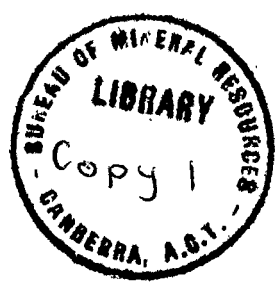

Geophysical Branch

Summary of Activities
1963

GEOPHYSICAL BRANCH

SUMMARY OF ACTIVITIES

1962

The following notes summarise the activities of the Geophysical Branch during 1962.

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.

CONTENTS

OIL SEARCH

1. SEISMIC SURVEYS

Surat Basin:

Moree Area:

Seismic Surveys from 1959-61 revealed a north-south trough which is the probable extension of the Bowen Basin southward. The trough which extends through Meandarra and Toobeah was thought to persist at least as far south as the Dolgelly bore (Lodwick and Bigg-Wither 1961).

During 1962 seismic work was extended to the Moree area. The main object of the Survey was to define the extension of the Bowen Basin southward and to find its relation to the Sydney Basin in N.S.W.

Aneast-west traverse in the latitude of 29° South, 32 miles north of Moree indicated a trough of sediments to a depth of at least 7500' beneath the traverse. An anticline or horst structure with a relief of about 500' was indicated in the middle of the trough in the approximate longitude of Moree. The eastern side of the trough is probably intersected by a thrust fault. Just 5 miles east of the end of this traverse an outcrop of quartzite occurs indicating that the margin of the basin is being approached. This trough is probably a further extension south of the Bowen Basin sediments.

An east west traverse through Moree indicated two troughs. The Moree and Biniguy Troughs separated by the Pallamellawa Ridge, which is probably an expression of a fault structure. The Moree Trough is the deeper of the two. A 20,000'/sec refractor was recorded near Moree at a depth of 14,000'. The velocity suggests that the refractor is a metamorphic or plutonic rock and represents unprospective basement. Reflections recorded to a depth of about 8000' in the Moree Trough are therefore possibly reflections from sediments above metamorphic rock. The Moree Trough or the double troughs - Moree and Biniguy - is possibly the extension south of the Bowen Basin. The eastern margin of the Biniguy Trough was not crossed but shallowing of the sedimentary section and the westerly dips on the shallow reflections near Yalgoble suggest that the margin is being approached. Volcanic rocks and tuffaceous sediments probably of Carboniferous age crop out about 2 miles east of Yalgoble, on the eastern end of the traverse. The Moree Trough shelves about 12 miles to the west of Moree, where the reflection section is about 5000' thick. A refraction probe indicated an 18,000'/sec refractor at 5400'. This confirms the interpretation from reflection results.

Reflections on the east west traverse from Bellata to Pollal were very poor. However, the cross section indicates a shallow shelf area near Bellata and very steep easterly dipping strata - probably carboniferous - towards Pollal. It is probable that a thrust fault exists about 12-15 miles west of Pollal. Between the shelf area to the west and the steeply dipping (?) carboniferous strata to the east, near Pollal, sediments reaching a depth of about 6000' exist, dipping east. It is possible that these sediments are in part Permian and if so they will probably be the only link between the Bowen and Sydney Basin, the Permian sediments ? being preserved between the shelf to the west, near Bellata, and the overthrust fault which possibly passes 12-15 miles west of Pollal.

It was mentioned above that a thrust fault probably existed on the eastern end of the east west traverse along latitude 29° south and probably also on the eastern end of traverse from Bellata to Pollal. It is possible that the fault system to the east of Goondiwindi, which extends northwards and bounds the eastern margin of the Bowen Basin is linked with the Hunter-Bowen thrust system to the south through the two probable faults mentioned above. The Pallamellawa ridge could be the expression of this fault.

St. George - Bollon Area:

Seismic reflection and refraction traverses carried out between St. George and Bollon indicated that the area west from St. George to the Nebine Ridge is a shelf area with approximately 5000 feet of sediments deposited on it. The section shallows gradually at the western end on to the Nebine Ridge.

Eromanga Basin:

Cunnamulla - Thargomindah - Innamincka Area:

A sedimentary section of about 3000 feet was demonstrated near Coongoola, about 20 miles north-east of Cunnamulla. This indicated that a narrow trough extends southward from Charleville through Coongoola, partially separating the Nebine Ridge from the Eulo Shelf.

To the west of Eulo, where granite outcrops, the basement gradually deepens towards Thargomindah, while there is probably about 4500 feet of Mesozoic sediments overlying basement.

Work is continuing in the Noccundra area, further west. Initial shooting suggests a section in excess of 6000 feet, but results are variable and often poor. A program of noise tests and experimental shooting was carried out in an effort to improve record quality.

1962 Summary of Activities - Seismic Party No. 2

N.T. Amadeus Basin - Gosse's Bluff - Missionary Plains

A north south reflection traverse was surveyed across the Missionary Plain through Gosse's Bluff extending on to the Archaen contact in the north and over the Gardiner Range Fault in the south. The survey showed that the sedimentary basin is readily investigated by relatively simple seismic reflection techniques. The deepest part of the Missionary Plain Syncline appears in the Basin north of Gosse's Bluff where the section shows approx. 30,000 ft of sediments. Seismic work has shown that deep reflections with little dip exist under Gosse's Bluff, suggesting that the Bluff has probably resulted from major movement within the sediments and little basemental movement. The Mareenie/Bitter Springs fault in the Gardiner Range is shown to be a major fault dipping at about 15° to 20° to the south.

- Alice Springs to Deep Well - Ooraminna Anticline

A north south reflection traverse, incorporating the Deep Well and Polhill 1961 reflection traverses, was surveyed from Deep Well to Alice Springs. Another traverse was recorded over the Ooraminna Anticline to the east of the main NS line. Relatively simple seismic reflection techniques gave good results except in areas near the outcrops. The cross sections show a maximum depth of sediments of approx. 20,000 ft in the basin north of the Ooraminna Anticline outcrops. The Ooraminna Anticline extends in the section to approx. 16,000 ft and there appears to be reflections with little or no dip below this depth; this suggests that the feature is of sedimentary origin.

W.A. Canning Basin - Mt. Beadell to Carnegie

Seismic traverses are being shot between Mt. Beadell and Carnegie in the South eastern part of the Canning Basin. This work is an extension of the regional traverses surveyed between Giles and Mt. Beadell in 1961. Complex patterns of holes and the use of multiple geophone techniques are necessary to obtain fair reflections in this area. A refractor of 17,000 ft/sec recorded at approx. 6000 ft at Mt. Beadell confirmed the existence of at least 6000 ft of unmetamorphosed sediments : the total sedimentary section may be even deeper.

