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REPORT ON
GRAVITY SURVEYS
OVER VARIOUS AREAS
NEAR QUEENSTOWN, TASMANIA
ON BEHALF OF
MOUNT LYELL MINING AND RAILWAY COMPANY LTD.

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PRIVATE AND CONFIDENTIAL

REPORT ON
GRAVITY SURVEYS
OVER VARIOUS AREAS
NEAR QUEENSTOWN, TASMANIA
ON BEHALF OF
MOUNT LYELL MINING AND RAILWAY COMPANY LTD.

BY

G.J. STREET, MSC, DIC.
GEOPHYSICIST

SYDNEY, N.S.W.

JULY, 1980
TAS-073E

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GEOPHYSICAL CONSULTANTS AND CONTRACTORS

SUMMARY

In order to test the use of the gravity method on the west coast of Tasmania, six lines were surveyed from the White Spur, Red Hills and Lake Selina areas. Despite terrain problems in some areas, it is still possible to recognise a number of anomalies. Two of these anomalies are recognised as being of primary interest. However, the use of single traverse surveys does not reveal enough information about the sources.

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REPORT ON
GRAVITY SURVEYS
OVER VARIOUS AREAS
NEAR QUEENSTOWN, TASMANIA
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MOUNT LYELL MINING AND RAILWAY COMPANY LTD.

INTRODUCTION

At the request of Mr. R. Meares Senior Exploration Geologist for the Mount Lyell Mining and Railway Company Ltd., Scintrex Pty. Ltd. executed gravity surveys over six lines on various grids north-east of Queenstown, Tasmania.

The work was undertaken over five production days between 25th February and 1st March, 1980 by Scintrex geophysicist Mr. G.J. Street,MSc,DIC., assisted by R. Prydon.

In total 91 stations were occupied and 23 base station readings taken over 8500 line feet.

Travelling time took up a considerable proportion of each day. Great care had to be taken moving the meter from one area to another due to the rough roads encountered to and from the survey area.

SURVEY DETAILS AND ACCURACY

Gravity readings were taken with a Worden extended range gravity meter number 273. A base station was established on each line and checks made back to this base every 3 or 4 readings.

Good readings were difficult to obtain in a number of areas, in particular on White Spur. The ground conditions here were very spongy which caused continual movement of the meter. Error bars are placed against the noisiest of these readings. At the worst it was found that an error of ±0.3 milligals might occur, though most readings are considered accurate to better than 0.1 milligal.

Levelling data was supplied by Mt. Lyell but the accuracy is not known.

The lines read were as follows:

White Spur	34.5N	300W to 1300W
	36N	1100W to 2600W
Red Hills	86S	100E to 1500W
	72S	500E to 2600E
	8S	00 to 1800E
Lake Selina	120N	2300W to 3500W

The data is adjusted for drift, free air and Bouguer corrections to an arbitrary base level on each line. No terrain correction has been applied. Except where otherwise noted, a density of 2.67 grams/cc was used. This was considered an approximate average for the type of rocks in the area. Later information supplied by Mt. Lyell suggests a base level of 2.7 gm/cc would be more accurate - this being the average density for barren volcanics.

[illegible]

[illegible] they weren't at Selina, a correct should have been made, although overall accuracy would have [illegible]

DISCUSSION OF RESULTS

WHITE SPUR

Line 36N ..... Topography on this line is quite flat. The western end of the line is across very spongy ground which made accurate reading difficult. Error bars have been attached to a number of readings based on variation of meter reading obtained.

Small positive anomalies are recorded at 2500W, 2300W, 2100W with a broader positive anomaly from 1800W to 1500W. A gradual increase in gravity from 2200W towards the west was measured.

The gravity high between 1500W and 1800W corresponds with a magnetic high recorded on previous survey. The correspondence of these highs indicates a probable increase in magnetite and/or pyrrhotite, or possibly mafic mineral content.

Previous induced polarization surveys on this line show a significant chargeability high and resistivity low in this region.

Due to this correspondence of results, the anomaly is considered of some importance. However, the gravity results indicate only a very small density change and therefore diminishes the importance to some extent.

Line 34.5N ..... Topography on this line is quite flat and while the ground was slightly spongy in places, it was much firmer than on line 36N. Two gravity

highs are recorded, separated by a low at 900W. The form is similar although much higher than that seen on line 36N 34.5N. These highs appear to be related primarily to deep seated density changes.

Superimposed on this are a number of gravity responses due to more shallow features. A graphical regional has been drawn to approximate the gravity due to deep seated changes. The gravity from the shallow features is then more obvious. Four shallow sources are then obvious with depths of the order of 15 - 20 metres centred at 1200W, 1000W, 800W and 500W.

