Department of Mines
South Australia

GRAVITY AND MAGNETIC TRAVERSES OVER AEROMAGNETIC ANOMALIES NEAR PORT NEILL, EYRE PENINSULA

BY

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GEOPHYSICISTS

Geophysical Report 6/58.

H.O. 46/207.

G.S. 1056.

CONTENTS

PLANS ACCOMPANYING REPORT

S.1820	Locality Plan
S.1817	Aeromagnetic Map of Total Intensity
58-163	Gravity and Magnetic Profiles

Copy No. 1

D.M.193/58.

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Report No. 46/207.
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GRAVITY AND MAGNETIC TRAVERSES OVER AEROMAGNETIC ANOMALIES NEAR PORT NEILL, EYRE PENINSULA

SUMMARY:

Vertical magnetometer and gravity meter traverses have been run over anomalies disclosed by aeromagnetic survey near Port Neill on Eyre Peninsula. The presence of a large quantity of magnetic rock, denser than the surrounding rocks and thus a possible iron ore, has been inferred from the results. The material probably occurs 150 feet or more below the sand and travertine surface. Testing by drilling is recommended.

INTRODUCTION:

On behalf of the Department of Mines, Hunting-Adastra Geophysics Ltd. carried out an airborne magnetometer survey of the southern portion of Eyre Peninsula early in 1955. The results showed, among a number of others, a small area of high magnetic intensity centred on Section 16, Hundred of Dixson, approximately 4 miles NNW of Port Neill. This report deals with ground magnetometer and gravimeter observations in this area.

Port Neill is a small township at the southern end of Dutton Bay on the eastern side of Eyre Peninsula. It is 2 miles from the Lincoln Highway about 50 miles north of Pt. Lincoln.

The party, consisting of the authors, a surveyor and 2 chainmen was in the field from 28/4/58 to 10/5/58 and 314 magnetometer and 322 gravimeter stations were read, including one 6,000 feet traverse across a long, linear, aeromagnetic anomaly of low order running close to the coast for many miles along the eastern side of Eyre Peninsula. This and some related traverses will be discussed in a later report.

PREVIOUS GEOPHYSICAL WORK:

Results of the Hunting-Adastra aeromagnetic survey appear as contours of total intensity at the height of the survey, 1,500 feet above sea level, on standard 1 inch = 1 mile plans and a portion of that covering the area in question, the Neill

sheet, appears as plan S1817 accompanying this report. On it can be seen a roughly circular series of contours 4 miles NNW of Port Neill, derived from peaks of magnetic intensity registered on two of the flight lines. The ground survey described here was made to obtain further information on the cause of this effect.

GEOLOGY:

In a minute in this docket (DM193/58) Geologist R. C. Mirams of the Iron Section reports as follows on the geology of the area: "Section 16 and the immediate surrounds have been mapped by Mr. Johns as Quaternary Recent. The major portion of the area is masked by wind blown sand, but where the anomaly centred there is a low ridge running approximately at right angles to the dunes. This ridge is capped with travertine which overlies a coarse ferruginous sandstone or quartzite of probable Tertiary age. No exposures or floaters of rocks of greater age were found near the centre of the anomaly. A sample was collected of material from a well situated ½ mile to the south. The well passed through coarse gravel wash and into a pinkish and white clay. (Weathered schist?)".

The low ridge can be clearly seen on the sections along lines 1800N - 600S as can a similar ridge further to the east. The general seaward slope of the country is evident on the western ends of all traverses (Plan 58-163).

METHODS USED:

Traverses were laid out by theodolite and tape and are more or less parallel to the system of sand dunes occurring in the area. Elevations were obtained by level and staff and are related to approximate mean sea level at Port Neill.

The vertical component of the earth's magnetic field was measured with a Watts' Vertical Force Variometer, No. 60565, with a station being repeated every couple of hours to observe diurnal variation.

Gravity measurements were taken with Worden gravity meter No. 204. During the reading of a traverse, one station was repeated approximately every 45 minutes to determine drift.

Station interval was generally 20^{0} feet, but less where considered necessary.

RESULTS AND INTERPRETATION:

Profiles of vertical magnetic intensity are presented on plan 58-163. Values range from a few hundred gammas below the arbitrary zero to nearly 20,000 gammas above. The regional level appears to be close to the arbitrary zero.

