1963/173
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1963/173

GEOPHYSICAL BRANCH

SUMMARY OF ACTIVITIES

1963

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1963/173
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The following notes summarise the activities of the Geophysical Branch during 1963.

For many surveys, the notes have been prepared before the data have been analysed completely and the conclusions reached are therefore tentative. Use should not be made of the data without first checking as to its validity. Preferably potential users within the Bureau should await the full analysis of the data and the issue of Records.

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CONTENTS

	Page
OIL SEARCH	
1. Seismic Surveys No. 1 Party	1
South-eastern Georgina Basin, Q.	1
Thargomindah Area, Q.	2
No. 2 Party	
Southern Carnarvon Basin, W.A.	3
Coolcalalaya Basin, W.A.	3
2. Aeromagnetic Surveys	4
North-eastern South Australia (partly under Contract)	4
Simpson Desert (contract)	4
Bowen Basin, Q. (VH-MIN)	5
Georgina Basin, Q. and N.T. (VH-MIN)	5
Sydney Basin, N.S.W.	6
3. Gravity Surveys	7
Great Artesian Basin, Q.	7
Great Artesian Basin, Q. (Contract)	7
Gravity Readings along Seismic Traverses, Q. and N.T.	7
4. Well Logging	8
METALS SEARCH	
1. Ground Metalliferous Surveys	9
Zeehan, Tasmania	9
Mt. Cleveland, Tasmania	9
Stawell, Victoria	10
Gibsonvale-Kikoira, N.S.W.	10
Mt. Cuthbert-Dobbyn, Q.	10
Mt. Isa Gravity Tests, Q.	11
I.P. Tests, Hundred of Goyder	11
Metalliferous Surveys, Darwin Group	11
Dolorite Ridge to Mt. Fitch	12
Reconnaissance Slingram Surveys	12
Tennant Creek	12
2. Airborne Metalliferous Surveys (VH-GEO)	13
Cobar Experimental Survey N.S.W.	13
Mt. Isa, Q.	13
Mt. Cuthbert-Dobbyn, Q.	13
3. Special Mineral Survey Programme, N.T.	15
Darwin-Pine Creek, N.T. Aeromagnetic Survey	15
MacArthur River, N.T. Aeromagnetic Survey	15
Union Reefs, MacArthur River (Contract)	15

NON METALS SEARCH

Gungahlin, A.C.T. 17

ENGINEERING GEOPHYSICS

Lake George, A.C.T. 18

1. Damsites

Northern Territory 18
Pieman River, Tas. 18
Gordon River, Tas. 18
Meadowbanks Damsite, Tas. 18

2. Flume and Tunnel Lines

Murchison Flume, Tas. 18
Sophia Tunnel, Tas. 18
Wilmot Tunnel 19
Ramu Valley Hydro Scheme, T.P.N.G. 19

3. Underground Water

Burdekin Delta Q. 19
Giru area, Haughton River, Q. 19

4. Rock Testing 19

5. Vibration Testing

Lake Bellfield Dam
Halls Gap, Vic. 19

REGIONAL SURVEYS

1. Regional Gravity Surveys 20

2. Regional Magnetic Surveys 21

OBSERVATORIES 22

LABORATORIES

1. Design and Development 24

2. Maintenance and Testing 25

WORKSHOPS 26

OIL SEARCH

SEISMIC PARTY NO.1.

1. SEISMIC SURVEYS

South-eastern Georgina Basin

Seismic Party No.1 commenced work on this survey on 26th April 1963 near Marion Downs station. Because it was not then possible to cross the flooded Georgina River, a month was spent doing reconnaissance reflection and refraction work between Marion Downs and Phillips' Canary No.1 bore. The results of this work are rather inconclusive regarding the presence or absence of Lower Palaeozoic sediments between Marion Downs and Canary.

Refraction probes were done on four more or less equally spaced traverses. If it can be assumed firstly that horizons with similar refraction velocities can be correlated from one traverse to the other across gaps of about 10 miles (i.e. that there are no major faults, facies changes or unconformities between traverses) and secondly that the sediments encountered beneath the cretaceous at 500 feet in Canary bore were Proterozoic, as believed by Phillips' geologists, then it seems likely that dips are consistently to the east and there are no Lower Palaeozoic sediments in this area. On the other hand, refraction velocities higher than the velocities measured for the Proterozoic in the Canary and Black Mountain bores were encountered at fairly shallow depth on the two westernmost traverses and it has been suggested that these refractors might represent Lower Palaeozoic rocks. Reflection work near Marion Downs and Canary indicated near-horizontal strata near the surface and some easterly-dipping horizons at depth.

From the latter part of May to the end of September, the party worked in the Pulchera-Yarrandilla area northwest of Sandringham station. The principal traverse shot was a continuous reflection traverse surveyed for 30 miles from Yarrandilla yard south-west past Pulchera waterhole across a gravity trough. Good reflections were obtained over 85% of the traverse. These revealed the existence of an assymetrical trough of sediments with relatively gentle slopes on the north-east side, an axis west of the gravity anomaly axis and a tectonically disturbed zone on the south-west side. The main reflecting horizon occurs at a depth of over 10,000 feet near the synclinal axis and there are indications of more sediments below it. This horizon was followed to the north-east until its depth was only about 300 feet. It was then drilled and cored and the samples obtained were identified as calcareous dolomite, probably of Lower Ordovician age. The traverse evidently crosses a major fault in the vicinity of Pulchera waterhole, but although some shorter supplementary traverses were shot in this area, the nature of the fault was not clearly defined.

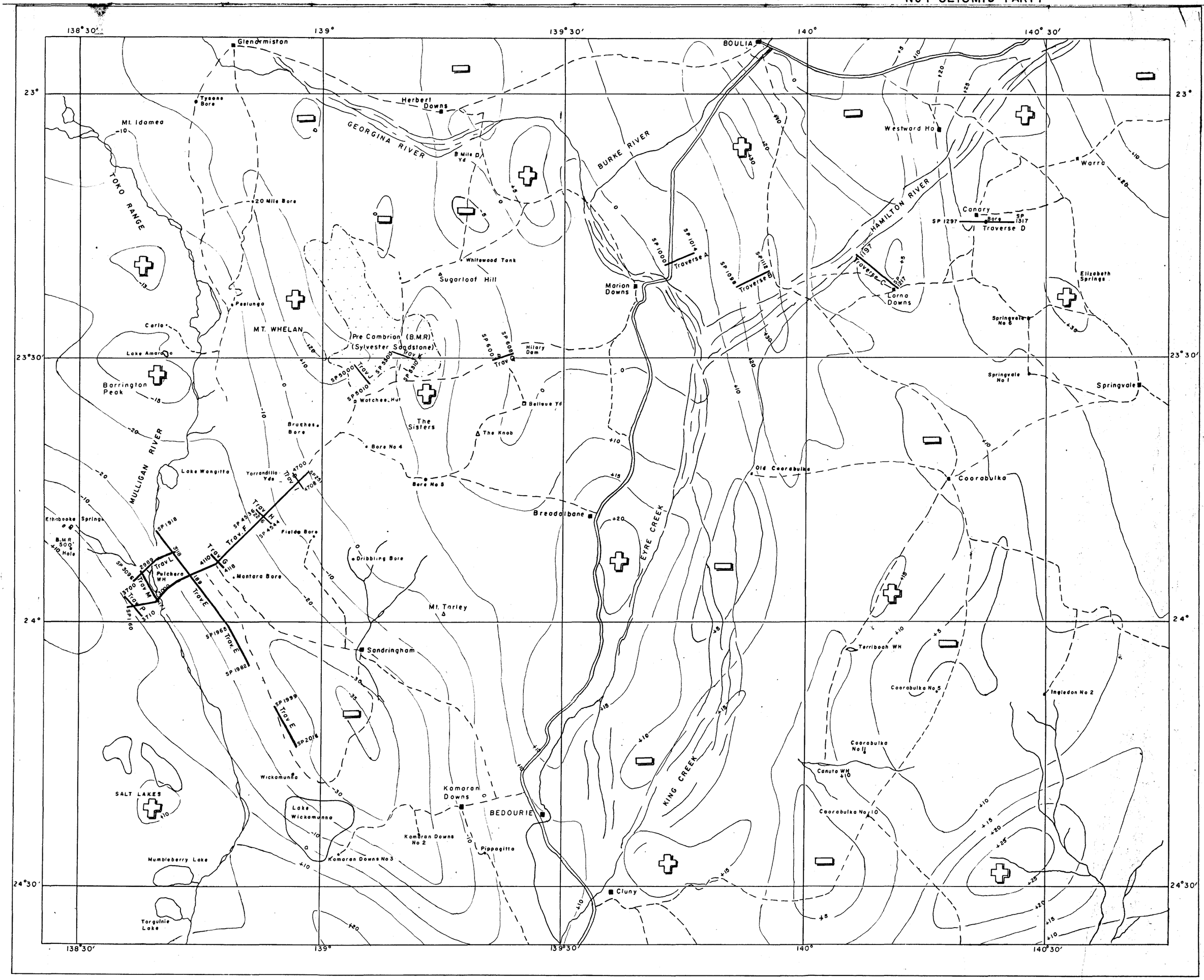
Reflection work on a traverse approximately at right angles to the main traverse, along the synclinal axis, showed that the thickness of sediments in the trough increases slowly to the south-east. Refraction work on this traverse indicated that the only persistant refractor recorded has a velocity of 19,000 ft/second and that this corresponds to the main reflecting horizon at a depth of 10,000 + feet. During the year it was learned that the French Petroleum Company planned a considerable amount of seismic work in the area south of Sandringham so that those portions of the 1963 B.M.R. programme in the Sandringham-Bedourie area were omitted.