Contract Seismic Party - Poole Range

W.A. Fitzroy Basin - Poole Range Area.

A contract seismic party engaged by B.M.R. conducted a reflection and refraction survey over the Poole Range structure in the Fitzroy Basin. Fair to poor reflections were obtained by complex techniques involving large patterns of holes and a large number of multiple geophones. The reflection method was abandoned in favour of a continuous profiling refraction method. Approx. 100 miles of profiling was carried out. The Poole Range structure was found to extend to approx. 20,000 ft deep. Traversing to the south of the Poole Range structure showed that the basin deepened considerably to the south and that there exists a series of faults probably running approx. east west, with downthrown side to the south. An east west traverse over a positive gravity anomaly (16A) confirmed the existence of an anticlinal reversal associated with the anomaly.

2. AIRBORNE SURVEYS

Early in the year the programme of survey work for the DC3 was modified to include the survey of the Curnamona 4-mile area, S.A. This modification to the programme was required because of the delay in the preparation of the Tanami-The Granites, N.T., survey. Further delays, which have been due largely to faulty equipment, have made it unlikely that the Bowen Basin, Q., survey will be flown south of Latitude 26°S, and required the postponement of the magnetic and radiometric survey of Tingha, Glencoe, Glen Innes, Clive, Emmaville, Maryland, and Inverell (part only) 1-mile areas, N.S.W., to the 1963 programme.

Torrens Basin, S.A.

During March and April, an airborne magnetometer and scintillograph survey was made of the two 4-mile areas of Andamooka and Torrens, the survey area being extended slightly eastward to cover Lake Torrens entirely. The survey was with a line spacing of 1 mile and at an altitude of 500 feet above ground level.

The Andamooka 4-mile area showed little magnetic activity east of Lake Torrens. Moderate to intense magnetic activity was recorded to the west of Lake Torrens, particularly along the western shore corresponding to a major fault. Two major anomalies exceeding 5000 gammas with a N-S elongation were delineated.

The Torrens 4-mile area was generally less disturbed magnetically than the Andamooka area. Little magnetic activity was recorded over the fault zone on the western shore of Lake Torrens. Minor anomalies originating from near-surface rocks were recorded in the extreme south of the area.

The Andamooka and Torrens area were found to be low in radioactive background level, with minor changes in the intensity level. Six possible radiometric anomalies were recorded in Andamooka area; there were none in Torrens area.

The survey records were sent to the S.A. Mines Department for reduction and production of aeromagnetic contour maps.

Curnamona, S.A.

The Curnamona 4-mile area was surveyed during May, with a line spacing of 1 mile and at an altitude of 1500 feet above general ground level.

Sharp magnetic anomalies of about 1000 gammas were recorded along a line striking roughly N.N.E. and passing through latitude 31° 45', longitude 139° 45'. The northern part of the line is flanked by broad anomalies of the order of 300 gammas which extend to the eastern and western boundaries of the survey area. This line of anomalies is less clearly defined to the south and is lost in the generally disturbed pattern associated with the Archaean granites and metasediments outcropping along the southern margin of the area.

The survey records were sent to S.A. Mines Department for reduction.

Bowen Basin, Q'ld.

The airborne magnetometer survey of the Bowen Basin, commenced in 1961 with the flying of the Clermont, Emerald and Duaringa 4-mile areas, was renewed in August, 1962.

The northern part of the survey area programmed, consisted of the 4-mile areas of Mt. Coolon, St. Lawrence and part of the Mackay area. The east-west flight lines were spaced two miles apart. The altitude was maintained at 2000 feet above sea level excepting regions of extreme topographic relief where the altitude was increased to ensure a terrain clearance of 750 feet.

In the St. Lawrence area, intense magnetic disturbance was recorded over Tertiary basalt in the central part of the area and granite outcrops in the extreme north-west. Intense anomalies in the Marlborough 1-mile area on the eastern side correspond to known serpentine bodies. More moderate disturbance was recorded over basement outcrops of metamorphics and granite in the east of the Stye, St. Lawrence and Broad Sound 1-mile areas.

A well-defined zone of minor magnetic disturbance trending N20°W through St. Lawrence occurs over the Lower Bowen Volcanics.

The western part of the area is occupied largely by Upper Bowen Coal Measures and the corresponding magnetic profiles are smooth. A broad magnetic anomaly with N-S elongation was recorded in this region.

The profiles in the Mt. Coolon-Mackay area have not yet been examined.

In the southern part of the programmed survey area, Baralaba, Springsure and Tambo (part) 4-mile areas were surveyed to November. Tertiary basalt in the eastern part of Springsure was the source of magnetic disturbance. The magnetic results indicate a shallow magnetic basement in the McDonald and Sterculia 1-mile areas.

In general, magnetic basement appears to be shallower in the Springsure area than in Baralaba and Tambo areas where it may be 15,000 feet deep.

Magnetic traverses from Mackay to Brisbane via Rockhampton and Bundaberg, and from Brisbane to Rockhampton via Monto were flown in October when the aircraft was en route for normal maintenance and servicing. The results of these traverses are not yet analysed.

Simpson Desert, N.T.

Aero Service Ltd. completed the contract airborne magnetometer survey of the northern part of the Simpson Desert on 25th July. The reduction and plotting of the results is in progress and is expected to be completed in December.

3. GRAVITY SURVEYS

South Canning and Amadeus Basins, W.A. & N.T.

In the south Canning and Amadeus Basins an area of over 100,000 square miles was surveyed, comprising the following 4-mile sheet areas: Herbert, Madley, Browne, Warri, Bentley, Cobb, Scott, Rawlinson, MacDonald, Petermann Ranges, Bloods Range, Mount Rennie, Ayers Rock, Lake Amadeus and Mount Liebig. This survey using helicopters for transport formed the westerly extension of last year's Amadeus Basin survey. Readings were normally taken on a 7 mile grid, though in the area of the Woolnough Hills and Madley salt domes a more detailed grid was used. A total of 2715 new gravity stations was established in 900 helicopter flying hours. A further 40 hours were flown on sorties by Bureau geologists working in the area.

The general E-W alignment of gravity features noted on last year's Amadeus Basin survey continues into the eastern part of the survey area and extends approximately as far as the West Australian border. The Bouguer anomalies clearly reveal the shape of the Basin as a northern trough and southern depression separated by a ridge and define its northern and western boundaries, although the southern boundary is not so apparent.

