DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOPHYSICAL REPORT

GROUND MAGNETOMETER INVESTIGATIONS OF SEVERAL GEOMAGNETIC ANOMALIES LOCATED BY AN AIRBORNE SURVEY IN THE GLENARCHY-KALABITY AREAS

by

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SR. 11-2-76

ASSOCIATED PLANS 56-17
56-18
56-19

Date: 25.1.56

H.O. Ref. No. 42/15
G.S. 425

SUMMARY

Ground magnetometer surveys were carried out by the writer over typical portions of the geomagnetic anomalies located at the North Billeroo dam area and adjacent to the Alconie dam to determine their cause.

Inspection of these areas showed that the anomalies were due to low grade magnetite and haematite bearing metasediments. The writer considers that the formation represents the dynamothermal metamorphic equivalent of archaean ferriginous shales in which the iron minerals are syngenetic.

The North Billeroo geomagnetic anomalies appear to represent the same geological horizon as the Billeroo iron ore deposits. The latter have been mapped by Lockhard Jack in 1922.

Based on the results of recent geological and geophysical surveys, the iron ore reserves at the Billeroo Dam appear to be of a higher order than the estimates of 1922.

The writer recommends that ground magnetometer surveys be carried out in the Ballara and Outalpa areas where geomagnetic anomalies are located.

It is possible that there may be economic iron ore deposits at shallow depth and concealed by alluvium and glaciofluvial beds.

INTRODUCTION

Ground magnetometer surveying was carried out with a Watt's vertical ~~fine~~ force magnetometer.

The magnetometer consists of two parallel magnetized bars attached to an aluminium cube which carries a knife edge, mirror, two lateral screws (temperature and latitude) and a vertical sensitivity screw.

The magnetometer system was adjusted approximately to the horizontal position for the area and variations in its inclination (which are a measure of variations in the vertical component of the earth's magnetic field) were read by means of a mirror attached to the magnetic system and an auto-collimation telescope.

The sensitivity of the instrument was set at 30.0 gammas per division (at 20°C) and the levels of the magnetometer adjusted to obviate errors.

Magnetometer traverses were laid out with compass, optical square, and tape and geological mapping carried out in the areas traversed as an aid to the interpretation of the geomagnetic anomalies.

GEOLOGY

(A) Geology of the North Billeroo Dam Area

Regional mapping has been carried out in the North Billeroo Dam area by B. Campana and incorporated in plan 5 4-138 entitled "geological map of the Plumbago-Crocker Well Area" and also in the plan "geological map of the Olary Province, South Australia" (2 inches per mile).

Detailed mapping was carried out by the writer in the area traversed (see plan No. 56 - 18) with a vertical ~~fine~~ force magnetometer. The predominant rocks exposed in this area are archaean schists.

These have been intruded by granite, pegmatites and milky quartz injections.

Floaters of magnetite occur at the surface in the alluvium along the axis of the magnetic anomaly.

A copper prospect occurs 900 feet north of the axis of the magnetic anomaly and about 0.85 miles westward of the North Billeroo Dam.

Malachite stained rocks occur over a distance of 550 feet along a line running 70°E of magnetic north.

Limonite milky quartz rocks containing a little pyrite and chalcopyrite have been gouged from the prospecting pits and suggest that the copper minerals were introduced with milky quartz intrusions into sericite mica-schist country rock.

The milky quartz intrusions probably accompanied the interse pegmatization of the metasediments.

Near the Billeroo dam (3.75 miles south of the North Billeroo Dam and 5.5 miles north east of the Mount Victoria Trig) four deposits of iron ore occur.

These appear to represent the same geological horizon as exposed in the vicinity of the North Billeroo Dam.

Geological investigation of the Billeroo Ironstone deposits

has been carried out by R. Lockhart Jack and presented in Bulletin No. 9 (pages 59 - 61) of the geological survey of South Australia.

Jack considers that the four exposures of iron ore represent unconnected metasomatic deposits, and, were introduced by replacement of siliceous material. More recent investigations (geological and geophysical) suggest that the deposits are sedimentary in origin but have undergone metamorphic changes during migmatization and mobilization of the host rocks. It is possible that the four exposures represent lenticular deposits with a thinning of the iron formation between them by tectonic movement, along the bedding.