SOUTH EASTERN GEORGINA BASIN SEISMIC SURVEY

BOULIA – SPRINGVALE – MT. WHELAN – BEDOURIE AREA

OIL SEARCH – SUMMARY OF ACTIVITIES 1963

No 1 SEISMIC PARTY



SCALE: 1" = 8 MILES

0 8 16 24 MILES

A

B

C

D

5930

14900

19000

5700

?

16300

18300

6450

15000

16500

?

?

6660

15000

16500

17900

0

·05

·10

·15

·20

·25

·30

·35

seconds

Intercept time in seconds

0

05

10

15

20

25

30

35

1000

2000

3000

Intercept time in seconds

Depth in feet very approximately

DIAGRAMMATIC CROSS-SECTION
MARION DNS TO CANARY
SHOWING REFRACTION
VELOCITIES RECORDED
ON TRAVERSES A TO D.

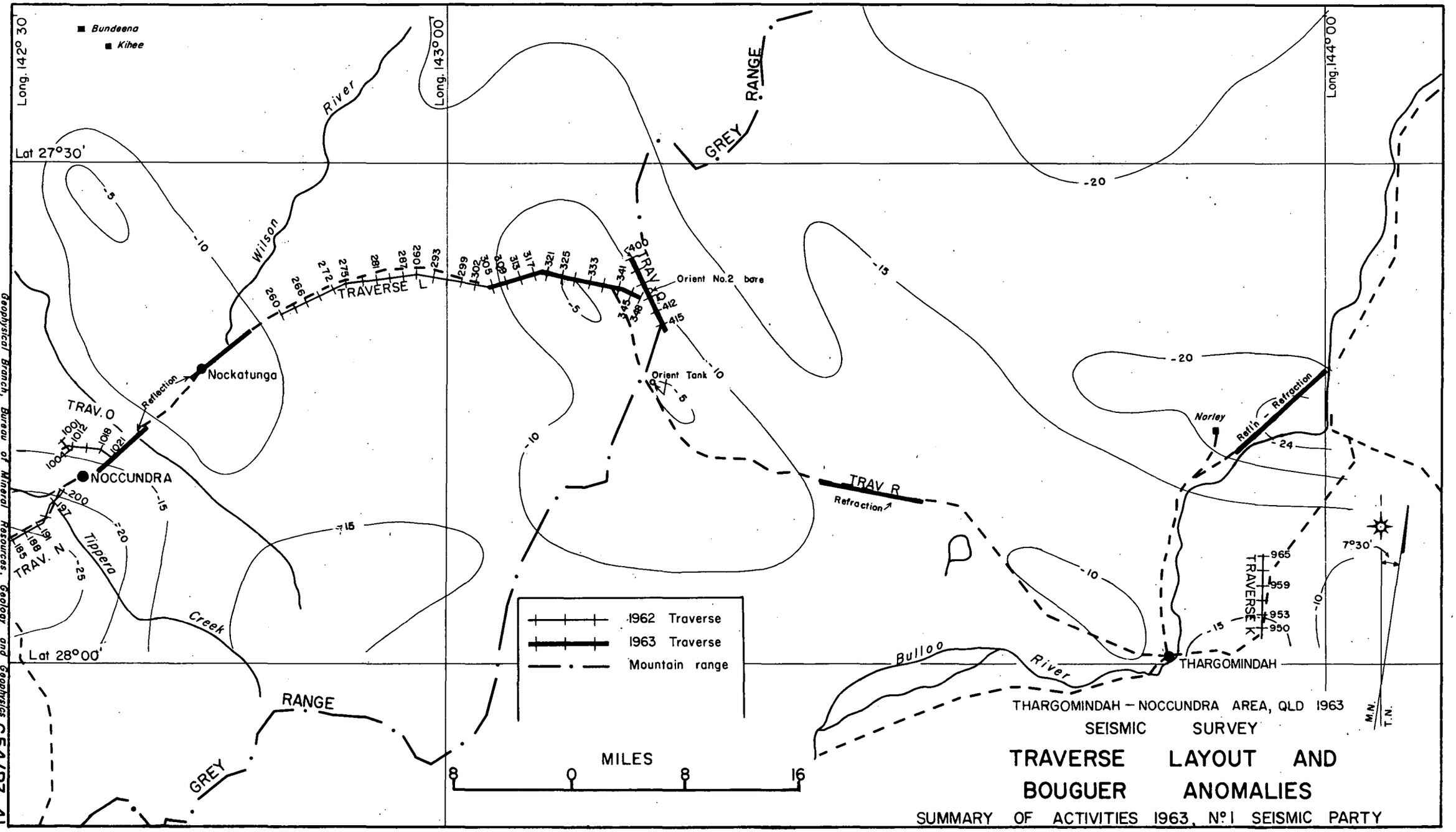
Horizontal Scale 1" : 20,000'
approx.

Summary of Activites 1963

No.1 Seismic Party

Thargomindah Area

At the beginning of October, Seismic Party No. 1 moved to the Thargomindah area to continue a programme of work commenced in 1962. A 1962 reflection traverse between Nockatunga and the Grey Range has been extended eastwards to tie with Orient No. 2 bore. Before the end of November, it is intended to fill in a number of gaps in the 1962 reflection work and to shoot refraction depth probes through Orient No. 2 bore, on a synclinal feature near Tygarra bore and on a gravity low 20 miles north-east of Thargomindah.



Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics G54/B3-41

SEISMIC PARTY NO. 2.

Southern Carnarvon Basin

Seismic Party No. 2 spent from mid-April to the 30th of September in completing reconnaissance Traverse "A" across the Southern Carnarvon Basin at its widest point approximately along latitude 26° 45'.

In the Gascoyne Basin a refraction probe at Tamala showed a depth of 18,000 ft of probable sedimentary section. This result is in rough agreement with the magnetic basement depth predicted by the Aeromagnetic Group.

Intensive refraction work on Coburn station with a total of 14 miles of surface coverage, revealed a westerly-dipping high velocity refracting surface which showed a gradual change in horizontal velocity from 19,000 feet/sec at 2000 ft. under Coburn H.S. to 17,200 1/s at 1000 feet near the N.W. Coastal highway. This refracting surface has been suggested to be an eroded surface of the Silurian Dirk Hartog series of the basis of velocity correlation with Wandagee No. 1 (Wapet). Between this refracting surface and the cretaceous surface cover, there remains 600-1600 feet of interesting section, possibly Devonian, Jurassic or Permian. No evidence was found to confirm the suggestion from water bore lithology of Tumblagooda Sandstone (Silurian-Ordovician) existing at very shallow depths on Coburn Station.

In the Ajana-Wandagee area, four miles of E.W. refraction coverage over the gravity maximum demonstrated the existence of a ridge in the shallow sediments. The existence of this ridge resulting from a Pre-cambrian basement ridge at shallow depth as predicted by gravity was not confirmed.

Coolcalalaya Basin

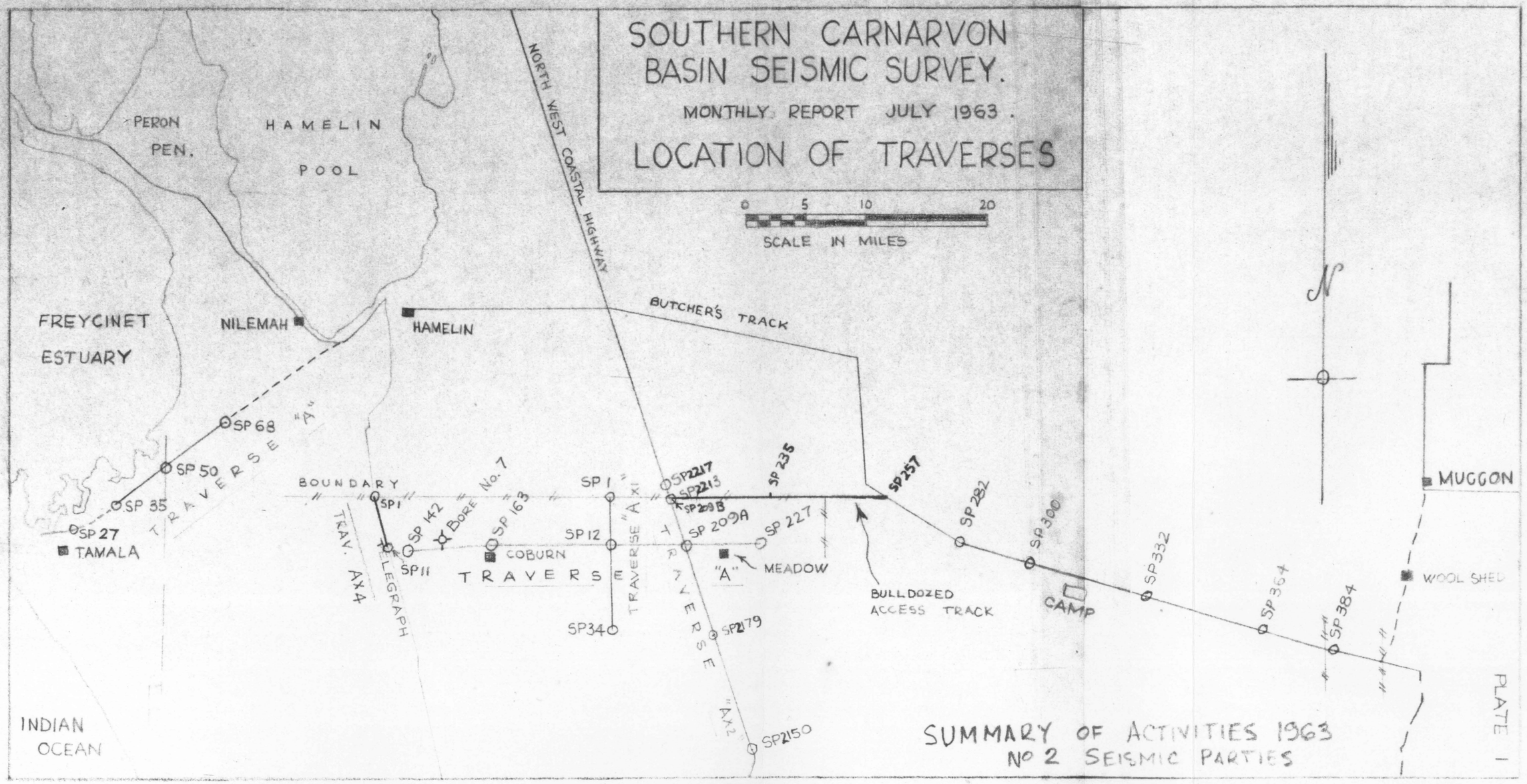
In the Coolcalalaya Basin fifteen miles of E.W. refraction coverage showed the probable depth of sedimentary section to be 10-12,000 ft, much shallower than predicted from gravity work. No information as to the total extent of the Permian section in this part of the basin was obtained. Some evidence exists for faulting in the central portion of this basin.