A rough gravity tie was made to a station in Cowell whose value had been determined by pendulum comparison with a base station in Adelaide. Values of Bouguer anomaly have been derived using this tie, the International Gravity Formula of 1930 and a combined free air and Bouguer correction factor of 0.6 gravity units per foot, corresponding to a density of 2.67 gm/c.c. for rocks above sea level. Because of the gentle slope of the country concerned it is considered that terrain corrections would be negligible and none have been applied.

Profiles of Bouguer anomaly are shown on plan 58-163 as are topographic sections at the same horizontal scale, 1 inch = 1,000 feet, but with a greatly exaggerated vertical scale, 1 inch = 20 feet, to emphasise the low ridges mentioned above.

The magnetic profiles of traverses 600S to 2400N show sharp peaks of considerable magnitude. Only a magnetite-bearing rock could cause anomalies of the size measured. The peaks are aligned along the topographic ridge although not coincident with the top. Where the peak is of much lower order, or absent altogether, on traverses 1800S,1200S,3000N and 3600N, the ridge is also absent. It is reasonable to infer that the anomalous rock is continuous between traverses 600N and 2400N and that it is connected with the occurrence of the ridge.

To the east of the line of major peaks there are a number of smaller peaks with no definite line-up. They may be due to small bodies of the rock causing the major peaks. There are no major anomalies associated with the ridge near the eastern end of the traverses.

Closely associated with the major magnetic peaks are peaks on the gravity profiles of up to 5 milligals in magnitude. The coincidence implies that the rock responsible for the magnetic anomalies is also responsible for the gravity increases.

The magnetic and gravity pattern shows a marked similarity to that obtained at the Bungalow Anomaly and described in report GS960, "Gravity and Magnetic Traverses over Aeromagnetic Anomalies near Cowell, Eyre Peninsula," by Seedsman. Although bedrock is obscured in both areas by superficial Recent deposits the broad features are probably similar in each - an Archaean metasedimentary complex, mainly gneissic (See standard geological sheets. Cowell and Neill.). It is also quite likely that the anomalous rock at Port Neill is similar to that at Cowell.

Pole depths obtained from profiles on plan 58-163 by the method described in the above report are in the range 150-350 feet, a little shallower than those at Cowell (200-500 feet). The presence of a topographic ridge along the strike of the anomalies at Port Neill, and its absence at Cowell supports a shallower burial at the former.

The slight decrease in depth seems insufficient to account for the greater magnitude of the gravity anomalies - 5 milligals on traverses 1200N and 1800N as against the 3 milligals maximum recorded at Cowell. The density contrast between the magnetite rock and the country rock is therefore probably greater at Port Neill than at Cowell. Since no figures for densities of country rock are available it is impossible to say, however, whether the grade of the Port Neill anomalous rock is higher than that at Cowell or not.

The longitudinal extent of the Port Neill occurrence, 3000-4000 feet, is considerably less than that at Cowell and a correspondingly smaller tonnage is present. By the method of Hammer described in the above report, if the density of country rock is 2.7 gm/c.c. and that of the magnetite-bearing rock is 3.9, there are 1.5×10^8 tons of the latter present.

CONCLUSIONS AND RECOMMENDATIONS:

