OFFSHORE 88
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ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LTD

AIRBORNE MAGNETOMETER SURVEY

OFFSHORE TASMANIA

EL 17/65

PART I

OPERATIONAL REPORT

PART II

INTERPRETATION

GEOPHYSICAL ASSOCIATES PTY. LTD.

JUNE 1967

Leamon report no. 307

036002

PART I

OPERATIONAL REPORT

AIRBORNE MAGNETOMETER SURVEY

OFFSHORE TASMANIA

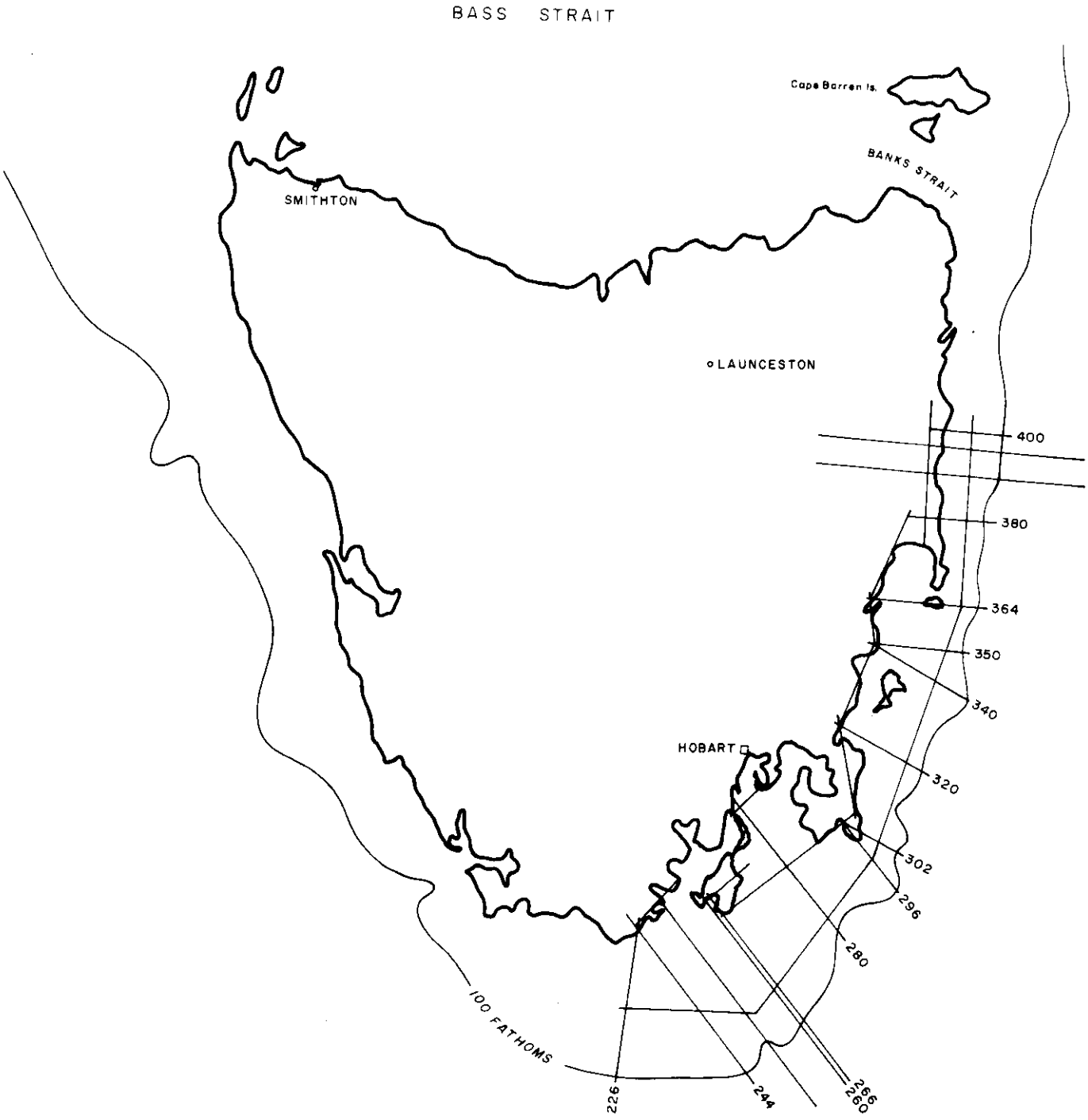
EL 17/65

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LTD

AERO SERVICES LIMITED

JUNE 1967

036003



AEROMAGNETIC SURVEY

OFFSHORE TASMANIA

SCALE – 1:2,534,400

5 cm

AERO SERVICE
LIMITED
SYDNEY, AUSTRALIA

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TOTAL MAGNETIC INTENSITY - AEROMAGNETIC SURVEY – OFFSHORE TASMANIA – E.L. 17/65 (FLIGHT PATHS)

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TOTAL MAGNETIC INTENSITY - AEROMAGNETIC SURVEY – OFFSHORE TASMANIA – E.L. 17/65

SHEET 1
SHEET 2
SHEET 3
SHEET 4
SHEET 5

I STATISTICS

CLIENT:	Electrolytic Zinc Company of Australasia Ltd.
CONTRACTOR:	Aero Service Limited
COMMENCEMENT OF FLYING:	12th. October, 1966
COMPLETION OF FLYING:	6th. November, 1966
AIRCRAFT:	Aero Commander Model 680F, reg. VH-MJJ
AIRCRAFT BASE:	St. Helens, Hobart
DAYS ON PROJECT:	26
PRODUCTION DAYS:	20
TIME LOST:	
WEATHER	4
DIURNAL	0
INST. MAINTENANCE	1
AIRCRAFT MAINTENANCE	0
FERRY	1
FLIGHT ALTITUDE:	1,500 feet above sea level
MAGNETOMETER:	Gulf Mark 111 continuous recording Fluxgate Total Field Magnetometer
RECORDER:	Gulf 10"
SENSITIVITY:	300 gamma full scale deflection

CAMERA:	Aeropath AS-5 continuous strip 35mm camera
TERRAIN CLEARANCE CONTROL:	APN-1 Radio Altimeter
NAVIGATION AIDS:	GPL Doppler and Kearfott N-1 Compass
MILEAGE FLOWN:	1,874 line miles
CREW:	Pilot - Captain A.E. McKenzie Electronics Engineer - Mr. D. Lyus, Mr. R. King and Mr. W. Clark Geophysical Data Technician - Mr. M. Chatenay

II FIELD CREW

PROJECT MANAGER AND PILOT — Captain A.E. McKenzie

Captain A.E. McKenzie was responsible for the co-ordination of all operations necessary to complete the project. In addition to his responsibilities as Project Manager, the Aero Commander VH-MJJ was in his command during the survey. Captain McKenzie has some 9500 flying hours and has been engaged continuously on aerial survey during the last eleven years.

ELECTRONICS ENGINEER — Mr. D. Lyus
Mr. R. King
Mr. W. Clark

These experienced technicians were jointly responsible for all the electronics instrumentation in the aircraft and on the ground necessary for obtaining the magnetic data.

DATA TECHNICIAN — Mr. M. Chatenay

The responsibility for the quality and assembly of the data fell upon Mr. M. Chatenay. Records which were obtained were examined and if not fully up to specification, were rejected and reflown. In addition, the Data Technician was responsible for operation and control of the Magnetic Storm Monitor Station, to ensure that production was not being achieved during period of such magnetic disturbance which were contrary to the specifications.

III SURVEY PROCEDURES AND EQUIPMENT

In September of 1966, agreements were reached between Electrolytic Zinc Company of Australasia Ltd., with registered offices at 390 Lonsdale Street, Melbourne, Victoria and Aero Service Limited, with registered offices at 31 Park Road, Ramsgate, New South Wales.

The purpose of the agreement was to conduct an airborne magnetometer survey over part of offshore Tasmania. The profile flight direction was at right angles to coast line with coastal tie-lines flown where practicable. Traverses were flown at an interval of two nautical miles. Tie-lines were flown in the offshore portions of the survey area.

1. OPERATIONS

The bases used for survey purposes, accommodation and fueling were St. Helens and Hobart, Tasmania.

Prior to commencement of flight operations, the Doppler was calibrated over a known distance and reciprocal heading checks were established. Compensation of the magnetometer was effected and checks were made on the correlation of all three records, viz. Magnetometer, Altimeter and 35mm Tracking Film.

The survey aircraft, Aero Commander registered no. VH-MJJ carried a Gulf Mark 111 Magnetometer with the detector head housed in a tail cone installation. In flight, the magnetometer continuously measures the earth's total magnetic field thereby indicating any variations in this field as the aircraft proceeds along pre-determined flight lines. Using a recording Potentiometer coupled with the detector head, the magnetic information is automatically recorded on a graph chart. The aircraft's altitude is also graphically recorded on a chart which shows the terrain clearance. In order to validate the flight path as flown by the aircraft, an Aeropath AS-5 continuous strip 35mm camera photographs the terrain.

The aforementioned three records, viz. Magnetometer, Altimeter and 35mm film are correlated by a Doppler driven timing or fiducial system which imposes serially numbered marks at one nautical mile intervals on each of the records simultaneously.

On the ground, a Gulf Fluxgate Magnetic Storm Monitor was continuously maintained over a twenty-four hour basis so that no aeromagnetic data would be accepted if obtained during period of abnormal magnetic disturbance.

2. Doppler Techniques.

The navigation used was pure Doppler, without resort to visual map aids. Using this navigation system which has a computer integrated Kearfott compass system, along track and off track distance relative to a given start point can be read off at any time.

At the survey base, a feature was selected which could be readily identified from the air; this feature was used as a start and finish point for each flight sortie. Effectively, the pre-determined along track and off track settings were set into the Doppler mechanism and the instrument was manually activated on passing over the start point at the commencement of each flight.

When flying, the aircraft's position can be ascertained relative to the start point by reference to the along and off track dials.

After performing the desired survey configuration, the flight would terminate by flying over the start point, the pilot manually switching off the Doppler. The survey mis-close could be then read as increments of along and off track distance relative to this point of commencement. The only minor difficulty encountered during flight operations was in the computer which introduced an occasional random error on the reciprocal track. This necessitated close scrutiny of heading checks in flight to determine necessary track correction for reciprocal direction.

All questionable lines were reflown.