Further to the west and separated from the gravity lows of the Amadeus Basin by a gravity high region is another gravity low region - the Cobb Gravity Depression. This is developed wholly in West Australia and extends in a N.W. direction towards, but probably not reaching, the south Canning Basin Gravity Depression. The Cobb Gravity Depression is bounded to the south by the Blackstone Gravity High and to the south-west and west by the Warri Gravity Ridge which appears to be an extension of the Anketell Gravity Ridge known further to the north-west.

To the west of the Warri Gravity Ridge is another area of low gravity values - the Gibson Desert Gravity Depression. The Woolnough Hills and Madley salt domes occur in this Depression and appear on the gravity plan as small local depressions. Towards the south-east of this Depression a gravity low is developing and indicates the probability that the Gibson Desert Gravity Depression is connected to the Officer Basin.

Boundary Area Between Amadeus and Georgina Basins.

During the 1962 Helicopter Gravity Survey parts of four 4-mile sheets were surveyed to complete the gap between the previously mapped areas of the Amadeus and Georgina Basins. The area surveyed comprised 2/3rd. Illogwa Creek sheet, ½ Hale River sheet, 2/3rd. Alcoota sheet and approx. 1/10th Napperby Sheet. 314 new stations were established during 131 hours of flying time.

The Bouguer anomalies clearly indicate that these areas are peripheral to the Amadeus Basin which is bounded to the east and north by steep gravity gradients.

The north-west trending belts of high and low gravity which originate in the Simpson Desert North and Hay River sheets respectively, are now seen to extend through the Illogwa Creek and Huckitta Sheets into the Alcoota sheet. In the west of the Alcoota sheet and east of the Napperby sheet a large gravity low, open to the west, has been mapped.

Gravity Readings Along Seismic Traverses.

In addition to the regional helicopter survey, gravity readings were taken along B.M.R. seismic traverses in the following areas:

(a) Giles - Carnegie, W.A.
(b) Gosse's Bluff, N.T.
(c) Ooraminna area, N.T.
(d) Moree area, N.S.W.
(e) St. George to Innamincka, Qld. and S.A.

The study of these results in conjunction with the seismic results has been commenced.

4. BOREHOLE LOGGING

Mt. Hunter, N.S.W. (A.O.G.)

Mt. Hunter No. 1 bore, in the South Sydney Basin, was logged with a gamma-ray probe in February. Coal seams in the Permian below 2113 feet showed low radioactivity, but the radioactivity of some of the sandstones is equally low.

Mt. Salt, S.A., (A.O.G.)

The Bureau logged one structural bore, and the well site geologist was instructed in the use of the 2000 ft logger. The Company logged 4 bores with a total depth of 3950 ft. Logging was started in January and completed in February.

Georgina Basin, N.T.

During April Georgina No. 2 and No. 5 were logged to depths of 450 and 385 ft, and two B.M.R. geologists were instructed in handling the electric and gamma ray logger to complete the programme of 16 holes.

Jerilderie No. 1, N.S.W.

In May a single point resistivity and S.P. log was made to a depth of 1190 ft.

Millicent, S.A., Beach Petroleum

In July personnel of Beach Petroleum were instructed in the use of the 2000 ft Widco logger near Millicent, S.A. Several shallow holes were logged in this area.

Queensland Water Bore Logging

The experimental logging of old water bores in the Artesian Basin was continued.

Up to November gamma ray logs were made of the following water bores: Augathella, Yarrawonga, Baker, Tullochard, Cunawarra, Tongi, Lomax No. 1, Highfield and Calabar No. 2.

The proposal to have about 130 water bores logged by contract was dropped as funds were not available.

5. PALAEOMAGNETIC GROUP

Work on the Innamincka, Buckabie and Cothalow bores was finished and the results supplied to the Geological Branch.

A search was made for a suitable site for new palaeomagnetic laboratories. The position finally chosen was largely dictated by University planning.

The major project of the year was the cutting, measuring and magnetic cleaning of the Weir and Sugar Basalts from Queensland. The latter appear stable. The former change in direction of moment on cleaning, and approach a direction 180° from the former. The suggested age for both is Triassic.

Some help was given to the airborne section in an attempt to interpret airborne magnetic anomalies near Canberra in terms of rock magnetism.

Programmes for data handling have been completed.

METAL SEARCH

1. GROUND METALLIFEROUS SURVEYS

The activities of the Metalliferous group were mainly concentrated on the search for alluvial tin and iron ore.

Long Plains - Savage River Iron Ore Deposits. W. Tasmania

An area of about 6 miles in length and about ½ mile wide was investigated mainly by magnetometer and on some selected traverses also by gravity meter. The southern 2 mile covered the distinct airborne magnetic anomaly - so called Rio Tinto anomaly - near the 31 mile peg west of the Waratah - Corinna Highway. This anomaly was covered in detail by traverses 250 feet apart and 50 feet apart at the northern end. The survey shows a rather continuous and more regular but also a narrow anomaly than over the Savage River deposits. The magnetic anomaly is strong with intensities exceeding 50,000 gammas in places but it is not quite as strong as the Savage River anomalies. Very substantial iron ore reserves can be expected from the Long Plains iron ore deposit but only one bore hole has been drilled so far (by Rio Tinto Exploration in 1959).

The reconnaissance survey carried out between the northern end of the Long Plains anomaly and the southernmost traverses of the Savage River area shows that in the intervening 4-miles of country no iron ore deposits can be expected. The northern end of the Long Plains ore deposits terminates quite abruptly and does not continue northwards even at depth.

Numerous drilling targets for a drilling campaign of several years have been provided for the Tasmanian Mines Department and the interested exploration company "Industrial and Mining Investigations Pty. Ltd."

Gladstone Tin District, N.E. Tasmania

The survey, requested by the Tasmanian Mines Department was commenced in October 1961 and comprised several areas of stanniferous deep leads in N.E. Tasmania. Gravity and seismic refraction methods were used in the investigations to find the positions of buried channels. The areas surveyed were at St. Helens, Great Fraser River, Great Mussel Roe River and an area north of Winnaleah. The most promising of these is the area north of Winnaleah where continuation of the Ringarooma lead could be expected. The Ringarooma lead has been worked extensively between its origin and Derby where it disappears under thick basaltic and detrital cover.

The gravity and seismic methods indicated the depressions in the unweathered bedrock and in most cases gave similar results regarding the positions of the old channels, but the seismic method gave more detailed information and better depth determinations to bedrock.

