070601

MARINE MAGNETIC SURVEY

EAST GIPPSLAND BASIN AREA

PEP 63(A), PEP 63(B), T/1P

MAGELLAN PETROLEUM SOUTHERN PTY. LTD.

ALEXANDER CHAMBERS, 201 WICKHAM TERRACE,

BRISBANE, QLD.

EG&G INTERNATIONAL

GAI-GMX DIVISION

P.O. BOX 36830, HOUSTON, TEXAS. U.S.A.

July, 1969

OR-070

INDEX

	Page
SUMMARY	1
INTRODUCTION	2
DATA COMPILATION	2
DATA QUALITY AND RELIABILITY OF RESULTS	4
OBSERVED MAPS	4
COMPUTED MAGNETIC FIELD	4
MAGNETIC BASEMENT MAP	5
COMPOSITE BASEMENT MAP	6
CONCLUSION	6
MIS-TIE ADJUSTMENTS	7
APPENDIX I - Data Resume'	9

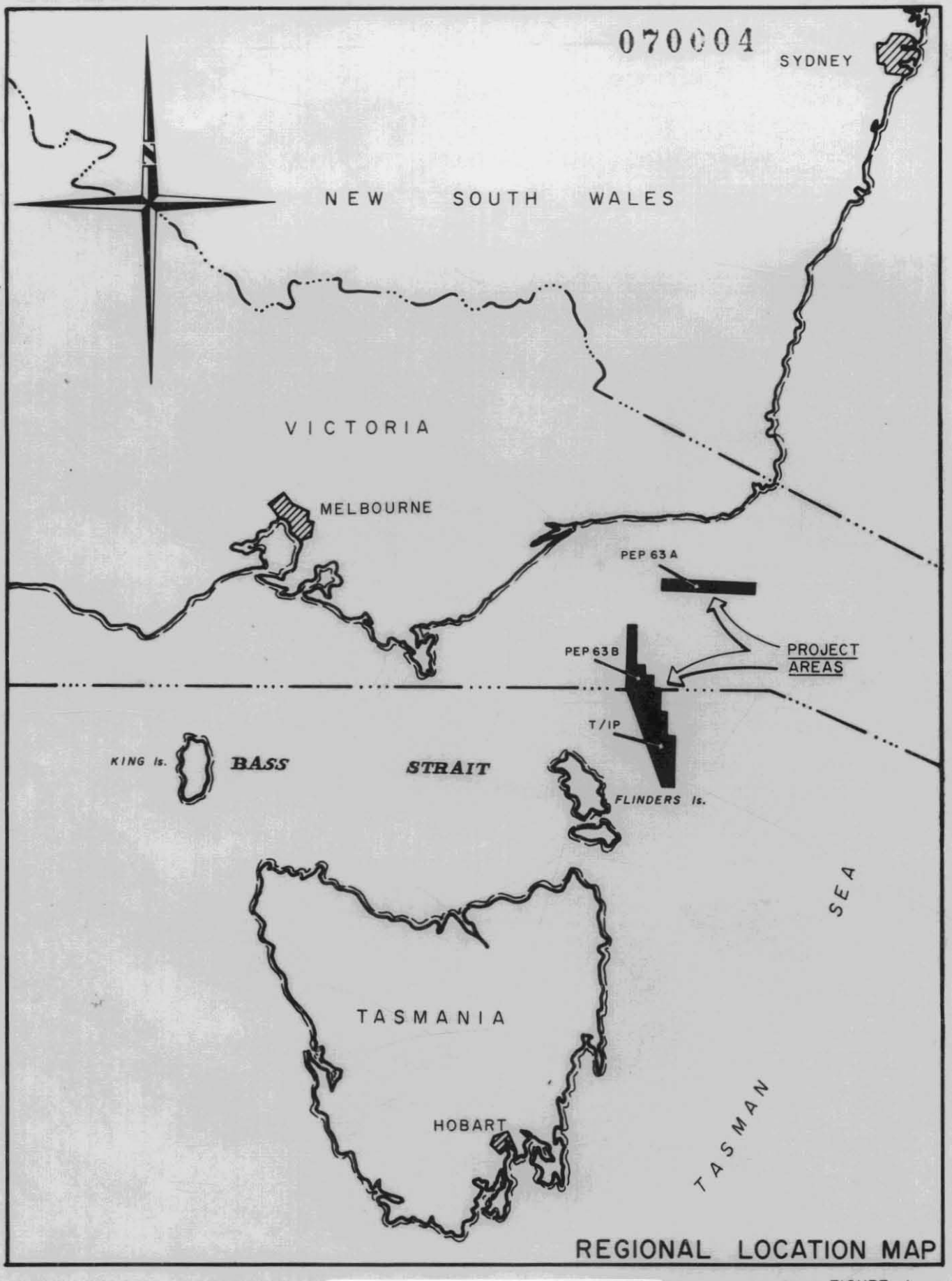
ILLUSTRATION

FIGURE I Location Map Frontispiece

ENCLOSURES

PLATE 1	Total Magnetic Intensity Areas PEP 63 (B) and T/1P Area PEP 63(A)	 Sheet I Sheet II
PLATE 2	Magnetic Basement Areas PEP 63(B) and T/1P Area PEP 63(A)	 Sheet I Sheet II

PLATE 3	Computed Magnetic Field	
	Areas PEP 63(B) and T/1P	Sheet I
	Area PEP 63(A)	Sheet II
PLATE 4	Composite Magnetic Basement	
	Areas PEP 63(A) and part PEP 63(B)	Sheet I
	Areas part PEP 63(B) and part T/1P	Sheet II
	Area part T/1P	Sheet III



REGIONAL LOCATION MAP

FIGURE 1

070005

SUMMARY

Western Geophysical conducted a marine seismic and magnetometer survey over three areas in the eastern Bass Strait during December 1968 and March 1969. The marine magnetic data were compiled and interpreted by GAI-GMX.