3. Data Reduction

a) Flight Path Recovery

Although some difficulty was encountered in the use of the Doppler due to computer difficulties resolving an accurate reciprocal track, we were of the opinion that the Doppler maintained adequate straight lines.

The maps used as a basis for plotting identified fiducials or aircraft's flight path track on landfall were the published maps at 1:250,000 scale of the Tasmania Lands and Surveys Department. For compilation purposes, these maps were photographically enlarged to 1:100,000 scale.

From Doppler output information and identified fiducials on landfall, the flight path was extended out over the water and fiducials were plotted at one nautical mile increments along each of the flight lines. These preliminary positions of fiducials over water were suspect, because of random errors introduced by incorrect ground speed data which drives the fiducial firing system via Doppler.

In theory, the true ground speed is derived via Doppler from a stationary reference plane, however in these circumstances, reference was made to a moving surface, i.e. wave motion, sea state, current, spray, etc. As spacing lines of two nautical miles length were flown at the ends of the seaward lines, we knew that the distance separating these lines must be two nautical miles.

Again, on reciprocal tracks, it was found that on the seaward leg, i.e. flying in a southerly direction, a line as flown may show 50 fiducials, i.e. according to the Doppler we flew 50 nautical miles to sea. However, on the return leg, dependent upon the sea state, we were at times recording a different mileage or number of fiducials, i.e. in cases 53 or 47. As it would be assumed the aircraft flew the same distance out to sea as it flew back, we took the mean of these two distances for the average length of a pair of lines and plotted on each of these lines the fiducials as recorded.

The coastal tie-lines were levelled one to each other via a periphery control circuit; true intersections of lines being determined by film crossovers. Having levelled these ties one to each other, film intersections between all traverses and ties were then obtained and magnetic values at the intersections of traverse and tie-line were obtained. Offshore tie line intersections were read from the work manuscript and levelling was done by means of modified least squares method of control.

Final base lines were then applied to the traverse profiles taking into account the recorded instrument drift which is shown at the ends of the line, when the magnetometer is standardised and balanced.

Inspections of the flight path maps show that very minor adjustments were necessary to establish track over water. A further check on our method was in the contouring. If herringbone was in evidence, or an apparent displacement was effected, it would be conceivable that our method of establishing path was incorrect.

The normal regional gradient was determined by charts published by Bureau of Mineral Resources (W D Parkinson, C R G Curedale - EPOCH 1957/5).

Regional field lines were plotted on the work manuscripts with respect to the geophysical co-ordinates and values were read at each end of the line and tie-line traverse intersections. Final magnetic values representing the difference between the field values recorded and the original field values determined were plotted on the magnetometer tapes and final base lines were applied. The final contours and reduced magnetometer profiles were inked and presented as sheets of total magnetic intensity.

IV TECHNICAL SPECIFICATIONS.

1. OPERATIONS.

The magnetic survey operations were conducted under licence from the Gulf Research and Development Corporation.

2. METHOD OF NAVIGATION.

a). The survey aircraft was navigated using the GPL Doppler navigation system and computer integrated Kearfott N-1 Compass.

b). Description of Navigation Aids:

(i) Kearfott N-1 Compass. This compass unit is integrated into the Doppler computer system and is a navigational aid using the output of sensitive elements suitably amplified to monitor an electrically driven directional gyro. This system provides accurate compass indication in which turning, accelerating and gyro wander errors are almost eliminated. Heading information in the form of a synchronous output is provided at the amplifier to feed a synchronous repeater of any of the following equipment:
radio compass,
electro-mechanical flight computer,
automatic reckoning system;
The following units are used in this compass:
detector,
gyro,
amplifier,
resolver,
slave unit,
indicator and master indicator.

(ii) Automatic Pilot:

The conventional automatic pilot was used. LEAR L3 three axis.

(iii) Doppler:

The GPL Doppler Navigation system is a self contained long range navigation aid that gives the pilot ;

1. ground speed
2. drift angle
3. distance to go to destination
4. distance right or left of selected course.

The output information is obtained by sending to the ground four beams of continuous wave energy and measuring the change in frequency of the energy return from the ground to the aircraft. This change in frequency commonly known as "Doppler Shift" is proportional to the aircraft speed in the direction that the beam is pointing. By checking the speed in the four directions in which the beams are pointing, the system derives ground speed and drift angle data and presents it on the Doppler Indicator on the instrument panel. This drift angle information is then combined with aircraft heading data and is fed along with ground speed information to the navigation computer. The computer accepts this information and computes automatically and continuously the aircraft's ground position relative to the selected course and point of origin. The Doppler unit is guaranteed to an accuracy of $\pm$ 1% of the distance flown by the survey aircraft, i.e. approximately one mile off track for a distance of sixty miles.

3. MAGNETOMETER.

a) The magnetometer used on this survey was a Gulf Research and Development Corporation Total Magnetic Field Saturable Core Magnetometer Mark lll recording through a Gulf 7-1 Recording Potentiometer. The sensing or detecting head was mounted on the tail stinger of the Aero Commander.

b) Technical Data:

(i) Sensitivity: The instrument was set to record a full scale deflection of 300 gamma for a complete excursion of a Leeds and Northrup ten inch chart and the recorder was run at a speed proportion to ground speed as determined by the Doppler output.
(ii) Noise level: The noise level as recorded at no time exceeded two gamma.
(iii) Instrument drift: During the course of this survey, the instrument did not drift at any rate greater than four gamma per hour.

4. RADIO ALTIMETER.

An APN-1 Radio Altimeter was used for recording the height of the aircraft above terrain. An Esterline Angus Recording Potentiometer running at 3" per minute continuously recorded the terrain clearance.

5. RECORDING 35mm CAMERA.

a) An Aeropath AS-5 continuously recording positioning camera was used to record the actual flight path of the aircraft over the terrain.

b) Technical Data:

Lens:	F2 Cook, Speed Panchro, ANGENIEUX 18.5 mm
Focal Length:	0.75 ins.
Shutter Speed:	Variable.
Magazines:	400 feet.

c) Control:

The recording 35mm. camera was driven by an electric motor at a constant speed and is pre-set for a given mean ground speed and altitude above the ground.

6. STORM MONITOR.

a) Magnetic field variations were monitored by a Gulf Research and Development Corporation Single Fluxgate Saturable Core Magnetometer recording on to a 5 inch curvi-linear chart using an Esterline Angus recorder, running at 1.5 inches per minute during sorties and 1.5 inches per hour at all other times.

b) Control:

The instrument was constantly attended whilst the survey aircraft was operating and time intervals of approximately ten minutes duration were noted on the chart by the operator.

7. SYNCHRONISATION OF RECORDS.

Synchronisation of all records taken during the survey was achieved by the use of Veeder counters and Fiducial system controlled by Doppler produced ground speed information.

An electrical pulse from the intervalometer operated the fiducial flag of the camera and at the same time moved the camera Veeder counter up one unit. The magnetometer recorder and the radio altimeter recorder are each fitted with the fiducial marking pen which is also operated by signals from the Doppler.

The magnetometer operator annotated each record by reference to the counters at the beginning and end of each profile, regularly throughout the survey for alignment of numbers. Using this technique the numbers appearing on the edge of the 35mm tracking film were also identified by interpolation on both the magnetometer and radio altimeter records. Thus the ground position of any anomaly and the height of the aircraft above the ground at that point may be easily ascertained.

The storm monitor and airborne magnetometer record were related by reference to time only, and were synchronised by time check prior to and at the end of each sortie.

AERO SERVICE LIMITED.

V TRAVERSE AND TIE LINE INDEX

Line No.	Direction	Flight No.	Fiducials Start	Fiducials End	Extent
226	S	24	024	057	S.Bdy. - TL.V
228	N	24	993	023	TL.V - SSE.Bdy.
230	S	24	962	992	SSE.Bdy- TL.V
232	N	24	934	961	TL.V - SSE.Bdy.
234	S	24	904	933	SSE.Bdy- TL.V
236	NNW	24	875	903	TL.V - SSE.Bdy.
238	SSE	24	845	874	SSE.Bdy- TL.V
240	NNW	24	815	844	TL.V - SSE.Bdy.
242	SSE	24	784	814	SSE.Bdy- TL.V
244	N	21	062	093	N.Point- S.Bdy.
246	S	21	028	061	S.Bdy. - N.Point
248	NW	20	823	964	TL.V - SE.Bdy.
250	SE	20	782	822	SE.Bdy.- TL.V
252	NW	20	741	781	TL.V - SE.Bdy.
254	SE	20	700	740	SE.Bdy.- TL.V
256	NW	20	551	616	TL.V - SE.Bdy.
258	SE	20	487	550	SE.Bdy.- TL.V
260	NW	20	420	486	TL.V - SE.Bdy.
262	SE	20	362	419	SE.Bdy.- TL.T
264 Pt.	E	19	712	743	TL.E - TL.T
264 Pt.	W	15	854	913	TL.E - Bdy.
266	E	15	795	853	Bdy. - TL.T
268	NW	22	200	242	TL.T - SE.Bdy.
270	SE	22	155	199	SE.Bdy.- TL.T
272	NW	20	220	274	TL.T - SE.Bdy.
274	SE	20	175	219	SE.Bdy.- TL.T
276	W	15	750	794	TL.S - Bdy.
278	E	15	705	749	Bdy. - TL.S
280	W	19	673	711	TL.S - E.Bdy.
282 Pt.	E	19	633	672	E.Bdy. - TL.S
282 Pt.	E	15	615	663	TL.S - TL.R
284	W	15	564	614	TL.R - Bdy.
286	E	15	513	563	Bdy. - TL.R
288	W	12	104	147	TL.R - E.Bdy.
290	E	12	059	103	E.Bdy. - TL.R
292	W	12	015	058	TL.R - E.Bdy.