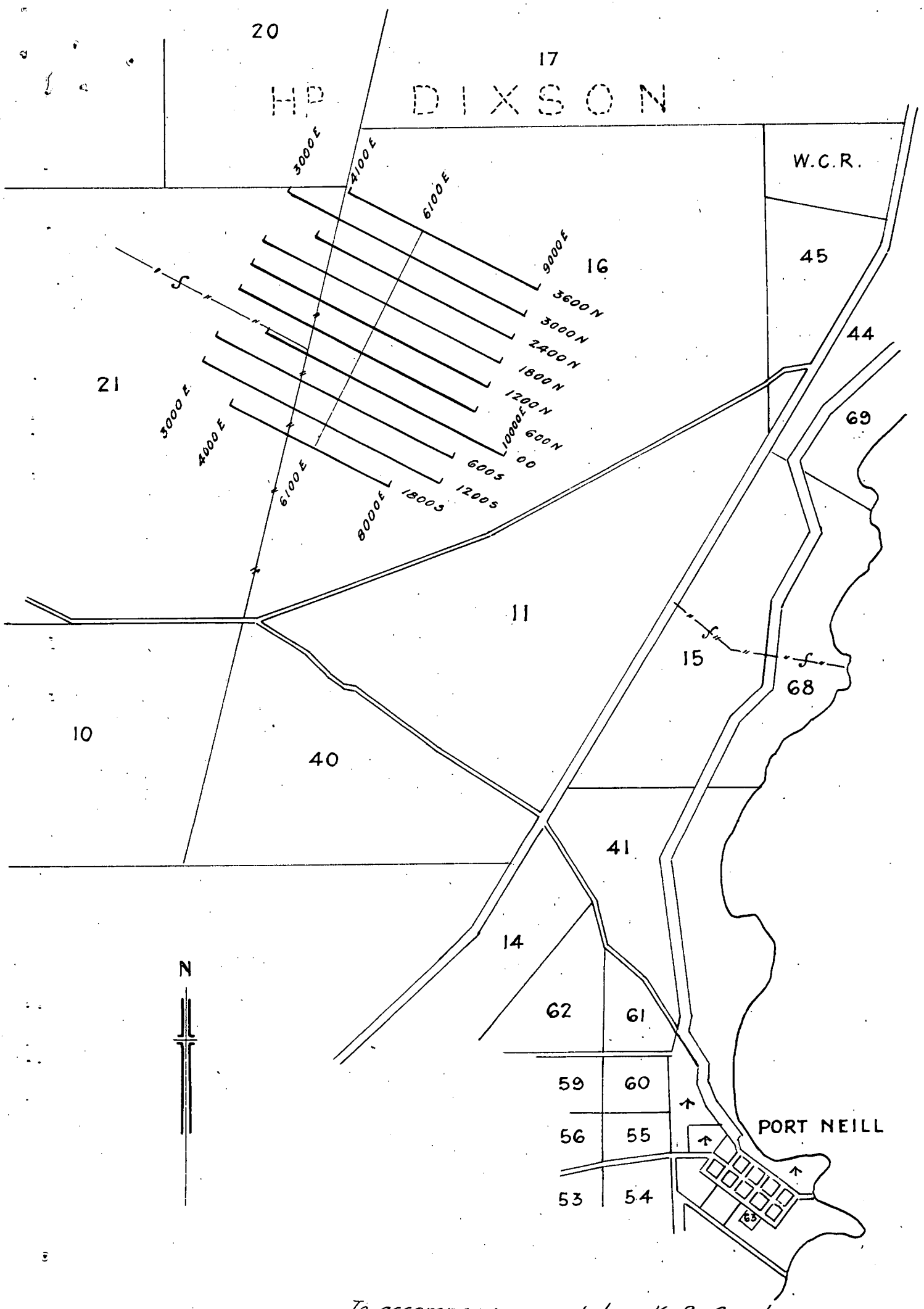
The foregoing discussion indicates that there is near Port Neill a large quantity of rock containing a considerable percentage of magnetite and thus a potential iron ore. As such the area warrants extensive testing by drilling. The Bungalow Anomaly area near Cowell, at which similar results were obtained

from gravity and magnetic surveys, is currently being tested by drilling. There is no doubt that further experience at Cowell would be of great help in deciding the most effective and economical means of testing the Port Neill occurrence. It is therefore suggested that drilling at Port Neill be delayed until sufficient information from Cowell is available to determine the most suitable programme.

K. R. Seedsman
I. H. McMutrie

KRS:IAM:JAH.
17/6/58.

GEOPHYSICISTS



To accompany report by K. R. Seedsman.