The survey was made somewhat difficult through the presence of remnants of basaltic layers and by the hilly nature of the country. Considerable variations in the depth to bedrock were found but it was possible to trace the old drainage pattern which has only little resemblance to the present one. It is thought that the results show the course of the old Ringarooma lead through the surveyed area north of Winnaleah and also an old channel in the Great Fraser River area.

The survey lasted over 6 months and during this time 53 miles were surveyed by the gravity method and 34 miles by the seismic method. No exploration by drilling or other methods has been done so far but the Mines Department intends drilling first at the Great Fraser and later in the area north of Winnaleah.

Scott River, W.A.

The magnetic survey over the bog iron deposit carried out in 1961 near Scott River was extended this year upon request of Consolidated Zinc Ltd. An area of approximately seven miles in length and about 3 miles in width was surveyed by magnetometer on traverse about 2000 feet apart and observations made at 200 feet intervals along the traverses.

The deposit is shallow and ranges in thickness from one foot to about five feet. The magnetic readings varied very rapidly as the ore is at or close to the surface and the magnetic minerals are mainly concentrated in the cap rock. About one third of the area surveyed showed some magnetic disturbance, but the anomalies exceeding 300 gammas, which possibly indicate the presence of ore grade material, cover only a small fraction possible less than one tenth of the area surveyed. It was not possible to establish any useful relation between the intensity of magnetic anomalies and thickness or grade of ore. It appears that the deposit does not cover the whole area but it restricted to several small basins and the ore reserves probably do not reach the originally expected high figures.

Tallebung Tin Field.

A small party carried out a brief gravity survey over part of the area surveyed by seismic refraction, the previous year. No gravity meter had been available at the time of the seismic survey, but it was considered that gravity results might support the interpretation of the seismic results. 9 miles of traverse were surveyed in about 2 weeks. The bedrock topography is relatively flat and the gravity profiles therefore showed only minor variations. The seismic and gravity profiles showed a reasonably good agreement in spite of the difficult geological conditions with heavy weathering of the bedrock consisting of quartzites and slates.

Information has been received recently that drilling carried out during the last month confirmed roughly the bedrock contours as determined by geophysical methods. In several boreholes also some tin was found.

Kings Plains, Cooktown N. Qld.

A small gravity party started in the last week of May the investigation of an area at Kings Plains which was assumed to contain tin bearing deep leads. The geophysical work had been recommended by the Geological Branch.

The area covered by the gravity survey is about 11 miles long, but varies considerably in width as the profiles are short in the narrow parts of the valley, but attain considerable length in the extensive Kings Plains. The traverses were mostly $\frac{1}{4}$ mile to 1 mile apart and 16 traverses with a total length of $27\frac{1}{2}$ miles were needed to cover the whole area. The survey was completed in about 7 weeks.

It was the first time that an attempt was made to determine the position and shape of the buried channels by gravity work alone. In spite of a strong regional effect caused by high granitic mountain massives nearby it seemed possible to trace the old channel over the whole length of the surveyed area. All gravity profiles were started over outcropping bedrock and crossed the valley to bedrock on the other side whereever possible.

Some drilling has been carried out and seems to confirm the geophysical work but not enough is known about the drilling results to be too sure about it. So far no payable tin concentrations seem to have been located although large depths of detrital material have been found.

Mt. Garnet - Tin District N. Queensland

The most extensive geophysical work carried out by the metalliferous group was done in the Mt. Garnet area to find suitable tin bearing ground as future reserves for the dredges working in the area. The survey was started upon request of the Geological Branch and of the Table land Tin Dredging Company in Mt. Garnet. Mainly seismic refraction and gravity methods were used and one seismic party worked there from middle of May until middle of July to investigate the area of Smith's Creek below the present dredging ground. The gravity party after completion of the work at Kings Plains started middle of July to investigate a very large area around Mt. Magnet to determine the main trends of the geomorphology of the area and to find out the old drainage pattern. The gravity survey covered an area of about 12 miles in an east-west, and about 5 miles in a north-south direction. The second seismic party started towards end of September and is still continuing to investigate the area of the ATR and Wirruma Prospects.

The geophysical investigations showed clearly that there is no evidence for an old channel (Ancient Tate River) flowing in a westerly direction and that the present drainage pattern with a prevailing N-S direction had it basis laid long ago. Channels were found running about in the same direction as Smith's Creek and Return Creek although the position of the old and the new channels differ considerably. The position of these old channels has been determined by the gravity survey and the depressions in the unweathered bedrock by the seismic survey. These bedrock profiles are well defined as the velocity of the unweathered bedrock is about 17,000 ft/sec and differs sharply from the detrital material above it which has mostly a velocity of 5000 to 8000 ft/sec. How much of that material includes strongly weathered bedrock is at present difficult to say. More information and geological logs from boreholes are needed to compare with velocities obtained in logging and during the seismic survey to complete the interpretation of the geophysical work.

2. AIRBORNE METALLIFEROUS SURVEYS

Tanami - The Granites, N.T.

During May, June and July, an airborne magnetometer and scintillograph survey was made of Tanami and the Granites 4-mile areas. The flight line spacing was 1 mile and the aircraft altitude was 500 feet above ground level.

The magnetic field was relatively undisturbed in the central part of the Tanami area over Upper Proterozoic sediments. Some broad anomalies were recorded to the west. The northern and eastern parts of the area occupied by Lower Proterozoic metasediments were more disturbed, with anomalies up to 800 gammas.

A number of sharp anomalies due to near-surface magnetic sources were recorded in The Granites area. Some of the anomalies are isolated, but the majority are part of extensive north-south magnetic trends in the central part of the area. The western part of the area is magnetically undisturbed.

In both the Tanami and Granites areas, the magnetic pattern over the Lower Proterozoic rocks, showed well-defined linear anomalies which are probably due to ironstone bodies. It has been suggested that ironstone reefs may be indicative of mineralisation at depth and for this reason the aeromagnetic data should be of considerable interest in further prospecting of these areas.

In a preliminary analysis of the radiometric records, 52 anomalies in Tanami area and 86 anomalies in The Granites area were listed for detailed interpretation.

A magnetic traverse was flown between Gordon Downs - Tennant Creek - Kamileroi - Cloncurry - Mackay during the transfer of the base of operations from Gordon Downs to Mackay. The results have not yet been analysed.

Airborne surveys (CESSNA)

The light aircraft programme for 1962 was modified by the postponement of the installation of the proton magnetometer from August to September and the replacement of the programmed detailed Structural Surveys, W.A., by a proposal to fly a test survey in the Cobar area, N.S.W., where the magnetic environment is known. Delays in the preparation of the aircraft for the test survey have occurred recently which make it unlikely that the test survey can commence until the latter half of November.

