83-1917

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Received Answered 24 JAN 1983				E & IL
DEPT. OF MINES REF. No. 570/83				

PROGRESS REPORT ON GEOPHYSICS

POWERHOUSE AREA

KING ISLAND, TASMANIA

J. SUMPTON

JULY, 1982

ML 17/79. / EL 15/66

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629003

ACCOMPANYING PLANS

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INTRODUCTION

During December 1981 and April 1982 gravity and VLF-EM surveys were conducted on a large grid, known as the Powerhouse grid, north-east of Grassy Township. The major aim of the gravity survey was to determine, if possible, the nature of the Bold Head Granite contact and hence determine the potential distribution of mine series rocks against the granite. The major aim of the VLF-EM survey was to locate east-west trending structures, notably fault zones, which may show a change in conductivity.

GRAVITY

Data Aquisition and Processing

The instrument was a Worden gravimeter, No. 592, which has a sensitivity of 0.1 μms^{-2}. Drift control was by closing loops generally within an elapsed time of two hours. This procedure also compensated for changes in observed gravity attributable to earth tides.

A total of 260 stations were occupied on eight 250m spaced gridlines. Stations were spaced at 100m intervals along these lines though some stations were abandoned due to unstable ground, access problems or lack of survey control.

The base station for the survey was station "Old 1". The observed gravity at this station is 9802016.8 μms^{-2} obtained by calculation from the King Island Airport (B.M.R. 6491.9143) station (vlaue 9801967.3 μms^{-2}. The I.S.G. co-ordinates of station"Old 1" are 220730.4E, 567095.8N.

All stations were levelled to an accuracy considered to 0.1m of better and the error in Bouguer anomaly is thus less than 0.2 μms^{-2}.

Terrain corrections have not been applied. The only areas where terrain may have a significant effect are on the southernmost part of the grid where the land surface drops away sharply to the coast and the deeply incised valley of the Grassy River cuts through the grid.

Insufficient repeat data has been obtained to reliably estimate errors due to poor repeatability of readings such as may occur through reading errors, instrument instability or inadequate drift corrections. Inspection of the Bouguer anomaly profiles shows that errors due to these sources plus elevation errors and local terrain effects are not likley to exceed $\pm$ 2.5 μms^{-2} for 90% of readings.

The data was reduced using sea level as the datum for elevation and Bouguer corrections, and a Bouguer density of 2670 kg/m^3 was used.

REGIONAL FIELD

The regional gravity field was computed by two methods as described in the Appendix. The regional field slopes steeply towards the centre of the island. The contour map also shows the effect of the Grassy Granite batholith to the west of the grid.

RESIDUAL BOUGUER ANOMALIES

The residual Bouguer anomaly map appears to a large extent to be dominated by the Grassy River Fault and the position of the bulk of the Bold Head Granite. The following interpretation refers to Figure A.

Line A-B is the Grassy River Fault which can be seen truncating the gravity high over the volcanics marked as area C. Anomaly D in the north is also truncated against the fault. The gravity trough marked E is undoubtedly reflecting the fault line, but gravity may also be depressed in this area due to terrain effects from the Grassy River valley.

The elongate low marked area F correlates with magnetic low and is thought to be less dense, non magnetic sediment within the volcanic pile.

The fault/contact between the underlying quartzites and the overlying volcanics, though more clearly seen on the magnetics, is evident in the gravity data along line H-I, especially in the truncation of the sharp gravity high marked area K.

The large low designated G lies over the Bold Head Granite, which is less dense than any of the other rock types in the area.

Perhaps the most significant anomaly is the sharp low marked on the map as area J. There are two likely explanations for this feature. The first is that it reflects a similiar, less dense (and non magnetic) sedimentary unit similiar to that considered to be responsible for anomaly F. The second is that it reflects a granite high or granite ridge extending down from the main body of the Bold Head Granite. The latter explanation is most important in terms of potential occurences of mine series rocks adjacent to such a granite ridge.

VLF-EM

VLF-EM is an electromagnetic technique which uses very low frequency (by radio standards) communication stations as a source of primary field. As by electromagnetic surveying standards the frequencies are very high, the technique responds well to poor, large volume conductors. Hence it is very useful in detecting conducting shear zones.

The receiver used for this survey was a Geonics EM-16 unit. The transmitter used was North West Cape (NWC), at a bearing fo 303° in the survey area. The stations transmitting frequency is 22.30 kHz. Readings were taken at 25m intervals in the area of expected faulting. The data is presented in profiles of inphase and quadrature components as percent. Also profiled are filtered inphase values processed according to the method of Fraser (1969). This operator smooths and phase shifts the data so that it becomes less noisy and the crossovers which mark conductors are seen as peaks.

The data is generally noisy (much of the noise through response to culture), but there is a conductor usually co-incident with and clearly related to the contact between the volcanics or mine series rocks and the underlying quartzites. This conductor can be seen on each line that crosses this contact (See figure B.). This, however, is not the case for the response on line 220000E, 567325N though this may relate to the Grassy River Fault or the granite contact. The strong response on line 219750E is most likely cultural.

The survey failed to reliably detect other faulting known to exist within the area, notably the Grahams Road Fault. This may be in part attributable to the less than optimum orientation of the strike of these features (~270°) compared with the bearing of the NWC transmitter (303°).

CONCLUSIONS AND RECOMMENDATIONS

The gravity survey has mapped a residual field which correlates well with the aeromagnetics and known geology. Of greatest significance is a gravity low which may be related to a granite rise at moderately shallow depth south of the Graham's Road Fault in the area known as Bold Head South.

The VLF-EM survey failed to detect any unknown shear zones.

In order to more reliably evaluate the potential of the Bold Head South area it is recommended that the area should be covered by a more detailed gravity survey, preferably along east-west grid lines. Magnetic Intensity should also be measured in order to assist in quantitative interpretation. Together these two methods should resolve which of the two most likely explanations for the anomaly, that of a granite rise or a non magnetic less dense sediment, best fits the data.