The marine magnetometer data were obtained primarily for comparison with the airborne magnetic survey of 1967 by Aero Service Corporation and interpretation by GAPL. The purpose was to evaluate the reliability of the marine magnetometer as an exploration tool.

The two observed magnetic fields were found to agree very well in overall shape except in areas of marginal marine data. A comparison of magnetic basement configurations was seriously hampered by the overall poor quality of the marine data.

INTRODUCTION

This is the report on the compilation and interpretation of approximately 640 miles of marine magnetometer data gathered by Western Geophysical during a marine seismic survey in the eastern Bass Strait. The three areas involved are identified as PEP 63(A), PEP 63(B), and T/1P. Area PEP 63(A) is covered by north-south control tied by east-west control. Areas PEP 63(B) and T/1P have a predominate control pattern of northwest-southeast and northeast-southwest control lines with random spacing, but averaging approximately three miles.

The marine data were reduced by removing the Earth's normal field and correcting for diurnal variations. The observed field thus obtained was computed upward on a Sigma 5 computer to 1000 ft asl for comparison with the airborne survey at 1000 ft asl over the same area.

The purpose of the survey was to evaluate the effectiveness of the marine magnetometer as an exploration tool. It is the intent of this report to outline methods used in marine data reduction and to discuss the comparison of the two surveys. For a more detailed description of the area, the reader is referred to the GAPL report of January 1968. The writer also has assumed that Western Geophysical has covered the field operations.

DATA COMPILATION

Magellan Petroleum furnished GAI-GMX with the original analog recordings of the Earth's total intensity along 48 ship's tracks and with shot point location base maps for these data. In addition, they supplied base station recordings from the Toolangi Observatory near Melbourne, Victoria, and all other field data necessary for the data reduction with the exception of the tabulated normal field values. The individual steps in the data reduction are outlined and discussed immediately below.

Normal Field Correction

The values of the Earth's normal field were computed on the Sigma 5 computer for each minute

of latitude and for each five minutes of longitude. These intervals are considered to be more than adequate to define a normal field that exhibits an almost exact east-west strike. The program that was used to obtain these values is one developed by Goddard Space Center that utilized a series of spherical harmonic expansions based on the 1960 epoch.

The surveyed area lies within the zone of 0 to -10 gamma yearly change in total magnetic intensity so the results after data reduction should not differ seriously from the results of the 1967 survey and data reduction by Aero Service Corporation that utilized data from the BMR Isomagnetic Maps of Australia, Epoch 1957.5. The aeromagnetic data were reduced by a normal field that preceded it by some ten years; the marine data by one that preceded by approximately nine years.

The values of the Earth's normal field were posted on copies of the shot point base map and contoured with ten gamma intervals. Values of the contoured Earth's field were then transferred directly to their corresponding locations on the magnetogram charts. The difference between a base line connecting these values and the total intensity trace was then posted on the shot point location map at each five shot point interval.

Traverse Mis-Tie Corrections

If one assumes that the track locationing is correct, then all the traverse intersection mis-ties must be attributed to diurnal changes in the normal field. However, in correcting these mis-ties, one must usually consider some error in locationing as well as diurnal variations. To accomplish this mis-tie correction, the amount and direction of mis-tie is noted on the location map at each traverse intersection. They are then reduced to zero at all intersections utilizing the smoothest possible correction curve.

On this survey the gamma amount of mis-tie varied from 0 to 45 and is considered to be typical of a survey of this type. Base station recordings from the Toolangi Observatory were used in conjunction with the mis-tie correction procedure.

DATA QUALITY AND RELIABILITY OF RESULTS

The quality of the field data was considered to be below average for this type of survey. The analog recordings were at vertical scale of 10 gamma/inch and horizontal scale of from .2 mile/inch to near .4 mile/inch. The vertical scale is ideal for the area, however, .5 to .7 mile/inch would be more workable horizontal scale, but this is not a major consideration. The recording trace at best had a 3 gamma noise envelope and frequently ran to 10 to 15 gamma of noise and in some cases became entirely unusable. A grading of the field data would have 23 lines graded fair, 13 poor, 5 very poor and 7 not usable. Considering the quality of the field data, the diurnal activity and the intersection mis-ties, the corrected observed map is probably not accurate to less than 10 gamma.

OBSERVED MAPS, PLATE 1, SHEETS I AND II

The observed field is contoured with an interval of ten gamma and apparently results from induced magnetization by the Earth's normal field. The field over area PEP 62(A) is intrabasement in nature and is apparently the negative component of intrabasement positives that exist beyond the limits of control. The gradient certainly suggests that the magnetic basement in the area is quite deep.

