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DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

GEOPHYSICS SECTION

Geophysical Report 7/55

G.S. 392

IRON KNOB AND KATUNGA HILLS GRAVITY ANOMALIES

by

C. Kerr Grant
Senior Geophysicist.

D.M. 637/55

Report Book No. 41/109.

KATUNGA HILLS
41/109

41/109

D.M. 637

TO THE DIRECTOR OF MINES:

The attached report of the Senior Geophysicist follows work carried out at my request to determine whether a direct comparison of gravity over known hematite quartzite (Katunga Hills) with that measured over the area under test by D.D.H. 10 would enable an interpretation of the latter anomaly. The results are inconclusive; it appears most likely however that the gravity anomaly under drilling test is due to the presence of hematite quartzites only and that no major iron ore body can be expected.

(L.W. PARKIN)
CHIEF GEOLOGIST

LWP:AGK
24/11/55

D.M. 637/55

DEPARTMENT OF MINES

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ABSTRACT

Three gravity traverses have been measured over the Katunga Hills in order to investigate the similarity of the gravity anomaly over them to an anomaly of magnitude six milligals just north of Iron Knob. An anomaly of magnitude 3-4 milligals was found centred on the east flank of the Katunga Hills. Both these anomalies can be interpreted as caused by a pitching keel of haematite or magnetite quartzite. There seems some doubt as to whether it is necessary to assume a mass of rock of higher density (ore body) to account for the size and shape of the anomaly north of Iron Knob. There is no evidence from the results indicating any ore body in the Katunga Hills ~~end of the~~ Keel.

PREVIOUS GEOPHYSICAL WORK

The anomaly north of Iron Knob was discovered by L.A. Richardson in the course of a survey made in 1954 for the Broken Hill Proprietary Co. The area has been covered by some airborne magnetic traverses flown by O. Weiss in the winter of 1950, and by an airborne magnetic survey conducted by the Bureau of Mineral Resources, Geology and Geophysics in November, 1951.

A ground magnetic survey, measuring the vertical force intensity has also been carried out by Richardson using the same stations on the gravity survey. No ground magnetometer measurements have been made in the Katunga Hills area, but D. McPharlin and C. Kerr Grant have run magnetic traverses over similar banded iron formations in the Middleback Ranges and found very large anomalies.

Airborne magnetic surveys have been made over the whole area by the Bureau of Mineral Resources. These show that the Katunga Hills are in an area of magnetic variation formed by a minor area of high intensity extending southward as a tongue from

the main anomaly over the Iron Monarch and an adjacent low to the east. As there is another low immediately to the west of this tongue there may be a possibility that the tongue is incorrectly plotted in the aeromagnetic map, especially as the flight lines in this part of the map are marked "interpolated" for a considerable part of their length.

The area north of Iron Knob is covered by the more gentle northward extension of the main Monarch anomaly.

METHOD USED

Traverses were laid out on three lines running in an East West direction from the base line established by B.H.P. for L.A. Richardson's southern geophysical surveys, and which is coincident with lease boundaries on the east (west??) side of Iron Monarch. Stations were sited at approximately 200 feet intervals on three traverses spaced 1,000 feet apart, surveying and levelling being carried out by stadia. Observations were taken with the Department's Worden Gravity Meter, W 204, this instrument being particularly suitable on account of the rugged terrain. The results were tied to stations E.O., F.O. and G.O. on Richardsons Survey; and also to the Pendulum Base station on the verandah on the west side of the northern end of the Iron Knob Hotel. A tie was also run between this lease and the one used by Richardson on the west verandah of the B.H.P. staff house, Fig. 1 shows the layout of the stations and rough topographic contours of the area based on station level values.

RESULTS

The results are based on a value 979.5088 at the Pendulum Base station. Levels have been reduced to M.S.L. by tying to a B.H.P. Bench Mark on the ore conveyor at Iron Monarch with R.L. 606.08' on Whyalla Tramway datum, which according to L.A. Richardson (Progress Report No. 4 to B.H.P. Co., page 1) is 2 feet below mean sea level at Whyalla. Latitudes have been

computed by tying the Katunga Trig. Station (Lat. 32° 46' 33.26") to the grid.