Mt. Isa, Q'ld.

The survey of the Mt. Isa area was continued to the north of the area completed in 1961. A total of 2600 square miles were surveyed with a line spacing of $\frac{1}{4}$ mile and at an altitude of 200 feet above ground level.

Nineteen recorded anomalies were reflown. Most were found to be due to deeply eroded creek beds or surface laterite.

Five anomalies recorded over Myally Beds (Lower Proterozoic) and one anomaly recorded over Ploughed Mountain beds (Lower Proterozoic) are considered to warrant investigation on the ground.

Cessna aeromagnetic survey project

The project is at the stage where the first field tests of the stage 2 installation are about to take place at Cobar, N.S.W. The stage 2 installation includes an MNZ1 proton magnetometer with a towed bird detector and Westronics recorder, an APN1 radio altimeter and T.I. recorder, and a vertical frame camera. If the tests are satisfactory it is planned to use the stage 2 installation in the 1963 programme of field work.

During the year an experimental towed bird equipment was developed for temporary attachment to a chartered Cessna 182 aircraft, and an early version of the proton magnetometer was tested in flight using this equipment. A second and smaller towed bird was built for use in VHGEO and aerodynamical defects in this bird, as revealed by wind tunnel tests, have now been corrected. The installation of the magnetometer and towed bird, a special winch of Bureau design, the camera and other equipment of stage 2 in VHGEO is almost complete. Local flight tests are still to be done before departure for Cobar.

Electrical circuits to provide a suitable chart recording of the proton magnetometer output and to provide impulses to drive the magnetometer and to time the recorders and camera have been developed and built.

The vertical wide angle camera has been flight tested in Victoria and Mt. Isa and an optical numbering system has now been added.

Navigational tests in various environments in Victoria and Mt. Isa were conducted and test plots of the photographs have been done. Further development of surveying techniques awaits the field tests at Cobar.

3. METALLIFEROUS SURVEYS, DARWIN GROUP

Hundred of Goyder

Further electromagnetic and radiometric surveys were carried out in the Hundred of Goyder in accordance with the programme agreed on in discussions between the A.A.E.C., T.E.P., and the Bureau.

In the area between Browns and the West Finniss River, no radiometric anomalies of interest were observed, but the electromagnetic work showed a zone of strong anomalies continuing from the known ore-body at Browns to Area 55. The anomalies were particularly strong in the neighbourhood of Rum Jungle Creek. The anomalous zone terminated abruptly at the south-western limit of Area 55A.

At the southern end of Castlemaine Hill the surveys were extended south of the Batchelor Laterites area. No radiometric anomalies were observed. The electromagnetic survey indicated several strong anomalies, which however do not appear to fit very clearly into the pattern of the continuous conducting zone suggested by the 1961 results. Conditions were complicated by the presence of conductors close to the surface, which are presumably connected with wartime installations.

The surveys at the northern end of Castlemaine Hill showed a small radiometric anomaly of 4 X background corresponding to the T.E.P. "Zeta" anomaly. No significant electromagnetic anomalies were located.

Radiometric logging of diamond drill holes was carried out for the Bureau's Phosphate Party.

South Alligator Area

Self-potential surveys were made in the South Alligator uranium field at the request of United Uranium N.L. This work was a continuation of the 1961 surveys which proved successful in assisting the Company to locate several new ore-bodies. The 1962 surveys covered areas near El Sherana and Coronation Hill and several other areas suggested by the Company.

Strong anomalies were observed mainly in the Stag Creek, El Sherana, Koolpin Creek and Coronation Hill South-East areas. The results have not yet been fully analysed. It is presumed that the anomalies are associated with the conducting black slate horizons which are favourable for occurrence of uranium mineralisation in the South Alligator area.

Jervois Range

At the request of New Consolidated Goldfields, surveys using electromagnetic and magnetic methods were made over an area of 1500 feet x 2000 feet at the Bellbird prospect, and an area of 1500 feet x 6000 feet at the Reward - Green Parrot prospect. The purpose of the surveys was to test for possible copper and lead sulphide mineralisation at depth. In each area, the electromagnetic method gave no anomalies, but strong magnetic anomalies were obtained in each area apparently associated with the known lines of mineralisation.

The Company proposes to test some of the anomalies by drilling. If this shows that the magnetic bodies are associated with mineralisation of commercial grade, an aeromagnetic survey would be an effective means of prospecting in this region.

Mt. Bundey

A reconnaissance survey using the magnetic method was made over an area 3000 feet x 1500 feet at the Mt. Bundey iron-ore deposit. The survey was requested by the Mines Branch. Very strong anomalies were found to be associated with outcrops of ore but were more extensive than the outcrops indicating the possible presence of concealed ore.

It appears that if similar lodes exist in the area, they can be easily prospected by magnetic methods.

Miscellaneous

Radiometric assays and repairs to radiometric equipment were carried out as required.

At the request of the P.M.G. Department, Broadcast Division, resistivity measurements were made near Charles Point Lighthouse and at two points near Humpty Doo. The P.M.G. required the information in connection with proposed construction of new installations.

ENGINEERING GEOPHYSICS

A.C.T.

Extension Googong Damsite Seismic Survey and Googong Saddle Damsite.

Seismic Survey

Further seismic refraction work was done on the Googong Damsite to remove uncertainties found by the 1961 surveys. The dam on the "Saddle" is necessary as a retaining wall for the water reservoir. An important shear zone was found in the centre of the Googong Saddle. The surveys were completed in April.

The Upper Cotter damsite survey was not carried out, as it was decided not to use this site. No firm request was received for a survey at the Molonglo bridge site.

Tasmania

Upper Paloona Damsite

A seismic refraction survey in February was carried out to find the depth to bedrock and to determine the elastic constants of the bedrock. The weathered layer is thin and the bedrock, showing high seismic velocities, appears to be of a better quality than the bedrock investigated in 1960 on the Lower Paloona Damsite.

Arthur Lakes Canal (Todd's Corner)

The seismic refraction survey was carried out to determine the thickness of lake deposits and the depth of weathering in a basalt filled valley. The results indicate the presence of deep weathering which could entail very deep erosion in the projected canal. The survey was completed in February.

Lake Mackenzie Power Scheme

The investigated part of the scheme consists of a damsite, a flume line, and a penstock line.

The seismic refraction survey on the penstock line indicates a thin cover of scree material on the steep slopes, but thick layers of scree are present below the dolerite cliffs near the outlet portal of the tunnel.