REFERENCES

Fraser, D.C., 1969 Contouring VLF-EM Data: Geophysics, Vol 34, No. 6 P. 958-967

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APPENDIX

629011

INTER-OFFICE MEMO

TO: R.H. DUFFIN DATE: 8-6-82

FROM: J.D. SUMPTON COPIES TO: G. BROWNE

SUBJECT: POWERHOUSE GRAVITY

Enclosed is the King Island Powerhouse grid gravity data comprising:

1. Regional and Total Bouguer Anomaly Profiles
2. Two residual gravity profile plans
3. Two regional gravity contour maps
4. Two residual gravity contour maps
5. Total Bouguer anomaly contour map

Once again these are preliminary plots as our drafting section is in its usual choked post Elliott Bay condition.

As the grid was oriented somewhat obliquely across the regional field, a two dimensional technique applied along the lines did not seem adaquate to distil an entirely convincing regional field. Therefore I used two methods which were less dependent on individual profiles.

A. The regional at any point was determined to be the average of all values lying within a unit area centred about that point. The unit area is a square the length of the side of which is related to the range of spatial frequencies suppressed, i.e. the process approximates a low pass filter which supresses lower frequencies as the length of side increases. The cell used here has a length of side of 900m, thus including 450m of data on either side of the point plus data from adjacent lines. The major disadvantage with this method is that it becomes somewhat unreliable at the ends of lines and on the extreme Eastern and Western lines where data density drops off and the data becomes biased in its distribution

B. Although the data collected along the North-South survey lines suggested a curved regional which changes its character from line to line, data from artifically constructed East-West lines shows a much more linear character, albeit with the slope of the lines diminishing as one goes north. Working from the premise that any smoothly varying surface which conforms well with the data (but whose constituant wavelengths are comfortably greater than those you would wish to include in the residual field), makes a good regional, I constructed a regional surface draped over these straight lines. A linear regression was performed on data taken from East-West lines averaging 250m apart, the value predicted (from the straight line thus obtained) at each North-South crossing was then taken as the regional at the point. Regional values corresponding to intermediate northings were interpolated from calculated points.

The regional surface thus obtained was in good agreement with that obtained by areal filtering, with the exception of those areas adjacent to the edges of the coverage. Mainly for this reason I have chosen the former surface to be "the regional" for general distribution.

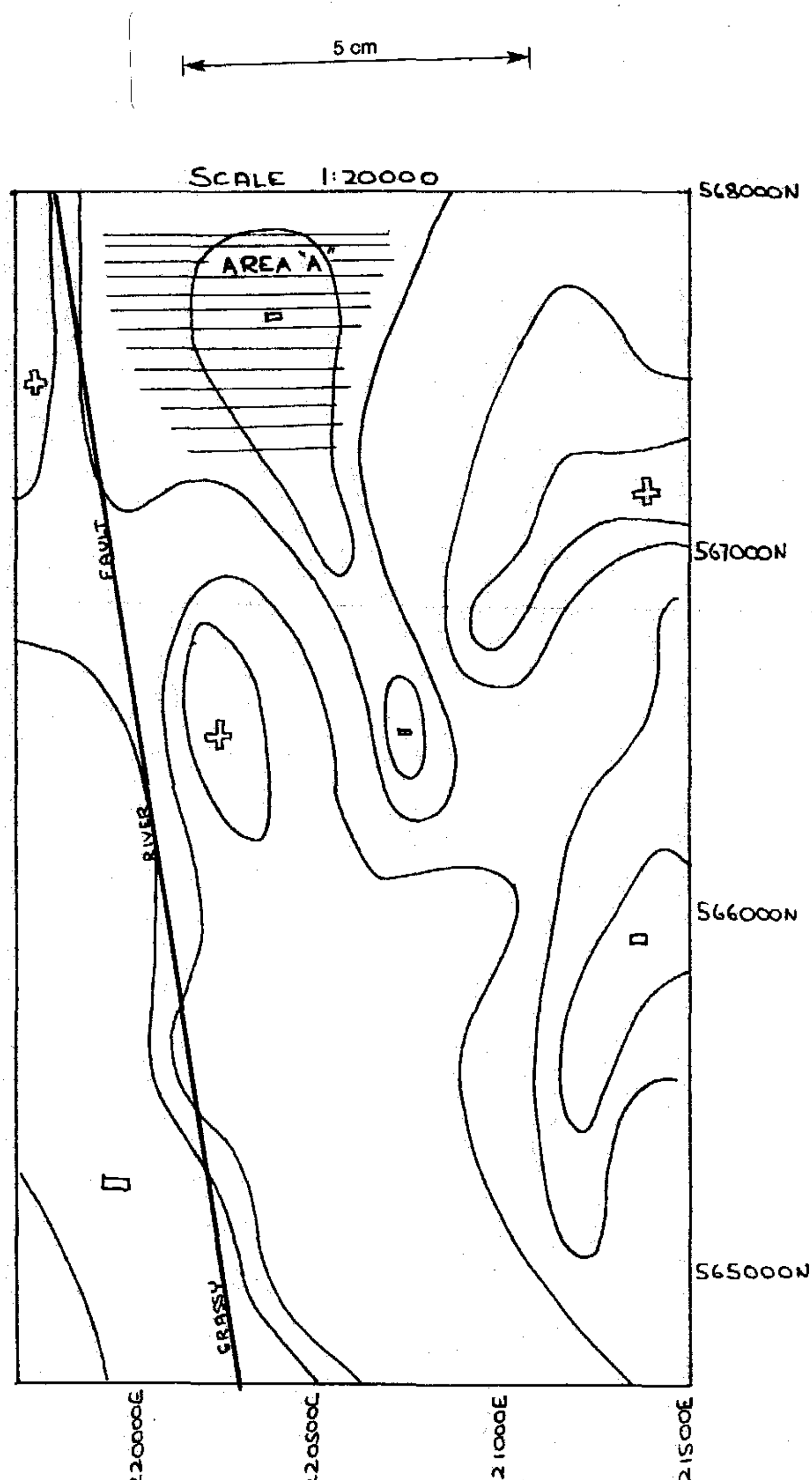
Although I have not yet undertaken a detailed interpretation of the data I am convinced that we are in touch with the granite contact in the area. My major evidence for saying this is the large residual low in the north-central part of the grid (Area A on attached diagram). The anomaly pattern also seems to some extent to be controlled by the Grassy River Fault. I believe it should be possible to determine at least the gross nature of the contact, though the presence of large masses such as the Grassy Granite orthogonal to the direction of the survey lines may make quantative interpretation hazardous.