An assay of a sample from the western Billeroo Ironstone deposit (carried out on behalf of Lockhart Jack) yielded -

Water	2.42%
Insoluble	26.04%
Iron Oxide	71.15% = 49.81% of iron
Aluvium	trace
Lime	0.14%
Phosphoric auhydride	1.11%
Titanium Dioxide	0.09%

An estimate of the total tonnage of the Billeroo deposits above 100 feet in depth is 385000 tons (1922).

This was calculated by assuming four individual deposits of iron ore, however, aerial magnetometer and structural geological mapping suggest that they belong to the same geological horizon, and also the aeromagnetic map of total intensity (Radium Hill area G143-1 Glenarchy) suggests that there is an extension of the iron bearing formatioms beneath the alluvium to the west of the Billeroo Dam.

These factors would suggest that the total tonnage would be of a much higher order.

(B) Geology of the Alconie Dam Area

The regional geology of this area is shown on the 1 inch per mile geological plan of the Kalabity area prepared by B. Campana.

Essentially the area in which the geomagnetic anomaly occurs is covered by quaternary sediments.

Detailed mapping was carried out in the area magnetically gridded by the writer and incorporated in plan No. 56 - 19.

Again, magnetite floaters were located on the surface

along the axis of the ~~geomagnetic~~ Geomagnetic anomaly and this zone, also, is considered by the writer to represent the weathered product of a magnetite bearing mica schist or phyllite.

The thickness of the magnetite bearing horizon is of the order of twenty feet and the shape of the magnetometer anomaly suggests that it has been repeated by intense folding of the incompetent host rocks.

An iron ore deposit (occurring in the Torrensian Series and related to the Braemar iron formation) commences 4 miles south of Tonga Hill and runs in a direction of 40° W of N for approximately 9 miles.

Its position can be seen clearly on the aeromagnetic plan G 143-4- Outalpa.

It appears that this iron ore deposit has been derived from erosion and glaciation of the iron bearing archaeozoic migmatites and pegmatized micaphyllites.

Method Used

(a) North Billeroo Dam Area

A base ~~Abase~~ line (6300 feet) was laid out bearing 70° E of magnetic north with compass and tape and eight parallel equidistant traverses were offset at intervals of 900 feet in an easterly and westerly direction for approximately 900 feet.

Magnetometer readings were taken at intervals of 100 feet (generally) along the traverses. The readings were corrected for diurnal variations, temperature changes and an isogam plan prepared showing the variations in the vertical intensity of the earth's magnetic field in the area investigated.

(b) Alconie Dam Area

A base ~~Abase~~ line running magnetic east-west was laid out. The length is 5400 feet. Four traverses were offset in a southerly direction for approximately 4200 feet.

Magnetic readings were taken at intervals of 100 feet along the traverses, the readings computed and the results presented on plan No. (56-19).

Results

(A) North Billeroo Dam Area

The major anomaly marked "A" approximately parallels the

base-line. It is a positive geomagnetic anomaly and has an intensity of approximately 2500 gammas along its length and in one part has an intensity of 9000 gammas.

A minor anomaly branches away from A at an angle of approximately 10^{o} and is represented as anomaly "B" on the plan (56-18).

(B) Alconie Dam Area

The mapped portion of the geomagnetic anomaly runs parallel to the baseline and approximately 2700 feet to the south of it.

Its average intensity is 4000 gammas, however, values up to 11000 gammas were recorded.

Interpretation

(A) North Billeroo Dam Area

The writer considers that the magnetite floaters which occur along the axes of the anonalies "A" and "B" are the surface expressions of magnetite bearing micaphyllites and quartzites and also the magnetite is syngenetic.

Anomaly "B" appears to be the surface expression of a magnetite bed which represents a repetition of anomaly "A" by intense folding of the incompetent mica-phyllites.

The geomagnetic anomaly can be traced for several miles and its axis has been plotted on plan (56-17).

The width of the magnetite bearing horizon is of the order of 20 feet, and the grade of a low order.

(B) Alconie Dam Area

Floaters of magnetite occur along the axis of the geomagnetic anomaly.

From the shape of the ground anomaly, the airborne anomaly and the geolgical enviroment the writer considers that the axis of the anomaly represent a magnetite bearing mica-phyllite and schist, originally of sedimentary origin, and that the North Billeroo Dam anomaly, the Billeroo Dam anomaly and the Alconie Dam anomaly represent the same geological horizon.

