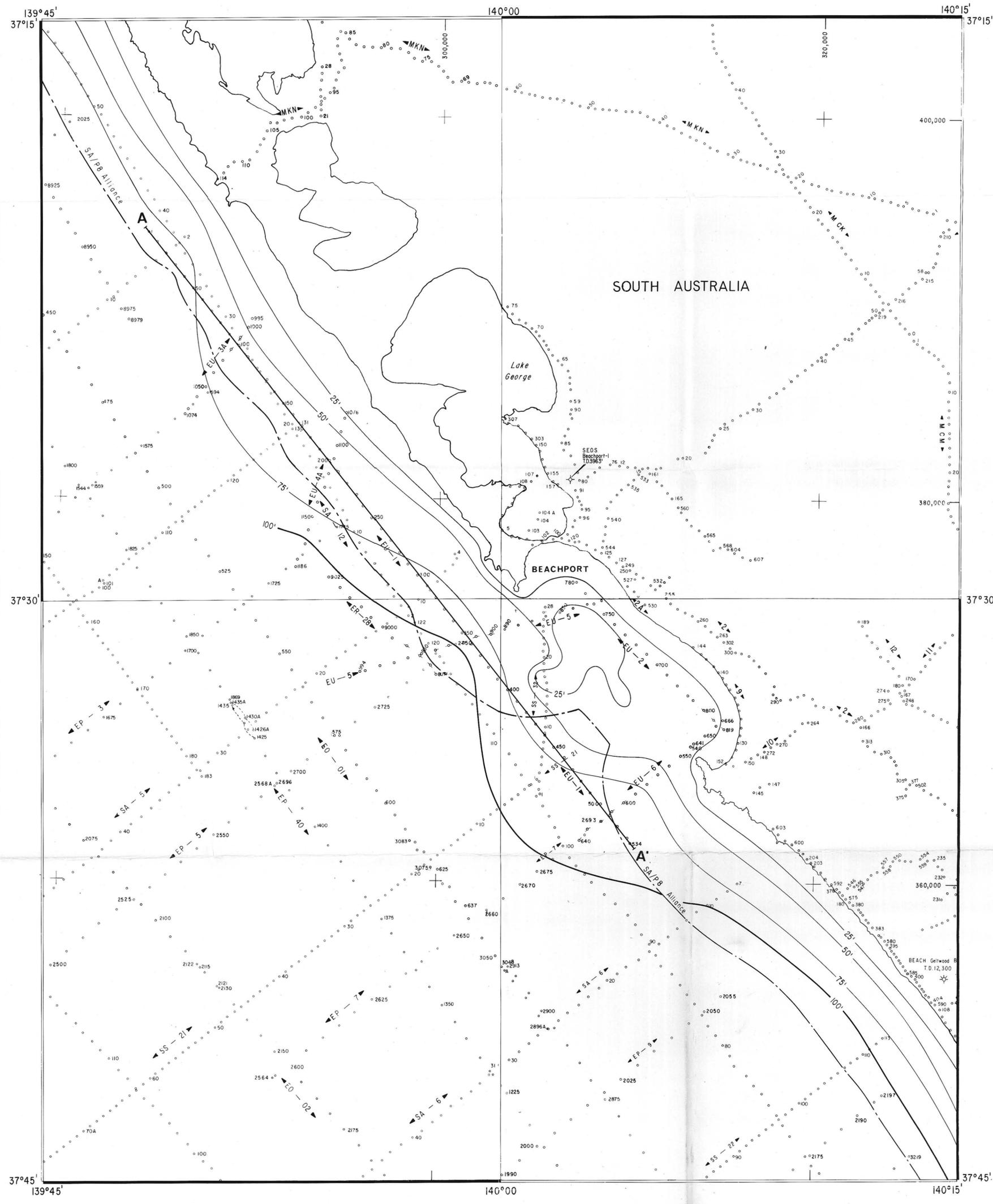
MILES

AUTHOR: R.W. WIGGIN      DRAFTED BY: P.L. SPINNER

TO ACCOMPANY: FINAL SUBSIDY REPORT OF THE OFFSHORE OTWAY EU-68 MARINE SEISMIC SURVEY      DATE: MARCH 1969

PLATE III      **OR-086**

Dwg: 1123/6/6



ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

# THE OTWAY BASIN

SOUTH AUSTRALIA

**WATER DEPTH MAP**

5 cm

034021  
DATUM: SEA LEVEL

CONTOUR INTERVAL: 25 FEET

Scale 1:100,000

2 1 0 2 4  
MILES

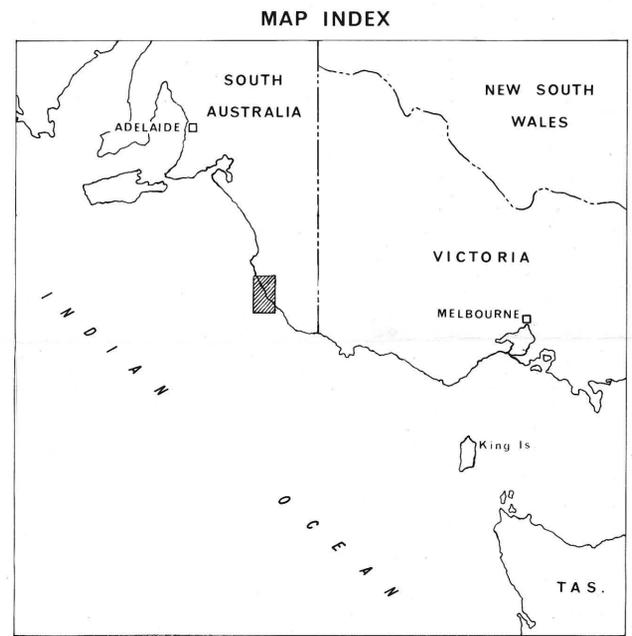
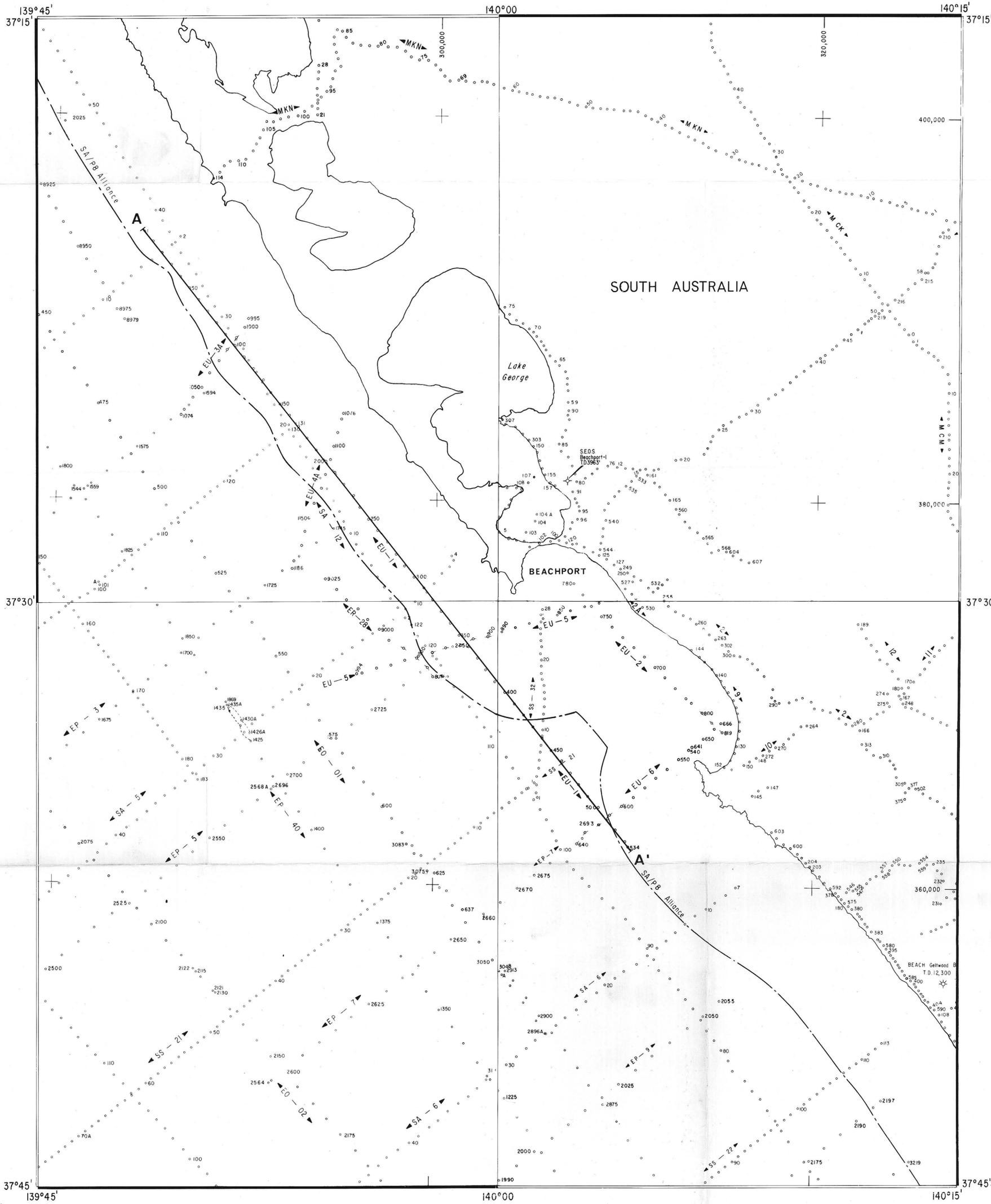
AUTHOR: J. BEIN  
TO ACCOMPANY FINAL SUBSIDY REPORT OF THE OFFSHORE OTWAY EU-68 MARINE SEISMIC SURVEY

DRAFTED BY: P. L. SPINNER  
DATE: MARCH 1969

PLATE IV

02-086

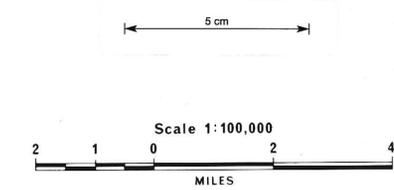
Dwg: 1123/6/7



- LEGEND**
- Dry and abandoned well with show of gas
  - Dry and abandoned well
  - Seismic shot point
  - Fault, "D" downthrown side
  - Structure contour in milliseconds
  - Line of seismic cross-section
  - Petroleum Tenement Boundary
  - Igneous intrusion, reflector pierced
  - Igneous intrusion, reflector not pierced

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.  
**THE OTWAY BASIN**  
 SOUTH AUSTRALIA

**SHOT POINT MAP**



TO ACCOMPANY FINAL SUBSIDY REPORT OF THE OFFSHORE OTWAY EU-68 MARINE SEISMIC SURVEY  
 DATE: MARCH 1969  
**PLATE V**  
 034022  
 OR-086  
 Dwg. 1123/G/8