I will attempt a detailed interpretation and report subsequent to some Elliott Bay joint venture proposal and Rocky Cape commitments being completed.

Regards,

John Sumpton

JOHN SUMPTON.


5 cm
SCALE 1:20000
568000N
567000N
566000N
565000N
AREA "A"
FAULT
RIVER
GRASSY
220000E
220500E
221000E
221500E

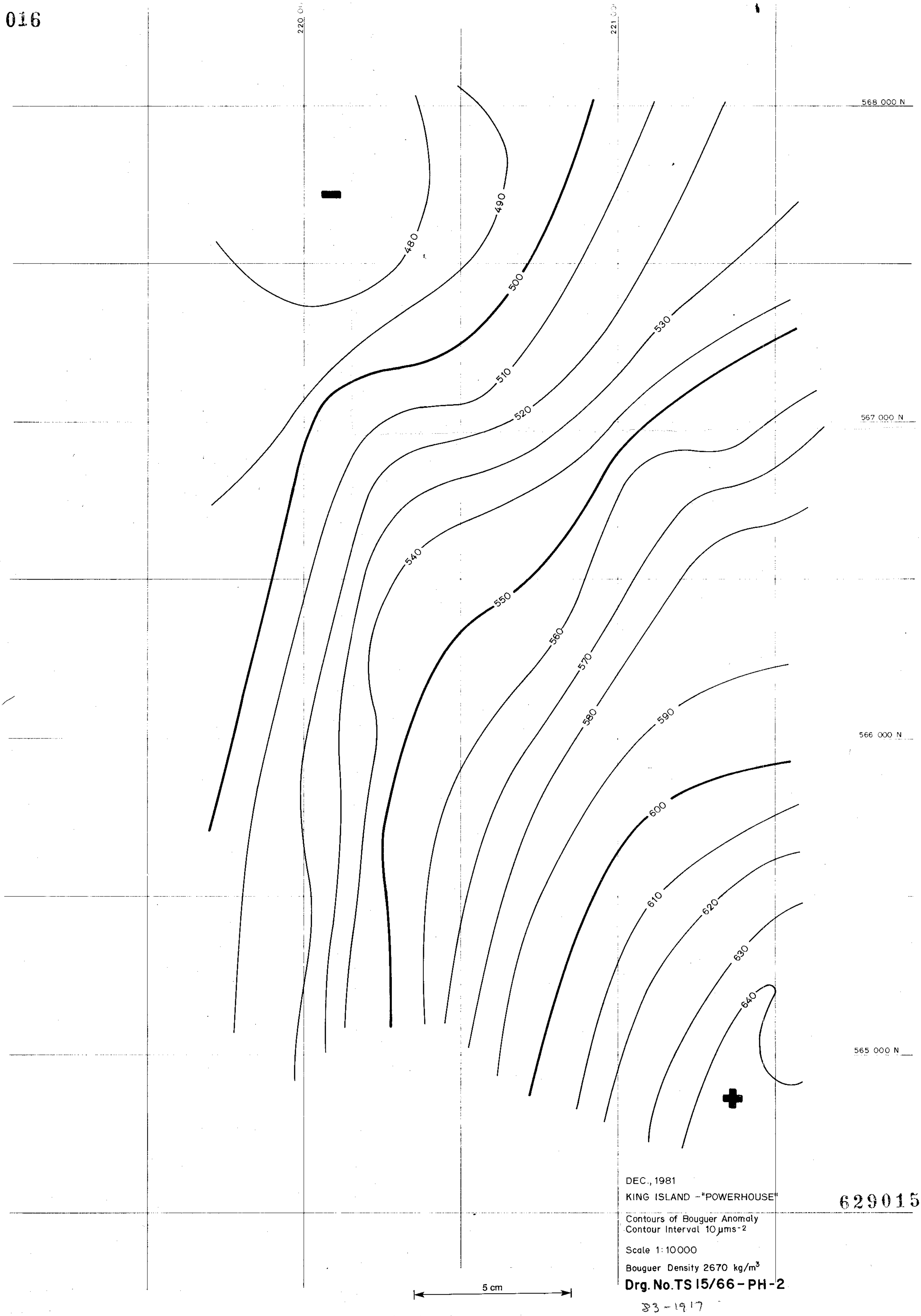
Notes
Horz Scale 1:10 000
Vert Scale 1cm = 10 ums⁻²
Bouguer Density, 2·67 gm cm⁻³

015

629014

DATE:	GEOPEKO A DIVISION OF PEKO-WALLSEND OPERATIONS LTD.
GEOLOGIST:	SCALE 1: — No. TS 15/66-PH-1 — PLAN
DRAWN:	E.L. 15/66 KING ISLAND, TAS. POWER HOUSE 83-1917
CHECKED:	PROFILES OF BOUGUER ANOMALY AND REGIONAL BOUGUER ANOMALY

016



DEC., 1981
KING ISLAND -"POWERHOUSE"