Line No.	Direction	Flight No.	Fiducials Start	Fiducials End	Extent
294	E	12	970	014	E.Bdy. - TL.R
296	W	12	944	969	TL.R - E.Bdy.
298	E	12	918	943	E.Bdy. - TL.R
300	W	12	845	865	TL.G - E.Bdy.
302	E	12	823	844	E.Bdy. - TL.G
304	W	12	802	822	TL.P - E.Bdy.
306	E	12	781	801	E.Bdy. - TL.P
308	W	12	760	780	TL.D - E.Bdy.
310	E	12	737	759	E.Bdy. - TL.P
312	W	12	714	736	TL.P - E.Bdy.
314	E	12	690	713	E.Bdy. - TL.P
316	W	12	668	689	TL.P - E.Bdy.
318	E	12	644	667	E.Bdy. - TL.P
320	WNW	11	491	517	TL.P - ESE.Bdy.
322	ESE	11	463	490	ESE.Bdy- TL.P
324	WNW	11	433	462	TL.P - ESE.Bdy.
326	ESE	11	403	432	ESE.Bdy- TL.P
328	WNW	11	372	402	TL.O - ESE.Bdy.
330	ESE	11	341	371	ESE.Bdy- TL.O
332	WNW	11	295	324	TL.O - ESE.Bdy.
334	ESE	11	264	294	ESE.Bdy- TL.O
336	WNW	11	230	260	TL.O - ESE.Bdy.
338	ESE	11	196	229	ESE.Bdy- TL.O
340	WNW	11	163	195	TL.O - ESE.Bdy.
342	ESE	11	131	162	ESE.Bdy- TL.O
344	W	9	434	465	Bdy. - Bdy.
346	E	9	402	433	Bdy. - Bdy.
348	W	9	371	401	Bdy. - Bdy.
350	E	9	339	370	Bdy. - Bdy.
352	W	9	245	275	Bdy. - Bdy.
354	E	9	214	244	Bdy. - Bdy.
356	W	9	184	213	Bdy. - Bdy.
358	E	9	153	183	Bdy. - Bdy.
360	W	9	122	152	Bdy. - Bdy.
362	E	9	091	121	Bdy. - Bdy.
364	W	10	670	701	Bdy. - Bdy.
366	E	10	639	669	Bdy. - Bdy.
368	W	10	608	638	Bdy. - Bdy.
370	E	10	577	607	Bdy. - Bdy.
372 Pt.	E	10	525	548	Bdy. - Bdy.

Line No.	Direction	Flight No.	Fiducials Start	Fiducials End	Extent
372 Pt.	W	10	549	562	Bdy. - Bdy.
374	E	10	496	524	Bdy. - Bdy.
376	W	5	776	803	TL.L - E.Bdy.
378	E	5	747	775	E.Bdy.- TL.L
380	W	5	718	746	TL.L - E.Bdy.
382	E	5	689	717	E.Bdy.- TL.L
384	W	5	658	688	TL.L - E.Bdy.
386	E	5	636	657	E.Bdy.- TL.L
388	W	5	616	635	TL.L - E.Bdy.
390	E	5	596	615	E.Bdy.- TL.L
392	W	5	522	558	TL.L - E.Bdy.
394	E	5	484	521	E.Bdy.- TL.L
396	W	4	115	151	TL.L - E.Bdy.
398	E	4	076	114	E.Bdy.- TL.L
400	W	4	040	075	TL.L - E.Bdy.
TL.J Pt.	S	6	837	875	S.Bdy.- N.Bdy.
TL.K	S	6	876	885	S.Bdy.- N.Bdy.
TL.KL	S	7	980	986	Bdy. - Bdy.
TL.L	N	5	804	836	N.Bdy.- S.Bdy.
TL.M	NE	9	070	090	T384 - T368
TL.N	N	10	466	483	T368 - T354
TL.O	N	11	978	004	T354 - T324
TL.P	N	11	951	977	T326 - T300
TL.Q	NE	11	913	950	T306 - T266
TL.R	SW	11	864	883	T282 - T294
TL.S	SW	11	884	896	T274 - T282
TL.T	SW	11	897	912	T262 - T274
TL.U Pt.	NE	13	175	183	T254 - T250
TL.U Pt.	SW	17	463	473	T254 - T260
TL.V Pt.	W	16	914	956	T190 - T250

036020

PART II

INTERPRETATION

AEROMAGNETIC SURVEY

OFFSHORE TASMANIA

EL 17/65

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LTD

GEOPHYSICAL ASSOCIATES PTY. LTD.

JUNE 1967

SUMMARY

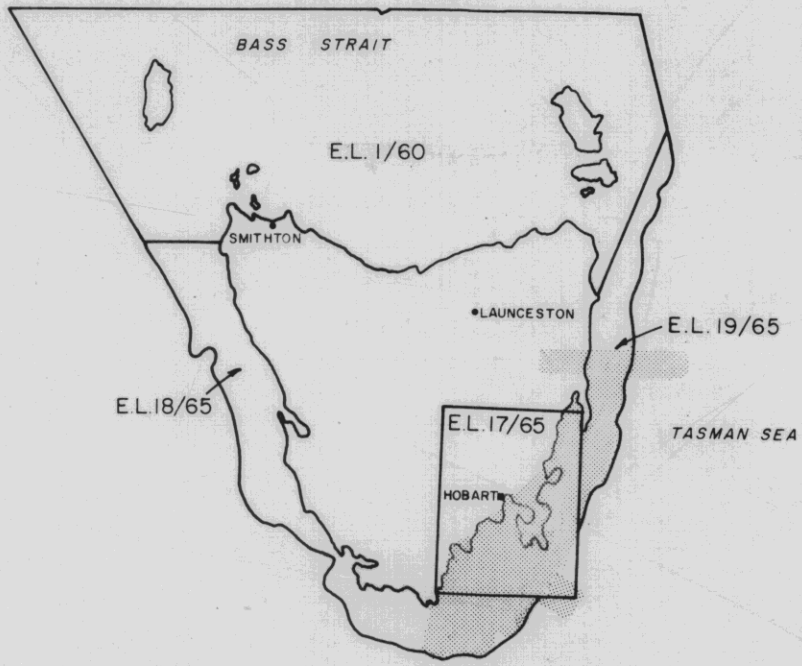
The survey was flown and completed by Aero Service Limited and interpreted by Geophysical Associates Pty. Ltd. A total of 1874 miles of single flight lines approximately perpendicular to the coast line were flown and are incorporated in this report.

The analysis of the aeromagnetic data is based upon a method of model comparison developed by GMX which includes both intrabasement and suprabasement model representing thick prisms and thin plates of magnetic rock. Such rocks, igneous or metamorphic, ordinarily underlie a sedimentary section. The interpretation attempts to show the volume of sediment within the area that may be potentially productive of oil or gas by mapping this basement - sedimentary interface.

The results are shown on a Magnetic Basement Map contoured at 1000 ft intervals from the computed depth estimates. These range from +1200 ft onshore to a maximum of -14,200 ft offshore.

Three prospective areas have been recommended as worthy of further geophysical investigation.

036022



5 cm

LOCALITY MAP
AEROMAGNETIC SURVEY
TASMANIA

SURVEY AREA

Miles 50 0 50 100 150

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MAPS

Total Magnetic Intensity, 1 : 250,000, Minimal contour interval 5 gamma. This Map was compiled by Aero Service Limited.

Magnetic Basement, 1 : 250,000 contour interval 1,000 ft. This Map was prepared by Geophysical Associates Pty. Ltd.

I INTRODUCTION

This is the final report on the interpretation of the aeromagnetic survey over the offshore portion of EL17/65. The surveyed area extends along the continental shelf from Swansea to South East Cape. The area is bounded approximately by latitudes 42°08'and 43°35', and longitudes 146°47' and 148°20'.

The aeromagnetic data were recorded and compiled by Aero Service Limited. The operation of the survey and the compilation of the data is described in Part I of this report.

The survey area was flown concomitantly with a more extensive aeromagnetic survey for Esso Exploration.

II QUALITY OF STAFF

The Magnetic Basement interpretation and report were prepared in Brisbane by Geophysical Associates Pty. Ltd.'s aeromagnetic geophysicist, A.S. Falloon. The preliminary interpretation was submitted to G.A.P.L.'s parent company in Houston for review by R.H. Hammons and Dr. N.C. Steenland.

Mr. Falloon has been engaged in geological and geophysical exploration for thirteen years, the last two years with G.A.P.L.

Mr. Hammons has been with G.M.X. since 1954 and has been engaged in aeromagnetic interpretation for seven years.

Dr. Steenland has been with G.M.X. since 1949 and has been in charge of aeromagnetic interpretation since that time.

III DESCRIPTION OF THE SURVEY

The survey was reconnaissance in nature with single flight lines spaced at intervals of approximately two miles. The lines are generally at right angles to the coast line.

Tie lines were flown along the coast, and paralleling the coast approximately midway between the coast and the edge of the continental shelf.

The magnetic data were recorded on a 300 gamma full scale chart. The ground/chart length ratio used was 0·82 miles per inch. Data quality was excellent throughout. The principal facts of the earth's magnetic field in the survey area are:

Inclination	-72^{o}
Declination	10^{o}E
Total Intensity	63,000 gammas

IV OBJECTIVE OF THE SURVEY

The purpose of the survey was to map the magnetic basement and thereby to indicate the volume of potentially productive sediments in the area; and additionally to map magnetic materials within the sedimentary section above the magnetic basement, should any anomalies indicate their presence.

The magnetic basement surface is that horizon at which materials become significantly magnetic to produce observable anomalies. Ordinarily this is an interface between relatively non-magnetic sedimentary rocks and ferromagnetic, igneous/metamorphic rocks, usually called "basement". However, "basement" to petroleum geologists identifies a surface below which rocks are no longer potentially productive. Therefore the usefulness of the aeromagnetic method in petroleum exploration depends on the correlation of the magnetic basement of the geophysicist with the economic basement of the petroleum geologist. Sediments usually have susceptibilities of less than 30×10^{-6} cgs whereas the metamorphic/igneous suite has values of the order of 1000×10^{-6} cgs. Magnetic basement in Tasmania ranges from the strongly magnetic granites and dolerites of the east coast to the weakly magnetic Cambrian and Pre-Cambrian rocks of the west coast.

V REGIONAL GEOLOGY

Only a small part of Tasmania has been covered by detailed geological surveys so the account of the geology of the Island is consequently a little vague.

Pre-Cambrian Rocks

These can be divided into two groups, the regionally metamorphosed schists, quartzites, slates etc. of central-west Tasmania and the little altered sandstones, quartzites, slates, dolomites etc. of the northwest part of the Island. Great thicknesses of these rocks occur, and occasionally they contain metamorphosed and unmetamorphosed igneous rocks.