The observed field over area PEP 63(B) exhibits sharper anomalies that suggest the magnetic basement occurs at depths less than the area to the north. Poor data over this area makes it impossible to confirm this assumption. The sharp observed anomalies along the western edge of the area T/1P certainly suggests a shallow basement exists along that edge at least to latitude 30°45' south. The two outstanding observed features in this area are the large positive at latitude 39°35', longitude 148°50', and the northeast-southwest trending negative through the southern portion of the area.

COMPUTED MAGNETIC FIELD, PLATE 3, SHEETS I AND II

One of the objectives of the marine magnetic survey was to compare the marine data with the airborne data of 1967. To accomplish this the field that resulted from the marine data at sea level was computed upward to

1000' to compare with the airborne data at 1000 ft. Computations of this type cannot be accomplished to the edge of the control. In an effort to minimize this edge effect on the computed field map, the observed field at sea level was contoured beyond the edge of control before the field was computed upward. Except for a decrease in intensity and some smoothing effect, the computed observed field map has the same characteristics as the observed field map at sea level.

A comparison of the computed field map and the airborne observed map reveals that the two are very similar in shape except for a small area in area PEP 63(B) where the quality of the marine data was extremely poor.

An integrated total intensity map was not prepared because it was felt the poor quality of the marine magnetic recording would only degrade the airborne total intensity map.

MAGNETIC BASEMENT MAP, PLATE 2, SHEETS I AND II

The magnetic basement is contoured with 1000 ft intervals from data obtained from an analysis of the observed data. The method of interpretation assumed the magnetic anomalies to result from induced magnetization by the Earth's normal field. The method is outlined in GSA Memoir 47 with the addition of thin-plate models.

A large part of the magnetic data used to map the observed field was completely unusable for a basement interpretation. In addition to a noisy trace, the ship's tracks were often too short to develop the slopes needed for basement depth estimates. This results in a basement map that contributes very little to the interpretation of the airborne survey. The contoured results have the basement dipping southeastward from a positive nose at latitude $39^{o}35'$ in area T/1P with northwesterly strike in the area north of the nose into area PEP 63(B) where control is absent due to poor data.

Two depth estimates north of area PEP 63(B) have the basement dipping northeast from -16,000 ft to -21,000 ft.

Finally, the two depth points obtained in area PEP 63(A) show south dip of 1100 ft.

COMPOSITE BASEMENT MAP, PLATE 4, SHEETS I, II AND III

The basement depth control from the marine survey was combined with the airborne magnetic basement map and the contouring was changed to reflect the new control. As stated before, the new control was sparce and contributed very little to the older survey.

CONCLUSION

It is felt that despite the poor quality of the field data, the survey has demonstrated that the magnetic field can be mapped and interpreted from marine magnetic data with results similar to those obtained from airborne data.

GAI-GMX DIVISION

Nelson C. Steenland

MAGELLAN-GIPPSLAND BASIN
MIS-TIE ADJUSTMENTS

Line 41	L19[1]x38,R15x25,WSL
Line 21	R10[2]x40,0x35,WSL[3]
Line 39	R12x40,R11x21,R7x22,0x41,WSC[4]
Line 36	L7x17,L1x19,0x20 to EOL[5]WSC
Line 35	L6x19,0x21,R11x22,WSC
Line 34	L7x18,L5x19,L3x20,0x22,WSL
Line 22	L8x39,0x38,L2x35,L7x34,WSC
Line 20	L3x36,L9x35,L14x34,WSC
Line 25	L11x40,0x41,WSL
Line 24	L28x20,L34x41,WSL
Line 23	R10x40,R1x41,WSL
Line 32	R7x12,R6x13,R5x15,R4x16,R3x17,R2x18,WSL
Line 17	0x36,R8x33,R10x32,WSC
Line 33	0x15,L10x16,L11x17,L4x18,R4x19,WSC
Line 15	0x33,L2x32,L19x31,WSC
Line 12	R5x32,R5x31,R6x29,WSC
Line 16	R14x33,R14x32,R34x31,WSC
Line 10	0x31,R13x30,R21x29,R23x28,WSC
Line 30	0x10,L2x28,WSL
Line 31	L13x10,L6x12,L3x13,R4x15,R7x16,WSL
Line 6	L21x27,R8x26,WSL

Line 9 R4x30,L2x29,L8x28,Ll3x27,WSC

Line 28 0x7,Ll5x8,0x9,WSC

Line 8 R31x29,R29x28,R27x27,WSL

Line 27 L5x6,0x7,R7x8,Rl2x9,WSL

Line 7 Ll4x28,Rl7x27,Rl0x26,WSC

Line 26 Rl0x44,Rl0x7,WSL

Line 5 0x26,Ll6x2A,WSL

Line 1 Rl2x2,Ll6x3,Ll8x47,L22x48,L24x4,WSC,L24 to EOL

Line 3 L25x46,L20xl,L20x45,WSC

Line 47 L2x46,R3xl,R8x45,WSL

Line 48 L4x46,R2xl,R7x45,WSL

Line 4 L45x46,L4lxl,WSL

Line 42 L25xl,L25x43,WSL

Line 43 Rl7xFid 621 to EOL,WSL

Line 44 R4x44(1st section) to EOL

Line 19 0x35,R20x36,R20 to EOL,WSL

[1]Line 41 lowered 19 gamma at its intersection with line 38

[2]Line 21 raised 10 gamma at its intersection with line 40

[3]With a straight line

[4]With a smooth curve

[5]End of line

APPENDIX I

Data Resumé

NAME OF SURVEY	East Gippsland Basin
AREA	Bass Strait
CONTRACTOR	Western Geophysical