629015

Contours of Bouguer Anomaly
Contour Interval 10 μms^{-2}

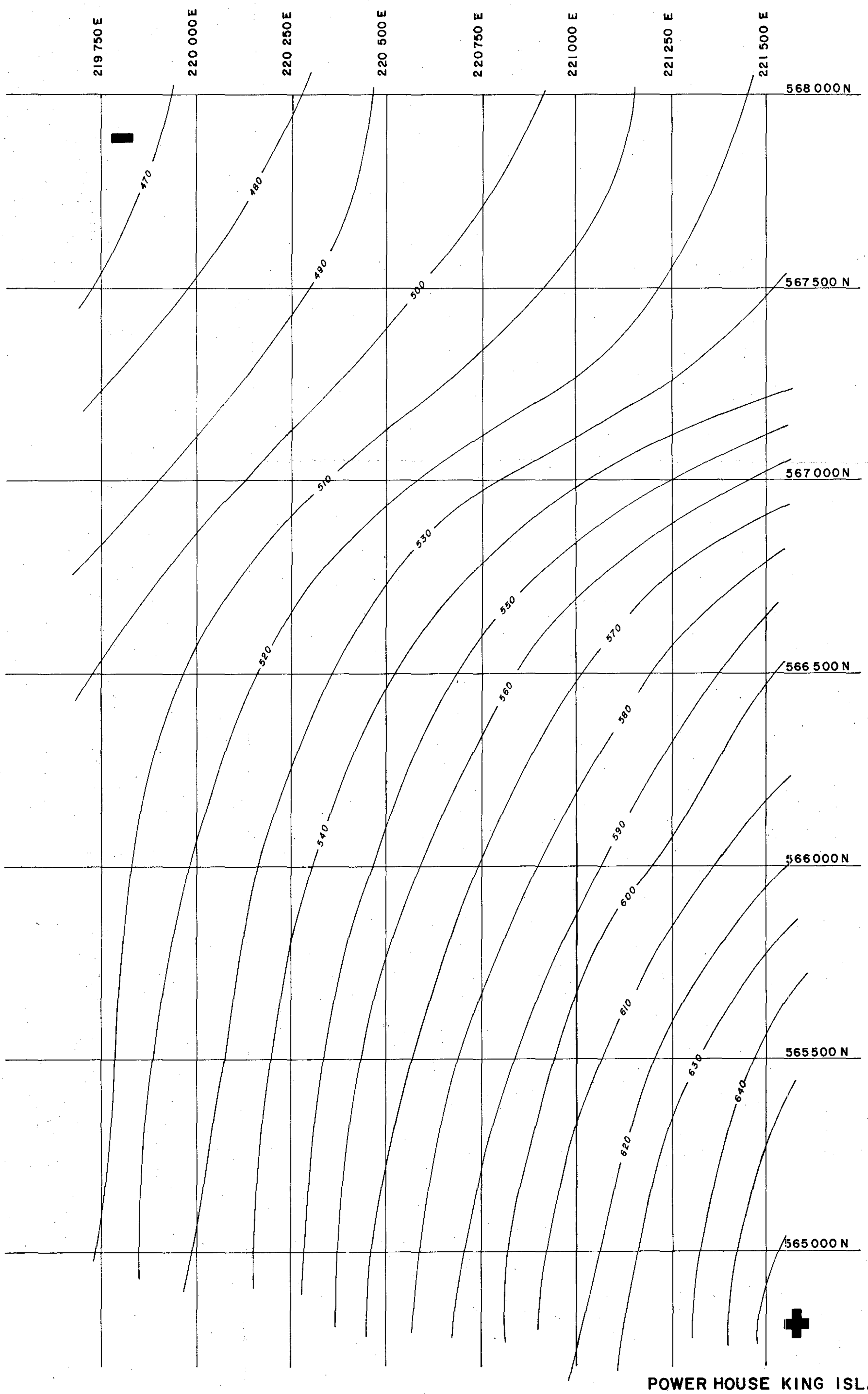
Scale 1:10000

Bouguer Density 2670 kg/m^3

Drg. No. TS 15/66 - PH - 2

83-1917

017



629016

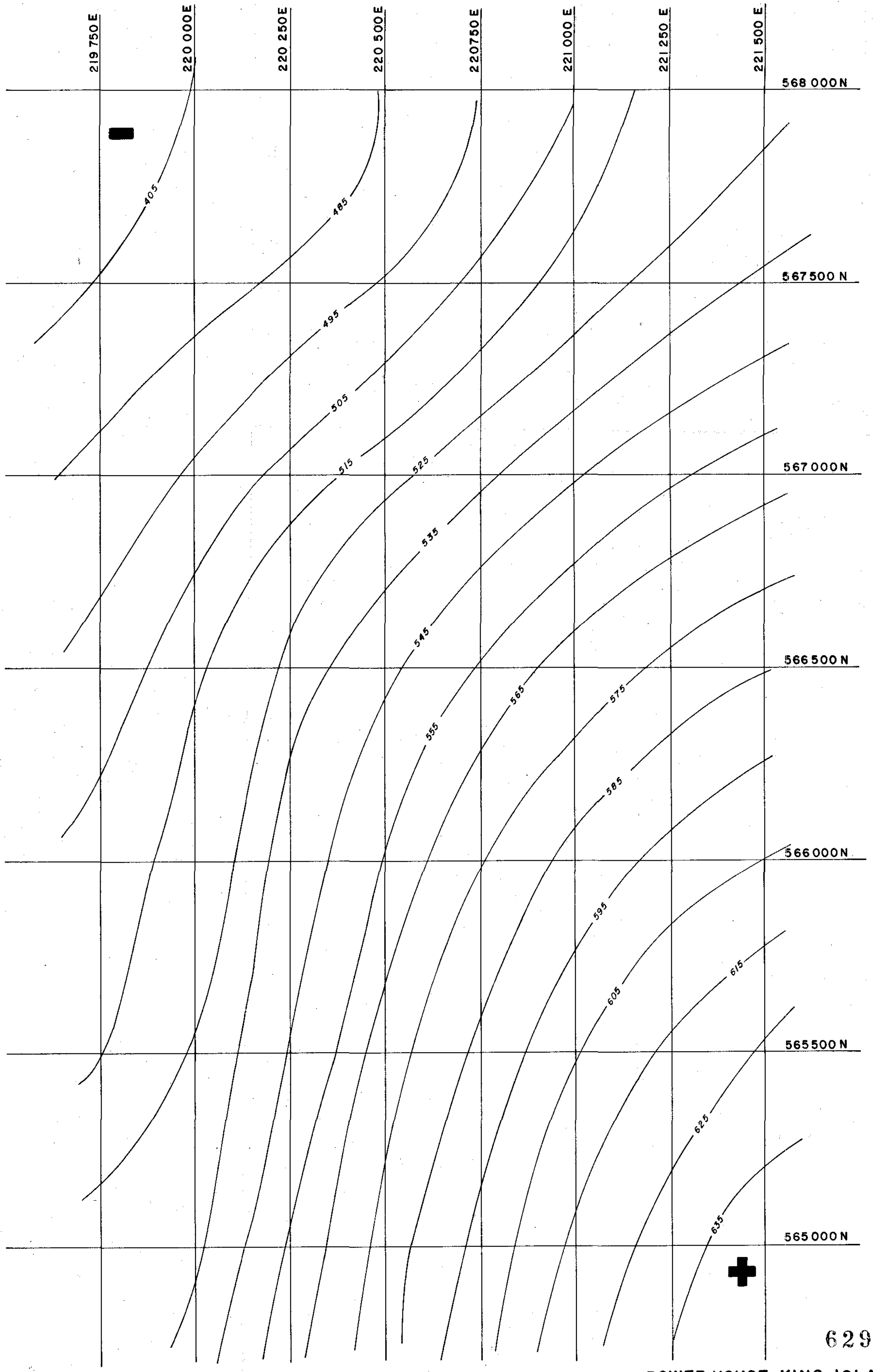
POWER HOUSE KING ISLAND