The value deduced for "g" at Richardson's base Station is 979.5053.

Bouguer anomalies have been computed for all the Stations assuming a terrain density of 2.5 above mean sea level. Topographic corrections have not been computed generally, but have been computed at six stations only, which have shown that they are of the order of one or two gravity units for stations on the steep sides of the ridge, and elsewhere zero. They have consequently not been included in the results. Fig. 2. shows the Bouguer anomalies, and a profile along Traverse K.

INTERPRETATION

The results show a moderate anomaly of the maximum amount of 4 milligals running along the eastern flank of the Katunga Hills. It is considered that this is caused by the excess in density of the banded iron formation of the Katunga Hills over that of the surrounding schist.

According to K.R. Miles (The Geology and Iron Ore Resources of the Middleback Ranges, Bulletin No. 33, page 62) the "long north-south ridge (in the Northern Katunga Hills) forms the western limb of a major synclinal structure". The gravity results confirm this picture locating the centre of the Keel approximately at Station 6E on line K.

From cross section of the anomaly the depth to the centre of gravity of the anomalous body can be estimated at approximately 1000 feet. The anomalous mass is evidently elongated in the north-south direction, its axis trending slightly east of north. An estimate of the size of this supposed keel can only be made by assuming a value for the difference σ of the mean density of the banded iron formation of the Katunga Hills from that of the surrounding schists. The approximate width of the supposed keel at its widest part is then $\frac{1300}{\sqrt{\sigma}}$ feet at the surface, if

it is assumed semicircular in section.

The density of the banded iron formation appears to bear a reasonable correlation with the total iron content of the material. This relation is shown in Figure 3 for five samples from diamond drill cores from the Katunga Hills bores Nos. 1, 2, and 6 and six samples from Bore No. 10 at 300E, 4300S on the B.H.P. grid north of Iron Knob, from this the average density of the Banded Iron Formation in the vicinity of bores Nos. 1, 2, and 6 in the Katunga Hills has been estimated at 3.05.

The density of some samples of the schists has been measured and a value of 2.70 has been assumed for the unweathered schist.

These densities, however, can only be taken as approximate; the value σ = 0.35 has been assumed as most probable. The width of the cross section of the Keel for varying values of σ is as follows:-

σ	Width of keel
0.3	2370 ft.
0.35	2200 ft.
0.4	2060 ft.
0.5	1840 ft.
0.6	1680 ft.

This range of values of σ appears to be consistent with the estimated depth to the centre of gravity of the anomalous body.

COMPARISON WITH RICHARDSON'S ANOMALY

Richardson's Anomaly centred at 250E, 4500S is of the order of six milligals or nearly half as large again as the Katunga Hills anomaly. It may therefore be explained as the expression of a larger keel than the Katunga Hills Keel, or possibly, if the keel itself does not account for the whole of the anomaly, it may in part be due to the effect of the banded iron formation of the Keel and in part to that of an ore body lying in its centre.

The depth to the centre of gravity of the anomalous body beneath co-ordinates 250E, 4500 S appears from the shape of the profiles to be about 750 feet, in other words appreciably shallower than the Katunga Hills anomaly.

From the iron analyses of the core of Bore No. 10 the mean density of the surrounding rock has been estimated at 3.12, or slightly higher than that of the Katunga Hills. The width of this keel is estimated at $\frac{1700}{\sqrt{\sigma}}$ feet, or assuming a density difference of 0.42 near Bore No. 10, at almost 5000 feet. This is over twice the size of the supposed Katunga Hills Keel.

As the centre of gravity of this anomalous body is higher one might possibly expect a smaller anomalous body. There is thus some slender evidence that part of this anomaly may be accounted for by the presence of a haematite ore body at the bottom of the keel with a density of approximately 5.0. An ore body of cross sectional area 50,000 square feet at a depth of 800 feet would account for over two milligals of the observed anomaly.

SUMMARY AND CONCLUSIONS

Summarising these results it may be said that the geophysical anomaly at present being drilled at co-ordinates 200E, 4300S can be accounted for entirely by the attraction of the higher density material in a keel of banded iron formation, but that the evidence is not inconsistent with the existence of either a relatively small or a relatively deep iron ore body in the core of the keel.

