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DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

EXPLORATION SERVICES DIVISION

REPORT OF A DETAILED GRAVITY SURVEY OF

IRON BLOW PROSPECT IN S.M.L. 360

BELTANA 1-mile sheet area

- Carpentaria Exploration Co. Pty. Ltd. -

by

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EXPLORATION GEOPHYSICS SECTION

Rept.Bk.No. 70/78

4th June, 1970

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BELTANA 1-mile sheet area

Client: Carpentaria Exploration Co. Pty. Ltd.

ABSTRACT

A detailed gravity survey over the Iron Blow prospect has revealed areas of low gravity and faults associated with the old mine.

The mass deficiency in this area is 71500 tons, probably representing porous leached material, which may extend to at least 100ft. below ground level. A large circular positive anomaly was delineated around drill hole B.H.I. and this anomaly has an excess mass of 127500 tons for a radius of 180ft. The density of this material was estimated to be higher than that expected for dolomite, which was encountered in the drillhole. Numerous faults have been delineated, the principle one being, the tectonic boundary of the diapir on the western side of the area.

A residual gravity map was produced from the Bouguer gravity data using a 4th Order Polynomial surface and the regional and residual contours of the mine area are displayed in this report.

PURPOSE

The purpose of the survey was to delineate regions of low anomalies compared with the background. It was suggested that leaching would reduce the density of the locally leached material compared with the country rock, thereby producing a local low in the contoured Bouguer Gravity valves over the leached zone.

INTRODUCTION

At the request of Carpentaria Exploration Co. Pty. Ltd., a detailed gravity survey was carried out over a 100ft. grid, pegged and levelled by the Company. The grid covered the immediate vicinity of the Iron Blow Prospect, which is located one mile northeast of Beltana Railway Station as shown on Plate 1. This survey was conducted in April, 1970.

The grid was subdivided into a cell-loop network system, and the observed gravity was determined using a LaCoste Gravitimeter, Model G No. 212 employing a series of closed loops for drift control. The Bouguer Gravity variation was expected to be of the order of 0.5 milligals.

The control station network was tight and the mean and standard deviation of the uncorrected network misclosures were 0.059 milligals and 0.036 milligals respectively. The small closure errors of the network were reduced using a method of least squares (Smith, (1951)). The final values are expected to be within ±0.03 milligals at any station.

RESULTS

Bouguer gravity results were calculated from the observed gravity valves obtained by correcting them for latitude (0.02178 milligals per 100ft.) and elevation. The elevation conversion factor used, was 0.060984 milligals per foot, corresponding to a density of 2.60 gm/cc for the country rocks. The Bouguer gravity results are shown in the form of a contour plan (Plate 2), contoured at an interval of 0.05 milligals.

The reference datum levels for the observed gravity and elevation were taken as 0.00 milligals for station 1800N, 1200E and 50.0ft. for station 1500N, 1600N respectively. This elevation datum value was changed from the original given by Carpentaria, so that the Bouguer values were small numerically.

The Bouguer results were then subject to a computer programme involving the fitting of a low-order polynomial surface for the assumed regional potential surface. The polynomial was fitted using a conventional least squares technique involving an orthogonal polynomial in the process. The values for the 4th Order polynomial were plotted and contoured to illustrate the assumed regional gravity pattern. These contours are shown in Plate 3.

The difference between the Bouguer values and the regional values as computed by the polynomial was then plotted and contoured as the residual anomaly plan, shown in Plate 4.

GEOLOGY AND INTERPRETATION

The Iron Blow Prospect (Beltana Edith Mine) is situated in the southwestern extremity of the Beltana Diapir. This diapir is shown in the regional geological sheet of Beltana 1:63,360 published by the South Australian Department of Mines, 1966, mapped by Leeson and Nixon (1966). The Proterozoic stratigraphy is outlined in the explanatory notes of the Beltana area by Leeson (1969).

The geology of Iron Blow Prospect which is described in the Mining Reviews covering the main period of activity from 1907 to 1913, is outlined below.