REGIONAL BOUGUER ANOMALY

Scale 1:10 000
BOUGUER DENSITY 2670 kg/m^3
Cont. Int. 10 μms^{-2} 83-1917

5 cm

Drg No. TS 15/66 — PH -3

018



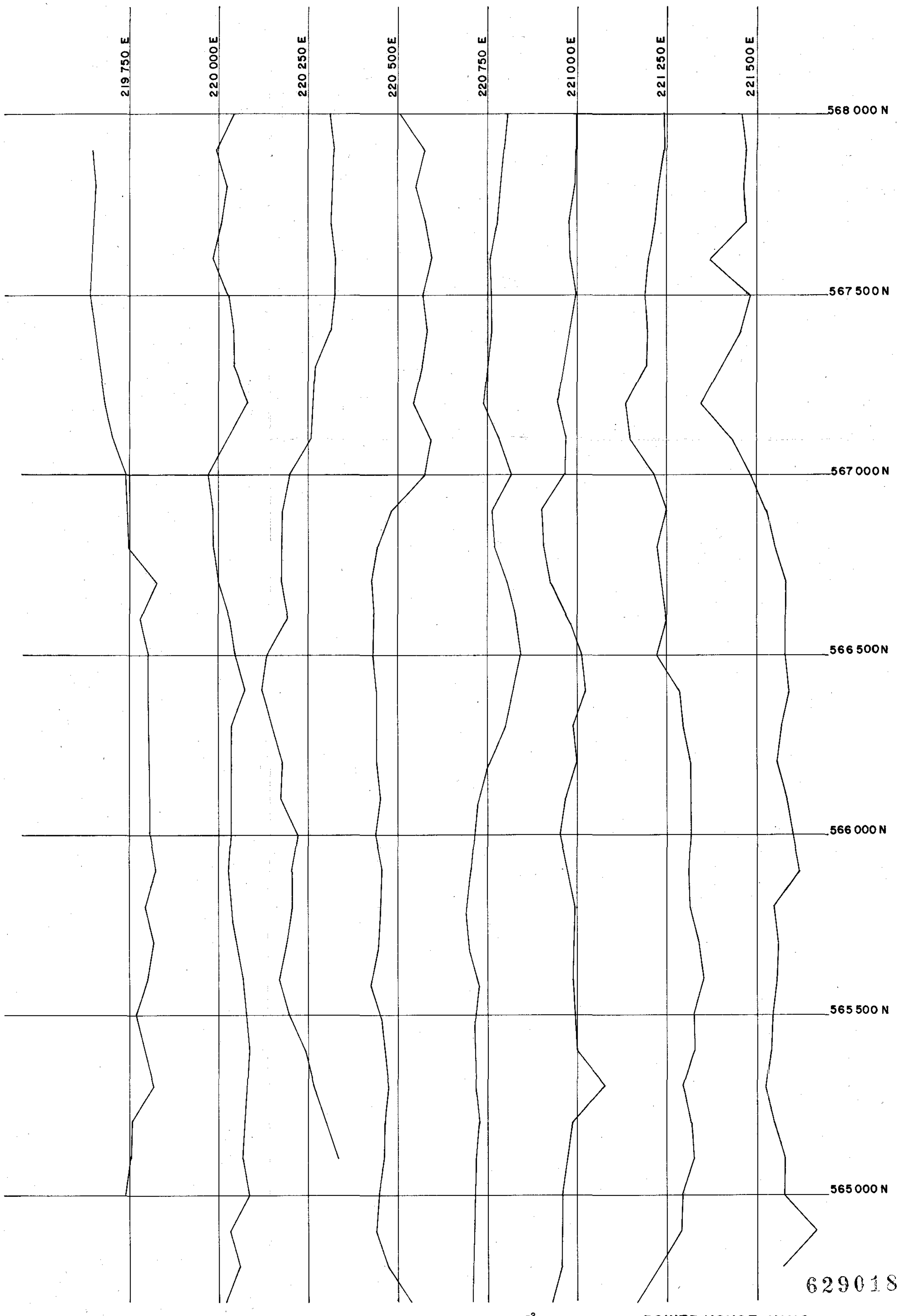
629017

Cont. Int. 10ums^{-2}
Bouguer Density 2670 kg/m^3
Regional determined using
900m x 900m cell.