There are however, a number of alternative interpretations. The interaction of gravity from four sources at intermediate depths may combine to give the profile shape measured at the surface. The maximum depths to the sources ar then in the order of 35 - 40 metres for the anomalies at 1200W, 1000W and 800W, and 65 metres for the anomaly centred at 500W. Gravity data is therefore quite ambiguous.

We can therefore take a number of interpretations between these two extremes, or even a combination of deep and shallow sources. The anomaly at 500W remains significant and of primary interest. regional removed not valid

(meaning here: a single pt. anomaly) QRS.

Geology shows that the peak lies over a black shale horizon containing pyrite in a drill hole. Calculated density is 2.79 A considerably higher density contrast is necessary to produce this anomaly.

Previous geophysical results correlate well with the gravity. There appears

(? due to 'regional' removal?

to be a major geophysical contact both in resistivity and magnetic results at 900W. This corresponds to the gravity low.

RED HILLS

Line 86S ..... The Bouguer anomaly profile shows a broad positive high between 1500W and 650W and another high between 550W and 00. A significant low is recorded at 600W.

An approximate regional anomaly has been drawn in graphically and a residual Bouguer anomaly calculated from this. A small positive anomaly of 0.22 milligals is calculated centred at 1300W.

The major feature of the line is a large positive anomaly centred at 500W. The feature is complicated by a low on its western side. This low is believed to be due partly to terrain effects. The combined effects of material on the hill above and to the west of station 600W plus the lack of material to the east will produce a negative anomaly at this point. All corrections for terrain effects are positive. It is believed, however, that the negative anomaly cannot be explained by terrain effects alone.

The anomaly of positive 0.5 milligals centred at 500W is considered to be a most significant feature of the line. Maximum depth to the source is considered to be 15 to 20 metres.

Line 72S ..... There are a number of small anomalies on this line. Sources

at 1500E, 1700E and 2100E appear to coincide with black shales and may indicate concentrations of pyrite/sulphide etc., in these horizons.

A broad anomaly between 900E and 1300E is due to a source in the crystal tuffs. Maximum depth to source is considered to be around 65 metres.

Lack of terrain correction can account to some extent for the steep drop off in the east.

Line 8S ..... The major feature of this line is a gradual decrease in gravity from west to east. This decrease is proportional to the increase in elevation. Three possible reasons can cause this response.

1 - The hill is more dense and the gravity anomaly reflects a true change in gravity due to density.

2 - The density used in the Bouguer correction is too low and the correction has not compensated for the extra mass of material in the hill.

3 - Terrain corrections have not been applied and that the two anomalies are created by the lack of compensation for terrain effects.

A combination of the second and third factors can cause the effect.

The negative anomalies at 1300E and 1600E, and to some extent that at 650E are caused by a lack of terrain correction.

In the light of these factors, it is considered that the anomalies at 800E and 1150E are the most significant on this line. A terrain correction will increase the size of both of these features. Maximum depths to the sources of these anomalies are 20 metres and 60 metres respectively.

LAKE SELINA

Line 120N .....Of the lines surveyed, line 120N at Lake Selina has the most significant anomaly.

A density of 2.88 gm/cc was used for calculation of the Bouguer anomaly on this line. This density is believed to be close to that of the rhyolites on the western end of the line containing up to 10% pyrite. The eastern end of the line, however, is over rhyolite lavas with lower density of 2.7 and this is accounted for by the lower gravity response on the eastern end of the line. To some extent this low is also caused by lack of terrain correction.

A broad gravity high is recorded across the entire line. Two probable sources are proposed for the gravity anomaly, one located at ~~3100W~~ 2800 W and the other at ~~2800W~~ 2500 W. Maximum depths to these anomalies are of the order of 60 metres. The sources appear to lie close to the upper and lower contacts of the quartz sericite rhyolite which drilling has shown to have high concentrations of pyrite at depth. Some contribution to the broad anomaly will come from this pyrite, however, the two discrete sources mentioned above are believed to be at a shallower depth than the material in the drill hole.

* The peg numbers as quoted in this report were 300'W greater than the correct values due to an original pegging error.

M.H.

CONCLUSIONS AND RECOMMENDATIONS

Despite severe terrain in some areas, it is still possible to easily recognise a number of anomalies which are due to changes in density. In some areas, particularly White Spur, the spongy nature of the surface layer makes accurate readings difficult. The error involved in taking measurements in such areas may obscure important anomalies. This problem can be overcome by removing the moss layer prior to surveying and/or picking firm areas in which to take readings.

A number of small anomalies are not resolved by a 100 foot station spacing. However, for a body to be of truly economic proportions, it can be expected to influence the gravity field over a number of stations at this interval.