It is also considered that it may be possible, if further work is contemplated in the Katunga Hills area to utilize these gravity measurements to some extent to determine the regions of denser rock and hence of expected higher iron content.

C. Kerr Grant

(C. KERR GRANT)
SENIOR GEOPHYSICIST

CKG:AGK
16/11/55

Plans accompanying Report:

55 : 356

55 : 360.

S1164

⊙ BORE No. 10 IRON KNOB CORE SAMPLE

○ BORE No. 10 IRON KNOB GROUND CORE SAMPLE

× KATUNGA HILLS BORE No. 1

o " " " No. 2

\+ " " " No. 6

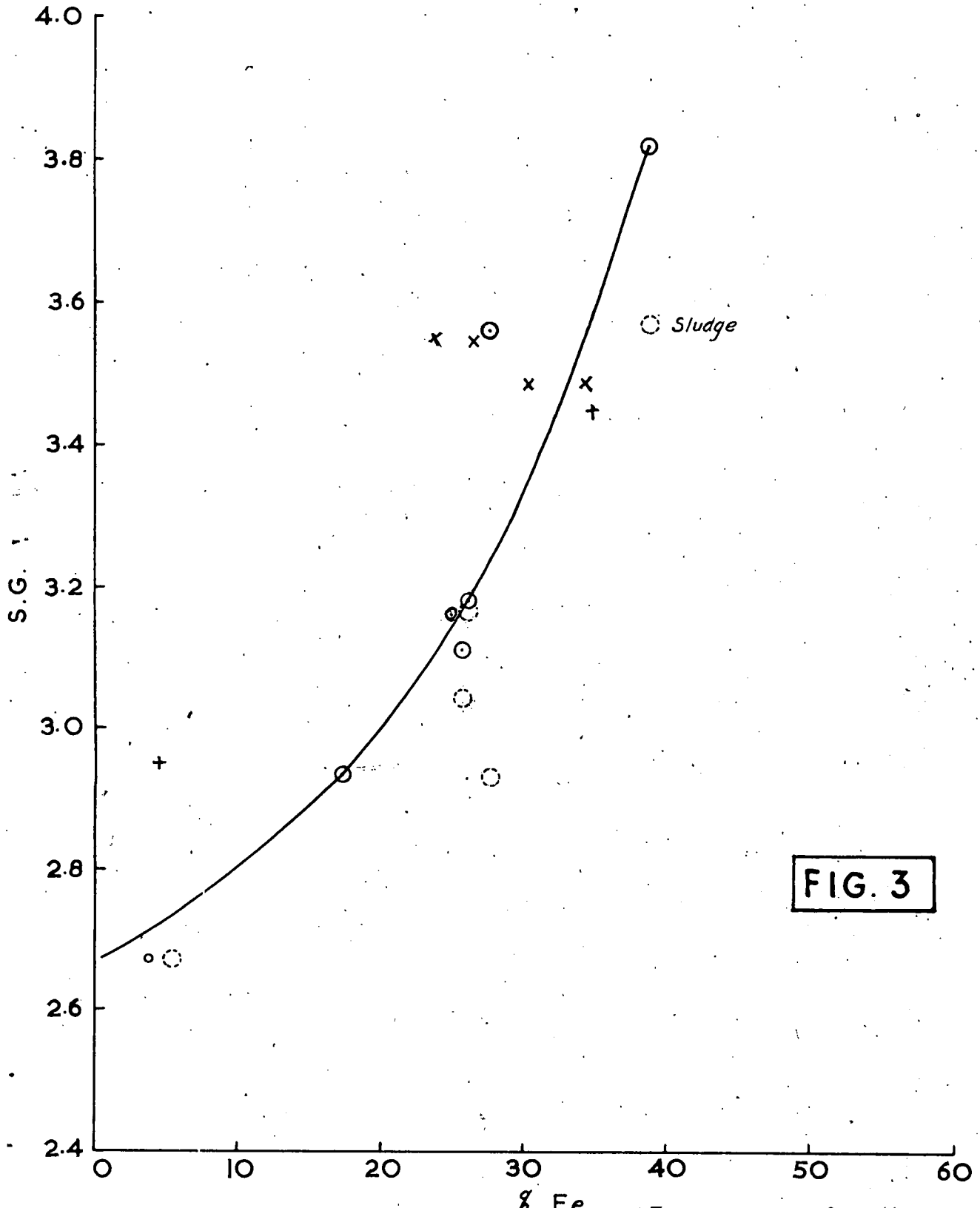
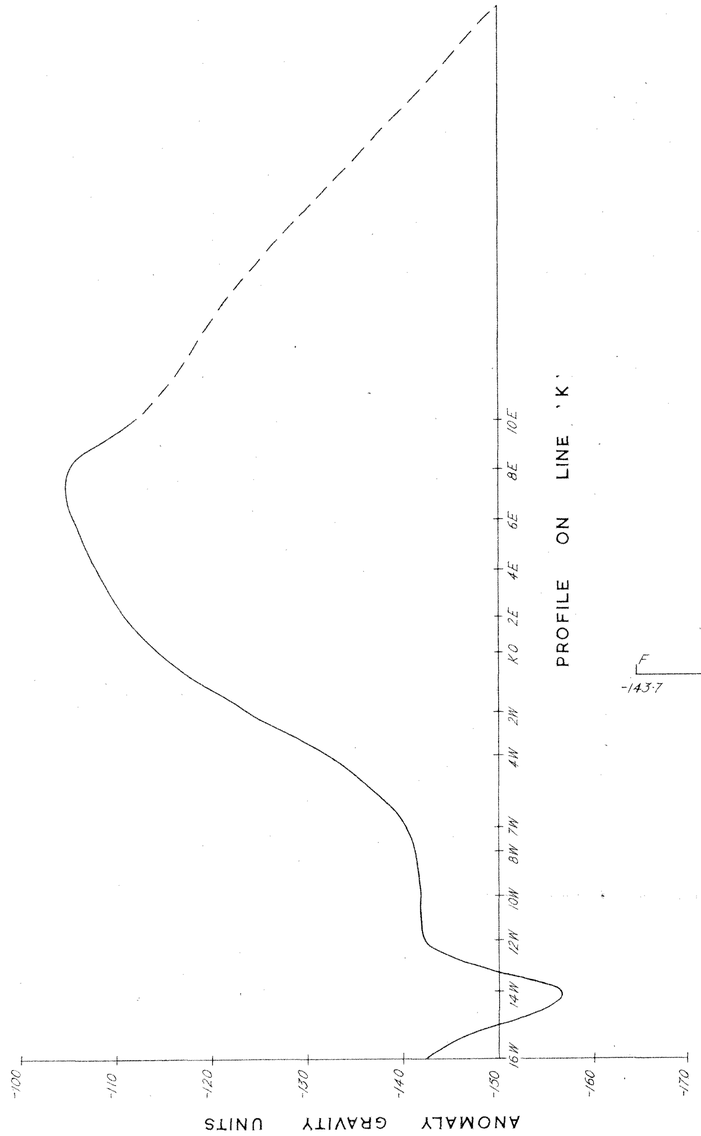