Shafts were sunk in soft shales and sandstones near an ironstone outcrop (Iron Blow), close to an older mine shaft showing signs of copper. The area was prospected for silver but without success. Production figures for this mine are not recorded.

Carpentaria Exploration Pty. Ltd. has drilled four rotary percussion drill holes in the mine area.

The extrapolated Bouguer gravity values outside of the original grid, is shown in Plate 2, are reasonable, except those in the southeastern corner, where additional control is needed to verify the contours.

The steep gradient, 0.3 milligals per 100ft., on the western side of the area is clearly shown in the Bouguer gravity contours, see Plate 2. This gradient is present in the 4th Order Polynomial Surface which was assumed to represent the regional gravity contours as shown in Plate 3. Here the gradient is 0.2 milligals per 100 feet, striking at 160^{o}. This feature is also present in the residual contours, see Plate 4. This gradient has been interpreted as fault F, striking at 160^{o}, shown on Plate 5, and represents the tectonic contact between the diapiric material to the east and the country rocks to the west. The country rocks, which have a similar strike direction to the fault are represented by a gravity high.

The regional contours show an approximate east-west strike direction over the mine area. The direction then changes to 130^{o} in the eastern side of the area. The increase in amplitude towards the southeastern corner is produced by the presence of relatively high magnitude anomalies as shown on Plate 2.

The small anomalies centred between lines 1400 to 1500N and 1100 to 1300E shown on Plate 2 are clearly resolved as a small amplitude positive anomaly with negative anomalies situated to the north and south. The positive anomaly probably represents a small raft of slightly higher density material, and the negative anomaly probably represents less dense material. This may indicate a contrast between weathered and unweathered material.

The gradients located to the east and north of the above anomaly suggest the presence of faults. The gradient striking at 170° between lines 1300 and 1400E south of line 1600N was clearly resolved on the residual map (Plate 4) as a gradient of 0.25 milligals per 100 feet, and is represented by fault F_2 as shown on Plate 5. There may be an east-west feature, shown as fault F_3 on Plate 5, truncating the positive anomaly along its northern portion. Another fault F_6 was delineated on the eastern side of the gravity low located at the old mine.

The high amplitude positive anomaly centred around drillhole B.H.I., is shown on Plates 2 and 4, is circular in form and could be represented by either a circular disc or vertical cylinder model. An excess mass was found to be 127,500 tons. This was determined by the method of Geotz (1958) for a circle of radius 180 feet, centred on the drillhole B.H.I. Assuming a vertical cylindrical body has a radius of 90 ft., situated at the surface, an estimate of the depth to the base of the cylinder was found to be approximately 70 ft. The density contrast in this case would be 1.0 gm/cc. This would give a density of 3.60 gm/cc, assuming that the country rocks had a density of 2.60 gm/cc, which may be an over estimate for diapiric rocks. This density suggests that the material of the body may be either limonite ore (3.8 gm/cc) or basic material. Drillhole B.H.I. was drilled to an effective depth of 150 ft. in dolomite. Its density is unknown, but is expected to lie between 2.7 to 2.8 gm/cc. The positive anomalies to the north of the former anomaly indicate a probably extension of the dolomite. The steep gradient striking at 030° located in the southeastern corner of the grid, indicates either a lithological contact or a possible fault F_4 as shown in Plate 5. This gradient is truncated by an east-west cross feature, probably a fault, F_5

(Plate 5) between lines 1300 and 1400N. The point anomaly located at 1400N, 200E may be related to this feature.

The gravity low situated in the neighbourhood of the old mine has an amplitude of 0.37 milligals, and two possible axial trend directions as shown in Plate 5. This low indicates an area of low density probably produced by leaching. Its mass deficiency was determined, after a method of Geotz, to be 71500 tons, for a circle of radius 300 ft. centred at station 1500N, 1500E. If a density deficiency is assumed of 0.37 gm/cc due to porosity as determined for Copper Queen Mine, then this porous material should extend down at least 100 ft. below ground level.

The other gravity low situated in the southeastern corner has an amplitude of 0.6 milligals and an axial direction of 030°. This represents material of low density produced by leaching and/or a different lithology (quartzite).