With effects of terrain and other factors, it is difficult to interpret the results from single lines in each area. By reading a number of lines and providing a contour map, a better picture of regional trends and terrain effects can be obtained, leading to better resolution of the local anomalies in which we are interested.

The major problem with the gravity method is recognising which are the most important anomalies, as a large excess mass at depth can produce a similar anomaly to a smaller mass near the surface. Again a better idea of the depth and importance of anomalies can be obtained by reading a number of lines.

Of the lines surveyed, the major anomalies recorded are considered to be as follows:

Lake Selina	Line 120N at ~~3100W~~ 2800W and ~~2800W~~ 2500W
Red Hills	Line 72S at 1100E
Red Hills	Line 86S at 500W
White Spur	Line 34.5N at 500W

Because of the ambiguous nature of the gravity results these anomalies should be looked at with input from other data including geology and geophysics. It is felt, however, that only those on line 34.5N at White Spur and line 120N at Lake Selina are of primary interest from the evidence of the gravity surveying alone.

Respectfully submitted on behalf of:

SCINTREX PTY. LTD.

G.J. STREET, M.Sc.,DIC.

GEOPHYSICIST

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GRAVITY DATA WHITE SPUR LINE 36N *TAS-073Q*

STATION	TIME	READING	ΔG(Meter Divisions)	HEIGHT	ΔG(Milligals) @ ρ=2.67
2100W	1549	1358.0	0	-	-
2200W	1555	1354.5	-3.60	3.087	0.243
2100W	1601	1358.2	0	2.249	0.442
2200W	1608	1354.5	-3.66	3.087	0.237
2300W	1612	1355.8	-2.34	3.680	0.487
2400W	1619	1356.9	-1.20	4.456	0.755
"	1625	1354.0	-4.07	"	0.465
"	1628	1354.4	-3.65	"	0.508
"	1630	1353.0	-5.04	"	0.367
"	1631	1350.2	-7.84	"	0.084
2500W	1638	1354.1	-3.90	5.117	0.612
2600W	1647	1353.1	-4.85	5.687	0.516
2600W	1649	1353.4	-4.54	5.687	0.660
2100W	1656	1357.9	0	-	0.442
27.2.80					
2100W	0951	1358.4	0	-	-
2100W	0952	1358.5	0	-	-
2100W	0953	1358.6	0	2.249	-
2000W	1007	1354.2	-4.15	4.139	0.395
1900W	1021	1354.5	-3.72	4.112	0.433
1800W	1032	1363.45	5.34	0.095	0.559
1700W	1042	1366.6	8.58	-1.640	0.545
1600W	1054	1368.9	11.00	-2.882	0.545
1500W	1100	1372.0	14.16	-4.522	0.542
1400W	-	-	-	-	-
1300W	1112	1370.6	12.87	-4.460	0.424
2100W	1125	1357.6	0	-	-
1200W	1144	1370.9	12.89	-4.251	0.467
1100W	1156	1363.7	5.02	0	0.508
2100W	1211	1359.2	0	-	-

GRAVITY DATA LAKE SELINA LINE 120W

TAS-073Q

STATION	TIME	READING	ΔG(Meter Divisions)	HEIGHT	ΔG (milligals) @ ρ=2.67	ρ=2.60	ρ=2.50	ρ=2.88	ρ=3.09
3400W 2700W	1013	1468.4	0	-	-	-	-	-	-
2500W 2800W	1028	1474.1	5.51	-12.588	-1.919	-1.956	-2.009	-1.807	-1.697
2600W 2900W	1043	1479.1	10.32	-15.242	-1.955	-2.000	-2.064	-1.819	-
2700W 3000W	1048	1484.1	15.26	-17.205	-1.842	-1.892	-1.964	-1.687	-1.536
2800W 3100W	1059	1487.9	18.92	-18.439	-1.715	-1.769	-1.846	-1.549	-1.386
2900W 3200W	1106	1489.4	20.33	-19.779	-1.836	-1.894	-1.977	-1.658	-1.484
2400W 2700W	1116	1469.2	0	-10.474	-2.061	-2.091	-2.135	-1.968	-1.876
3000W 3300W	1134	1489.2	19.77	-20.843	-2.102	-2.163	-2.250	-1.914	-1.731
3100W 3400W	1142	1489.0	19.47	-21.866	-2.333	-2.397	-2.489	-2.137	-1.945
3200W 3500W	1152	1488.7	19.04	-22.562	-2.514	-2.580	-2.674	-2.311	-2.113
2400W 2700W	1203	1469.8	0	-10.474	-2.061	-2.091	-2.135	-1.968	-
2500W 2600W	1210	1463.8	-6.23	-7.909	-2.186	-2.209	-2.242	-2.117	-2.048
2200W 2500W	1219	1458.0	-12.32	-5.653	-2.358	-2.374	-2.398	-2.310	-2.261
2100W 2400W	1229	1443.2	-27.45	0	-2.775	-2.775	-2.775	-2.781	-2.781
2000W 2300W	1241	1411.4	-59.64	-	-	-	-	-	-
2400W 2700W	1243	1471.1	0	-	-	-	-	-	-