SURVEY		
INITIATION	7 December 1968	3 March 1969
COMPLETION	19 December 1968	13 March 1969
SURVEY MILEAGE		
LINEAR	641	
SQUARE	1748 mi^2	
COST OF INTERPRETATION		
TOTAL	$4312.00	
PER MILE	$ 6.70	
PER SQUARE MILE	$ 2.48	
M/V	Western Spruce	
LOCATION SYSTEM	Shoran	
MAGNETOMETER	Varian Proton Precession	

ORIGINAL RECORDING

	Type	Vertical Scale	Horizontal Scale	Quality
ANALOG	Rectlinear	10 gamma/ in	.3 mi/in	Poor

PRINCIPAL FACTS OF EARTH'S NORMAL FIELD

INCLINATION	-70°
DECLINATION	13°E
INTENSITY	61,500 gamma

OBSERVED MAPS

BASE	Latitude-longitude
SCALE	1/100,000
NUMBER OF SHEETS	2
CONTOUR INTERVAL	10 gamma

COMPUTED OBSERVED FIELD

BASE	Latitude-longitude
SCALE	1/100,000
NUMBER OF SHEETS	2
CONTOUR INTERVAL	10 gamma

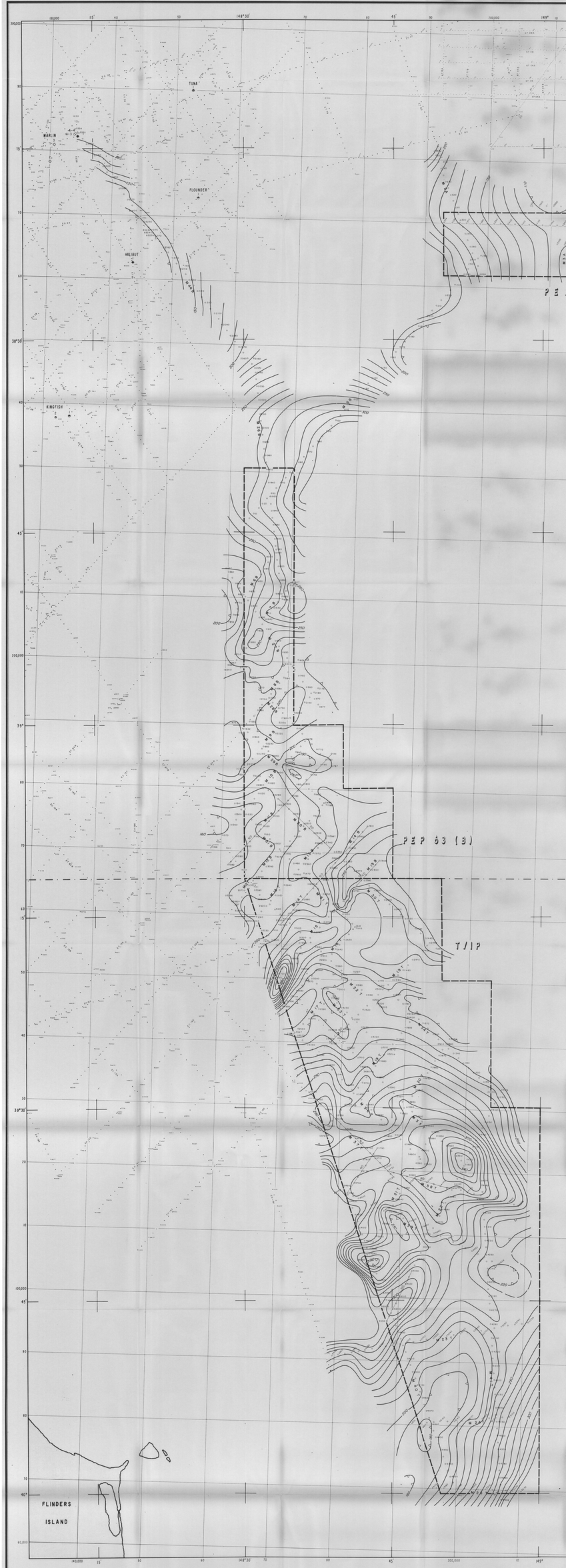
COMPOSITE BASEMENT MAPS

BASE	Latitude-longitude
SCALE	1/100,000
NUMBER OF SHEETS	3
CONTOUR INTERVAL	1000 ft

MAGNETIC BASEMENT MAPS

BASE	Latitude-longitude
SCALE	1/100,000

NUMBER OF SHEETS	2
CONTOUR INTERVAL	1000 ft
FINAL INTERPRETATION	GAI-GMX, Houston, Texas, Dr. N.C. Steenland H. R. Selman
MAGELLAN SUPERVISOR	Brisbane, Queensland, A. Sabitay