Cambrian Rocks

These rocks consist of quartzites, slates, dolomites, with thick sequences of volcanics and range in age from Lower to Upper Cambrian. Cambrian rocks have been metamorphosed in some areas.

Ordovician Rocks

These rocks range from conglomerates to sandstones and limestones. The sandstones are siliceous and well-sorted. A shallow water origin for the sandstones is suggested by the presence of annelids and other shallow water fossils. The limestones are richly fossiliferous in places but no coral reefs as such have been reported. Shallow water deposition of some of the limestone is indicated by the presence of calcareous algae. The limestone has a bituminous odour when freshly broken and stylolites are common. Some dolomite is present in the limestone.

Silurian and Devonian Rocks

These rocks consist of conglomerates, quartzites, siltstones, and shales. Limestone which is partly coralline and sometimes dolomitized is present in the Port Hibbs area. A number of granite intrusions took place during the Devonian/Silurian. Devonian and older sedimentary rocks are not exposed in the area of EL 17/65 but a thin section

of Silurian/Devonian rocks is possibly present at depth. It is not known whether the thick Ordovician/Pre-Cambrian sections exposed to the west are also present in the area of EL17/65.

Permian Rocks

Rocks of the Permian age are widely distributed in Tasmania. Rock types range from a basal tillite to conglomerates, sandstones, oil shales, limestones, and coal measures.

Triassic Rocks

These rocks consist of quartzites, conglomerates and coal measures. The greatest known thickness of Triassic rocks is about 2,000 feet and present day distribution is confined to the southeast part of Tasmania.

Jurassic Rocks

Large scale intrusion of tholeiitic magma took place during the Jurassic. Permian and Triassic rocks have been intruded extensively by this magma. Jurassic sediments are not present in Tasmania.

Tertiary Rocks

Marine and non-marine Tertiary sediments are found at various places in Tasmania. The marine Tertiary rocks consist of a thin sequence of limestone and sandstone. Non-marine Tertiary up to 1,000 feet thick consists of silts, greywackes, and agglomerate.

Volcanic activity was widespread during the Tertiary. Basic volcanic rocks outcrop over an area of 1,600 square miles. Some of the sources of basaltic flows are located on Tertiary faults.

Structure

The Tasmanian shield has the gross form of a downward bent plane in its southeastern quadrant. In other words, it has a synclinal axis plunging southeastward with a Permian basin, later filled with Jurassic dolerites, occupying the core of the syncline. The rim is com-

posed of Lower Paleozoic sediments and intrusives with granites particularly common in the northeast. The undifferentiated Paleozoics are shown on the Tectonic Map of Australia of 1960 as "quartzite, phyllite, dolomite, conglomerate, schist, rare gneiss. Metamorphism to sillimanite grade. Moderate to strong folding. Basic intrusions." The terrane of undifferentiates is split by an arcuate band of Lower Devonian to Cambrian geosynclinal deposits with "moderate to strong folding. Greywacke, volcanic and pyroclastic rocks in Cambrian; sandstone, shale, limestone, and conglomerate in Ordovician, Silurian and Devonian. Ultrabasic and acid intrusions." This simple regional framework is distorted by a northwesterly trending salient from the inner Permian-Jurassic core which encounters the northern coast at Port Dalrymple. Certainly, the regional geology shows that the entire shield is basement as far as hydrocarbon exploration is concerned except for the possibility that some of the Permian section may be free of intrusives and metamorphism. The other potential on land would involve apparently thin and very localized Tertiary cover which is particularly present in the Port Dalrymple salient and within the western limb of the arcuate geosynclinal band of Lower Paleozoics.

Structure during the Tertiary is pertinent to this discussion. Tectonism during this period resulted in horst and graben structures across most of the Island. These structures, which trend approximately N/S, may persist onto the continental shelf and slope.

Petroleum prospects are possible in Ordovician to Tertiary rocks but the widespread occurrence of Jurassic dolerite intrusions diminishes the prospects in Pre-Tertiary rocks.

VI PREVIOUS GEOPHYSICAL SURVEYS

There has been no previous geophysical activity in the offshore portion of EL. 17/65.

VII RESULTS

The results are presented on observed Total Magnetic Intensity Maps compiled by Aero Service Limited and the Magnetic Basement Maps prepared by G.A.P.L. Both are submitted with this report on single sheets at scale of 1 : 250,000.

Observed Map

The observed field, contoured with an interval of 10 gamma wherever possible, is distinctly anomalous except for very limited and outstanding zones. Anomalies seem to result from induced magnetization by the earth's normal field. For large anomalies reference can be made to Figures A64 through A76 in GSA Memoir 47 for intra-basement anomalies at inclination 75°. These show that the negative components, here south of the southerly edges of causative bodies, commonly have amplitudes of 5% of the positive amplitude. Unpublished anomalies of thin plates, which can represent local structure, show that smaller anomalies in the range of 10 to 50 gamma have negative components of approximately one-third the value of the positive component.

Anomalies adjacent to or over the shoreland correlate directly with outcropping Jurassic dolerites. This terrane is at very shallow or zero depths under Stormy Bay east to 147°45' and on Tasman Peninsula east to 148°00'. Possibly a Precambrian basement is moderately deep in the "flat" magnetic areas east of these limits.

The dolerite's identification is based on the similarity of these anomalies with those farther south which occur, for example, in a narrow band parallel to the shore southward from 42°05'. This band is ten miles wide. Its abrupt termination is thought to be the faulted or intrusive edge of the dolerites.

Note also that the marked dissimilarity between the Paleozoic granites and the Jurassic dolerites can be traced along the north-south string of islands between 42°00' and 42°45' where both types occur on outcrop.

The Jurassic dolerite terrane may be followed around the coast to its abrupt termination along a north-south contact which is coincident with the Permian-Jurassic contact with its Paleozoic flank approximately at 146°45'. The Jurassic system of anomalies had previously lost its prominent north-south grain in places as the dolerites apparently form the shape of Tasmania in the southwest where arcuate northeast-southwest systems occur.

One can conjecture that the Port Dalrymple salient continues offshore through the syncline core southeastward under the coastal plain as is manifested by the northwest-southeast oriented system of anomalies entering approximately at 42°40' / 148°20'. Moreover, one can attempt to connect the northeastern flank of this system with similar trends just southwest of Cape Tourville at 42°10' / 148°05'.

Before leaving this eastern part of Tasmania, one must observe that the anomalies offshore are generally distinctly different from the Jurassic terrane. Many are characterized by east-west or subcircular forms which contrast sharply with the alternating positive and negative systems with north-south axis. It might be speculated that the offshore anomalies come from a Precambrian surface.

Jurassic terrane is missing west of a NNW line from 43°30'/146°40' to 42 15'/146°00' and indeed the magnetic field along the southwestern and western coasts differs from that over the dolerites. This is not to say that the field isn't generally intensely anomalous; but anomalies trend more northwesterly, do not vary as rapidly, and are not quite as sharp.

Beginning in the south, the small re-entrant of Lower Paleozoics on the mainland between 146°30' and 40' is in an area of weak magnetic field as though there may be a nonmagnetic section between the dolerites on the east and the undifferentiated Paleozoics on the west. The contact with the latter is as abrupt as with the former. The anomaly in the Paleozoics is sharp and oriented slightly west of north. More detailed geologic mapping shows that the rocks onshore are Precambrian.)

This anomaly is separated by a very narrow minimal area from another anomaly system which is somewhat unique for the area as it is east-west in trend. Little section can be expected over it, but farther offshore and west of it the field is flat as though there might be good sedimentary section.

Magnetic Basement Map

The magnetic basement is not difficult to map.

Difficulties stem from defining its geologic age.

"A" at 41°45'/148°30' is on a prominent nose at -9000 ft which also interrupts the northeastern basin. The large intrabasement anomaly at this location, probably generated by a relatively deep-seated intrusion, is nevertheless a good prospect.

"B" is farther offshore and in very deep water. The anomalies there imply the edge of the offshore basin, and this area calls attention to its eastern flank with about 3000 ft of relief from the axial part of the basin. The flank seems highly faulted.

"C" at 42°10'/148°30' is a nose west of a high with the basement at -8000 ft on the nose and -3500 ft on the north-south anticline. These terminate southward against a broad dome with little section. If there is enough section, the top is interesting. But in any event, the possibility of pinch-outs against its flanks should be examined.

There seems to be a right-lateral offset of the dolerite terrane enabling 6000 ft of section at "D" at 42°28'/148°20'. This marks the southern end of the northeastern basin which seems to terminate against the offshore continuation of what is herein called the Port Dalrymple salient. In addition, there is a lot of offshore faulting around the 100 fathom line which may indicate that the salient itself terminates.

The southeastern basin begins at area "E" at 43°00'/148°05' where specific attention is called to a half-block, upthrown to the east which only has about 3000 ft of section.

Farther south there is an eastward projection of the basement on a nose at "F" with section increasing from 5000 to 9000 ft at approximately 43°22'/148°00'.

South of here, but in deep water, there is good local structure at "G" at 43°32'/148°05'.

"H" at 43°50'/147°50' calls attention to a faulted anticline with NNE strike just west of the point and a small

dome with the basement at -6000 ft just east of it.

Finally, "I" farther south at 44°05'/147°45' calls attention to small noses on the western flank of the southeastern basin with the basement at -6000 ft. This is also in deep water.

Area "J" is a syncline or graben at 43°55'/147°20' where the basement is at -7500 ft in a very narrow area between areas of essentially no section to the north and south. It is not highly recommended at all.

"K" at 44°05'/146°45' calls attention to a north-south graben situated between the dolerite terrane in the east and the undifferentiated Paleozoics in the west. This is marked onshore by an outcrop of a small segment of Paleozoic geosynclinal material which apparently is nonmagnetic in this area, making the area probably not very prospective.

In general, contouring the magnetic basement at 1000 ft illustrates that the Jurassic dolerite terrane of eastern Tasmania is terminated abruptly, probably by faulting, along its eastern face. This is another way of saying that it is responsible for the land form of Tasmania in the east. The shelf is narrow on the east; and, when this is combined with the fact that the Jurassic terrane extends offshore, there is little room for well-developed basins along the eastern coast. These contain shallow magnetic materials which make the definition of basement somewhat unreliable.