Reflection profiling proved impractical in the Southern Carnarvon Basin, because very large arrays of geophones and holes were required to obtain even the poorest of results. Refraction coverage was substituted, resulting in more time being spent on a reconnaissance traverse in this area than originally planned.

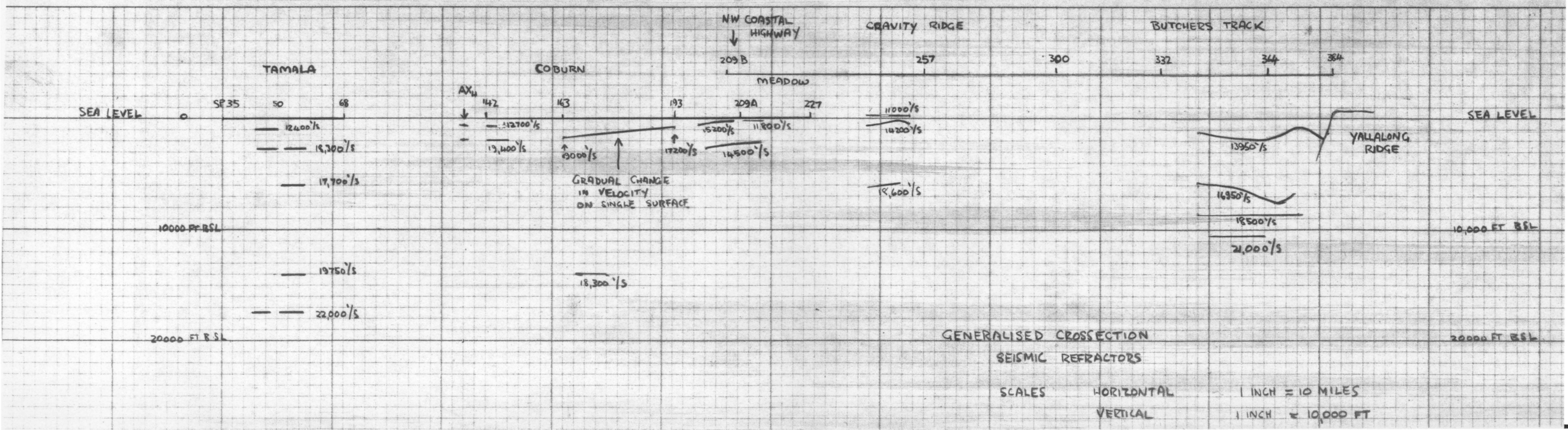
SOUTHERN CARNARVON BASIN SEISMIC SURVEY.

MONTHLY REPORT JULY 1963.

LOCATION OF TRAVERSES



SUMMARY OF ACTIVITIES 1963
No 2 SEISMIC PARTIES



GENERALISED CROSSECTION
SEISMIC REFRACTORS

SCALES HORIZONTAL 1 INCH = 10 MILES
VERTICAL 1 INCH = 10,000 FT

2. AEROMAGNETIC SURVEY (Under Contract)

North-Eastern South Australia Aeromagnetic Survey (Partly under Contract)

This survey comprised the southern halves of the 1:250,000 areas of Kopperamanna and Strzelecki and the whole of the 1:250,000 areas of Maree, Callabonna and Frome. The field work was performed by Adastra Hunting Geophysics Pty.Ltd., under contract to the Bureau, and the data will be reduced and published by the South Australian Department of Mines. The survey had been programmed for VH-MIN, but a major overhaul of survey equipment was required which grounded the aircraft until July.

Traverses were spaced two miles apart and the total line mileage was approximately 14,500. The nominal flying altitude was 1500 ft above sea level but this had to be modified over high ground in the south-western part of the area.

The field work was completed in October, about three months later than specified and the reduction of the data by the South Australian Department of Mines will probably not be completed before the end of 1964.

The results of the survey have not been examined as a whole and no comments on them can yet be made.

Simpson Desert

The field operations of the contract aeromagnetic survey of the northern part of the Simpson Desert (Hale River, McDills, Simpson Desert North, Simpson Desert South and Southern halves of Illogwa Creek and Hay River, 1:250,000 areas) were completed in July 1962. The final aeromagnetic contour maps were supplied to the Bureau in March 1963. An interpretation of the results has been completed.

The structure of the basin interpreted from the aeromagnetic data may be summarised as follows:

The northern part of the survey area lies on the margin of the sedimentary basin with basement rock overlain by a thin veneer of sediments. The basement rock is strongly lineated and closely resembles Archaean and Lower Proterozoic outcrop characteristics of the Arunta Complex to the north. A promiment nose of this basement rock projects from the central northern part of the survey area into the basin with a south-west trend.

The south-western and south-central parts of the area are occupied by a basement rock resembling metamorphics of the Proterozoic or Lower Palaeozoic. The basement is shallow on the western margin but forms an embayment over most of the western and central parts of the survey area.

In the eastern part of the survey area, another embayment is formed within lineated rock type of the Arunta Complex. In the south-eastern corner of the area, a magnetic horizon corresponding probably to a slightly metamorphosed sequence of the Lower Palaeozoic constitutes basement. Basement rock deepens toward the south, with depth estimates of about 9000 feet on the southern edge of the survey area.

AEROMAGNETIC SURVEYS (VH-MIN)

Bowen Basin Q'ld.

The airborne magnetometer survey of the Bowen Basin which commenced in 1961 and continued in 1962, was completed during July and August, 1963. The area surveyed was made up of those parts of the Taroom, Roma, Mitchell and Eddystone 4-mile sheets which lie between 148 and 149 degrees of longitude, together with a western extension of the northern part of Eddystone and the north-east corner of Augathella.

East-west flight lines were spaced two miles apart. The altitude was maintained at 2000 feet above sea level except in regions of extreme topographical relief, where it was increased to ensure a terrain clearance of 700 feet.

Magnetic profiles of the northern half of the Eddystone sheet are marked by steep anomalies of the order of 600 gammas which are associated with superficial tertiary basalts. A line of similar anomalies occurs towards the southern boundary of the Eddystone sheets and extends southward into the Mitchell sheet.

Apart from superficial anomalies the magnetic pattern is largely undisturbed and data for estimation of basin depth are scarce and localized. Depths to magnetic basement between 8,000 feet and 10,000 feet have been estimated in the northern half of both Eddystone and Taroom areas. South of the town of Roma depths of the order of 4000 feet are likely.

A magnetic traverse from Roma to Cloncurry via Boulia was flown in August when the aircraft was en route between operational bases. The results of this traverse have not been analysed yet.

Georgina Basin, Q'ld and N.T.

An airborne magnetometer survey of the Georgina Basin was commenced in September 1963. The programme called for seven 1:250,000 areas, namely Mt. Isa, Elkedra, Sandover River, Urandangi, Huckitta, Tobermory, and Glenormiston, and Northern halves of Illogwa Creek and Hay River, to be completed during 1963.

The DC3 aircraft was flown on east-west lines spaced two miles apart. The altitude was maintained at 2,000 feet above sea level except in regions of extreme topographical relief, where it was increased to ensure a ground clearance of 700 feet.

Preliminary estimates of depth to magnetic basement have been made on the magnetic profiles of the Elkedra, Sandover River and Urandangi 1:250,000 areas. In the Elkedra sheet the sedimentary rocks appear to be less than 4,000 feet thick except in a few small areas to the south and east. Over much of this sheet the basement is less than 2,000 feet below sea level. In the south east corner an anomaly of 2,000 gammas extends for 25 miles east-west and north-south. This corresponds roughly with a region of gravity highs.