5 cm

POWER HOUSE KING ISLAND
CONTOURS OF REGIONAL
BOUGUER ANOMALY
Scale, 1 : 10 000
Date, Dec 1981
Drg No. TS 15/66 – PH-4

019



629018

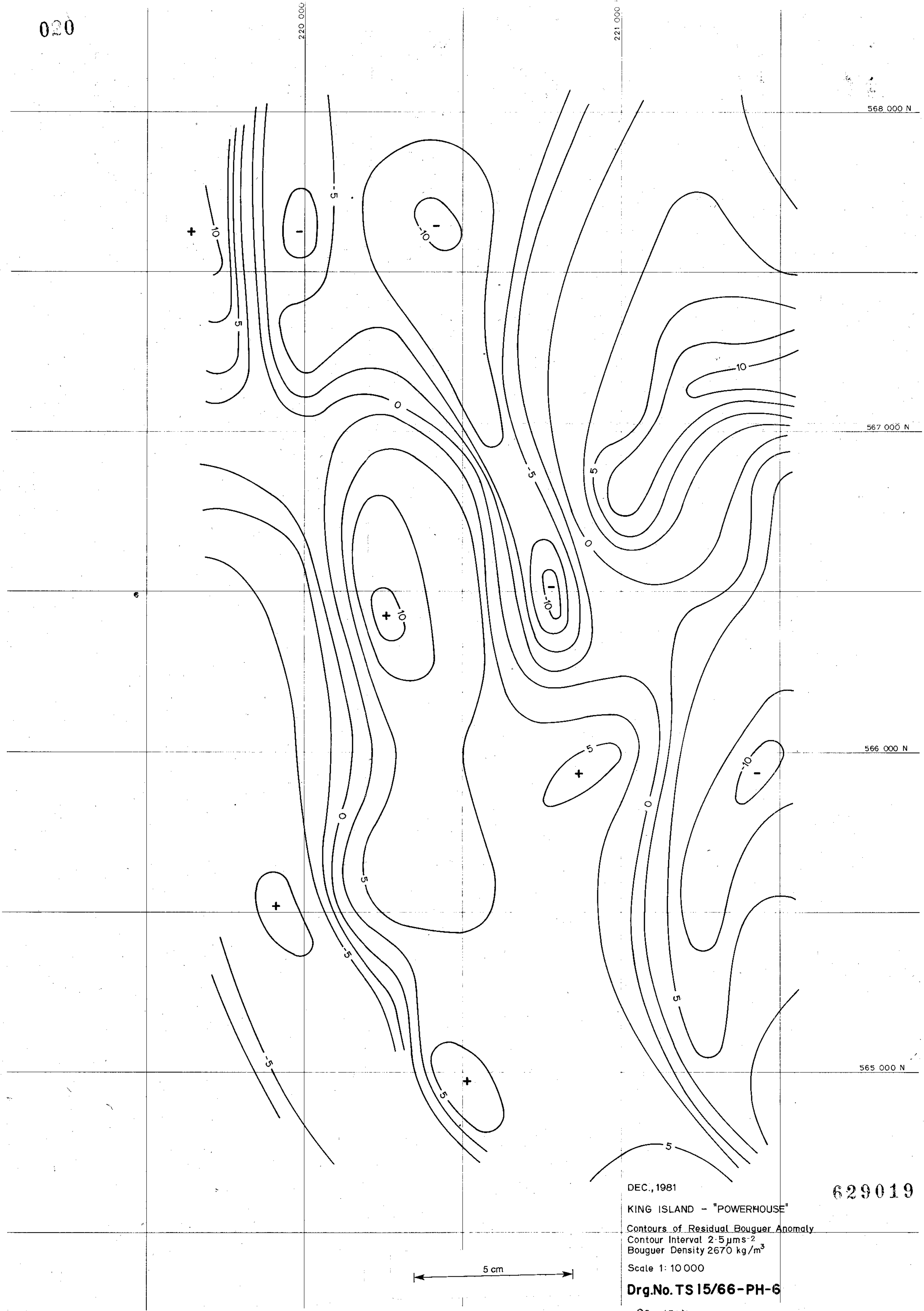
Vert. Scale 1cm = 10 μms^{-2}
Bouguer Density 2670 kg/m^3
Datum 0 μms^{-2}

5 cm

POWER HOUSE KING ISLAND
PROFILES OF RESIDUAL
BOUGUER ANOMALY

Scale, 1:10 000
Date, Dec 1981

020



DEC., 1981

KING ISLAND - "POWERHOUSE"

Contours of Residual Bouguer Anomaly
Contour Interval 2·5 μms⁻²
Bouguer Density 2670 kg/m³