Conclusion

This reconnaissance aeromagnetic survey with flight lines spaced at two miles, flown approximately perpendicular to the coast, is quite adequate for the purpose of defining the prospectiveness of the coastal areas of Tasmania for oil and gas. Ties to land show that the variable geology of the shore is irrelevant because most of the land area is magnetic basement. The relatively nonmagnetic areas which are found are small although quite numerous.

GRAVITY METER EXPLORATION COMPANY

Nelson C. Steenland

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VIII ELEMENTS OF AEROMAGNETIC INTERPRETATION

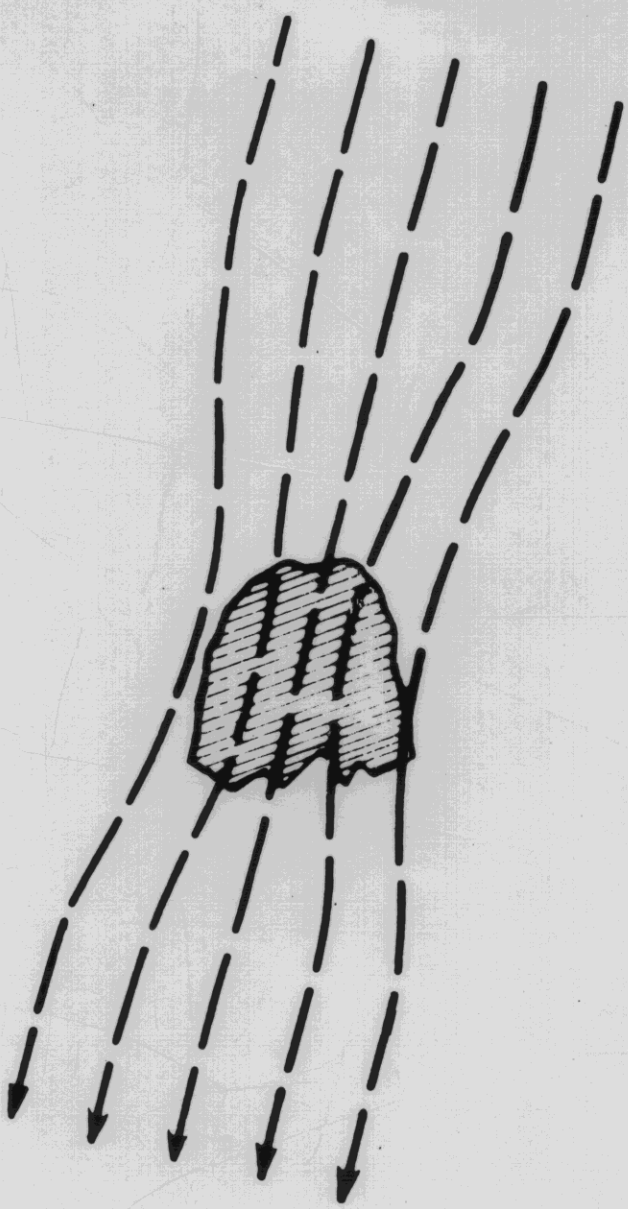
In general, the earth is a uniformly magnetized sphere with a generally uniform external magnetic field. This phenomenon has been known since the beginnings of civilization as attested by such primitive practices as navigation by the magnetic compass.

There are local distortions to this magnetic field, and man has long been aware of these also. Several centuries ago, even in 1640, the so-called distortions or anomalies were employed for the search of iron ores; so magnetic exploration is one of the earliest geophysical methods.

The local distortion suggested by Figure 1 is occasioned by a mass of more easily magnetized material, soft iron for example, than the surrounding space where the magnetic susceptibility is zero. It is more convenient for the magnetic lines of force to travel through the material than through space so they are crowded together in the vicinity of the material. In other words, the magnetic intensity is increased and a positive distortion or anomaly is created above and below the mass.

A geologic explanation of a magnetic anomaly must translate the disturbing mass into a geologic entity of some sort. Where to begin? Fortunately there is a magnetic classification that follows a geologic classification. For the most part, sedimentary rocks have little, if any, magnetic susceptibility, whereas igneous and metamorphic rocks, the basement rocks, have susceptibilities that range from 100 to 10,000 times that of sedimentary rocks. Therefore, rock masses of variable susceptibilities will, in the main, be confined to basement rocks.

Can the distorting basement masses be further defined by examining their possible configuration? First of all, what is the nature of these common local distortions to the normal field? Commonly, anomalies of several hundred gamma, normal intensity is tens of thousands of gamma, are observed over several tens of square miles. Such anomalies cannot originate in thin sheets of highly magnetized rocks because the opposing polarity of the top and bottom layers would essentially obliterate the magnetic effect. Therefore, the anomalous rock mass must have great depth extent.



AEROMAGNETIC ANOMALY

FIGURE 1

Secondly, the rock mass must uniformly magnetized as dissimilar internal magnetization would also tend to reduce the net magnetic effect.

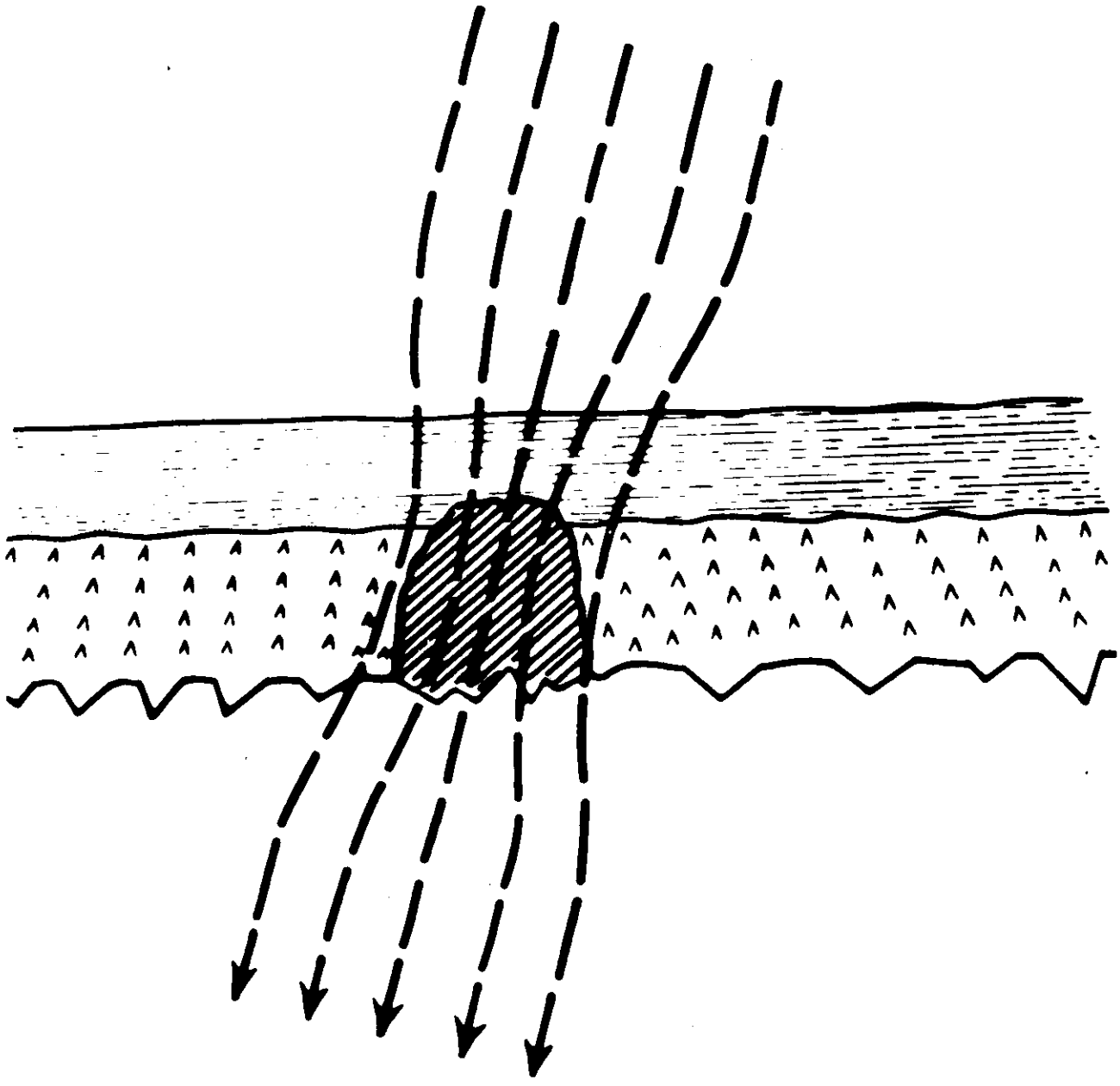
The third limitation is more or less inferred from the definiteness of the observed anomalies. It consists simply of assuming that the basement magnetic units are bounded by vertical sides and that their upper surfaces are approximately coincident with the basement's surface.

So the nebulous mass of Figure 1 can be translated into a geologic entity, the intrabasement unit of Figure 2.

Figure 2 also shows the increased magnetic intensity over an intrabasement rock unit, the primary source of anomalies observed on magnetic maps. Their existence has been known throughout the years of magnetic prospecting, and they are in no sense a discovery of the airborne magnetometer. The anomalies are actually of sufficient amplitude and area to have been mapped rather accurately by earlier magnetic instruments, most of which measured the vertical magnetic intensity to an accuracy of five gamma with careful surveying practices.

In theory, the airborne magnetometer, which measures total intensity, can yield no more information that the ground instruments. If even the same locations were read with the land-type instrument and the airborne magnetometer, the only advantage would be an increase in accuracy as the probable error of an aeromagnetic value can easily be less than two gamma. The fact that total intensity is measured instead of vertical intensity is of no import. The one can be computed from the other and vice versa. True enough, the aeromagnetic data can be obtained at several higher levels. This is likewise of no import. Higher levels can be computed from lower levels to as great an accuracy as they can be flown and at much less cost, too. So no new information is provided by an aeromagnetic survey that essentially repeats a ground survey.

There is this distinction, however. The airborne magnetometer is able to obtain so much more data so much more rapidly and accurately that it is really an entirely new tool of exploration. The great increase in data is primarily the result of the continuous recording of the magnetic field by the airborne magnetometer, one of the few



BASEMENT EFFECT

FIGURE 2

geophysical instruments that make a continuous record. Secondarily it is the result of the ability of the airborne instrument to fly as many lines as desired over territory that simply cannot be inaccessible to it.