CONCLUSIONS & RECOMMENDATIONS

The region of low gravity associated with the old mine in the area has a mass deficiency of 71500 tons, probably represents an area of leached porous material which extends to at least 100 ft. below ground level. This area should have additional drill holes to locate any mineralization within the gravity low. The other region of low gravity located in the southeastern corner should also be drilled.

The density determined for the excess mass estimation of the positive circular anomaly located around drillhole B.H.I. was higher than that expected for dolomite. This higher density may indicate the presence of a possible denser material beneath the fresh dolomite. This could be verified by drilling another vertical hole near B.H.I. to a greater depth.

REFERENCES

GEOTZ, J.F., 1958. A gravity investigation of a sulphide deposit. Geophysics 13 (3). pp. 606-623.

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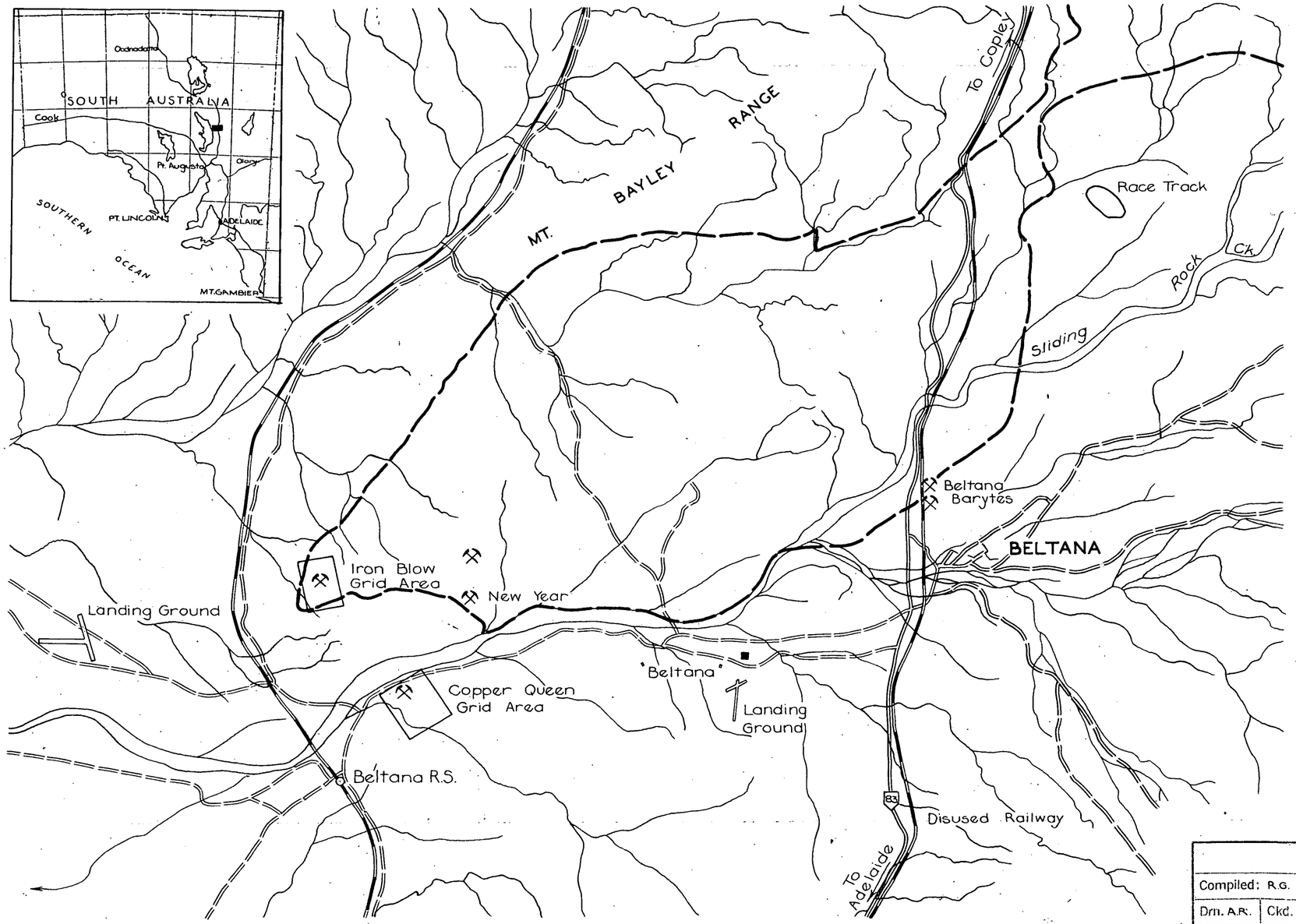