S.A. DEPARTMENT OF MINES					
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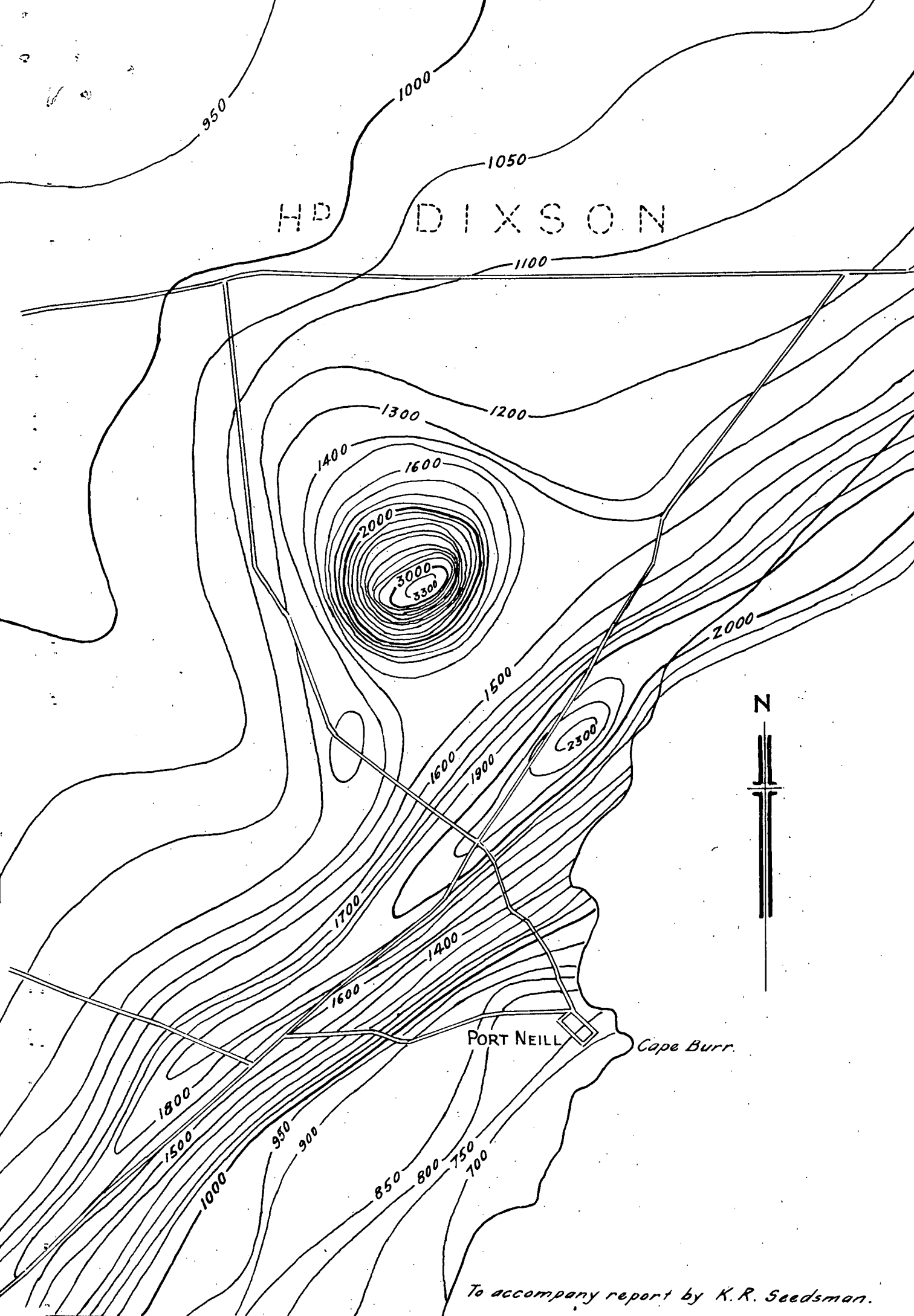
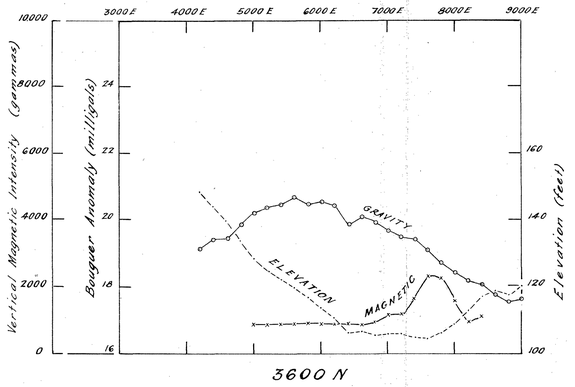
		Tcd. R.R.		Req.	S 1820
		Ckd.			Dm 29
Director		Exd.			Date 4·6·58