Recommendations and Conclusions

The north Billeroo Dam and the Alconie Dam Anomalies have been related to a magnetite bearing mica-phyllite which was initially

an archaean ferruginous shale which has undergone intense dynamo-thermal metamorphism. The axes of this formation has been plotted on plan No. (56-17).

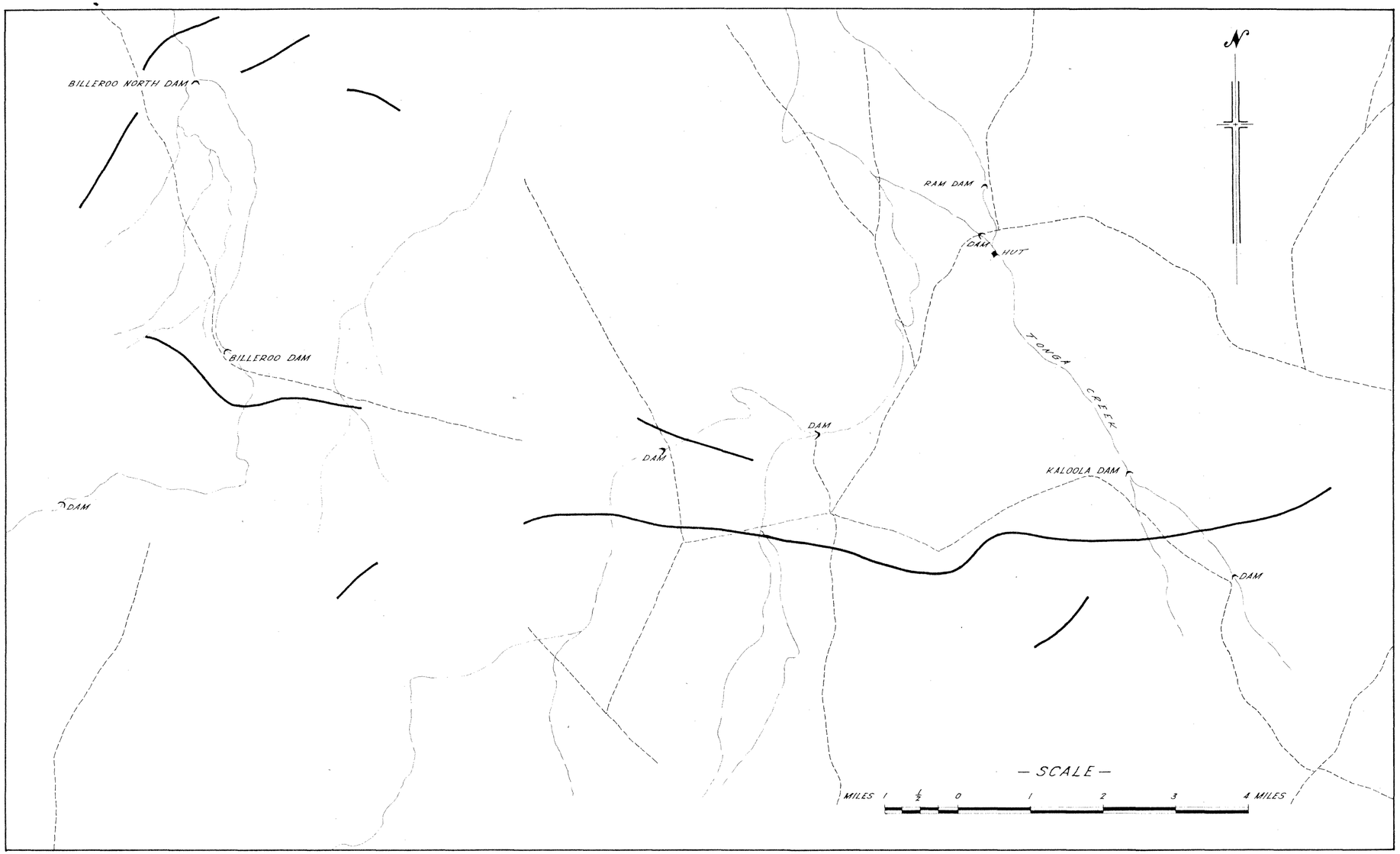
Samples are being forwarded to the Parkside laboratories for testing for the presence of titanium and Vanadium.