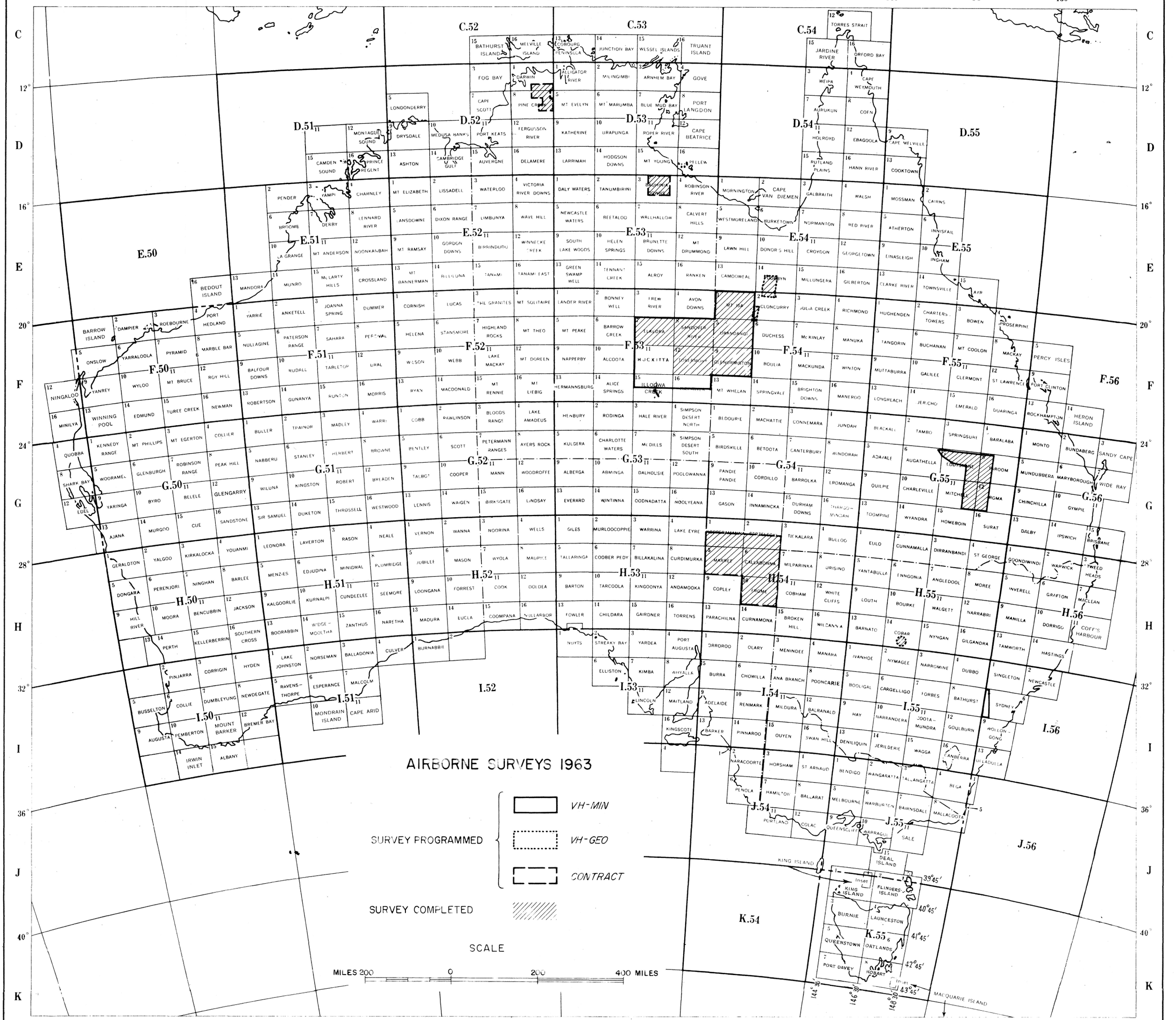
In the Sandover River sheet the sediments thicken towards the south-east. This deeper region extends 30 miles east on to the Urandangi sheet with depth decreasing to the west and less sharply to the north. Profiles in the south-west corner of Sandover River area are indicative of a sharp change in magnetic susceptibility, and suggest considerable basement relief or possibly faulting.

A region of magnetic disturbance associated with surface bodies is apparent along the eastern edge of the Urandangi sheet. This is probably associated with the Eastern Creek Volcanics and the extensive fault system in that area.

It is unlikely that the survey will be completed in 1963, and the flying of Huckitta, Illogwa Creek and Hay river may require deferring until 1964.

Sydney Basin, N.S.W.

This work entails about 600 miles of flying at 2 miles spacing to cover the gap between Bathurst 1:250,000 area aeromagnetic work and the aeromagnetic work by Adastra over the Sydney Basin. An unsuccessful attempt was made to fly this gap when VH-MIN was en route to Roma in July to do the Bowen Basin survey. A further attempt will be made during MIN's flight to Melbourne at the end of the Georgina Basin survey.



NMP/59/151·1

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS G 350-86

3. GRAVITY SURVEYS

Great Artesian Basin, Queensland

A helicopter elevation and gravity survey was carried out in Central Queensland as a joint operation by the Division of National Mapping and the Bureau of Mineral Resources. Approximately 33,000 square miles were traversed at an average station density of 1 per 50 square miles. The following 4-mile sheet areas were covered : Mackunda, Winton, Muttaburra, Maneroo, Longreach and Manuka (part).

The results indicate a region of complex irregular Bouguer anomalies which are unrelated to the superficial geology. The most significant feature of the gravity result is the presence of a continuous zone of high gravity values extending east from the Winton 4-mile sheet area. This zone appears to bridge the basin and could be important in defining the boundaries of the Palaeozoic basin within the Great Artesian Basin.

The survey is continuing eastwards between latitudes 20° and 24° and is expected to be completed to the coast early in December.

Great Artesian Basin, Queensland (Contract Survey)

The northern and eastern parts of the Eromanga Basin, a sub-division of the Great Artesian Basin, were surveyed by a private contractor on behalf of the Bureau. Approximately 53,000 square miles were covered at an average station density of one station per 50 square miles. The following 4-mile sheet areas were covered : Julia Creek (part), McKinlay (part) Manuka (part) Richmond, Hughenden, Tangorin, Charters Towers, Buchanan, Galilee and Jericho.

The results clearly show the northern and eastern margins of the Great Artesian Basin. A major gravity low extending from the western part of the Galilee 4-mile sheet area to the eastern part of the Julia Creek sheet area was mapped. The southern margin of the low is formed by an east-west trending gravity ridge which was mapped on a previous gravity survey. The results of this survey show that the ridge extends east to the area of the Drummond Basin. Abrupt changes in gravity anomaly were recorded in the Charters Towers area and are probably caused by density variations in the Charters Towers batholith.

Gravity Readings along Seismic Traverses, Queensland and N.S.W.

Gravity was read along seismic traverses in the following areas:

(1) B.M.R. traverses in the Boulia and Thargomindah areas, Queensland.

(2) A.O.G. traverses in the Moonie Cabawin area (A.T.P. 57) Queensland

(3) Exoil traverses in the Lake Galilee area (76 P)

(4) L.H. Smart traverses in the Singleton area N.S.W. (P.E.L. 58)

Some 4400 readings have been made along the various seismic traverses. The study of these results in conjunction with the seismic results has been commenced.

RECONNAISSANCE GRAVITY SURVEY (1957-1963) S.W. QUEENSLAND

BOUGUER ANOMALIES

SCALE IN MILES

40 0 40 80 120

Reference – Division of National Mapping 40 miles to 1 inch topographic map

CONTOUR INTERVAL 5 MILLIGALS

LEGEND

- Isogals, values in milligals
- ▲ 56 BMR gravity pendulum station
- Mt Isa BMR 4-mile gravity map area
- 80 Feature number

Bouguer anomalies are based on the observed gravity values at B M R pendulum stations:

No. 54	Longreach	978,789·8 milligals
No. 55	Cloncurry	978,650·7 "
No. 56	Boulia	978,793·2 "
No. 57	Birdsville	979,003·0 "
No. 58	Quilpie	979,006·5 "

For the calculation of Bouguer anomalies 1·9g/cm³ has been adopted as an average rock density.

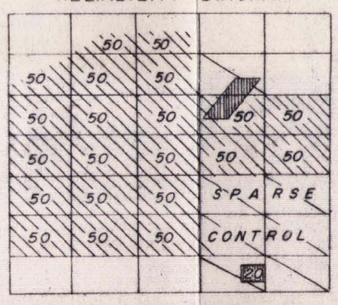
Elevation datum Queensland State.

Major tectonic boundaries (as deduced from gravity)

Major gravity features within the Great Artesian Basin

SUMMARY OF ACTIVITIES 1963 OIL SEARCH GRAVITY SURVEYS

RELIABILITY DIAGRAM



GRAVITY	
SURVEY	METHOD
HELICOPTER BY BMR	REGULAR GRID COVERAGE, AIR PHOTOGRAPHY, BAROMETRIC LEVELLING.
GROUND TRAVERSES BY BMR	WIDELY DISPERSED TRAVERSES, AIR PHOTOGRAPHY, CONVENTIONAL LEVELLING, ASTROFIXES.
SEMI-DETAILED BY GEOSURVEYS AND DETAILED BY MAGELLAN PET'M. CORP.	GROUND TRAVERSES, CONVENTIONAL LEVELLING.

FIGURE IN EACH AREA DENOTES SQUARE MILES PER ONE GRAVITY STATION

Compiled September 1960
Revised November 1961, July 1962, January 1963, July 1963

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS F54/B2-17 - 9

4. WELL LOGGING

Field Work In July the Widco 10,000 ft winch with Failing Logmaster logger was sent to the Georgina Basin to log the Bureau's stratigraphic holes B.M.R. 11, 12 and 13. Logging of B.M.R. 12 and 13 will be done by Schlumberger. Work on B.M.R. 11 is still proceeding but the Bureau's logs will be duplicated by Schlumberger for some unknown reason.

The 500 ft/Widco gamma ray logger is employed on shallow holes in the Burdekin Delta.

It was intended to log water bores in the Great Artesian Basin but it was not possible to release the Failing logger from work on B.M.R. 11 in the Georgina Basin until it was too late.

Logging equipment was lent to Beach Petroleum for work in the Murray Basin, and to Farmont Drillers for work near Alice Springs.

Equipment Repair work to Widco 10,000 ft winch was finalised after installation of a hydraulic drive. The Widco winch was then integrated with the Failing Logmaster recorder.

Installation and testing of C.V.L. equipment proceeded slowly, involving design and construction of associated equipment, and control panels, and modifications to the probe.

Design and construction of a shallow density logger proceeded during the year.

Reports Report of the 1961 gamma ray logging was completed and work is continuing on the 1962 gamma ray logging report. Interesting contour plans of the base of the Roma formation are developing as the logging proceeds each year.