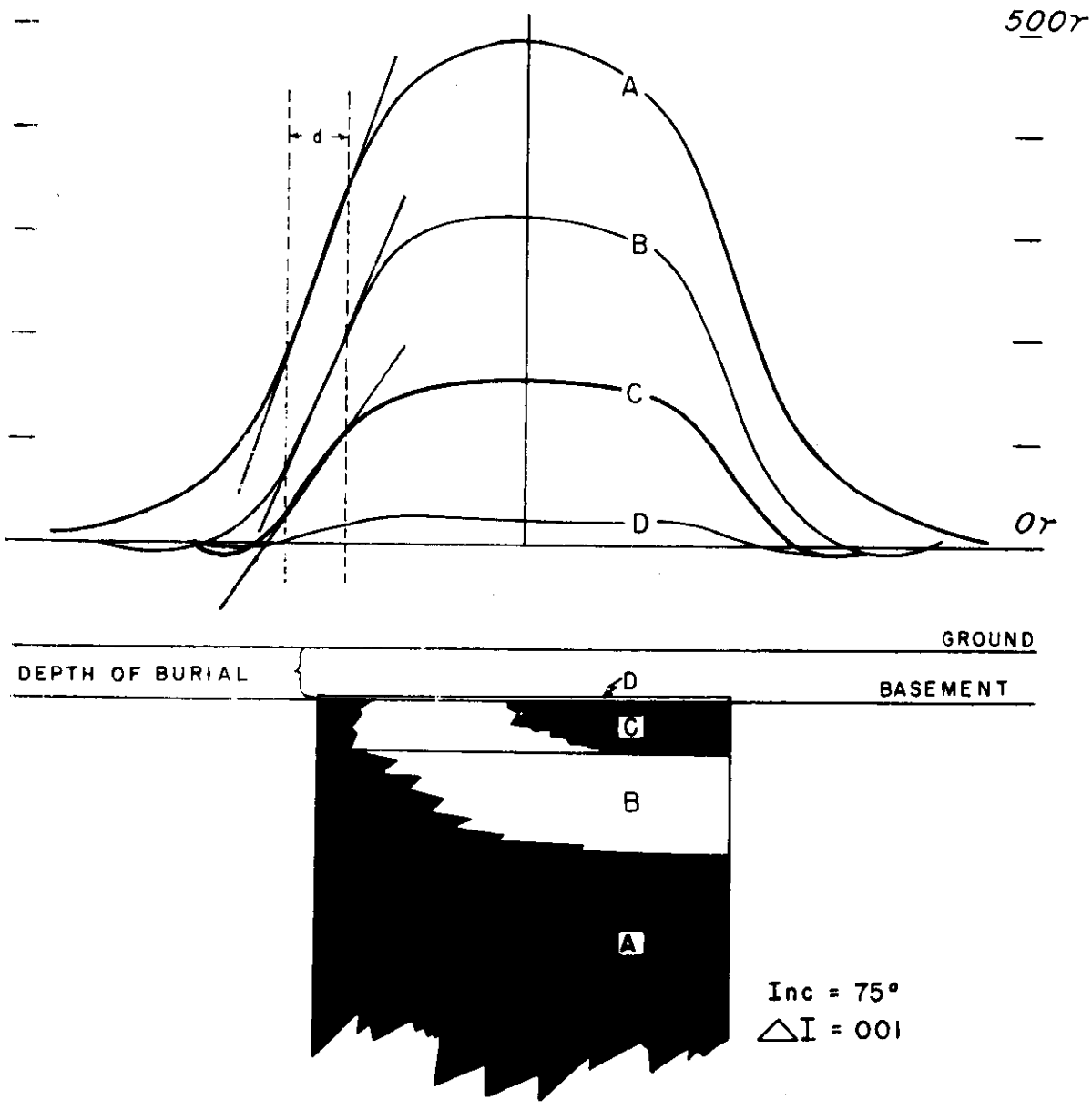
Returning to Figure 2, the intrabasement unit, the primary source of magnetic anomalies, can serve as the fundamental basis of interpretation. For example, theoretical aeromagnetic anomalies can be computed for a large assortment of of intrabasement blocks.

Figure 3 illustrates a series of east-west profiles computed for an intrabasement block which has a surface eight units of length on a side, with a unit of length equal to the depth of burial. This series illustrates the change in amplitude as the thickness of the intrabasement block is changed. For example, the uppermost profile, with a maximum amplitude of 500 gamma, corresponds to the block which is infinitely thick. The essential shape of the profile is determined by the depth of burial of the block because the amplitude of the anomaly can be drastically changed by assigning different magnetization contrasts to the block. Such changes can be compensated by altering the vertical scale of the profiles so that the profile maintains its original shape. An example of a function of the curve which varies with the depth of burial of the block is, for example, the horizontal length of the constant gradient. Such a property of an anomaly is derived from its shape and not its amplitude and can, therefore, be used to compute the depth of burial of an intrabasement block.

The second profile from the top is similar to the upper one except that the thickness of the intrabasement block is reduced to three units. This limitation essentially only affects the amplitude of the anomaly. The horizontal length of the linear gradient has practically remained constant. The same conclusions are reached from a block only one unit thick as shown in the next profile. This profile, although considerably reduced in amplitude, has depth indices which are only reduced by approximatley 10 percent.

Therefore, it can be concluded that the assumption that intrabasement blocks are infinitely thick is a practicably useful assumption.

The assumption which is most suspect is that these intrabasement



INTRABASEMENT AND SUPRABASEMENT EFFECTS

FIGURE 3

magnetic units are bounded by vertical sides. This problem has been investigated along with the other assumptions by the empirical test of calculating from the magnetic anomalies the depths to the basement's surface where they actually are known. These investigations have altogether supported the assumption of vertical sides. Preliminary results of such tests were the basis of the first publication on this method of interpretation, Geological Society of America Memoir No. 47, 1951.

The fourth or lowermost curve of Figure 3 is derived from a thin sheet of magnetic or basement material which is located on the basement's surface as shown on top of the basement block. This sheet has the top and bottom layers of the disturbing mass in close proximity, thereby decreasing the amplitude of the anomaly to a maximum of 21 gamma. Moreover, the depth indices are also significantly decreased substantially. This type of anomaly is called the suprabasement anomaly and is applicable to sheets with thicknesses up to approximately 20 percent of the depth at burial. The sheet shown in Figure 3 is actually 10 percent of the depth to burial. This second category of anomalies has an obviously useful role in magnetic prospecting for it represents relief of the basement's surface. Sufficient data are accumulated from actual surveys over known surfaces to demonstrate that these anomalies do exist and that their representation by a thin sheet is a valid one.

The two fundamental types of magnetic anomalies have been developed at this point and are called "intrabasement" and "suprabasement" according to their geneses. An interpretation starts with the instrabasment anomalies which afford computations of the depth to the basement's surface. Two internal methods are available with which to evaluate the results of the depth computations. First, the estimates made from various measurements on one anomaly must agree among themselves. Second, the depth which is finally assigned to that anomaly must conform to the regional basement configuration which is being developed by the depth computations from all of the intrabasement anomalies. Naturally, the degree of conformity is arbitrary. The regional structure of the basement's surface is that which the interpreter is assigning to the area.

After the intrabasement anomalies have been examined for depths, anomalies remain which are too small or too sharp

to originate from the intrabasement block. These are residual anomalies which may, because of their shape, be assumed to originate from the basement's surface. If that is correct, these are the suprabasement anomalies which may be of direct and local importance for petroleum exploration when the superimposed sediments have related structure.

Figure 4 illustrates a typical suprabasement anomaly by way of an east-west profile. The profile is relatively large in order to show the details of an anomaly. Of interest are the flanking negatives, the sharpness of the positive gradients, and the broad, flat nature of the apex of the anomaly. Of course, if the edges of the plate become even more separated so that the distance between them is considerably great compared to the depth of burial of the plate, the apex of the anomaly can easily degenerate into two apexes, each occuring near the edge of the plate with a lower intensity between them over the centre part of the plate.

Some mention should be made of the preponderance of the occurrence of this type of anomaly in association with obvious intrabasement anomalies. The association may be classified as follows:

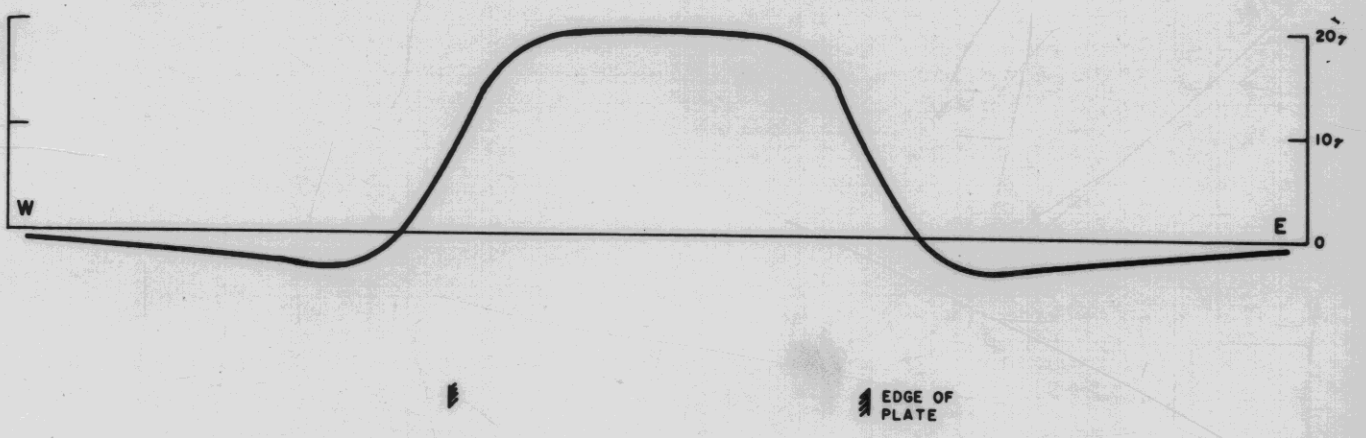
(a) Superposition or congruency with an intrabasement anomaly,

(b) occuring adjacent to or as noses from intrabasement anomalies, and

(c) occurrence along an obvious intrabasement trend but not otherwise connected with any assumed intrabasement anomalies.