The seismic survey of Lake Mackenzie Damsite has shown thin to moderately thin glacial sediments and weathered bedrock overlying unweathered dolerite bedrock. On the left bank a shear zone suggested by seismic evidence agrees with a probable fault based on geological information.

The seismic survey of the Lake Mackenzie Flume shows a thin to moderately thin glacial and weathered layer overlying unweathered dolerite bedrock, except near the tunnel portal where the dolerite is deeply weathered.

The survey of the Mackenzie project was completed in the beginning of May.

Mersey Falls Wilmot Scheme

"Mersey below Fisher" Damsite:

Slightly upstream on the site investigated in 1960 the seismic survey shows a thick cover of scree and tillite overlying jointed mica schist bedrock.

The seismic survey of the "Lemonthyme Penstock Line" shows the presence of a subsurface valley filled with basalt.

At present the valley shows up as a small topographical ridge. The Mersey Falls Wilmot survey was completed on 7th June.

Pieman River, between Hell's Gate and Donaldson Damsites.

The seismic survey shows a thin layer of river sediments overlying bedrock of a seismic velocity of 14,000 ft/sec. The survey was completed on 14th July.

Cethana Damsite

An effort was made to measure rock constants, but due to bad weather and instrument trouble the results are probably of poor quality.

Lawrence Vale Landslip

This survey was deleted from the programme, as the Tasmanian Government was not prepared to provide the requisite ancillary services.

Queensland

Flaggy Creek Damsites

At the request of the Co-ordinator General's Department a geophysical survey was carried out to determine foundation conditions on the damsite for the Barron River hydro-electric scheme. Seismic refraction results indicate a thin weathered layer for the major part of the area. Deep weathering is found on the left bank of the creek; this is confirmed by magnetic and resistivity work. The survey was completed in July.

Vibration Tests

No vibration tests were made during the year. (Has any Commercial Co taken this over?)

N.T.

Airstrips near Katherine

At the request of Department of Works, tests were made by the Darwin Group using the potential ratio method with Turam transformer, at Venn and Tindall airstrips, near Katherine, N.T. The purpose of the surveys was to investigate methods for detecting the presence of solution cavities in the limestone underlying the strip. Two traverses were read at each strip, together with some short test traverses close to Venn strip.

The potential ratio method clearly defined areas having anomalous electrical properties at each strip. They were shown most definitely on the phase profiles.

The potential gradient profiles gave clear anomalies at Venn, but in other areas were irregular. It appears that these profiles are critically dependent on surface conditions. The cause of the anomalous conditions is not known. It is recommended that they be tested by drilling, to discover if any correlation exists between the anomalous electrical properties, and suitability for airstrip construction.

REGIONAL SURVEYS

1. REGIONAL GRAVITY SURVEYS

Gravity ties between pendulum stations

Using the new La Coste-Romberg gravity meter connections were made between pendulum stations at Wiluna (W.A.), Alice Springs (N.T.) and Oodnadatta (S.A.). Additional traverses were read between Kulgera and Wall Creek (N.T.), and Giles and Signpost (W.A.) via Mt. Davies and Warburton Mission.

Stations at intervals of approximately 5 miles were read along the traverses. Between Wiluna and Alice Springs levels were provided by the Department of Interior. Between Alice Springs and Oodnadatta levels along the railway line were used. In all, approximately 1,850 miles of traverse and 376 new gravity stations were read.

Preliminary reductions show that the intervals between the pendulum stations as measured by gravity meter agree closely with the differences between the pendulum station values themselves. The immediate purpose of the work, however, was to provide some ground control for the helicopter gravity survey extending between Carnegie and Ayers Rock.

At intervals during the programme, four sets of measurements were made over the Alice Springs Calibrating Range to help establish its value more accurately.

Gravity Map of Australia

Stations were added to the 1 degree square files. Data was obtained either from regional surveys or from the reduction of Bureau and subsidized sedimentary work to density 2.67.

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

Pendulum Measurements

One officer visited Japan to take delivery of a set of G.S.I. pendulum equipment. After the doubly read tie Tokyo - Melbourne is completed, it is proposed to reoccupy several of the 1951 Cambridge pendulum stations particularly those in the east coast chain.

Earth-tide recording

A considerable amount of time has been spent in modifying the North America Underwater Gravity Meter for this purpose. The equipment is set up at the Old Melbourne Observatory and satisfactory records are being obtained.

A start has been made on adapting one of the Heiland gravity meters for earth tide recording. The two instruments will be run together at Melbourne for some time and then it is intended to obtain data from other parts of Australia.

Gravity Meter Performance Tests

A series of tests using all available gravity meters was carried out in January. Most of the work was done on the Melbourne Calibrating Range but some laboratory tests were also included. Further work under controlled conditions of temperature and pressure remains to be done but the studies to date have yielded valuable information on the behaviour of quartz-type gravity meters.

Automatic Computing Procedures

Development of this work was continued and programmes for the reduction and adjustment of elevation and gravity data, and for the calculation of cross sections were developed. The present task is to reorganize the filing system and to get all gravity data onto tape preparatory to the recalculation of earlier data using later more accurate gravity control and more accurately determined gravity meter scale values.

Regional gravity Victoria - deferred till 1963, January or February.

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

2. REGIONAL MAGNETIC SURVEYS

First order re-occupations and detailed declination surveys.

Twenty five first-order stations were read throughout Australia. Most of these were exact reoccupations of previous stations, but their main purpose is to furnish accurate field measurements for future secular variation determinations. A declination traverse in S.W. of Western Australia was surveyed. A similar survey was planned for late 1962, but will probably be deferred until 1963.

Variograph

An Askania variograph has been in operation at Thursday I. since March. Some of the trace is not usable because the level of the instrument changed. A fluxgate variograph has been in operation at Hobart since June.

Compass Swinging Sites

The compass testing site at Amberley airfield was surveyed for declination.

Papua - New Guinea

Nine regional magnetic stations were read by the staff of Port Moresby Geophysical Observatory on three short field trips.

Antarctica

Five new regional magnetic stations were observed in the coastal area of the eastern sector of Australian Antarctic Territory. Reoccupations were made at Davis and at Chick Islet.

General

Computer programmes have been developed to determine azimuths from sun and star observations made on regional magnetic surveys.