METAL SEARCH

1. GROUND METALLIFEROUS SURVEYS

The activities of the Metalliferous Group in 1963 were concerned with the search for tin, - lode tin at Zeehan and Mt. Cleveland in Tasmania, and alluvial tin in the Gibsonvale-Kikoira tinfield in New South Wales, and for copper in the Dobbyn area of Queensland. Test gravity surveys were carried out in the Stawell Goldfield Victoria and in the Mt. Isa area, Queensland.

The I.P. method was used by the Bureau for the first time and the equipment was in almost constant use, first in Tasmania, then in test surveys in the Rum Jungle area and finally at Dobbyn.

Contract surveys, forming part of the Northern Territory Special Mineral Survey Programme, were arranged to assist the search for gold at Union Reefs and lead-zinc at McArthur River.

Zeehan, Tasmania

A geophysical survey was carried out between January and March 1963 in the Oonah Hill - Queen Hill area just west of Zeehan. The work was at the request of the Tasmanian Mines Department. The aim was to search for extensions of the Stannite and Galena lodes previously worked in the Oonah mine and to investigate nearby areas for mineralisation. At the time of the Mines Department's request, a prospecting licence over the Oonah mine area was held by Dr. Loftus Hills but subsequently Clutha Development Ltd., took an option over the area and commenced a programme of geological mapping and diamond drilling.

The methods used in the geophysical survey were I.P. (using the recently purchased Geoscience Incorporated equipment), electromagnetic (Turam) and S.P. Anomalies were recorded with all three methods over the Stannite lode and over Bradshaw's lode about 1000 ft to the south-west but no anomalies were recorded over the Galena lode. The I.P. results over the Stannite lode are of interest in that they appear to show the easterly dip of the lode and to have detected the lode to a depth of about 600 feet. The Turam and S.P. anomalies are continuous between the Stannite and Bradshaw's lodes, suggesting that both lodes are in the same shear zone.

On Queen Hill, in the eastern part of the survey area, S.P. and weak Turam anomalies were associated with Clarke's and Taylor's lodes. A single I.P. traverse surveyed showed weak irregular anomalies.

In the area between Oonah and Queen Hills a strong I.P. anomaly was recorded apparently to a depth of about 500 feet and coincided with S.P. and Turam anomalies. These anomalies do not correspond to any known lode and have been recommended for testing by a diamond drill hole.

Clutha Development Ltd., has now drilled three holes, which are reported to confirm the geophysical results over the Stannite and Bradshaw's lodes, but the detailed drill hole data have not yet been supplied to the Bureau for comparison with the geophysical results. The Stannite lode was intersected at a depth of about 1000 feet, where there was a considerable width of sulphide mineralisation but only traces of tin. Bradshaw's lode was intersected at about 300 feet depth. The lode was about 20 feet wide and carried 1% copper and 0.4% tin.

At the Company's request it is proposed to extend the geophysical survey in the Oonah area during the next Summer.

Mt. Cleveland, Tasmania

At the request of Aberfoyle Tin Development Partnership an area north-east of the known Mt. Cleveland tin prospect was investigated with magnetic and S.P. methods. Previous geophysical work by the Bureau in 1953 and 1954 at Mt. Cleveland had shown that the ore bodies, in which tin is accompanied by pyrrhotite and pyrite, could be detected by these methods. The new area was selected by the Company because of the occurrence

of the "chocolate shales" considered to be the favourable bed for mineralisation.

No significant S.P. anomalies were found in the 1963 survey. Several magnetic anomalies were recorded but appeared to be associated with the volcanics which occur in the area. Susceptibility determinations on specimens of the volcanics confirmed that they are sufficiently magnetic to account for the observed anomalies. The geophysical results gave no evidence of any ore bodies and no drilling recommendations were made.

Stawell, Victoria

At the request of Gold Mines of Australia, Ltd., three gravity traverses were read over the Stawell goldfield to test if the gravity method could give information on the nature of the folding. In particular it was hoped to determine the disposition of the "footwall Sandstone", the dense marker bed that underlies the "mine schists" in which the quartz-gold reefs mainly occur.

Readings were taken at 100 feet intervals over a length of 3000 feet in each direction with readings at 200 to 500 feet intervals to check on regional effects.

Residual anomalies of the order of 0.5 to 1.0 milligal were found to be associated with the mineralised zone but they arise from material close to the surface and are not related to the deeper "footwall sandstone". Two of the profiles show features that are possibly due to the Stawell Fault but otherwise the gravity results appear to give no information on the structure at depth.

Gibsonvale-Kikoira, N.S.W.

A geophysical survey of three areas in the Gibsonvale alluvial tinfield was requested by Aberfoyle Tin Development Partnership. The survey commenced about the end of July and is still proceeding. Gravity, seismic and resistivity methods are being used to search for extensions of the known Gibsonvale and Kikoira leads.

Results have so far been inconclusive and have been different in character in the three areas. In Area No.1, neither the seismic nor the gravity methods has given any indication which can be correlated with the borehole data. In area No.3, neither method gives evidence of depressions in the unweathered bedrock, but there is evidence of the existence of layers of intermediate velocity and correlation of these with the borehole data may be possible.

In Area No.2, seismic, gravity and resistivity methods give clear evidence of a depression in the bedrock but a limited amount of boring has so far failed to show that it contains tin in payable quantities. Intermediate traverses are being surveyed at present to outline the course of the lead in more detail using mainly the resistivity method.

Mt. Cuthbert-Dobbyn Area, Cloncurry District, Q'land.

The general Dobbyn area, selected for geophysical investigation in 1963, includes a large number of small copper shows and also a few larger copper mines such as Dobbyn and Mt. Cuthbert. Nearly all the prospects were worked in the enriched secondary zone and the primary zone has not been investigated except in a very few places. Previous regional gravity work showed that the gravity method could be used to trace the major fault and shear zones which are considered to be a major control in the occurrence of copper deposits in the region.

The 1963 geophysical work commenced with a gravity survey on a semi-regional scale with stations at intervals of about $\frac{1}{2}$ mile along the traverses, to study the geological structure and establish important shear zones. The gravity survey covered an area about 48 miles long from Kamileroi in the north to Kajabbi in the South and about 26 miles wide. About 900 gravity stations were observed.

Although two surveyors were provided by the Department of Interior, the topographical surveying fell seriously behind the gravity work. Positioning and levelling of the gravity stations are still in progress. Pronounced gravity anomalies were observed but in the absence of the required survey data, the reduction of the gravity results has not been completed and no interpretation has been attempted as yet.

Early in August a survey using Turam, I.P. and S.P. methods was started in the area of the Dobbyn and Orphan mines to search for copper mineralisation. Several east-west traverses about 8 miles long and 500 feet apart were surveyed. Turam and I.P. anomalies were recorded over the Mt. Cuthbert, Dobbyn and Orphan mines. The results of the work so far suggest that the combination of Turam and I.P. methods should prove a useful tool in the investigation of the Cloncurry district. The Turam anomalies are usually well-defined but some of them are not accompanied by I.P. anomalies, and these are believed to arise from shear zones only. It appears that the I.P. method can be used to eliminate those conductors not due to mineralisation.

The survey in the Dobbyn area is still in progress. Further Turam, I.P. and S.P. work in the area is proposed for 1964.

Mt. Isa Gravity Test Survey

A test gravity survey requested by Mount Isa Mines Ltd., was carried out in the Leichhardt Valley to determine if the gravity method could assist in the investigation of the deeper regions of the area surrounding the Mount Isa mine, and in particular if it could locate the "greenstone" basement beneath the Mount Isa shales.

Three pairs of traverses were surveyed across the full width of the Leichhardt valley with stations at 100 feet intervals. The pairs of traverses were located at (a) Tombstone Hill, 13 miles north of the mine, (b) just south of the township, and (c) near the Native Bee, 5½ miles south of the mine. 926 gravity stations were observed.

The profiles show pronounced gravity anomalies. The central and southern traverses show a steep rise of about 10 milligal to the east approaching the Eastern Creek Volcanics. A minimum of about 1½ milligal occurs on the central traverses over the main mineralisation in the Urquhart Shale and a similar anomaly occurs over the Urquhart Shale in the Northern Leases. This anomaly and others shown on the profiles do not appear to correlate with the formation densities, as estimated from presently available density data, and the preliminary view is that they are probably caused by faulting. The Company is expected to provide detailed geological sections along the gravity traverses and drill core samples for further density determinations and until this information is available for study no conclusions can be reached on the significance of the gravity results.

I.P. Test Surveys, Hundred of Goyder

Test I.P. surveys were made over several areas in which strong E.M. anomalies had previously been discovered. In all but one case, the results of the I.P. surveys added nothing to what had previously been discovered by E.M. methods. The only case of a discrepancy between the results of the two methods was at Batchelor Laterites. Here Slingram surveys showed a strong anomaly of large extent, and of a very unusual type. Turam surveys tended to resolve the anomaly into several weaker ones, and the I.P. survey showed only a weak anomaly of small extent. Drilling has not so far revealed an adequate cause for the E.M. anomalies. It is hoped that electric logging may assist in this.

Metalliferous Surveys, Darwin Group

The Darwin geophysical staff assisted with the I.P. test surveys referred to above. Radiometric assays and repairs to equipment were carried out as required. Radiometric logging of diamond drill holes was done to assist the Rum Jungle Phosphate Party. The electromagnetic and radiometric surveys in the Hundred of Goyder were continued.

Hundred of Goyder

Dolerite Ridge to Mt. Fitch

This was the largest area covered, and joins the areas of previous surveys at each end. The results have not yet been plotted completely. The main feature is a zone of intense electromagnetic anomalies about 3000 feet wide with a northerly strike. One ground magnetic traverse has shown an intense magnetic anomaly about 1000 feet wide, near the centre of this zone. The zone of electromagnetic anomalies is obviously associated with the large aeromagnetic anomaly in this region, and in the centre of the zone, the anomalies can be confidently attributed to large masses of pyrrhotite. It is not so certain that the anomalies on the eastern and western sides of the zone are due to a similar cause. These anomalies appear to have no connection with large electromagnetic anomalies previously found near Mt. Fitch.