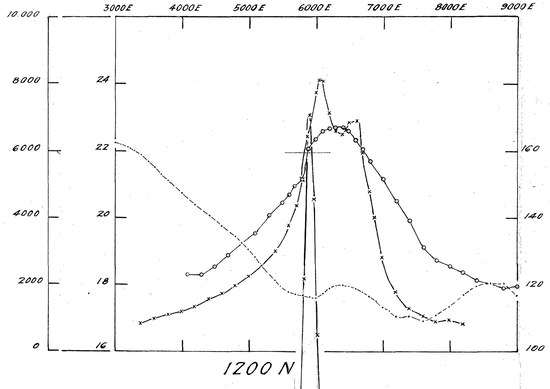


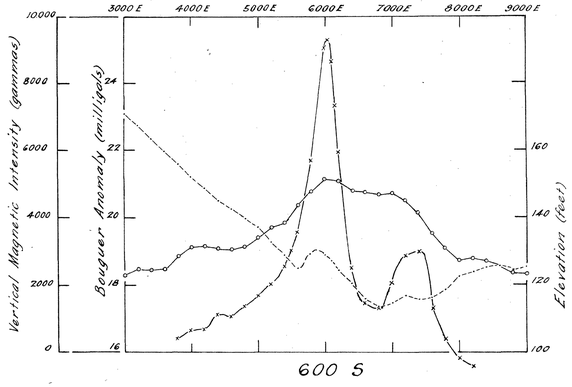
To accompany report by K.R. Seedsman.

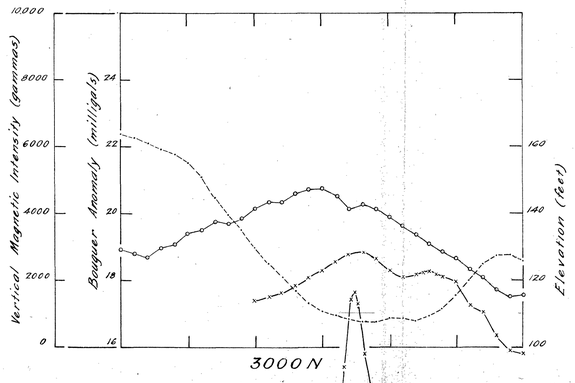
S.A. DEPARTMENT OF MINES

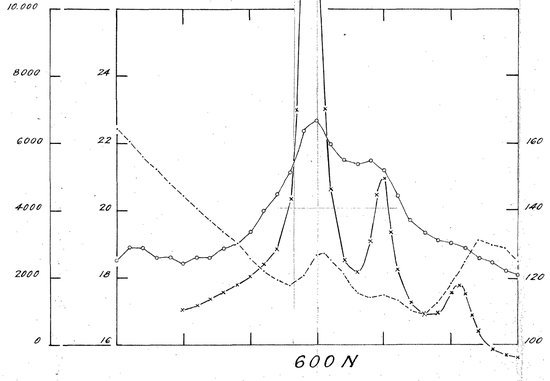
Approved	Passed	Drn.	AEROMAGNETIC MAP OF TOTAL INTENSITY . PORT NEILL	D.M.	Scale: 1 Mile to 1 inch
		Tcd.		Reg.	S 1817
		Ckd.			Dm 29
Director		Exd.			Date 3 6 58