LEGEND

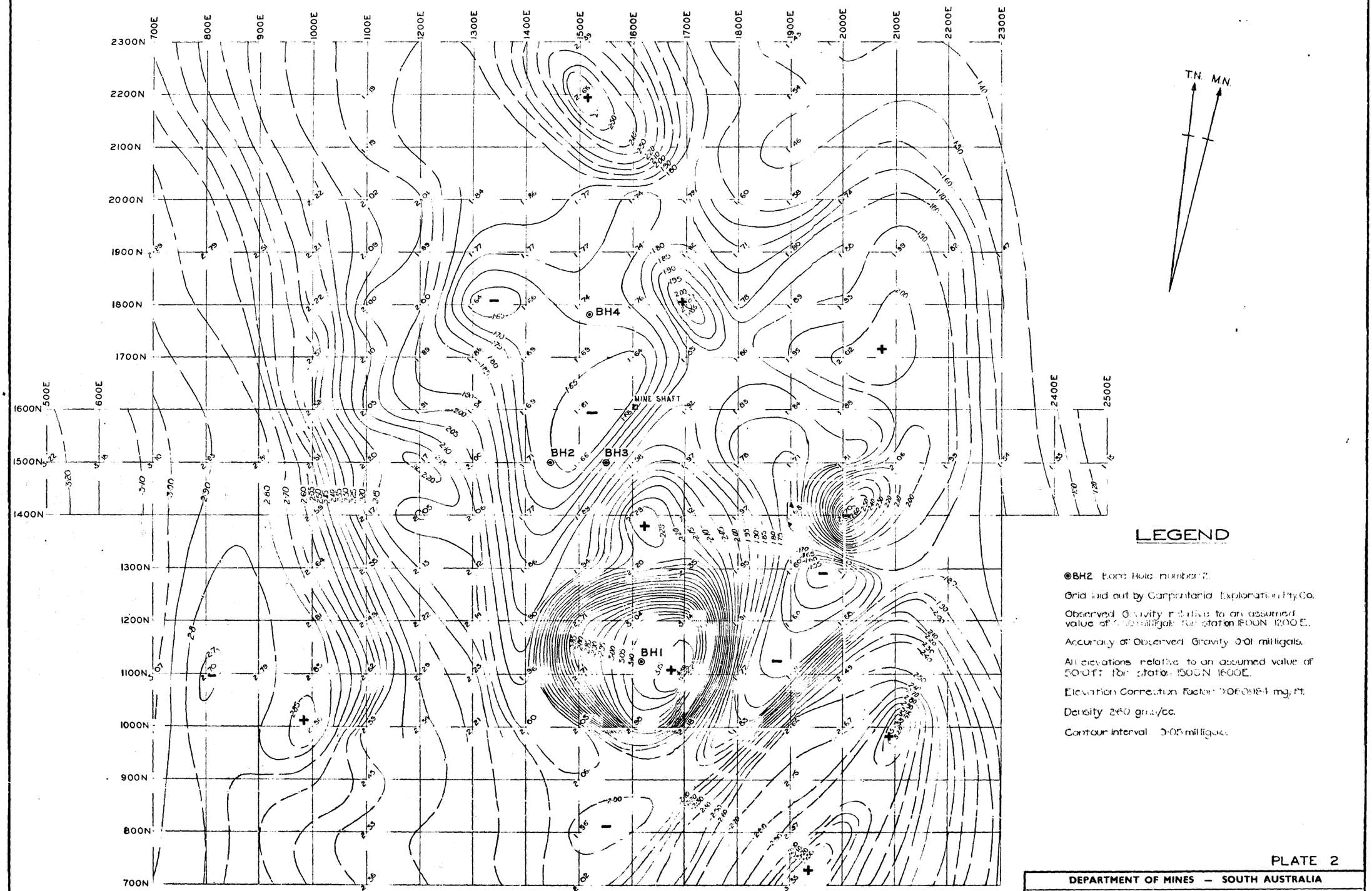
- Beltana Diapir
- Mine
- Railway
- Road
- Track
- Stream