The writer recommends that ground magnetometer surveys be carried out in the Ballara and Outalpa areas where large geomagnetic ~~geomgenetic~~ anomalies are located.

It is possible that there may be ecomomic iron ore deposits at shallow depth, and concealed by alluvium and glaciofluvial beds.

(For location of these airborne magnetometer anomalies see aeromagnetic plan G143-7 Ballara and G143-4 Outalpa)

J. A. Beeman



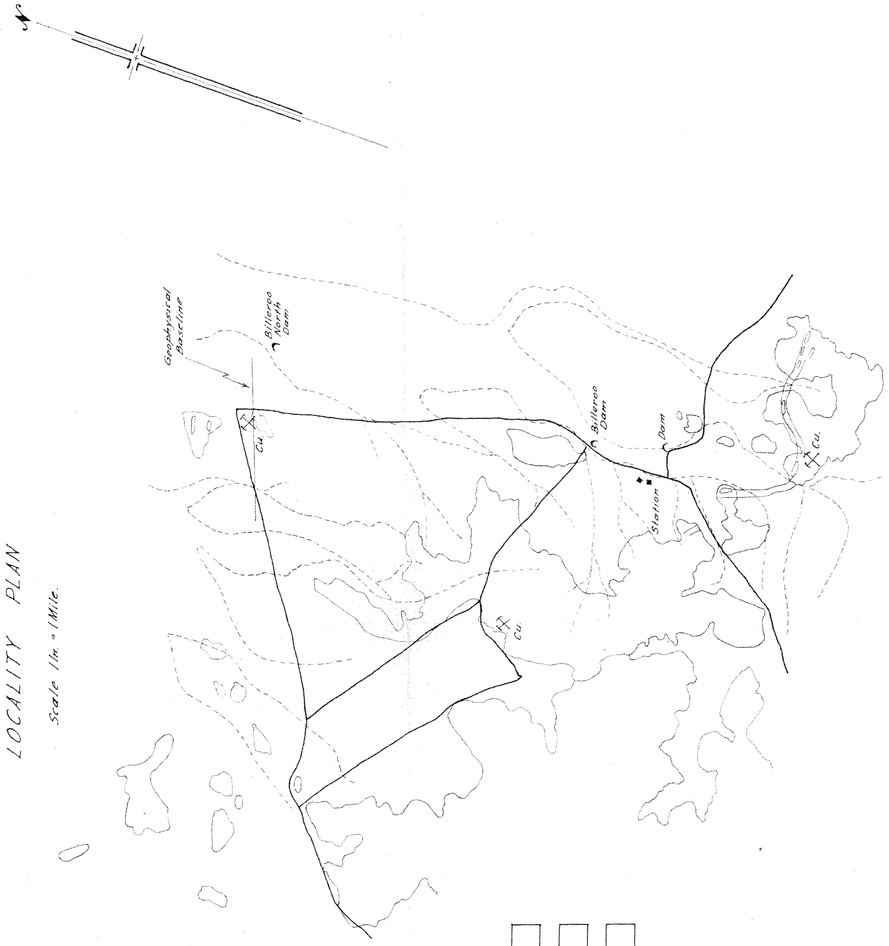
To accompany report by I. A. Mumme. Assistant Geophysicist.

S.A. DEPARTMENT OF MINES

Associated Drawing No.	No. Amendment Exd. Date	Req. No. D.M. Compiled from	GLENORCHY—KALABITY AREA AXES OF MAGNETOMETER ANOMALIES WHICH REPRESENTS LOCATION OF IRON ORE DEPOSITS	Approved / Passed Director of Mines	Drn. Tcd. R.G.C. Ckd. Exd.	Scale: 1 Mile to 1 Inch. 56—17 Date 19-1-56 F1.

LOCALITY PLAN

Scale 1 in. = 1 Mile.