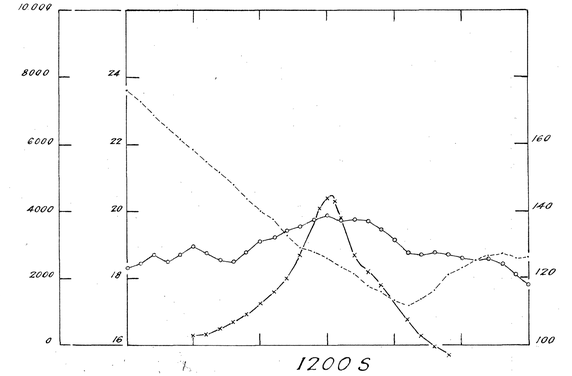


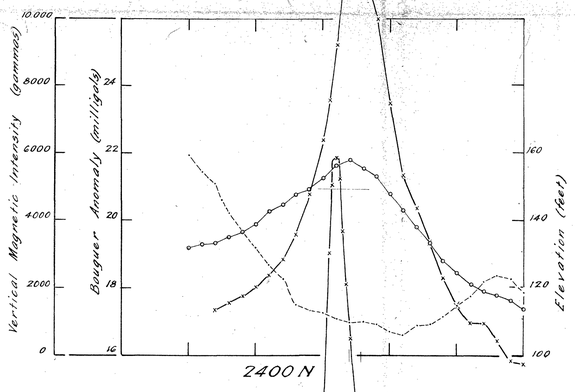


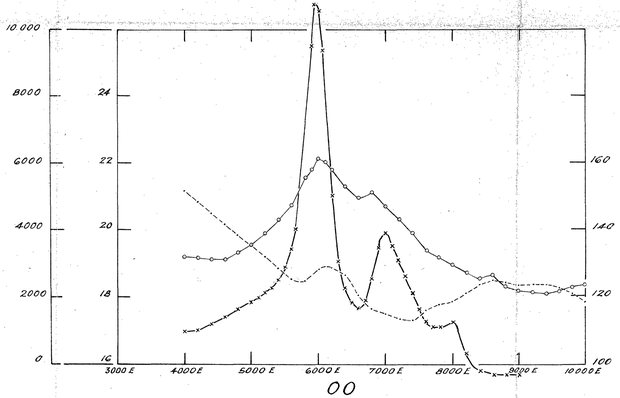


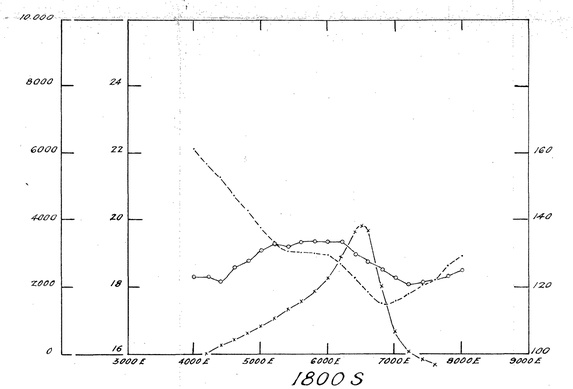


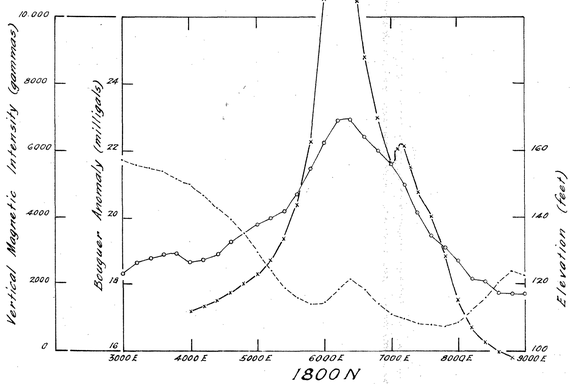












SCALES

HORIZONTAL 1 inch to 1000 feet.

VERTICAL

Elevation 1 inch to 20 feet.

Bouguer Anomaly 1 " " 2 milligals.

Magnetic Intensity 1 " " 2000 gammas.

To accompany report by K.R. Seedsman.