Area 44

A small area, defined by a surface radioactive anomaly, was examined by electromagnetic methods. No anomalies were found in the area, but there was indications of the possible presence of good conductor anomalies at the extremities of the layout. Extension of the survey area would be necessary to delineate these.

Reconnaissance Slingram Surveys

Traverses on some of the layouts were extended for several thousand feet, using the Slingram method. The results are of interest, in that, away from the layouts, they were completely featureless. It appears that previous surveys have all been on potentially mineralised areas, and that, in the Rum Jungle district, such areas can be economically located by Slingram reconnaissance.

Tennant Creek

A magnetic survey was carried out at the Quartz Bowl Area, about 14 miles west of Tennant Creek. The survey aimed to investigate a broad aeromagnetic anomaly which it was thought could comprise several smaller anomalies. Twelve N-S traverses, 5000 feet long were surveyed across the area and stations were read at 100 feet intervals. All traverses were read with the vertical force magnetometer and two with the horizontal force magnetometer.

The results show only one broad anomaly indicating a body with centre at a depth of about 3000 feet.

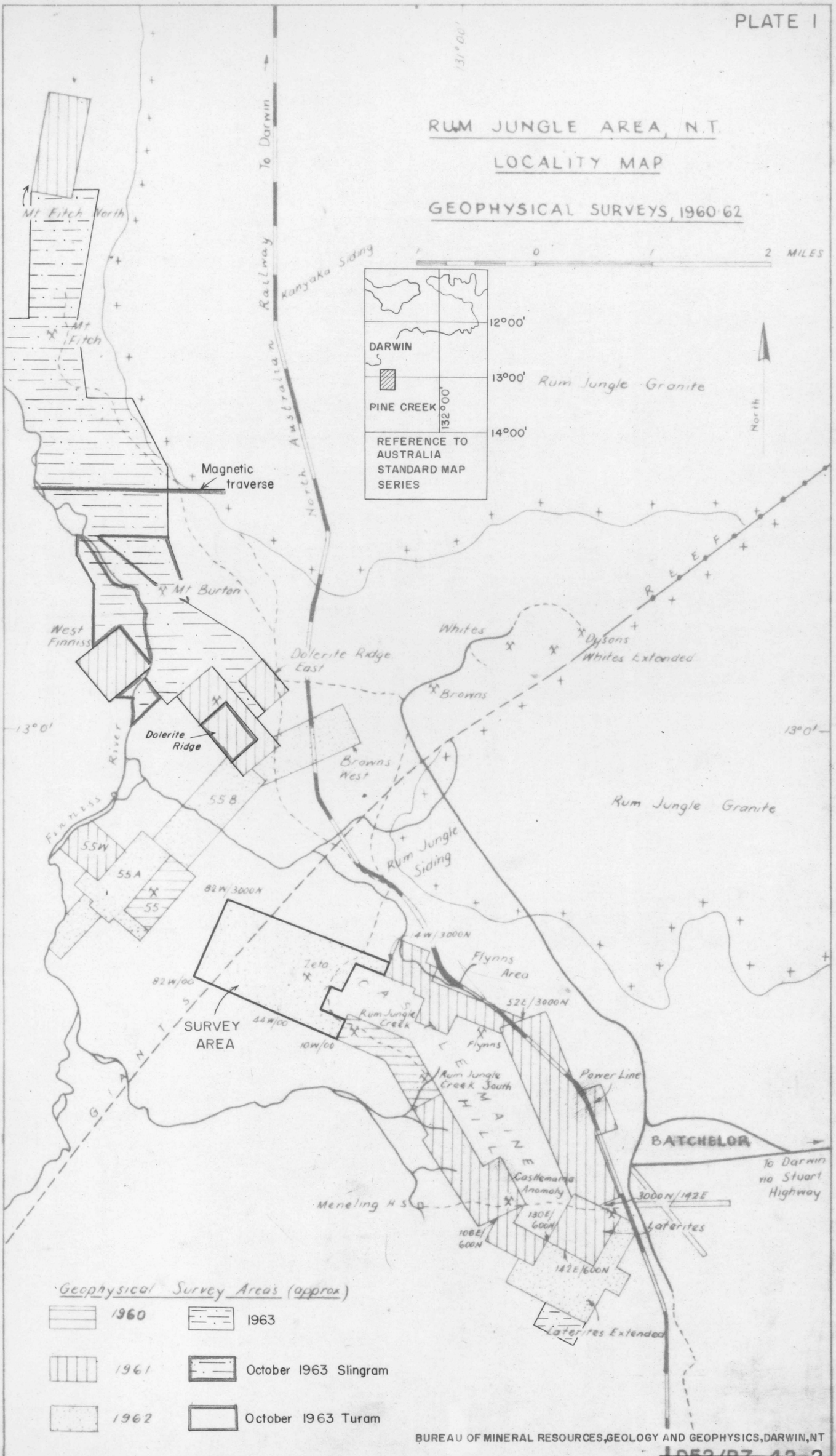
While in Tennant Creek the party, at the request of Australian Development, N.L., also investigated Red Bluff Anomaly 11, an aeromagnetic anomaly about 22 miles west of Tennant Creek. One N-S traverse 7000 feet long was read with vertical and horizontal force magnetometers. The results indicate two magnetic bodies, one with centre at depth of about 1000 feet, the other at a depth of about 3000 feet.

PLATE 1

RUM JUNGLE AREA, N.T.

LOCALITY MAP

GEOPHYSICAL SURVEYS, 1960-62



BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS, DARWIN, NT

To accompany Record No. 1963/127

~~052/B7 42 2~~

2. AIRBORNE METALLIFEROUS SURVEYS, VH-GEO.

Cobar Experimental Survey

The Cobar Survey took place between March and April, 1963, and its main purpose was to test the equipment under field conditions, to evolve flying techniques and data reduction procedures, and to estimate survey accuracy. The results of the survey proved to be very encouraging and fully justified using the light aircraft for detailed magnetic surveys at Mt. Isa and Dobbyn, Queensland, later in the year.

The survey proved that the Cessna is able to survey with such detail and accuracy that it is possible to replace many ground magnetic surveys with Cessna surveys. The rate of working is many times that of a ground party, but is limited at present by the existing staff available to treat the data and interpret it.

The Cobar survey was performed over eight small areas, where magnetic anomalies of widely differing types had previously been detected. The areas were called; The Peak, Spotted Leopard, Weltie North, Budgery, Girilambone, Mt. Boppy, Nurri and Geweroo. The Peak, Spotted Leopard, Budgery and Girilambone anomalies had previously been surveyed in detail and hence new information on them was not obtained. The Weltie North anomaly was found to consist of two separate maxima, which could be associated with granite plugs thought to exist in the area. At Mt. Boppy a small sharp anomaly was measured in an otherwise flat field, but no cause for its existence, or for the anomaly at Nurri was postulated. At Geweroo the anomalies at the New Burra shaft were seen to lie along the line of the Slate and Conglomerate outcrops.

Mt. Isa, Q'ld. Aeromagnetic Survey

This survey was performed from June to August, 1963, and because the first exploration magnetic survey with the Cessna. became

The survey covered a rectangular area about 12 miles in east-west extent and about 36 miles in north-south extent, centred approximately on Mt. Isa. Several flight line spacings were used, the largest being 1 mile and the smallest, over much of the Mt. Isa Shales, 1/10th mile. The aircraft was flown with the detector at a nominal altitude of 250 ft above ground level. The Mt. Isa township and a small region surrounding it could not be surveyed owing to restrictions imposed by D.C.A.

The magnetic pattern exhibits a marked correlation with known geology; in particular the Eastern Creek Volcanics and several structural features are well defined. The Mt. Isa Shales have a very smooth magnetic field generally and several small anomalies within the Shales are thought to be significant. A preliminary assessment of the data suggests that at least one of the anomalies is caused by mineralisation. Measurements of susceptibility on rock samples taken by Bureau staff or obtained from Mt. Isa Mines Ltd. are being used in the interpretation.

Mt. Cuthbert-Dobbyn, Qld.

The Dobbyn survey was started in September and is expected to be completed early in November. The area is approximately rectangular, about 30 miles from east to west and 50 miles from north to south, with Dobbyn about 4 miles south of the centre.

Traverses at ½ mile separation will cover the whole area and a small part of the area, about 1 mile by 12 miles and including the Dobbyn mine, is being covered in detail with traverses spaced 1/10th mile apart. The survey thus consists of two parts, the larger area being surveyed to obtain information on the broader geological structure, while the detailed area corresponds to that being covered by ground metalliferous surveys and the results will be evaluated in conjunction with those of the ground surveys.

A preliminary assessment of the results available to date indicates that the magnetic pattern correlates well with mapped geological formations. In addition some modification to existing ideas on the structure have already been indicated. Measurements of susceptibility on rock samples from the survey area are being made to assist in the interpretation.

3. SPECIAL MINERAL SURVEY PROGRAMME, NORTHERN TERRITORY

This programme included three contracts for geophysical work. These, with provisional estimates of the total expenditure involved are:-

(a) Aeromagnetic Survey, Darwin-Pine Creek : £13,600

(b) Aeromagnetic Survey, McArthur River : £15,000

(c) Electromagnetic and potential-ratio survey at Union Reefs and electromagnetic survey at McArthur River : £30,300

Darwin-Pine Creek, N.T. Aeromagnetic Survey

This survey covered an area comprising the 1-mile of Mt. Bundey and Burrundie, and portions of the 1-mile areas of Marrakai, Batchelor, Wool Wonga and Ban Ban. The field work and data reduction were both performed under contract by Adastra Hunting Geophysics Pty. Ltd., the field work being completed by early October, two months behind schedule. The preliminary maps are not expected to be available much before the end of the year.