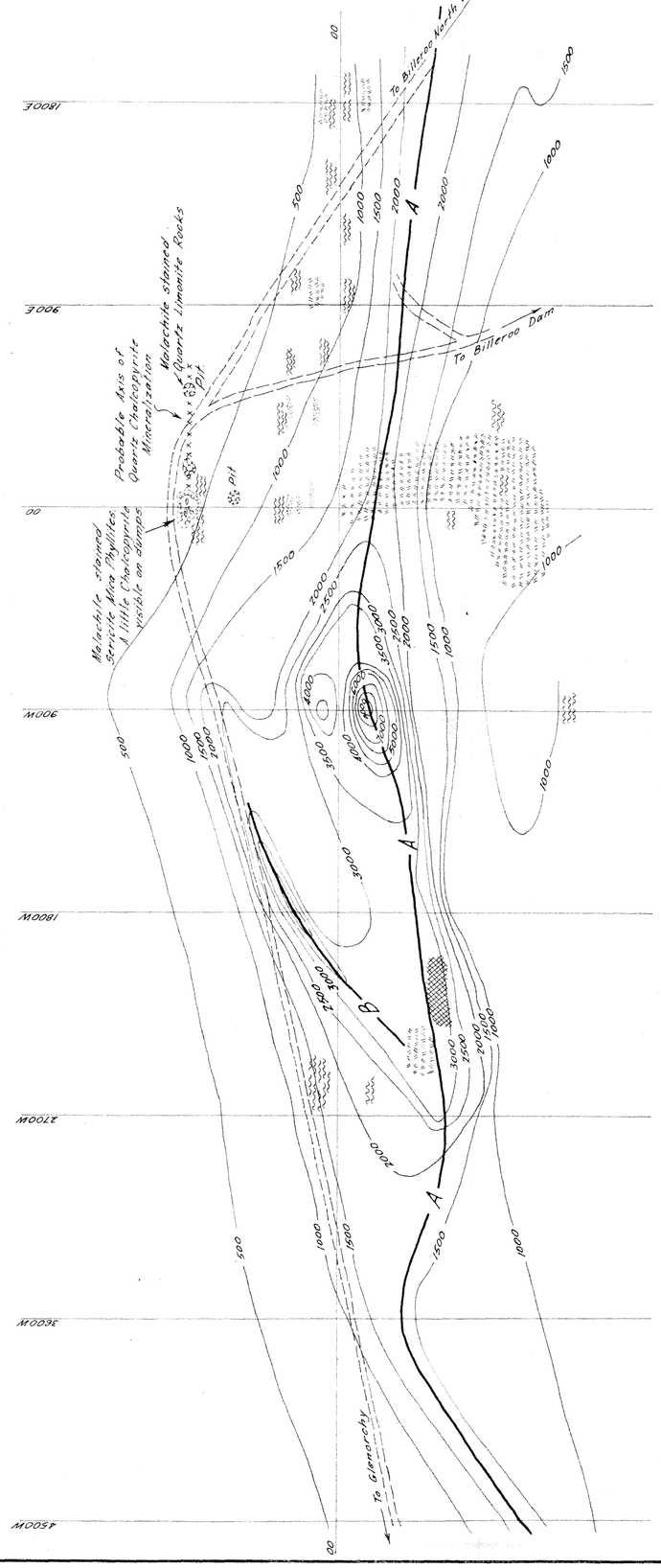


—LEGEND—

Granites

Pegmatized Mica Schists

Iron Ore



—LEGEND—

Sericite Mica Phyllites & Schists

Pegmatites & Pegmatized Schists

Magnetite Bearing Hornfels

Iron Minerals (Haematite & Magnetite)

Axis of Magnetite Floaters —A—

Vertical Force Magnetic Contours 1000

To accompany report by I.A. Mumme. Assistant Geophysicist.

S.A. DEPARTMENT OF MINES

Associated Drawing	No.	No.	Amendment	Exd.	Date

Req. No.
D.M.
Compiled from

NORTH BILLEROO DAM AREA
GEOLOGICAL &
VERTICAL FORCE MAGNETOMETER SURVEY

Approved	Passed
Director of Mines	

Drn.
Tcd. R.G.C.
Ckd.
Exd.