AUSTRALIAN TRANSVERSE MERCATOR PROJECTION 10,000 YARD GRID

ZONE 8



KILOMETRES

MILES

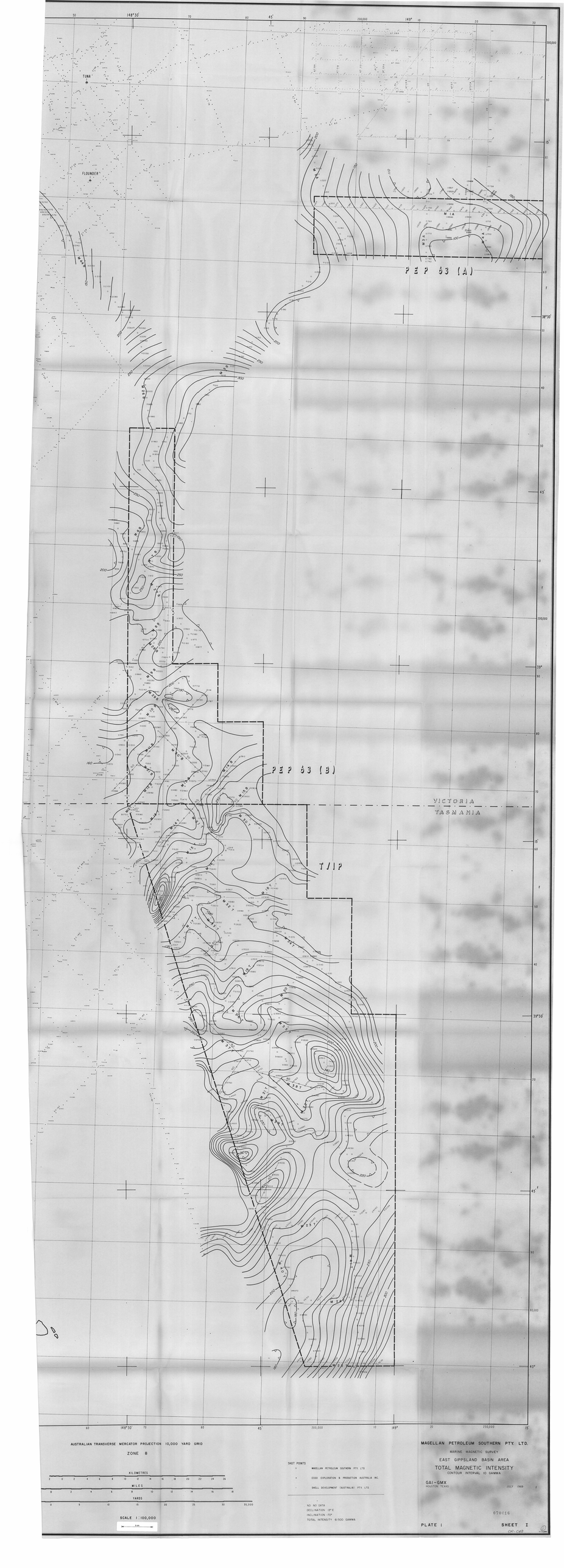
YARDS

SCALE 1:100,000

SHOT POINTS

- MAGELLAN PETROLEUM SOUTHERN PTY. LTD.
- ESSO EXPLORATION & PRODUCTION AUSTRALIA INC.
- SHELL DEVELOPMENT (AUSTRALIA) PTY. LTD.

NO NO DATA
DECLINATION 13° E
INCLINATION -70°
TOTAL INTENSITY 61500 GAMMA



AUSTRALIAN TRANSVERSE MERCATOR PROJECTION 10,000 YARD GRID

ZONE 8

KILOMETRES

WILES

YARDS

SCALE 1:100,000

SHOT POINTS

- MAGELLAN PETROLEUM SOUTHERN PTY. LTD.
- ESSO EXPLORATION & PRODUCTION AUSTRALIA INC.
- SHELL DEVELOPMENT (AUSTRALIA) PTY. LTD.

NO NO DATA
DECLINATION 13°E
INCLINATION -70°
TOTAL INTENSITY 61500 GAMMA

MAGELLAN PETROLEUM SOUTHERN PTY. LTD.

MARINE MAGNETIC SURVEY

EAST GIPPSLAND BASIN AREA

TOTAL MAGNETIC INTENSITY

CONTOUR INTERVAL 10 GAMMA

GAI-GMX

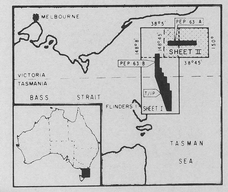
HOUSTON TEXAS

JULY 1969

070016

PLATE I

SHEET I



AUSTRALIAN TRANSVERSE MERCATOR PROJECTION 10,000 YARD GRID

ZONE 8

SHOT POINTS

- MAGELLAN PETROLEUM SOUTHERN PTY. LTD.
- ESSO EXPLORATION & PRODUCTION AUSTRALIA INC.
- SHELL DEVELOPMENT (AUSTRALIA) PTY. LTD.