A traverse separation of ½ mile, and a flying height of 500 ft above ground level were specified for this survey. The total line mileage was approximately 6,000.

The preliminary results of this survey were inspected at the contractor's Sydney office, for the purpose of assessing the area with regard to the 1964 programme. It seems likely that the Mt. Bundey martite deposits were detected by the survey and several anomalies in the Mt. Bundey area are proposed for detailed surveying in 1964. The Frances Creek and Mt. Harris areas were associated with magnetic disturbances but it will not be possible to assess these areas for future work until the final results of the survey are available.

McArthur River Area, N.T., Aeromagnetic Survey

A rectangular area of about 3,000 square miles, bounded by the 16° 00' and 16° 45' parallels of latitude, and the 135° 25' and 136° 15' meridians of longitude is being covered by this survey. Adastra Hunting Geophysics Pty. Ltd. are performing the field work and data reduction, under contract to the Bureau.

A flight line spacing of ½ mile and flying height of 500 ft above ground level have been specified. The total line mileage will be approximately 6,200.

The field work started in October, three months later than specified, and was completed on 6th November. The preliminary maps showing the results will probably not be available before early 1964.

Union Reefs, McArthur River Contract

The contract was let to J.J. Masur and Co. Pty. Ltd., who engaged two geophysicists from ABEM Stockholm to conduct the geophysical field operations. The field work commenced on 20th June; the Union Reefs survey was completed on 16th August and the McArthur River survey on 28th October. The contractor is allowed a further three months in which to furnish reports, which will give full presentation of results and interpretation.

At Union Reefs about ten miles north of Pine Creek, an area about 13,000 feet long and 2000 feet wide was surveyed using electromagnetic (Turam) and potential ratio methods. The aim was to locate further auriferous bodies, particularly in the sulphide zone which has not been worked to any extent in previous mining operations. The survey covered the Union and Lady Alice lines of reefs. Traverses were laid at intervals of 200 feet.

A large number of anomalies was obtained indicating the presence of good and poor conductors. No systematic interpretation of the results has yet been done but it is already established that the poor conductors coincide with the known lines of reefs. The good conductors probably coincide with lines of shearing and faults which might be mineralised. The results will be discussed in Melbourne with the ABEM party leader with a view to selecting diamond drilling targets.

In the McArthur River Area, Carpenteria Exploration Ltd.has been engaged in exploration for lead-zinc deposits for several years. The ore occurs in mineralised shales which are confined to three different basins. The geophysical survey using the electromagnetic method was required to determine the extent of the mineralised shales, which should act as good conductors. The three areas were investigated with traverses 400 feet apart. A total of about 88 miles of traverse was completed.

The results have not yet been studied in detail. From preliminary inspection of the field data, it appears that strong electromagnetic anomalies were recorded in Areas No. 1 and No. 3, which should assist in tracing the suboutcrop of the mineralised shales. In Area No. 2, the results may be difficult to interpret because of the presence of a thick conductive overburden.

NON METALS SEARCH

Gungahlin, A.C.T. Gravity and resistivity surveys carried out in late 1962 suggested several locations for test-drilling for clay seams. Proposed seismic work was abandoned, as it appeared that this would not add anything worthwhile.

ENGINEERING AND HYDROLOGY

Lake George, A.C.T. A gravity survey was carried out to study the nature of faulting associated with the scarp. The results are difficult to interpret, as the down-thrown side of the fault anomaly is marked by the anomaly of a large amphibolite mass; the tentative interpretation is a thrust fault with a throw of about 3000 to 5000 ft.

Proposed seismic work was replaced by the Ramu Valley survey, but is now programmed for 1964.

1. DAMSITES

Northern Territory

A seismic survey was carried out on a damsite on the Darwin River, two saddles and two pondate reservoir sites. At the damsite two shear zones were located, and the greatest depth to bedrock was found to be in excess of 100 ft. The survey suggests that the best foundation conditions for the dam are about 200 ft downstream of the present site. At one saddle the reduced level of bedrock may be less than 100 ft, at the second saddle fresh bedrock is below sea level. Either of the two pondage sites are suitable from a foundation point of view.

Tasmania

Pieman River, between Hells Gate and Donaldson damsites. Interpretation of a seismic refraction survey along the centre line of the river (carried out in 1962) shows a probably uniform increase in riverdetritus from Hell's Gate towards Donaldson damsite. The presence of a major fault crossing the river is indicated by a change in seismic bedrock velocity from 17,000 to 11,000 ft/sec.

Gordon River (West coast of Tasmania)

Seismic refraction surveys were made of 4 damsites to allow the H.E.C. to complete preliminary assessments. On three sites riverdetritus is only about 20 ft thick and the sandstone bedrock velocity ranges between 7000 and 12,000 ft/sec, the lower velocities being caused by jointing. At the fourth site river detritus is about 50 ft thick, the bedrock velocities range between 7000 and 11,000 ft/sec; there is probably a fault and a change of rock type.

Meadowbanks damsite

The H.E.C. requested a determination of the elastic constants of the Triassic mudstone and sandstone. The investigations showed that the mudstone is not a suitable foundation rock; the underlying sandstone is stronger but still relatively weak. Using Stoneley's Mathematical theory of wave propagation in transversely isotropic media, the 5 elastic constants for the mudstone and the sandstone could be determined from seismic refraction work and bore hole shots.

2. FLUME AND TUNNEL LINES

Tasmania

Murchison flume line. Five thousand feet of seismic survey were carried out. Soundrock is about 15 ft deep except in two sections where it is about 50 ft deep.

Sophia tunnel. A seismic refraction survey along the tunnel line shows thin overburden and a significant change in bedrock velocity halfway along the tunnel. The change coincides with a fault inferred from geology.

Wilmot tunnel Geological mapping and a seismic refraction survey showed the presence of a valley filled with basalt.

New Guinea, Ramu Valley hydroelectric scheme.

A seismic, magnetic and resistivity survey was made of the tunnel line. The seismic results indicate that the tunnel will be situated in unweathered rock for nearly the whole length, but along the penstock line the weathering was found to be very deep. The magnetic profile indicates the presence of several dykes, and micro-magnetic work indicates the strike of the bedding planes.

3. UNDERGROUND WATER

Queensland

Burdekin Delta

The work at the delta, started in 1962, was continued. Its purpose is to prepare a picture of the subsurface structure of the delta, where about 100 sq. miles produce about 15 million pounds worth of sugar every year. An extension of the gravity work provides more information of the bedrock configuration and may possibly disclose features of the near surface sediments. More than 350 resistivity depth probes will provide information on the nature of sediments, the salinity of ground water and the location of salt water. Repeated resistivity depth probing is used to check on salt water encroachment, which is becoming a serious problem. A number of experimental resistivity sondes have been established in bore holes to check water movement due to pumping. Seismic depth probes were made to provide controls for resistivity depth probes. Several drill holes up to 60 ft depth were drilled with the Proline drill mounted on a tractor.

Several holes were logged with the gamma ray logger to obtain an accurate idea of the clay content. Preparations were completed to do radioactive tracer tests to measure the flow of water in aquifers.

Giru area, Haughton River.

Investigations on the same lines as used in the Burdekin delta were carried out to provide information on water supply problems for cane growers. Up to date interpretation has given a clear picture of the distribution of salt and fresh water.

4. ROCK TESTING

In collaboration with the University of Melbourne, seismic velocities and dynamic properties were measured on about 200 drill hole cores from strata along the proposed Underground railway in Melbourne.

Concrete samples were tested for the Victorian State Electricity Commission and the Department of Public Works to check the strength of piles under the new office buildings in Flinders Street.

5. VIBRATION TESTS

Victoria, Lake Bellfield dam, Hall's Gap

It was desired to know what charge of explosives could be used in excavating the spillway without damaging the concrete lining of the tunnel. Measurements of acceleration were made for charges of various sizes.

1. REGIONAL GRAVITY SURVEYS:

Basic grid for helciopter work:

Most of this work consisted of laying down a basic grid for the 1963 helicopter gravity survey in Central Queensland. The La Coste gravitymeter was used for the principal ties between pendulum stations at Rockhampton, Clermont, Longreach, Hughenden, Cloncurry and Townsville. The World Wide gravitymeter was used to read most of the other traverses. Approximately 850 new gravity stations were established in readiness for the helicopter work.

Gravity tie between pendulum stations

Using the La Coste gravitymeter a connection was made between the pendulum stations at Cloncurry (Qld.) and Tennant Creek (N.T.). Stations were established at intervals of approximately 5 miles along this traverse. The Cessna aircraft was not available for ties.

Other regional traverses.

At the request of the Geological Branch, three regional gravity traverses were included in the 1963 programme. These traverses are:

(1) From Mt. Molloy to Wrotham Park (Qld.) a distance of approximately 130 miles. Readings along this traverse were tied to the pendulum station at Cairns.

(2) From Ewan to Einasleigh (Qld.), a distance of approximately 180 miles. Readings along this traverse the surveying of which is not yet completed, will be tied to the pendulum station at Townsville.

Traverses (1) and (2) were included in the programme to assist in the geological interpretation of portion of the Tasman geosyncline. No interpretation of the gravity results has yet been carried out.

(3) Barkly Tableland traverse, from near Frewena to near McArthur River, a distance of approximately 300 miles. Approximately one half of this traverse has been completed, but this work had to be abandoned because of the onset of heavy rain.

Gravity Map of Australia

Data was prepared for addition to the 1 degree square files. Data was obtained either from regional surveys or from the reduction of Bureau and subsidised sedimentary work to density 2.67.

The analysis of the data has not been carried further because of other commitments.

Earth-tide recording

Recordings at the Old Melbourne Observatory site were obtained using the North American underwater gravity equipment and a modified Heiland gravitymeter. Periods of record have been lost because of equipment failures.