OBSERVATORIES

Toolangi-Melbourne

The normal programme of magnetic recording was continued at the Toolangi Magnetic Observatory. A proton precession magnetometer, built at the Footscray Laberatories was used at Toolangi three times during the year. The consistency expected from the instrument has not yet been achieved, but preliminary measurements indicate that the standards adopted at Toolangi are within a few gammas of the proton precession value, which is now considered as a world standard.

The installation of seismic instruments at the new site at Blue Mount, a few miles from the Toolangi Magnetic Observatory, was started in March. The seismographs themselves were moved during July and have been operating satisfactorily since. The lower noise level allows the instruments to be operated at higher magnification. Almost twice as many earthquakes are reported as were reported in Melbourne.

Mundaring

The normal programme of magnetic and ionospheric recording continued throughout the year. The proton precession magnetometer was used in May. A rapid-run Lacour magnetograph was set up and tested prior to being installed at Macquarie I. The development of a fluxmeter for recording rapid magnetic variations was started.

During May and June the Vela Standard Seismographs were installed in place of the Benioffs which had been in continuous operation since July, 1959. In September a short period vertical seismograph was installed to assist in the study of local earthquakes.

Purchase of riometer equipment was deleted from the estimates.

Port Moresby

The normal programme of magnetic and ionospheric recording continued throughout the year. Special recordings were made during the solar eclipse on 5th February. The proton magnetometer was used in February.

The Vela standard Seismographs were installed during June and July in place of the Sprengnether seismographs. A short period vertical (Wilson-Lamison) and two Wood-Anderson seismographs are also kept in operation.

Antarctic Observatories

The normal programme of magnetic and seismic recording was maintained at Macquarie I., Mawson and Wilkes. A Grenet short period vertical seismograph was installed at Wilkes in February to complement the long period seismographs.

A rapid run LaCour magnetograph will be installed at Macquarie I. in December.

Darwin

The portable Willmore seismograph continued in operation throughout the year. Some preliminary investigations were made for a possible permanent vault site in the N.T.

General

Preparations have been completed to process observatory magnetic data by punched paper tape and electronic computation. Full operation of the programme is awaiting the delivery of equipment. In response to a request, four months of Gnangara data was processed using only partly automatic methods. About 50 months of back data has been punched onto tape and is awaiting verifying.

Magnetic effects of the high altitude nuclear explosion of 9th July were recorded at Port Moresby, Thursday I., Gnangara, Toolangi, and Hobart.

LABORATORIES

1. ELECTRONIC DESIGN AND DEVELOPMENT

The functions of the Electronic Design and Development Group are:

1. Devise techniques and methods of attack on problems received from all groups in the Branch.

2. Devise and investigate new geophysical methods and modifications of existing methods.

3. Provide an electronic design service for all groups in the Branch.

4. Supervise, advise and assist staff from subsections and groups in the development of new methods and techniques.

5. Encourage the construction of geophysical equipment by Australian manufacturers.

During 1962 the group's aim has been to build up the services required to enable it to discharge efficiently the above functions, and also to make some contributions to the development of equipment for various projects.

An electronic drafting service has been organised and is now producing first class circuit schematics, wiring diagrams, and chassis and panel construction diagrams. These diagrams are required for contract construction of equipment and for inclusion in equipment handbooks. A total of 143 individual drawings were produced in ten months to November.

An electronic coil and transformer design and construction service has been organised. A technician has been trained and is now responsible for most of the design as well as the construction of coils and transformers employing a variety of core materials. During 1962 136 coils and 50 transformers were produced operating at power levels up to 60 watts, and frequencies from 33 cycles to 10 megacycles.

Considerable effort has been devoted to improvement of circuit design techniques, particularly for circuits which have a wide application. The following list indicates the range of experience being built up in this field. All circuits are solid state.

(a) Decade dividers, readout decade counters, synchronised free running frequency dividers, count storage " emory" units, astable switching units, low drift multivibrator frequency sources - all including modifications of a basic "saturating" biscale operating up to one megacycle and designed for minimium sensitivity to external interference and supply voltage variation.

(b) Low noise preamplifiers (noise figure 2.8 to 3.2 dB) for proton precession applications. A thermal noise generator was constructed for use in this development work.

(c) Voltage regulators and constant current supplies. A simple constant current supply, with temperature coefficient easily adjustable to 2 parts in one million, was developed for nulling the earth's field in fluxgate and proton magnetometer applications.

(d) Various low distortion bridged T and phase shift oscillators were developed for bridge measurements, fluxgate drivers, and other applications.

(e) A phase locked tracking multivibrator to enhance signal to noise ratios and improve readout presentation in proton precession magnetometers, is under continuous development.

(f) Transformer coupled power amplifiers. The main design problem was to reduce switching transients in square wave operation. Employed mainly to synchronise recorder chart driver with crystal clocks and multivibrator frequency sources.

(g) Passive "constant K" and active feedback filter circuits - for bridge measurements and amplifiers employed in proton magnetometers, fluxgates and other equipment.

(h) High voltage, low power, DC converters.

(i) Various tunnel diode circuits are being explored as part of an investigation to reduce the complexity (in terms of numbers of components) of oscillators, frequency dividers and counters.

Three proton magnetometers were completed during the year. They have been used in various applications including the cross correlation of diurnal field variation at various sites in the Bowen Basin, the standardisation of magnetograph equipment at the Bureau's various observatories, and for experimental flying with a Cessna aircraft.

Fluxgate design was improved and simplified during the year. The new design is being used in the construction of equipment for use in Antarctica and to replace the detector channel in the Bureau's airborne fluxgate magnetometer equipment. Attempts are being made to reduce barkhausen noise level (equivalent to 0.2 gamma peak to peak) by heat treatment of new domain orienting core material, so that the fluxgates can be applied to telluric investigations.

A crystal controlled clock and synchronised seismograph recorder drive was completed and installed at Toolangi magnetic observatory. Attempts are being made to simplify the basic clock circuits before considering other applications in observatory and field equipment.

Equipment for measuring electrical and magnetic properties of rock samples by inductive means was simplified. A resistance ratio bridge was developed for susceptibility determinations at 130 cycles, and a series resonance bridge for conductivity determinations at 100 kilocycles and one megacycle.

Gamma ray density logging equipment was completed and tested satisfactorily in the Burdekin River delta (Queensland). Further laboratory experiments indicate that replacement of the Cobalt 60 radiation source with Caesium 137 should improve performance.

Terrella Project

The Terrella modelproject is still being worked on. The primary coil (representing ionospheric currents) for the northern hemisphere has been wound and preliminary measurements of the direction of the field have been made.

Rock Magnetism

Canberra Area, A.C.T.