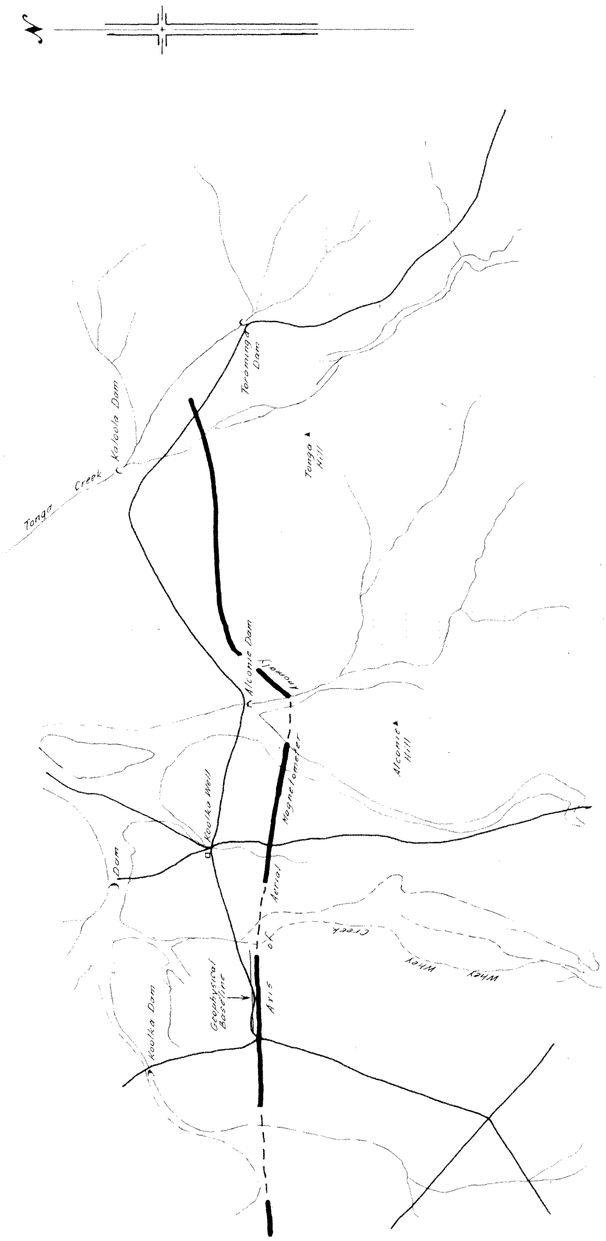
Scale: 1 inch = 400 Feet.

56 – 18

Date 19-1-56 FI.

LOCALITY PLAN

Scale 1in = 1 Mi.



—LEGEND—

- Felspar Actinolite Rock
- Floaters of Pegmatite & Microcline Granite
- Magnetite Floaters
- Alluvium Covered Areas
- Vertical Force Magnetic Contours ——1000——

To accompany report by I.A Mumme. Assistant Geophysicist.

S.A. DEPARTMENT OF MINES					
Associated Drawing No.	No. Amendments Exd. Date	Reg. No. D.M. Compiled from	ALCONIE DAM AREA GEOLOGICAL & VERTICAL FORCE MAGNETOMETER SURVEY	Approved Passed / Director of Mines	Drn. / Tcd. R.G.C. / Ckd. / Exd. — Scale: 1 inch = 500 Feet. 56 – 19 Date 19-1-56 F1.

D.M. 170/56

TO THE ACTING DIRECTOR OF MINES:

The magnetometer Surveys described in the attached report comprise a partial ground follow-up of an airborne magnetic survey carried out by the Bureau of Mineral Resources. The ground Survey has shown that the anomalies so far checked are caused by small sedimentary iron formations of limited tonnage and medium to low grade. Other anomalies remain to be similarly checked and are on the programme for action when opportunity permits.

L.W. PARKIN
CHIEF GEOLOGIST

LWP:BRS
23/2/56

D.M. 170/56

TO THE CHIEF GEOLOGIST:

Ground Magnetometer Surveys - Glenorchy - Kalabity Areas

Attached is a report by I.A. Mumme, assistant geophysicist, entitled "Ground Magnetometer Investigations of Several Geomagnetic Anomalies Located by an Airborne Survey of the Glenorchy-Kalabity Area."

This report covers two separate sections within the area. The results are presented as contour plans of vertical magnetic intensity and a composite plan of both areas shows the axes of the magnetic anomalies.

The writer recommends that similar surveys be conducted in the Ballara and Outalpa areas where large anomalies are known to exist.

SENIOR GEOPHYSICIST

JEW:AGK
20/2/56