FIG. 3

To accompany Report by C. Ker

S.A. DEPARTMENT OF MINES

Approved.	Passed	Drn.	KATUNGA HILLS — IRON KNOB - CORE SAMPLES COMPARISON OF DENSITY AND TOTAL IRON CONTENT	D.M.	Scale
		Tcd. C.J.K.		Req.	S 1164 DE
		Ckd.			
Director		Exd.			Date 21·11·55



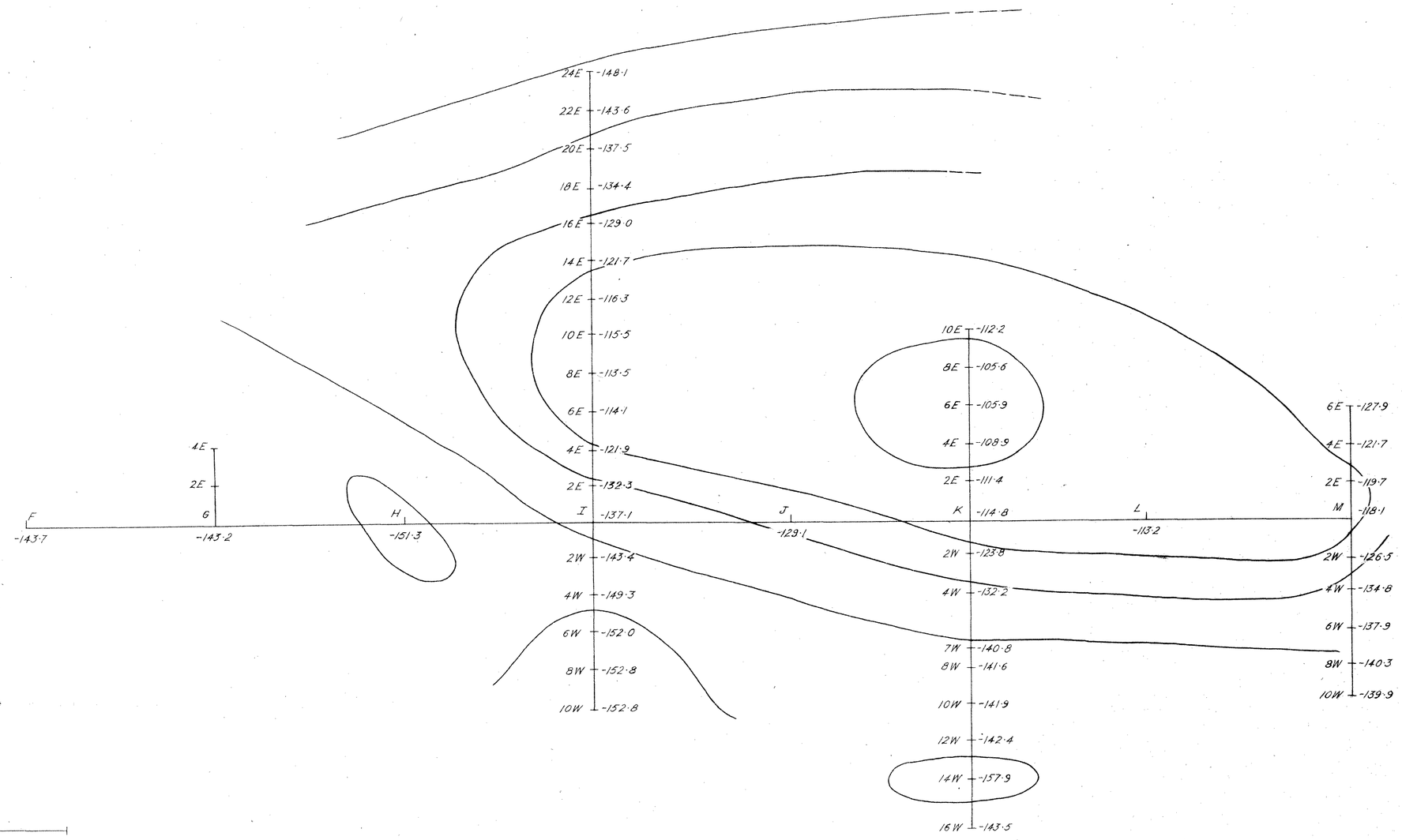
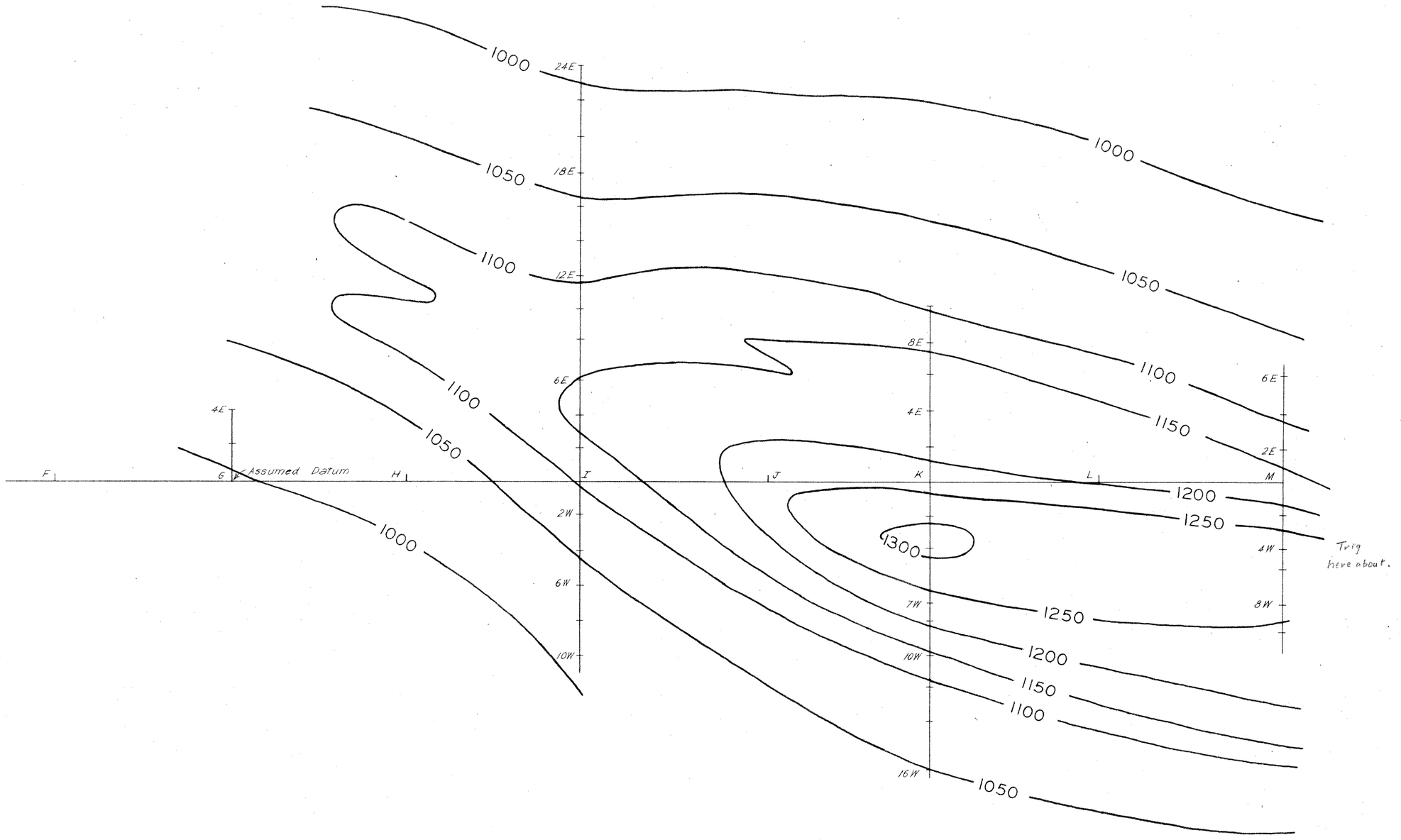


Fig 2

To accompany Report by C. Kerr Grant.

S.A. DEPARTMENT OF MINES

Reg. No. D.M. Compiled from	KATUNGA HILLS CONTOURS OF BOUGUER ANOMALY VALUES IN GRAVITY UNITS CONTOUR INTERVAL 1 MILLIGAL = 10 GRAVITY UNITS	Approved	Passed	Drn. Tcd. C.J.K. Ckd. Exd.	Scale: 400 Feet To 1 Inch 55·356 DE Date 15·11·55
Associated Drawing No.	No. Amendment Exd. Date		Director of Mines		



CONTOUR INTERVAL : 50 FEET

SCALE : 400 FEET TO 1 INCH

Fig 1

To accompany report by C. Kerr Grant

S.A. DEPARTMENT OF MINES

Store Drawing No.	No. Amendment Exd. Date	Req. No. D.M. Compiled from	KATUNGA HILLS SURFACE PLAN	Approved Passed Director of Mines	Drn. Tcd. C.J.K. Ckd. Exd.	Scale: 400 Feet to 1 Inch DE 55:360 Date 17·11·55