The reason for introducing these categories may be apparent from their clarification. The first instance attempts to describe the case where large anomalies with amplitudes of hundreds of gamma yield depth estimates which are much too shallow from the point of view of the regional configuration. It then becomes necessary to introduce a residual anomaly, along with the intrabasement anomaly and usually on its crest, in order to use suprabasement coefficients which must, if these assumptions are correct, place the

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TYPICAL AEROMAGNETIC PROFILE FOR THIN PLATE
NORMAL MAGNETIZATION AT INCLINATION 75°

FIGURE 4

basement at a deeper and correct depth. Translated into geologic terms, this means that a lithologic unit of relatively high magnetic polarization would either (1) have sufficient relief on the basement's surface to cause a concomitant suprabasement effect or (2) have a phenomenal layer of mineralization at and immediately under the basement's surface in order to create the suprabasement effect. The latter interpretation is favoured in spite of its perhaps more difficult manifestation because too many instances of this first category (a) occur in the interpretation.

The second category is considered to mean, geologically, that the more highly magnetically polarized intrabasement units flare out either on or immediately under the basement's surface rather than having a sharp vertical contact extending completely to the basement's surface. This is suggested by the fact that many large anomalies nose, especially along their strike, with such magnitude that the presence of additional thin plates of material at or near the basement's surface must be assumed. In this second case, as in the first case, the observed anomaly is not completely accounted for by either a suprabasement or intrabasement type but by a combination of these.

In the third category, the anomaly is completely accounted for by a suprabasement residual, but the occurrence of the anomaly along a previously recognized or assumed intrabasement trend suggests strongly that the anomaly is caused by an intrabasement slab of relatively highly polarized material rather than by relief of the basement's surface.

Of course, these considerations are a matter of interpretation because the distinctions are made not from the anomalies themselves but from assumptions regarding their origins.

GRAVITY METER EXPLORATION COMPANY

Nelson C. Steenland

Nelson C. Steenland

APPENDIX I

Data Resumé

NAME OF SURVEY	Offshore Tasmania
CONTRACTOR	Aero Service Limited, Sydney, Australia

FLYING	
INITIATION	12th October, 1966
COMPLETION	6th November, 1966
SURVEY MILEAGE	
LINEAR	1874
AIRCRAFT	Aero Commander
LOCATION SYSTEM	Doppler
FLIGHT DIRECTION	Perpendicular to coast line
FLIGHT ALTITUDE	1500 and 3750 ft asl
TRAVERSE INTERVAL	2 nautical miles
MAGNETOMETER	

ORIGINAL RECORDING

	Type	Vertical Scale	Horizontal Scale	Quality
ANALOG	Rectilinear	300 gamma	0.82 miles per inch	Good

PRINCIPAL FACTS OF EARTH'S NORMAL FIELD

INCLINATION	72°
DECLINATION	10°E
INTENSITY	63,000 gamma

OBSERVED MAPS

SCALE	1/250,000

MAGNETIC BASEMENT MAPS

BASE	Overlay on halftone observed Map
SCALE	1/250,000
NUMBER OF SHEETS	1
CONTOUR INTERVAL	1000 ft

147°30' 147°45' 148°00' 148°15' 148°30'

41°30'

41°45'

42°00'

42°15'

42°30'

RIVER

ESK

SOUTH

EL 17/65 ELECTROLYTIC ZINC

MACQUARIE RIVER

T 376 T 374 T 372 T 370 T 368 T 366 T 364 T 362 T 360 T 358 T 356 T 352

T L M

T L N

T L O

EL 17/65 ELECTROLYTIC ZINC

EL 19/65 ESSO

TRAVERSE INTERVAL — 2 NAUTICAL MILES (APPROX.)
CONTROL LINE INTERVAL — VARIABLE
FLIGHT ALTITUDE — 1500 FEET A.S.L.
CONTOUR INTERVAL — 5 & 10 GAMMA
BASE INTENSITY — ARBITRARY
REGIONAL VARIATION CORRECTION APPLIED
PROJECTION — TRANSVERSE MERCATOR

HORIZONTAL CONTROL DERIVED FROM DOPPLER NAVIGATION AND PUBLISHED GOVERNMENT MAPS.

COMPILED BY B.K. LENON & ASSOC PTY LTD.



TOTAL MAGNETIC INTENSITY

AEROMAGNETIC SURVEY — OFFSHORE TASMANIA

EXPLORATION LICENCE 17/65 (flight paths)

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

SCALE 1:126,720

MILES 2 1 0 2 4 6 8 10 MILES

5 cm

AERO SERVICE LIMITED
SYDNEY, AUSTRALIA.

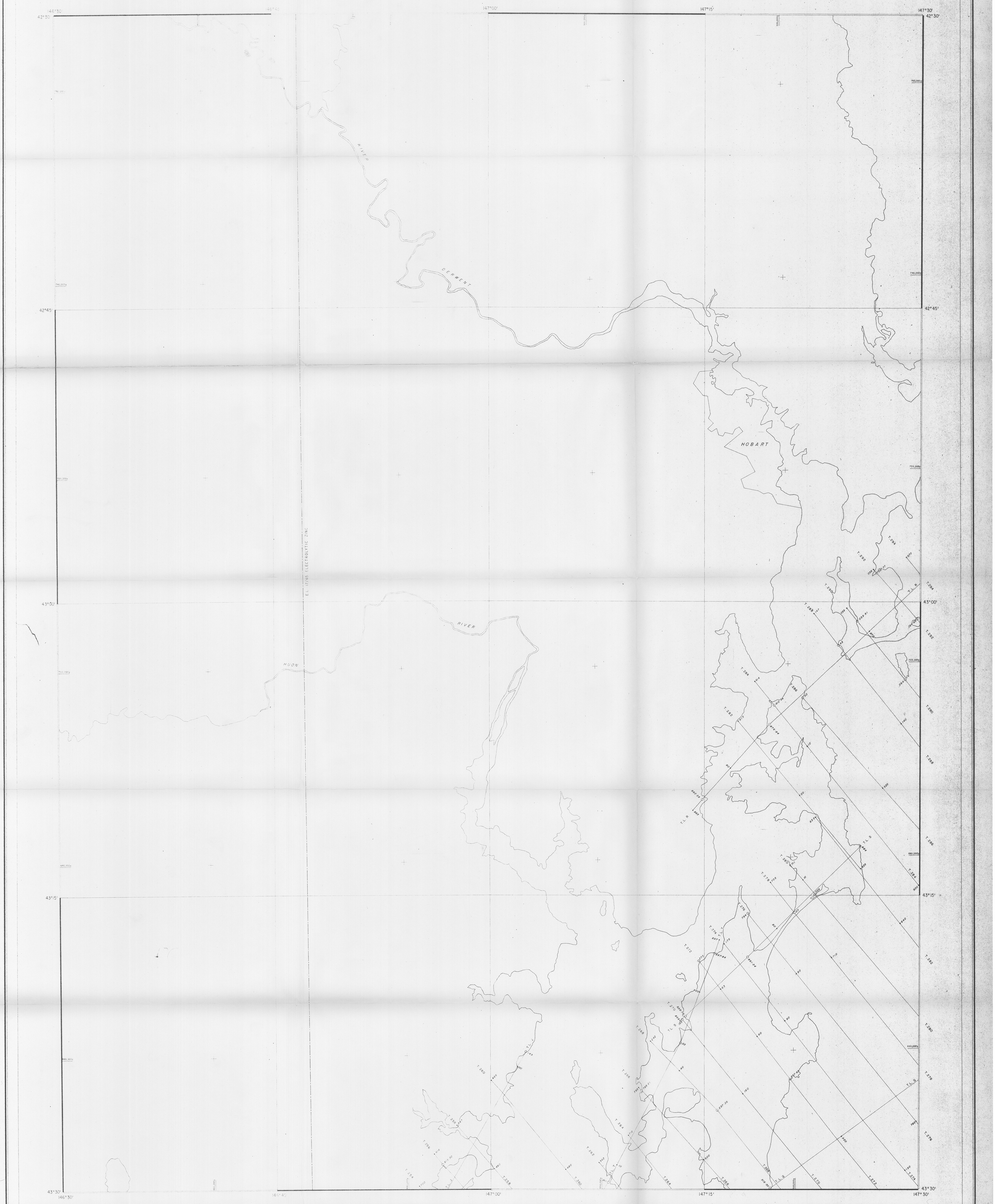
036045

SHEET 1

CR-082

Offshore Airmag part-1*

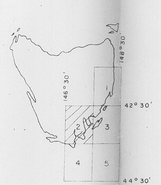
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TRAVERSE INTERVAL — 2 NAUTICAL MILES (APPROX.)
CONTROL LINE INTERVAL — VARIABLE
FLIGHT ALTITUDE — 1500 FEET A.S.L.
CONTOUR INTERVAL — 5 & 10 GAMMA
BASE INTENSITY — ARBITRARY
REGIONAL VARIATION CORRECTION APPLIED
PROJECTION — TRANSVERSE MERCATOR

HORIZONTAL CONTROL DERIVED FROM DOPPLER NAVIGATION AND PUBLISHED GOVERNMENT MAPS

COMPILED BY B.K. LENON & ASSOC. PTY. LTD.



TOTAL MAGNETIC INTENSITY

AEROMAGNETIC SURVEY — OFFSHORE TASMANIA

EXPLORATION LICENCE 17/65 (flight paths)

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

SCALE 1:126,720

MILES 2 1 0 2 4 6 8 10 MILES

5 cm

AERO SERVICE LIMITED
SYDNEY, AUSTRALIA

036046

SHEET 2

OR:082

Offshore Armag part-I*

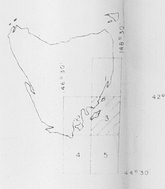
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CONTOUR INTERVAL — 5 & 10 GAMMA
BASE INTENSITY — ARBITRARY
REGIONAL VARIATION CORRECTION APPLIED
PROJECTION — TRANSVERSE MERCATOR

HORIZONTAL CONTROL DERIVED FROM DOPPLER NAVIGATION AND PUBLISHED GOVERNMENT MAPS

COMPILED BY B.A. LENON & ASSOC. PTY. LTD.