S.A. DEPT. OF MINES

PORT NEILL
GRAVITY AND MAGNETIC PROFILES

Req. No.
D.M.
Compiled from

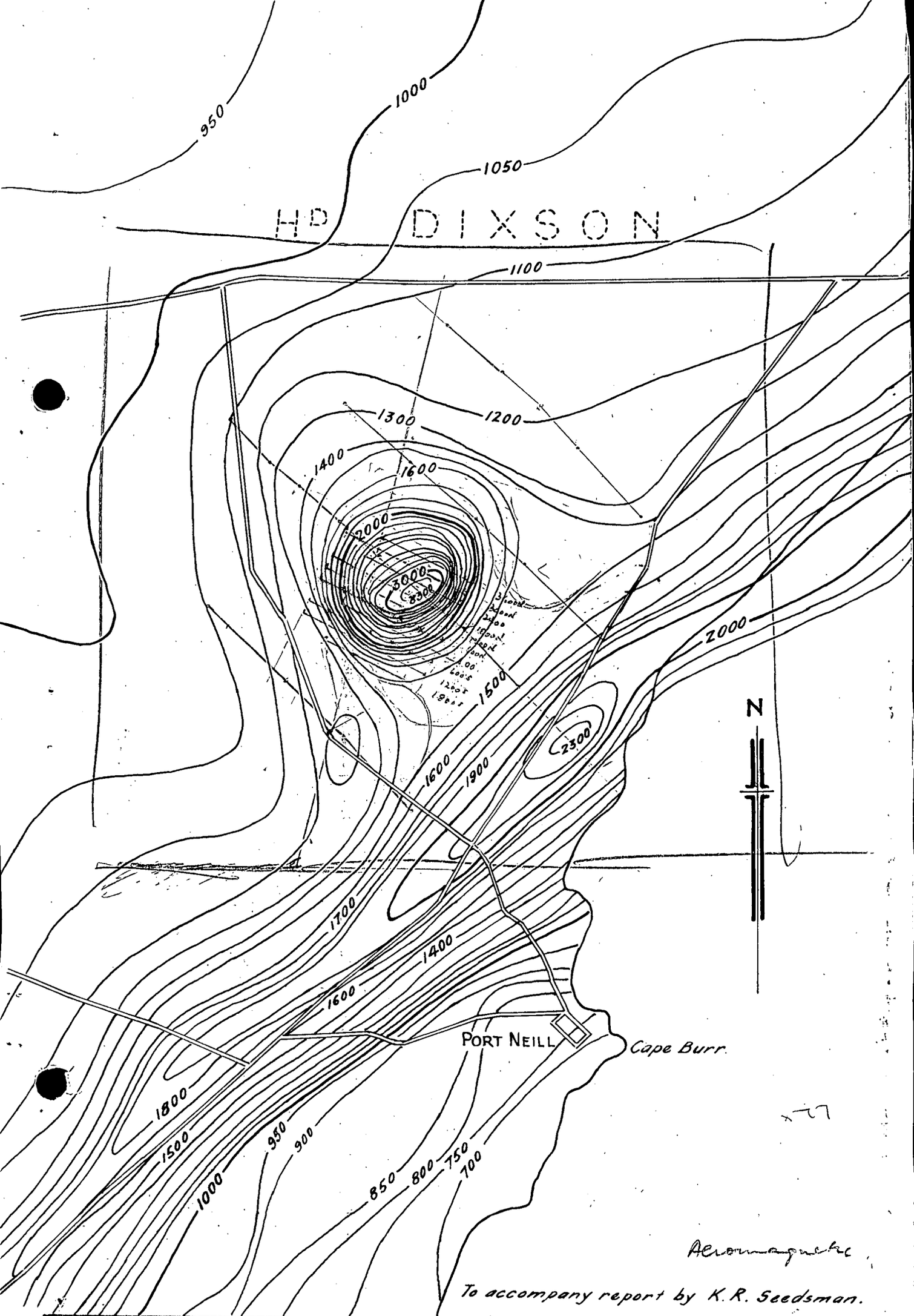
Associated Drawing | No. | No. | Amendment | Exd. | Date

Approved | Passed

Director of Mines

Drn. K.R.S.
Tcd. R.R.
Ckd.
Exd.

Scale As shown.
58 - 163
Dm 29
Date 12 - 6 - 58



Aeromagnetic

To accompany report by K.R. Seedsman.

S.A. DEPARTMENT OF MINES					
Approved	Passed	Drn.	AEROMAGNETIC MAP OF TOTAL INTENSITY PORT NEILL	D.M.	Scale: 1 Mile to 1 inch
		Trd.		Req.	S 1817
		Ckd.			Dm 29
Director		Exd.			Date 3 6 58

TO THE SENIOR GEOPHYSICIST:

Testing of Gravity and Magnetic Anomalies near Port Neill by Drilling

Conclusions reached in reports on gravity and magnetic surveys near Cowell and Port Neill, Eyre Peninsula (GS Reports 960 and 1056, by K. R. Seedsman and I. H. McMutrie) suggest similar origins of the anomalies obtained. The shape of profiles and greater magnitude of anomalies at the Port Neill prospect indicate a shallower depth of burial than at Cowell. The occurrence of outcrops of a ferruginous grit at the Port Neill prospect similar to that capping weathered bedrock (Precambrian) in the cliffs several miles to the east also suggests a shallow depth of burial of the presumed magnetite - bearing rocks, with very little loose overburden.

It is recommended that the prospect be tested by drilling and that a series of inclined diamond drill holes is the most suitable method of beginning such testing. The first hole should be collared at 600N, 5100E, bearing grid west and depressed 45° below horizontal. The width of anomalous rock is not known and the depth to be drilled must be determined by results obtained. However a hole depth of 500 feet must be allowed for to pass sufficiently far beyond the point of peak magnetic intensity.

A minimum of two such holes, the second to be sited after results of the first are available, would be necessary before the prospect could be rejected. It is therefore recommended that approval for the cost of 1,000 feet of diamond drilling be sought.

KRS:AM
8.7.58

K. R. SEEDSMAN
GEOPHYSICIST