Little analysis of the records has been carried out because of the shortage of staff.

Gravity meter tests. Calibrations as required.

Pendulum Measurements

The doubly-read tie Melbourne-Tokyo is almost completed; but field work using this equipment is held up because of the shortage of staff.

Automatic Computing Procedures

Programmes for the reduction and adjustment of elevation and gravity data were finalized. Other programmes for cross-section analysis and interpolation of gravity data have been developed. Reorganization of the filing system preparatory to getting all data onto tape is well advanced.

Regional Gravity Victoria - deferred until January 1964.

Underwater gravity survey - no suitable boat was available, so this survey was not carried out.

2. REGIONAL MAGNETIC SURVEYS

Five first order stations were read in the south of Western Australia. This work was a continuation of the 1962 first order survey, the main purpose of which was to furnish accurate field measurements for future secular variation determinations. Two first order and four second order magnetic stations were read by the staff of Port Moresby Observatory on two short field trips.

Declination observations (third order stations) were made at five mile intervals along 750 miles of traverse in South Australia and 750 miles of traverse in New South Wales. The South Australia survey was originally planned for 1962.

In Antarctica a reoccupation of the magnetic station at Davis and observations along the over-ice traverse from Wilkes to Vostok were made. The over-ice traverse started in 1962.

A fluxgate variograph was in operation in Hobart for most of the year.

A declination map of Australia for the epoch 1965.0, and a record on secular variation in Australia, were prepared.

SUMMARY OF ACTIVITIES 1963

Regional gravity traverse

Regional magnetic traverse

NMP/59/151-1

G 350-85

OBSERVATORIES

Headquarters

Magnetic and seismic results were extracted and distributed to appropriate organisations.

The Creed verifier and comparitor for punched paper tape were received. All previously punched magnetic data was checked on these machines in preparation for processing by EDP equipment. Punching and checking of Watheroo magnetic data was completed. Computer programs for the reduction of magnetic data were written.

Toolangi

Routine recording with the magnetic and seismological instruments was continued throughout the year. Regular magnetic control observations were carried out.

Comparisons of magnetic instruments at other observatories with those at Toolangi were made.

The Milne-Shaw seismograph and the Press-Ewing long period seismograph were installed in the Toolangi vault. The latter had been in use at the Perth Observatory. It is on permanent loan from Columbia University.

Mundaring Observatory

The normal recording programme of geomagnetic seismic and ionospheric variables was continued throughout the year.

A micropulsation recorder was constructed and put into operation during the year. A network of three temporary seismic stations were established between April and June. One station is at Mundaring itself. The purpose of the network is partly to record surface wave dispersion for crustal thickness determination, and partly to improve knowledge of local seismicity. Seismic waves from six depth charges exploded from H.M.A.S. Diamentina were successfully recorded.

Port Moresby Observatory

The normal programme of geomagnetic, seismic and ionospheric recording was maintained throughout the year. Considerable interference to the ionospheric recording was experienced owing to transmission from a local broadcast station.

Orders were placed for equipment for temporary field seismic stations. These are to be installed during 1964.

Regional magnetic and gravity surveys based on Port Moresby Observatory were carried out; see activities of the relevant groups.

Antarctic Observatories

Normal routine magnetic and seismic recordings were continued and magnetic control observations were made weekly if conditions permitted. Preliminary analysis of the records were carried out and the results were forwarded to Melbourne for distribution.

Two of the three elements of the fluxmeter at Mawson were returned to Melbourne for further tests.

Darwin

The Willmore seismographs were operated throughout the year.

Further investigations were carried out for a permanent seismological observatory site. The most suitable site appears to be near Manton Dam.

Palaeomagnetism

Preliminary measurements on the Weir basalt were completed and a record written. Components of the new astatic magnetometer were tested. Mr. Stott was co-author of "Pole List No. 6" published in the Geophysical Journal.

Terrella

The terrella model was completed during the year and a fairly complete set of measurements made. These were reported at a symposium on the upper mantle at the I.U.G.G. Meetings at Berkeley, California.

LABORATORIES

1. DESIGN AND DEVELOPMENT GROUP

This group continued its work in devising new geophysical techniques, and equipment and modifying existing ones. Problems submitted by various groups were attacked, and assistance and supervision provided for staff from these groups temporarily working with the Development Group.

An advisory service in electronics has been provided for all sections of the Branch and on several occasions assistance in such matters has been provided for the Geological Branch.

The Group's electronic drafting service has become thoroughly established as an essential part of the organization. Schematic and layout circuit diagrams are used for construction both by the Branch and by contractors, and for equipment operating and maintenance handbooks. Over 200 drawings were completed during the year.

A coil winding service established in 1962 because satisfactory coils, chokes and transformers could not be obtained readily from the trade, continued satisfactorily. Over 200 units were designed and wound during the year.

Design work continued on proton precession and fluxgate magnetometers. The basic proton magnetometer was used for the design of a survey unit for airborne use in the Cessna aircraft. A reading frequency of 2 per second with an accuracy of $\pm$ 1 gamma has been achieved.

Progress with this project was not sufficiently rapid to enable field tests to be performed in 1962 and the Cobar Experimental Survey in 1963 provided the first occasion for these tests.

The project was completed to stage 2 before the Cobar Survey. This stage includes the installation of the MNZ1 proton magnetometer, with towed bird detector, a Westronics recorder, an APN1 radio altimeter with TI recorder, a wide angle vertical frame camera, and ancillary electronic equipment.

The main reasons for the progress on the project being slower than planned were the delays in completing the installation of the magnetometer, bird and winch equipment by a contractor, the final development of the ancillary electronic equipment, and the additional modifications to the bird, required as a result of flight tests.

A transistorized version of a fluxgate magnetometer for ground monitoring the airborne magnetometer in the D.C.3 aircraft VH-MIN, was designed and built. The fluxgate magnetometer in the aircraft was redesigned and rebuilt during the aircrafts lay off period during the first half of the year.

Designs already completed were used to develop crystal clocks for timing in field seismology including the proposed tripartite networks for crustal thickness studies. They were used also for a time mark programming unit for Wilkes Observatory.

Other work included a calibrated time delay for the V.I.P. equipment to delay the shot instant trigger 0.001 to 10 seconds, testing shielding for gamma ray density probes, rock conductivity by inductive means, telluric fluxgate investigations, gamma ray density meter etc.

Terrella Project see under Observatories.

Rock Magnetism see under Observatories.

2. MAINTENANCE AND TESTING

Demands for maintenance, repair and modification of numerous items of geophysical equipment were met through out 1963. Several major projects were undertaken and several projects commenced in 1962, were completed.

For the Seismic Group, reinstallation of the type 8000 seismic amplifiers and associated equipment was completed. The TIC type 621 amplifiers were overhauled and modified for integration with the Variable Intensity Plotter system in the city office.

Installation and checkout of the continuous velocity logging equipment was commenced. The logger which was supplied by Shell Development Co., was still in the prototype stage and several modifications were required to achieve reliable operation.

A major overhaul of the equipment and installation in VH-MIN was carried out in the first six months of 1963. The overhaul had become necessary following the deterioration in the quality of magnetic records and the likelihood of a steadily decreasing reliability of the survey as a whole, as a consequence of the very full field programme in previous years.

The aim of the overhaul was to develop a new fluxgate magnetometer detector using transistor circuits, and other magnetometer circuits, and to overhaul the magnetometer orientor system, digital equipment, scintillographs, cameras, recorders, radio altimeter and Air Position Indicator, and to provide more adequate handbooks, maintenance schedules and fault finding procedures. In addition, the opportunity was to be taken to reinstall some of the equipment in the aircraft, to improve the accessibility for maintenance and the ease of operation, and to modify the aircraft wiring.

The time allotted to complete the above work was six months. In this time it was not possible to complete the work to the level which was desired. In particular little headway was made on the scintillographs, electronic circuitry of the magnetometer orienter system, handbooks, maintenance schedules, and fault finding schedules. Contributing delays were due to T.A.A. requiring much more time than they had estimated for completion of the reinstallation and wiring changes. Significant delays also occurred in the supply of some components from commercial suppliers.

Routine measurements of rock properties, both magnetic susceptibility and elastic constants, were made as requested.

Adequate maintenance of instruments and equipment is essential if field work is to proceed smoothly. Understaffing of the group was aggravated by the absence overseas of the senior geophysicist in charge. There remains a large backlog of maintenance work to be done. In particular many of the handbooks for equipment are inadequate and these must be brought up to date as soon as possible.

Workshops

Routine maintenance and testing of geophysical instruments and equipment accounted for more than half the workshop capacity. The rest of the workshop time was spent in major modifications to equipment or construction of new equipment.

Some of the bigger jobs were, major modification to an elevation meter and its installation in a 4 x 4 vehicle, the rebuilding and integration of a Failing logger and Widco logger into a 10,000 foot logger which combines the best features of both, installation the Shell continuous velocity logger on vehicles, and rebuild of the Cessna magnetometer towed bird including the construction of a spare bird.

The rebuild of a 35 mm strip camera for use in the DC3 aircraft was completed and the camera was installed and used during the year.

An astatic magnetometer with field coils was completed for use in studies of palaeomagnetism in conjunction with A.N.U.

Six high temperature compression chambers for sulphide experiments were built for the Geological Branch. Additional units will be made by a contractor.

A prototype 35 mm strip film viewer was designed and built for the drafting office. Six more will probably be made by contract.

The design of a parallel guidance mechanism for use with a stereoscope in the examination of air photos was completed. This was requested by the Geological Branch and work on the prototype has commenced.

Many small jobs were completed and all sections of the workshop were fully employed. Further staff losses occurred amongst the instrument makers during the year and the possibility of recruiting replacements is not good. The staff position seriously affects the work of this group.