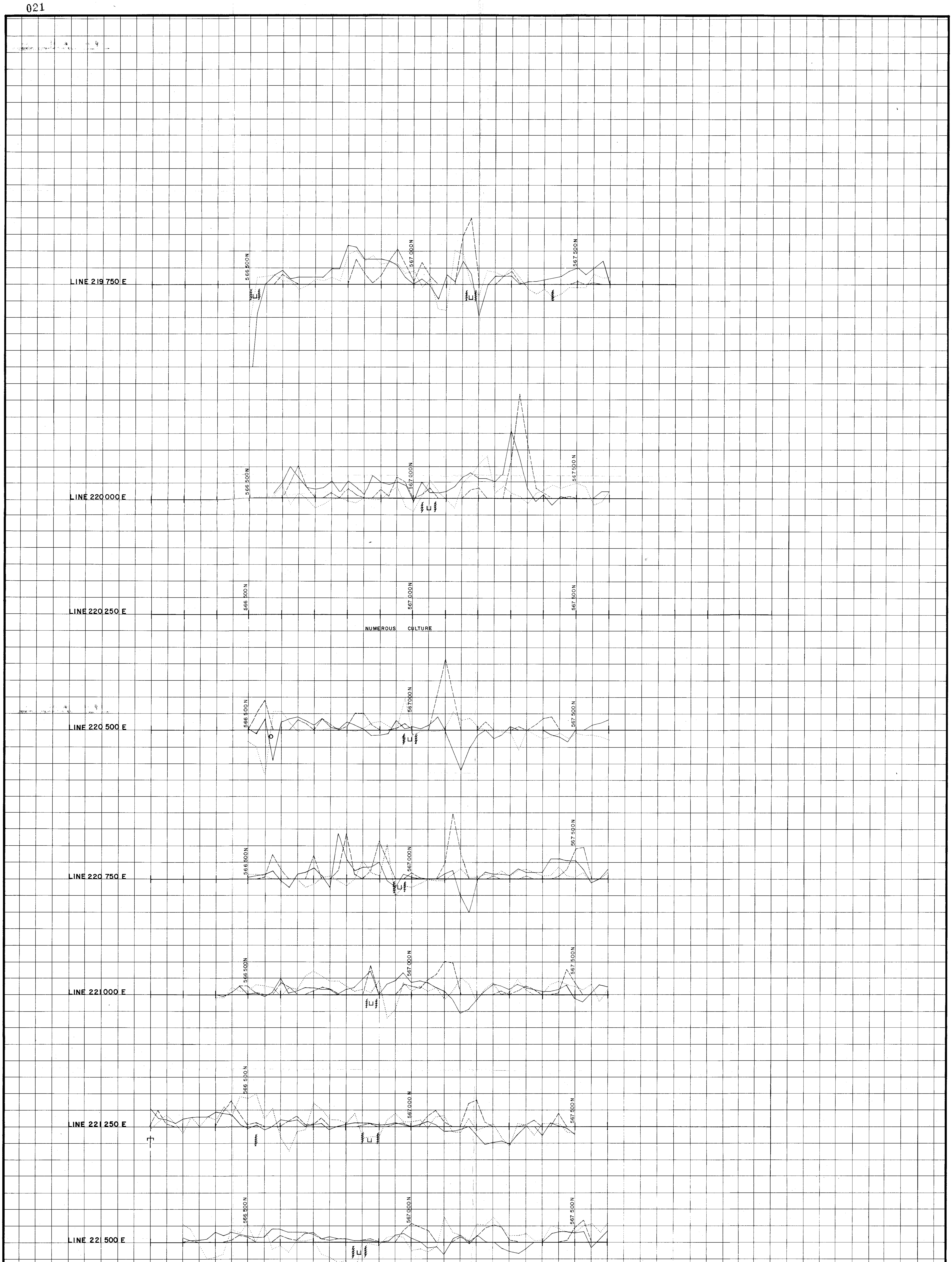
Scale 1: 10 000

Drg.No. TS 15/66-PH-6

629019

83-1917

021



Notes:

Horz. Scale.	1:5000
Vert. Scale	1cm = 10%
Datum	0%
In Phase	————
Quadrature	············
Filtered in Phase	- - - - - - -
Instrument	Geonics EM-16

Fence
Road
Power line
Pipe line

629020 NWC

N

DIRECTION OF READINGS

DATE:
GEOLOGIST:
DRAWN:
CHECKED:

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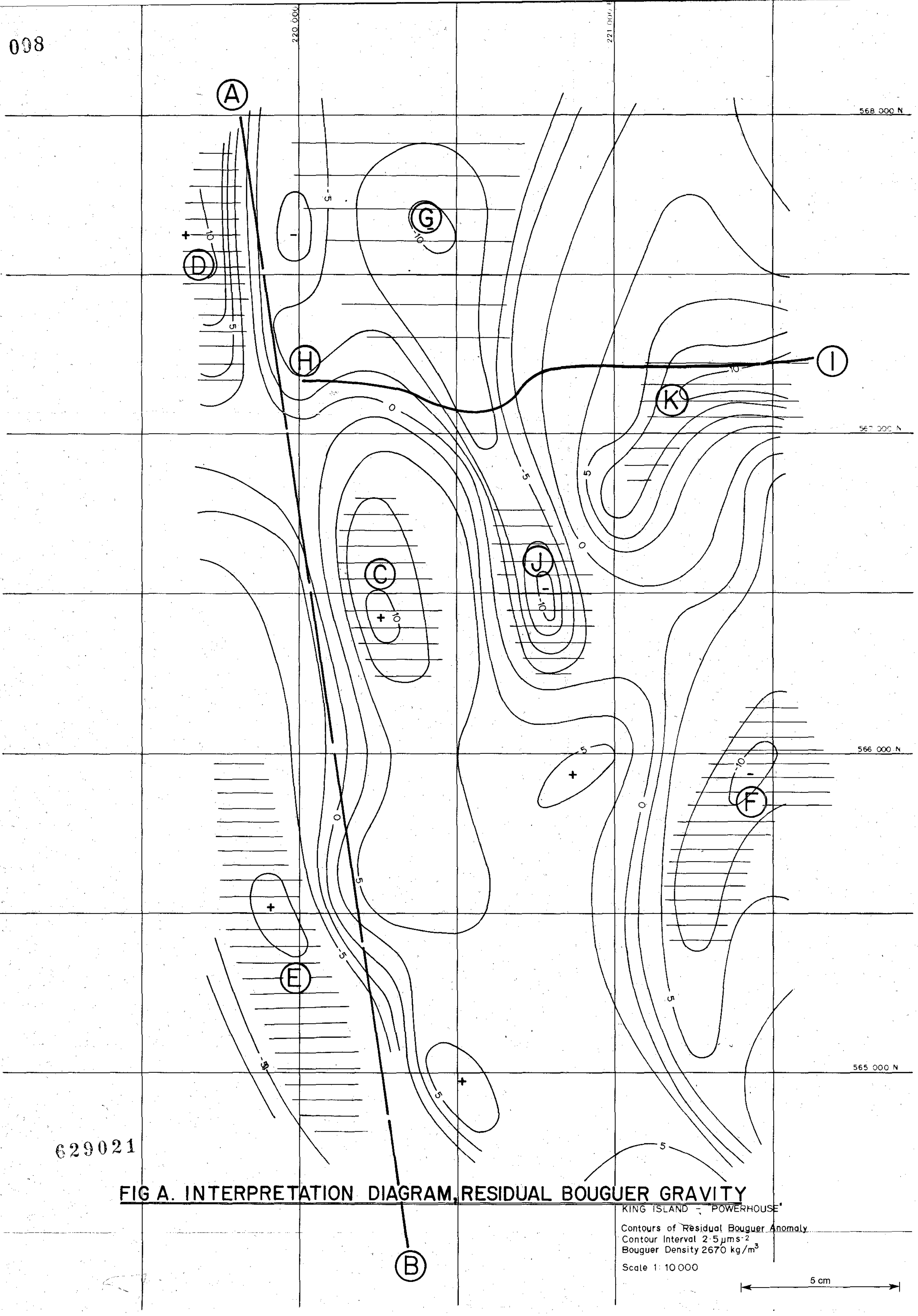
SCALE 1: | No. TS 15/66-PH-8 | PLAN

E.L. 15/66 KING ISLAND, TAS.
POWER HOUSE
PROFILES OF VLF-EM

83-1917.