SCALE IN CHAINS
60 0 60 120 180 240
1000 0 1000 2000 3000 4000 5000
SCALE IN METRES

PLATE. 1.

	DEPARTMENT OF MINES — SOUTH AUSTRALIA	Scale: AS SHOWN
Compiled: R.G.	IRON BLOW AND COPPER QUEEN MINES BELTANA 1:63360 LOCALITY PLAN	Date: 20TH MAY 1970
Drn. A.R. | Ckd.		Drg. No. 70-333 Cc

1M—2.70 A1811



LEGEND

◉BH2 Bore Hole number 2.

Grid laid out by Carpentaria Exploration Pty Co.

Observed Gravity relative to an assumed value of [illegible] milligals for station 1600N 1200E.

Accuracy of Observed Gravity 0·01 milligals.

All elevations relative to an assumed value of 500 ft for station 1500N 1600E.

Elevation Correction Factor 0·06984 mg./ft.

Density 2·60 gm./cc.

Contour interval 0·05 milligals.

SCALE IN FEET

100 0 100 200 300 400 500

50 0 50 100 150

SCALE IN METRES

PLATE 2

DEPARTMENT OF MINES — SOUTH AUSTRALIA

IRON BLOW MINE

BELTANA 1:63,360

BOUGUER ANOMALY CONTOURS

EXPLORATION GEOPHYSICS SECTION		Drn. R G	SCALE As shown
	GEOPHYSICIST	Tcd. A.F.	70-344
		Chd. L.V.W.	Cc
Director of Mines	SUP. GEOLOGIST	Encl.	DATE [illegible]