A project to collect and analyse rock samples from the Canberra area surveyed by airborne magnetometer in 1958 (Map G.301-3) was commenced in April.

Rock samples were collected on Mt. Ainslie and near Sutton at sites relating to aeromagnetic anomalies. Considerable weathering prevented adequate sampling on the eastern edge of the area and south-east of Bungendore.

Measurements of the magnetic properties of the samples were made at A.N.U., and calculations made in an attempt to relate these properties to the type of anomalies recorded in the aeromagnetic survey.

Bowen Basin Area, Q.

Rock sampling for magnetic studies was commenced later in the year in the Bowen Basin area, Queensland, during the course of the 1962 Bowen Basin, Q., airborne survey. To date few samples have been collected because of the requirements of the Diurnal Variation Investigation, and the complexity of the geology. More progress is expected to be made in November when the lavas in the eastern part of the Duaringa 4-mile area will be examined.

Diurnal Variation Investigation

Two proton magnetometers and a fluxgate magnetometer were set up at predetermined locations in the Mackay - Clermont area to measure diurnal variation during the course of the Bowen Basin, Q., airborne survey. Difficulties were met in the setting up and operation of the magnetometers but useful data has been obtained.

In November, the project was restricted following the return of one of the proton magnetometers to Melbourne. Diurnal variation measurements were continued with the remaining magnetometers.

Electronic Data Processing

Preliminary investigations were made of the practicability of digitising airborne survey positioning data and processing by E.D.P. methods. This investigation disclosed a means of improving the existing method of processing position data without the requirement of E.D.P.

It was not found practicable to attempt the proposed investigation of the application E.D.P. methods to the calculation of derivatives, residuals, and other transformations of aeromagnetic data.

Model Anomalies

The revision of formulae used for calculating magnetic anomalies due to 3-dimensional prismatic models was completed. The actual calculations were postponed pending the results of an analytical method of investigation on the magnetic effects due to two-dimensional prismatic models. This investigation was completed in September. The results were satisfactory and found adequate for most interpretation purposes. The project as originally proposed was therefore deferred indefinitely.

2. MAINTENANCE AND TESTING

When this group was formed 2 years ago, there was a large back-log of equipment requiring a major overhaul, including, in some cases an almost complete rebuild. Work has proceeded steadily to reduce this backlog. Much of the group's work for 1962 was concerned with the overhaul of seismic equipment, some of which is several years old and which in this period has had little effective maintenance. Work was commenced on five different sets of seismic field equipment, but due to the fact that they were available only between field surveys, work has been completed only on the two of the SIE 12 channel refraction sets and the two T.I.C. oscillographs.

The new Texas Instruments type 8000 seismic amplifier was integrated with its auxiliary equipment and installed in its special cab. The seismic Variable Intensity Plotting system has continued to demand considerable maintenance but a useful output from the system has now been achieved.

Three design and construction projects have been almost completed during the year. These are the digital paper tape recording system for observatory magnetic records, a check unit for the VH-MIN digital system, and six blasters complete with intercommunication units for refraction seismic surveys.

Overhaul of well-logging equipment together with integration of accessories and spares also formed an important part of the year's work. Compilation of more adequate handbooks for the equipment was commenced.

Field party requirements for smaller items of geophysical equipment were met throughout the year. The work included maintenance and checks of transceivers, power supplies, recorders, electrical prospecting equipment and auxiliary equipment for seismic surveys.

A major overhaul of airborne survey instruments from the aircraft VH-MIN is planned for the first half of 1963. Preliminary design work for this has been commenced .

Laboratory instruments were maintained and calibrated continually throughout the year. Some new instruments were received, checked and put into service.

Development of rock testing equipment has been carried out under the supervision of the design and development group.

Susceptibility and conductivity measurements were made on a large number of samples using the new equipment.

WORKSHOPS

Routine maintenance and testing of geophysical instruments and equipment accounted for about half the workshop capacity. The rest of the workshop time was spent in the construction of new instruments or components for new equipment being built by other groups.

The workshop is still understaffed and responses to advertisements for instrument makers were disappointing. It was hoped some sub professional grade positions in the workshops would have been created this year.

The gravity integrator for two-dimensional vertical sections which was commenced last year was completed and put into use in the early part of this year. Other organisations have expressed interest of this instrument.

The design and construction of a special wide angle camera for use with the Cessna aircraft was undertaken. This was necessary because no suitable vertical frame camera for plotting the aircraft position on surveys at low altitude could be obtained commercially. The camera uses a special lens designed by Weapons Research Establishment. Work is almost complete and the camera will be used on survey before the end of this year.

A towed bird and winch for use with a proton precession magnetometer in the Cessna aircraft was designed and constructed and is now in use.

The reconstruction of a 35 mm strip camera for the DC3 aircraft is another major job which should be completed and tested before the end of this year.

The design of an astatic magnetometer for palaeomagnetic work was completed early in the year and construction of all components should be complete by the end of the year. The biggest job remaining is the winding of the large field coils for nulling the earth's field.

Many smaller jobs were done. The carpenter, mechanics and photographer were fully employed throughout the year.

MISCELLANEOUS SURVEYS

BURDEKIN DELTA, IRRIGATION AND WATER SUPPLY COMMISSION.

A survey was started in August, and continued until 15th October, to investigate the structure of the delta, and any characteristics which may be important for the hydrology of the area. The gravity data indicate a deep circular minimum suggesting the presence of a volcanic caldera or a coral reef atoll. The seismic work indicates thick layers of alluvium overlying highly weathered rocks of intermediate seismic velocities. Where tested, the cross-section of the river appears to be very shallow. Constant spacing resistivity traverses show large variations indicating clay deposits in the low resistivity zones, and gravels and sands in the high resistivity zones. Resistivity depth probing indicates large

vertical variations of resistivity above the unweathered bedrock. The magnetic work delineated the granite boundary in the "Rocks" area. Electromagnetic methods were attempted but time-consuming equipment breakdowns were frequent. Gamma ray logs in shallow holes indicated clearly the variations of sand and clay in the profile. Experiments with density logging were carried out to help develop a density logger.

Lake George fault scarp, A.C.T.

A survey using gravity and resistivity methods was started in November and is still in progress. Seismic work could not be done this year because of the need to overhaul the equipment, but may be done during 1963 if this seems desirable.

Gungahlin Clay deposits, A.C.T.

Gravity and resistivity work in this area is in progress. Seismic work may follow in 1963.

Seismic tests near water bores, A.C.T.

This survey was dropped from the programme as the Geological Branch did not want it carried out.