DECLINATION 13°
INCLINATION -70°
TOTAL INTENSITY 61500 GAMMA

PEP 63 (A)

KILOMETRES
2 0 2 4 6 8 10 12 14 16 18 20 22 24 26

MILES
1 0 2 4 6 8 10 12 14 16 18

YARDS
5,000 0 5 10 15 20 25 30 35,000

SCALE 1:100,000
5 cm

MAGELLAN PETROLEUM SOUTHERN PTY. LTD.

MARINE MAGNETIC SURVEY

EAST GIPPSLAND BASIN AREA

TOTAL MAGNETIC INTENSITY

CONTOUR INTERVAL 10 GAMMA

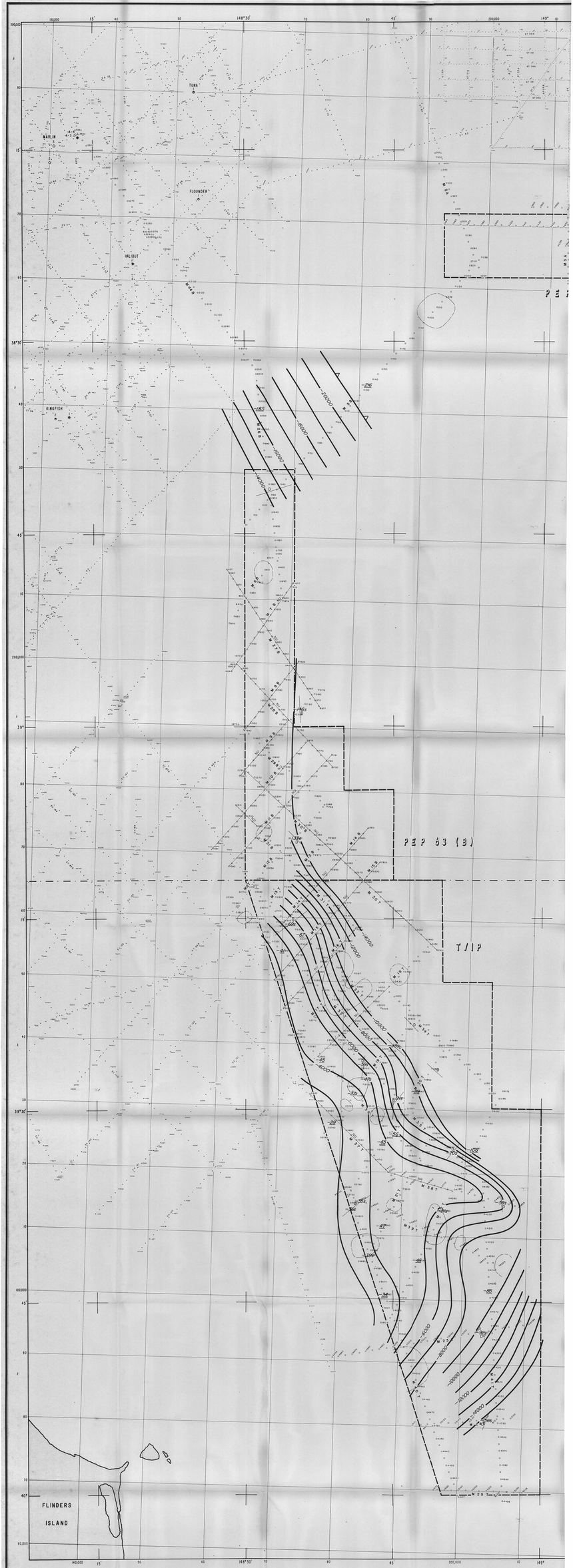
GAI-GMX
HOUSTON TEXAS

JULY 1969

070017

PLATE I SHEET II

CR-048



AUSTRALIAN TRANSVERSE MERCATOR PROJECTION 10,000 YARD GRID

ZONE 8

KILOMETRES

MILES

YARDS

SCALE 1:100,000



SHOT POINTS

- MAGELLAN PETROLEUM SOUTHERN PTY LTD.
- ESSO EXPLORATION & PRODUCTION AUSTRALIA INC.
- SHELL DEVELOPMENT (AUSTRALIA) PTY. LTD.