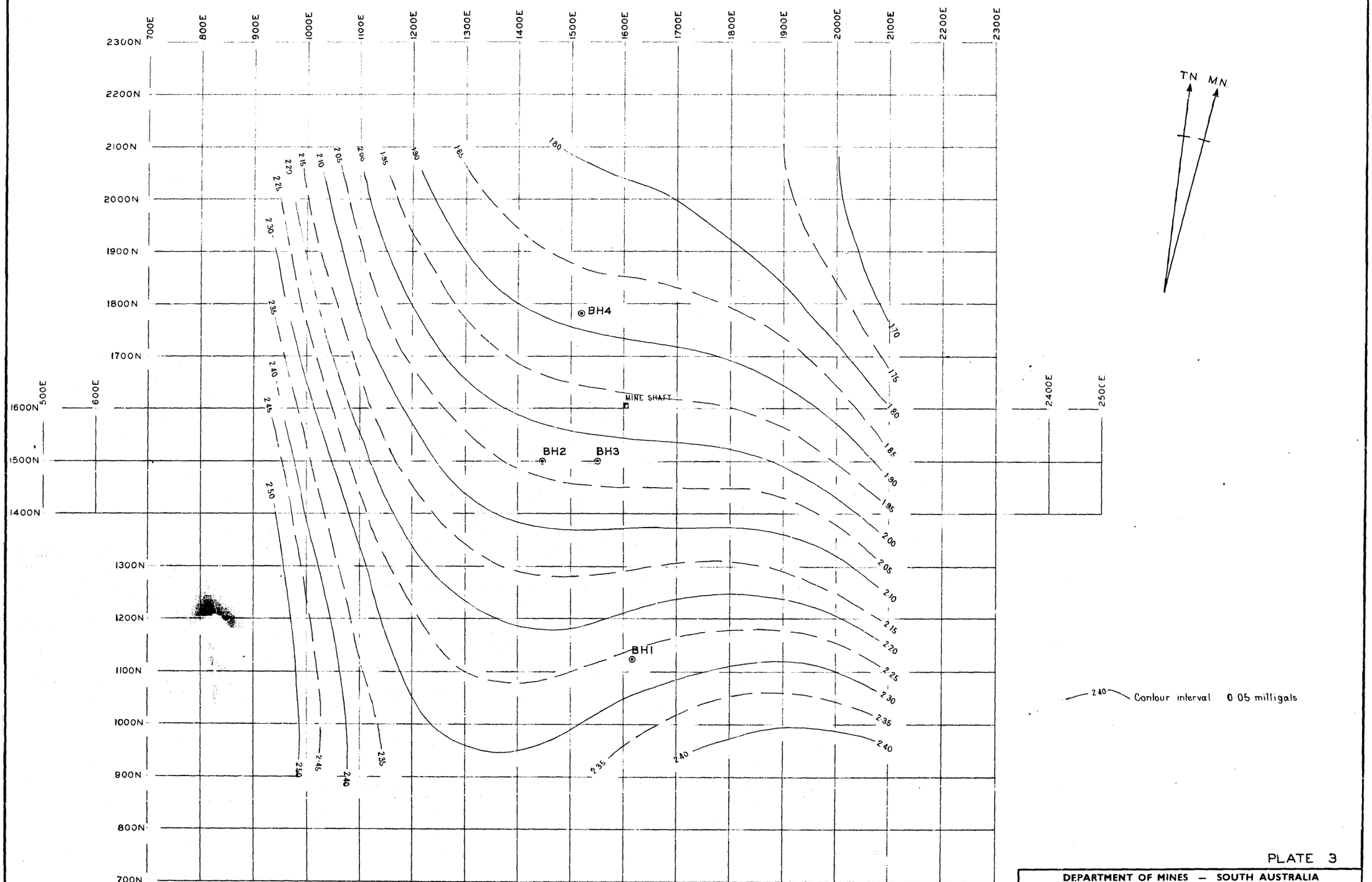


PLATE 3

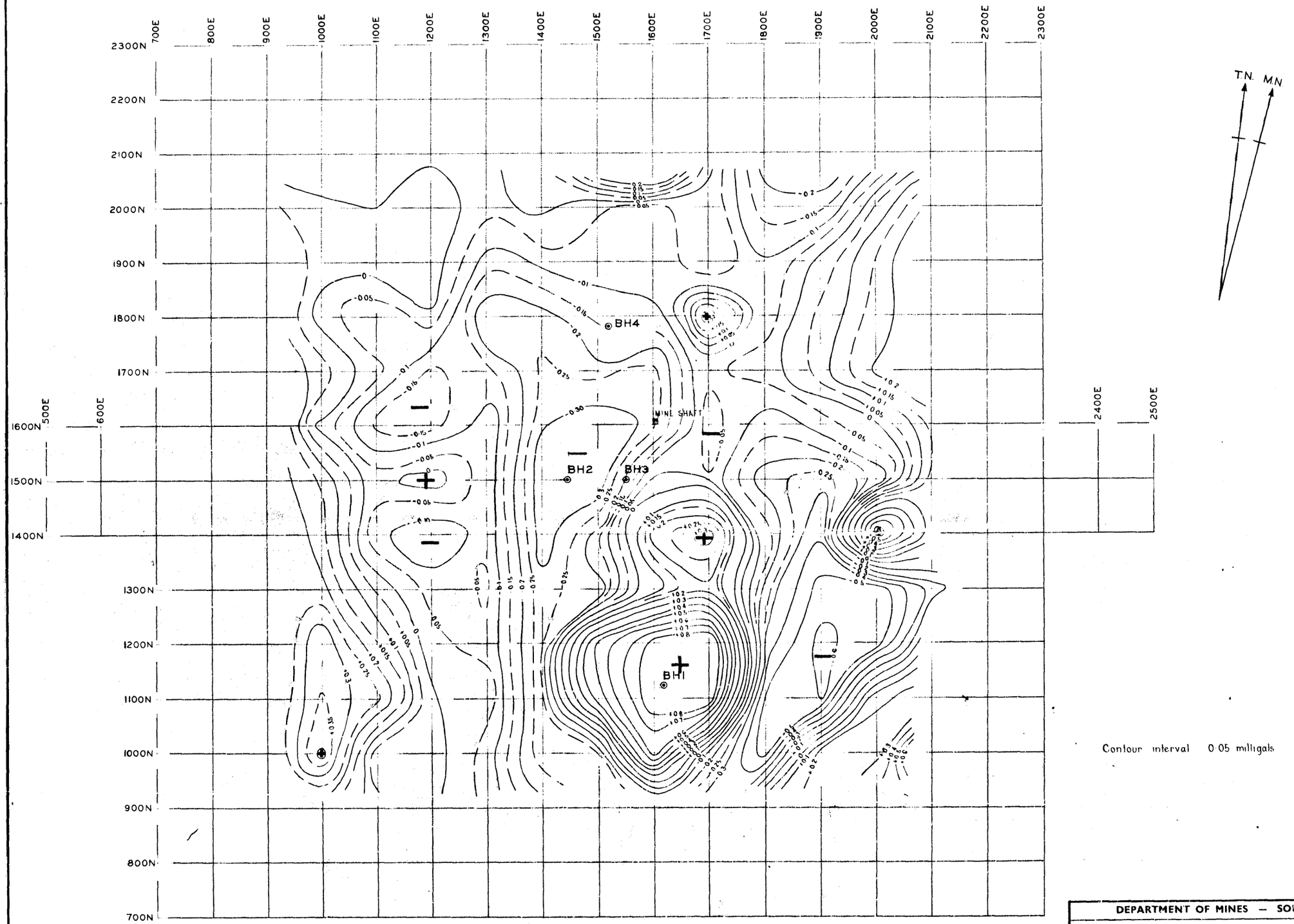
DEPARTMENT OF MINES — SOUTH AUSTRALIA

IRON BLOW MINE

BELTANA 1:63,360

REGIONAL GRAVITY CONTOURS REPRESENTED BY 4TH ORDER POLYNOMIAL SURFACE

EXPLORATION GEOPHYSICS SECTION		Drn. R G	SCALE As shown
	GEOPHYSICIST	Tcd. S v C	70-343 Cc
Director of Mines	SUP GEOLOGIST	Ckd. L.V.W.	DATE: 27th May 1970
		Exd.	



Contour interval 0·05 milligals

SCALE IN FEET

100 0 100 200 300 400 500

50 0 50 100 150

SCALE IN METRES

PLATE 4

DEPARTMENT OF MINES — SOUTH AUSTRALIA

IRON BLOW MINE

BELTANA 1:63,360

RESIDUAL GRAVITY CONTOURS AFTER SUBTRACTION OF 4TH ORDER POLYNOMIAL SURFACE

EXPLORATION GEOPHYSICS SECTION		Drn. R G	SCALE As shown
	GEOPHYSICIST	Tcd. S V C	70-359 Cc
		Ckd. L V W.	
Director of Mines	SUP GEOLOGIST	Exd.	DATE: 29 May 1970

LEGEND

- Direction of positive trend
- Direction of negative trend
- Region of higher density
- Region of lower density
- Positive Point Anomaly
- F — Interpreted fault
- F? — — — Tentative fault.

SCALE IN FEET

100 0 100 200 300 400 500

SCALE IN METRES

PLATE 5

DEPARTMENT OF MINES — SOUTH AUSTRALIA

IRON BLOW MINE

BELTANA 1:63,360

INTERPRETATION OF RESIDUAL GRAVITY CONTOURS

EXPLORATION GEOPHYSICS SECTION	GEOPHYSICIST	Drn. A.T.G.	SCALE: As shown
		Tcd. A.R.	70-360
		Chd. L.V.W.	C.e
Director of Mines	SUP. GEOLOGIST	Exd.	DATE: 25TH MAY 1970