008



629021

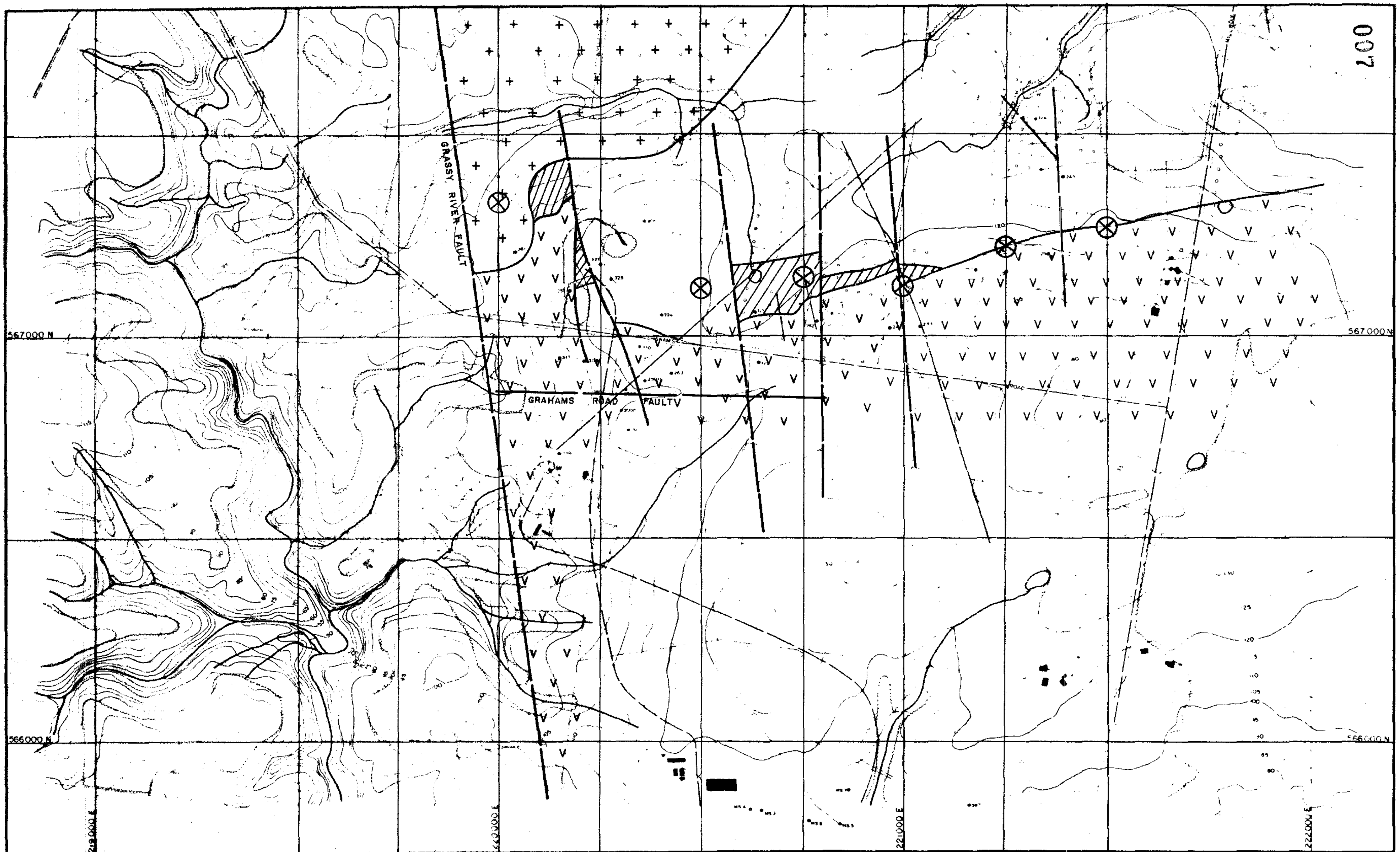
FIG A. INTERPRETATION DIAGRAM, RESIDUAL BOUGUER GRAVITY

KING ISLAND – 'POWERHOUSE'

Contours of Residual Bouguer Anomaly
Contour Interval 2·5 μms⁻²
Bouguer Density 2670 kg/m³

Scale 1: 10 000

5 cm



|+ + +| BOLD HEAD GRANITE
|V V V| OVERLYING VOLCANICS
|////| MINE SERIES
| | UNDERLYING QUARTZITES
⊗ VLF–EM CONDUCTOR

FIGURE B

5 cm

NOTE

1. Co-ordinate system is the integrated co-ordinate system based on Australian Geodetic Datum
2. Level Datum is mean low water ordinary spring (RAN) as established by H.M.A.S. Tallaroo, 1949
3. Compiled from aerial photographs, Tasmanian Lands Dept.

629022

DATE
GEOLOGIST
DRAWN
CHECKED

GEOPEKO LIMITED

SCALE 1 : 5000

No. KF 3

TOPOGRAPHICAL BASE MAP
SHOWING
DRILL HOLE LOCATIONS
AND
INTERPRETED GEOLOGY

KF1	KF2	KF3
KF4	KF5	KF6
KF7	KF8	KF9