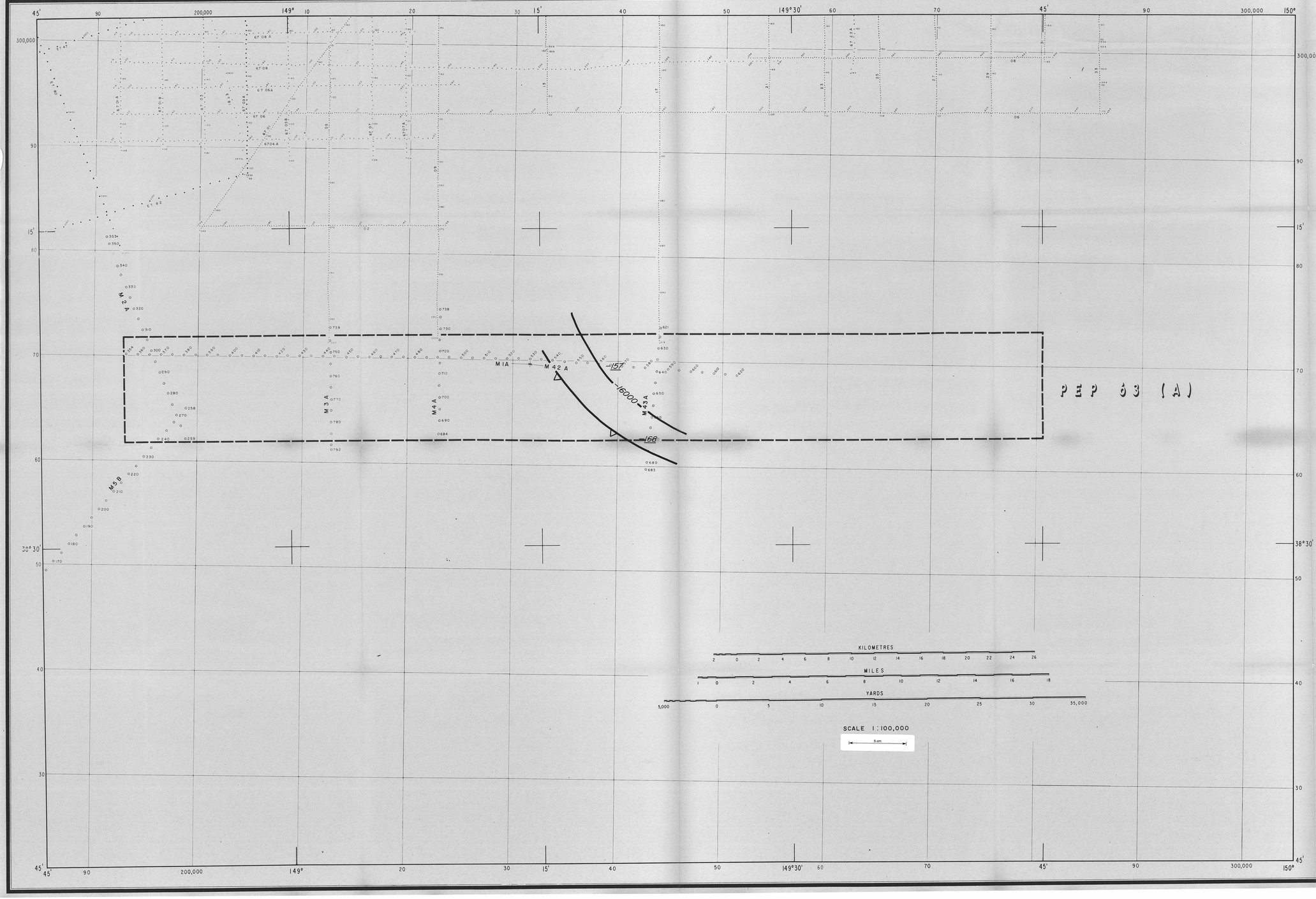
NR NO RECORD

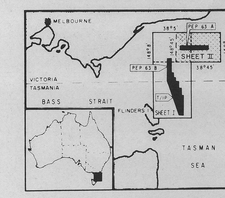
NU NOT USED

MAGNETIC BASEMENT DEPTH ESTIMATES FT/100 SEA LEVEL DATUM
FROM SUPRABASEMENT ANOMALY
IN 1000 FT FROM 1 FOOT
FROM SUPRABASEMENT ANOMALY

OUTLINES OF PLATES FROM SUPRABASEMENT ANOMALIES


PEP 63 (A)
PEP 63 (B)
VICTORIA
TASMANIA
T/1P
TUNA
FLOUNDER
MARLBOUT
M.I.A.
148°30'
149°
149° 10'
38°30'
39°
39°30'
40°
45'
15'
30'
200,000
300,000
100,000
M 48 A
M 48 B
M 48 C
M 48 D
M 48 E
M 48 F
M 48 G
M 48 H
M 48 I
M 48 J
M 48 K
M 48 L
M 48 M
M 48 N
M 48 O
M 48 P
M 48 Q
M 48 R
M 48 S
M 48 T
M 48 U
M 48 V
M 48 W
M 48 X
M 48 Y
M 48 Z
M 49 A
M 49 B
M 49 C
M 49 D
M 49 E
M 49 F
M 49 G
M 49 H
M 49 I
M 49 J
M 49 K
M 49 L
M 49 M
M 49 N
M 49 O
M 49 P
M 49 Q
M 49 R
M 49 S
M 49 T
M 49 U
M 49 V
M 49 W
M 49 X
M 49 Y
M 49 Z
M 50 A
M 50 B
M 50 C
M 50 D
M 50 E
M 50 F
M 50 G
M 50 H
M 50 I
M 50 J
M 50 K
M 50 L
M 50 M
M 50 N
M 50 O
M 50 P
M 50 Q
M 50 R
M 50 S
M 50 T
M 50 U
M 50 V
M 50 W
M 50 X
M 50 Y
M 50 Z
M 51 A
M 51 B
M 51 C
M 51 D
M 51 E
M 51 F
M 51 G
M 51 H
M 51 I
M 51 J
M 51 K
M 51 L
M 51 M
M 51 N
M 51 O
M 51 P
M 51 Q
M 51 R
M 51 S
M 51 T
M 51 U
M 51 V
M 51 W
M 51 X
M 51 Y
M 51 Z
M 52 A
M 52 B
M 52 C
M 52 D
M 52 E
M 52 F
M 52 G
M 52 H
M 52 I
M 52 J
M 52 K
M 52 L
M 52 M
M 52 N
M 52 O
M 52 P
M 52 Q
M 52 R
M 52 S
M 52 T
M 52 U
M 52 V
M 52 W
M 52 X
M 52 Y
M 52 Z
-20000
-30000
-40000
-50000
-60000
-70000
-80000
-90000
-100000
-110000
-120000
-130000
-140000
-150000
-160000
-170000
-180000
-190000
-200000
-210000
-220000
-230000
-240000
-250000
-260000
-270000
-280000
-290000
-300000
-310000
-320000
-330000
-340000
-350000
-360000
-370000
-380000
-390000
-400000
-410000