TOTAL MAGNETIC INTENSITY

AEROMAGNETIC SURVEY — OFFSHORE TASMANIA

EXPLORATION LICENCE 17/65 (flight paths)

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

SCALE 1:126,720

MILES 2 1 0 2 4 6 8 10 MILES

5 cm

AERO SERVICE LIMITED
SYDNEY, AUSTRALIA.

026047

SHEET 3

OR-082

146°30'
146°45'
147°00'
147°15'
147°30'
43°30'
43°45'
44°00'
44°15'
44°30'

E.L 17/65 ELECTROLYTIC ZINC
E.L 18/65 ESSO

T 250 T 252 T 254 T 256 T 258 T 260 T 262 T 264 T 266 T 268 T 270 T 272

T.L U T.L T T.L Q

640,000y 620,000y 600,000y 580,000y 560,000y 540,000y

460,000x 480,000x 500,000x 520,000x

TASMAN SEA

TRAVERSE INTERVAL — 2 NAUTICAL MILES (APPROX.)
CONTROL LINE INTERVAL — VARIABLE
FLIGHT ALTITUDE — 1500 FEET A.S.L.
CONTOUR INTERVAL — 5 & 10 GAMMA
BASE INTENSITY — ARBITRARY
REGIONAL VARIATION CORRECTION APPLIED
PROJECTION — TRANSVERSE MERCATOR

HORIZONTAL CONTROL DERIVED FROM DOPPLER NAVIGATION AND PUBLISHED GOVERNMENT MAPS.

COMPILED BY B.K. LENON & ASSOC. PTY. LTD.



TOTAL MAGNETIC INTENSITY

AEROMAGNETIC SURVEY — OFFSHORE TASMANIA

EXPLORATION LICENCE 17/65 (flight paths)

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

SCALE 1:126,720

MILES 2 1 0 2 4 6 8 10 MILES

5 cm

AERO SERVICE LIMITED
SYDNEY, AUSTRALIA

03604S

SHEET 4

OR-082

Offshore Airmag part-1*

147°30' 147°45' 148°00' 148°15' 148°30'

43°30' 43°45' 44°00' 44°15' 44°30'

T 272 T 274 T 276 T 278 T 280 T 282 T 284 T L E T 286 T 288 T 290 T 292 T 294

E L 17/65 ELECTROLYTIC ZINC
E L 18/65 ESSO

T A S M A N S E A

620,000y 600,000y 580,000y 560,000y 540,000y

TRAVERSE INTERVAL — 2 NAUTICAL MILES (APPROX.)
CONTROL LINE INTERVAL — VARIABLE
FLIGHT ALTITUDE — 1500 FEET A.S.L.
CONTOUR INTERVAL — 5 & 10 GAMMA
BASE INTENSITY — ARBITRARY
REGIONAL VARIATION CORRECTION APPLIED
PROJECTION — TRANSVERSE MERCATOR

HORIZONTAL CONTROL DERIVED FROM DOPPLER NAVIGATION AND PUBLISHED GOVERNMENT MAPS.

COMPILED BY B.K. LENON & ASSOC. PTY. LTD.

TOTAL MAGNETIC INTENSITY

AEROMAGNETIC SURVEY — OFFSHORE TASMANIA

EXPLORATION LICENCE 17/65 (flight paths)

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

SCALE 1:126,720

MILES 2 1 0 2 4 6 8 10 MILES

5 cm

AERO SERVICE LIMITED
SYDNEY, AUSTRALIA.

036049 SHEET 5

OR-082

Offshore Airmag part-1*

5

147°30' 147°45' 148°00' 148°15' 148°30'

41°30' 41°45' 42°00' 42°15' 42°30'

ESK RIVER

SOUTH ESK

MACQUARIE RIVER

EL 17/65 ELECTROLYTIC ZINC

EL 17/65 ELECTROLYTIC ZINC

EL 19/65 ESSO

T.L.N

T.L.O

T.376 T.374 T.372 T.370 T.368 T.366 T.364 T.362 T.360 T.358 T.356 T.352

TRAVERSE INTERVAL — 2 NAUTICAL MILES (APPROX.)
CONTROL LINE INTERVAL — VARIABLE
FLIGHT ALTITUDE — 1500 FEET A.S.L.
CONTOUR INTERVAL — 10 GAMMA
BASE INTENSITY — ARBITRARY
REGIONAL VARIATION CORRECTION APPLIED
PROJECTION — TRANSVERSE MERCATOR

HORIZONTAL CONTROL DERIVED FROM DOPPLER NAVIGATION AND PUBLISHED GOVERNMENT MAPS.

COMPILED BY B.K. LENON & ASSOC. PTY. LTD.



TOTAL MAGNETIC INTENSITY

AEROMAGNETIC SURVEY — OFFSHORE TASMANIA

EXPLORATION LICENCE 17/65

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

SCALE 1:100,000

MILES 2 1 0 2 4 6 8 MILES

5 cm

AERO SERVICE LIMITED
SYDNEY, AUSTRALIA.

036050 SHEET 1

OR-082

Offshore Airmag part-1*

6

146°30' 146°45' 147°00' 147°15' 147°30'

42°30'

42°45'

43°00'

43°15'

43°30'

RIVER DERWENT

HOBART

E.L. 17/65 ELECTROLYTIC ZINC

RIVER HUON

760,000y 740,000y 720,000y 700,000y 680,000y 660,000y

480,000x 500,000x 520,000x 540,000x 560,000x

TRAVERSE INTERVAL — 2 NAUTICAL MILES (APPROX.)
CONTROL LINE INTERVAL — VARIABLE
FLIGHT ALTITUDE — 1500 FEET A.S.L.
CONTOUR INTERVAL — 10 GAMMA
BASE INTENSITY — ARBITRARY
REGIONAL VARIATION CORRECTION APPLIED
PROJECTION — TRANSVERSE MERCATOR

HORIZONTAL CONTROL DERIVED FROM DOPPLER NAVIGATION AND PUBLISHED GOVERNMENT MAPS.

COMPILED BY B.K. LENON & ASSOC. PTY. LTD.



TOTAL MAGNETIC INTENSITY

AEROMAGNETIC SURVEY — OFFSHORE TASMANIA

EXPLORATION LICENCE 17/65

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

SCALE 1:100,000

MILES 2 1 0 2 4 6 8 MILES

5 cm

AERO SERVICE LIMITED
SYDNEY, AUSTRALIA

036051

SHEET 2

OR-082

Offshore Armag part-I*

TRIABUNNA

SORELL

TASMAN PENINSULA

TASMAN SEA

E.L. 17/65 ELECTROLYTIC ZINC
E.L. 19/65 ESSO

TRAVERSE INTERVAL — 2 NAUTICAL MILES (APPROX.)
CONTROL LINE INTERVAL — VARIABLE
FLIGHT ALTITUDE — 1500 FEET A.S.L.
CONTOUR INTERVAL — 10 GAMMA
BASE INTENSITY — ARBITRARY
REGIONAL VARIATION CORRECTION APPLIED
PROJECTION — TRANSVERSE MERCATOR

HORIZONTAL CONTROL DERIVED FROM DOPPLER NAVIGATION AND PUBLISHED GOVERNMENT MAPS.

COMPILED BY B.K. LENON & ASSOC. PTY. LTD.



TOTAL MAGNETIC INTENSITY

AEROMAGNETIC SURVEY — OFFSHORE TASMANIA

EXPLORATION LICENCE 17/65

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

SCALE 1:100,000

MILES 2 1 0 2 4 6 8 MILES

5 cm

AERO SERVICE LIMITED
SYDNEY, AUSTRALIA.

036052 SHEET 3

OR-082

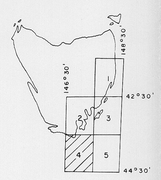
Offshore Airmag part-I*



TRAVERSE INTERVAL — 2 NAUTICAL MILES (APPROX.)
CONTROL LINE INTERVAL — VARIABLE
FLIGHT ALTITUDE — 1500 FEET A.S.L.
CONTOUR INTERVAL — 10 GAMMA
BASE INTENSITY — ARBITRARY
REGIONAL VARIATION CORRECTION APPLIED
PROJECTION — TRANSVERSE MERCATOR

HORIZONTAL CONTROL DERIVED FROM DOPPLER NAVIGATION AND PUBLISHED GOVERNMENT MAPS.

COMPILED BY B.K. LENON & ASSOC. PTY. LTD.



TOTAL MAGNETIC INTENSITY

AEROMAGNETIC SURVEY — OFFSHORE TASMANIA

EXPLORATION LICENCE 17/65

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

SCALE 1:100,000

MILES 2 1 0 2 4 6 8 MILES

5 cm

AERO SERVICE LIMITED
SYDNEY, AUSTRALIA.

036053 SHEET 4

CR.082

Offshore Airmag part-I*

9

147°30' 147°45' 148°00' 148°15' 148°30'

43°30' 43°45' 44°00' 44°15' 44°30'

T 272 T 274 T 276 T 278 T 280 T 282 T 284 T 286 T 288 T 290 T 292 T 294

T L U

640,000 y 620,000 y 600,000 y 580,000 y 560,000 y 540,000 y

6740 6750 6760 6770 6780 6790 6800 6810 6820 6830 6840 6850 6860 6870 6880 6890 6900 6910 6920 6930 6940 6950 6960 6970 6980 6990 7000

E.L. 17/65 ELECTROLYTIC ZINC

E.L. 18/65 ESSO

TASMAN SEA

TRAVERSE INTERVAL — 2 NAUTICAL MILES (APPROX.)
CONTROL LINE INTERVAL — VARIABLE
FLIGHT ALTITUDE — 1500 FEET A.S.L.
CONTOUR INTERVAL — 10 GAMMA
BASE INTENSITY — ARBITRARY
REGIONAL VARIATION CORRECTION APPLIED
PROJECTION — TRANSVERSE MERCATOR

HORIZONTAL CONTROL DERIVED FROM DOPPLER NAVIGATION AND PUBLISHED GOVERNMENT MAPS.

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TOTAL MAGNETIC INTENSITY

AEROMAGNETIC SURVEY — OFFSHORE TASMANIA

EXPLORATION LICENCE 17/65

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

SCALE 1:100,000

MILES 2 1 0 2 4 6 8 MILES

5 cm

AERO SERVICE LIMITED
SYDNEY, AUSTRALIA.

036054

SHEET 5

OE.088