AUSTRALIAN TRANSVERSE MERCATOR PROJECTION 10,000 YARD GRID

ZONE 8

MAGNETIC BASEMENT DEPTH ESTIMATES FT/100 SEA LEVEL DATUM
FROM INTRABASEMENT ANOMALY
BB 6000 — FAIR — POOR
FROM SUPRABASEMENT ANOMALY

OUTLINES OF PLATES FROM SUPRABASEMENT ANOMALIES

SHOT POINTS

MAGELLAN PETROLEUM SOUTHERN PTY. LTD.

ESSO EXPLORATION & PRODUCTION AUSTRALIA INC.

SHELL DEVELOPMENT (AUSTRALIA) PTY. LTD.

MAGELLAN PETROLEUM SOUTHERN PTY. LTD.

MARINE MAGNETIC INTERPRETATION

EAST GIPPSLAND BASIN AREA

MAGNETIC BASEMENT

CONTOUR INTERVAL 1000 FEET

GAI-GMX
HOUSTON TEXAS

JULY 1969

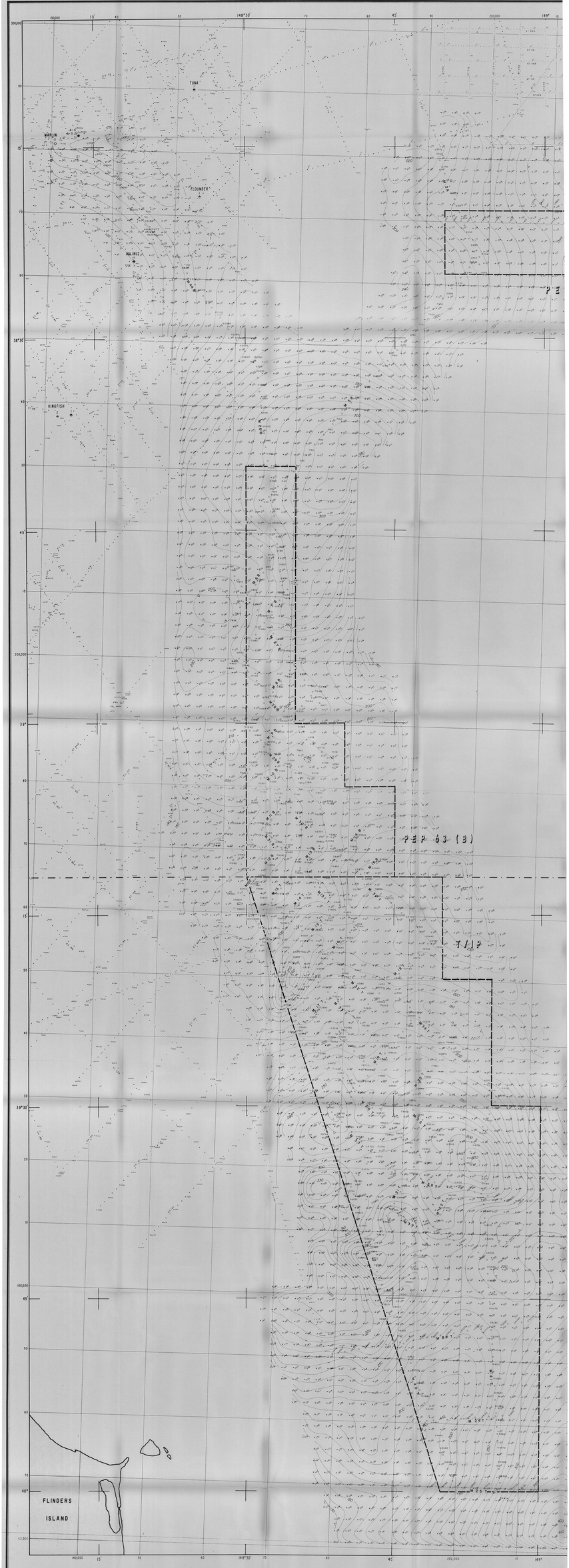
070019

PLATE 2

SHEET II

OR-048

4



AUSTRALIAN TRANSVERSE MERCATOR PROJECTION 10,000 YARD GRID

ZONE 8



KILOMETRES

MILES

YARDS

SCALE 1:100,000

SHOT POINTS

- MAGELLAN PETROLEUM SOUTHERN PTY LTD
- ESSO EXPLORATION & PRODUCTION AUSTRALIA INC.
- SHELL DEVELOPMENT (AUSTRALIA) PTY LTD