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GRAVITY DATA RED HILLS LINE 86S *TAS-073Q*

STATION	TIME	READING	ΔG(Meter Divisions)	HEIGHT	ΔG(Milligals) @ ρ=2.00	ρ=3.20	ρ=2.70
900W	1414	1141.3	0	-	-	-	-
1000W	1425	1142.6	1.04	3.935	0.990	0.792	0.875
1100W	1438	1145.2	3.34	2.145	0.820	0.712	0.758
1200W	1449	1140.4	-1.72	4.201	0.770	0.559	0.647
1300W	1456	1134.2	-8.08	7.137	0.786	0.429	0.577
1400W	1506	1120.8	-21.72	11.958	0.492	-0.109	0.137
1500W	1517	1110.2	-32.57	17.280	0.592	-0.277	0.078
900W	1531	1143.1	0	4.054	0.911	0.708	0.792
800W	1543	1131.55	-11.70	9.345	0.918	0.448	0.641
700W	1554	1126.8	-16.58	10.916	0.778	0.229	0.454
600W	1605	1143.3	-2.40	1.900	0.184	0.089	0.128
500W	1616	1150.5	6.85	0.902	0.895	0.850	0.870
400W	1624	1154.5	10.75	-3.124	0.385	0.542	0.478
300W	1636	1156.4	12.50	-4.240	0.311	0.524	0.437
200W	1646	1153.9	9.88	-2.730	0.385	0.522	0.467
100W	1655	1149.3	5.17	-1.310	0.228	0.294	0.268
00	1705	1145.5	1.25	-	0.126	0.126	0.127
100E	1713	1136.8	-7.55	-	-	-	-
900W	1725	1144.5	0	-	-	-	-

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GRAVITY DATA RED HILLS LINE 8S *TAS-073Q*

STATION	TIME	READING	ΔG(Meter Divisions	HEIGHT	ΔG(Milligals) @ ρ=2.67	ρ=2.20	ρ=3.00
1100E	1135	0887.6	0	-	-	-	-
1000E	1151	0892.6	5.04	17.705	3.993	4.341	3.748
900E	1159	0896.6	9.06	15.876	4.039	4.352	-
800E	1210	0900.8	13.28	14.861	4.266	4.556	-
700E	1221	0918.6	31.11	4.862	4.102	4.197	-
600E	1231	0898.6	11.13	14.962	4.069	4.363	-
500E	1243	0905.8	18.36	12.385	4.293	4.537	-
1100E	1300	0887.4	0	-	-	-	-
400E	1315	0911.8	24.19	9.601	4.334	4.523	4.202
300E	1329	0911.2	23.39	9.837	4.300	4.494	3.187
200E	1343	0924.5	36.49	3.701	4.417	4.490	4.366
100E	1354	0929.5	41.33	1.301	4.434	4.460	4.416
00	1400	0931.4	43.14	0	4.361	4.361	4.361
1100E	1417	0888.5	0	20.222	3.978	4.376	3.699
1200E	1428	0879.0	-9.45	24.204	3.806	4.283	3.472
1300E	1445	0853.1	-35.28	35.656	3.448	4.150	2.955
1400E	1457	0857.3	-31.02	33.741	3.502	4.166	3.035
1500E	1503	0852.7	-35.6	35.019	3.290	3.980	2.806
1600E	1512	0835.3	-52.96	42.085	2.925	3.750	2.343
1700E	1520	0862.3	-25.92	28.879	3.061	3.629	2.661
1800E	1530	0873.4	-14.78	23.280	3.086	3.544	2.760
1100E	1548	0888.1	0	-	-	-	-

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GRAVITY DATA RED HILLS LINE 72S *TAS-073Q*

STATION	TIME	READING	ΔG(Meter Divisions)	HEIGHTS	ΔG(Milligals) @ ρ=2.67
2000E	1149	1157.9	0	19.860	3.907
2100E	1200	1159.6	1.42	19.595	3.998
2200E	1209	1160.2	1.80	18.652	3.851
2300E	1222	1150.1	-8.63	23.464	3.744
2400E	1231	1143.6	-15.35	27.615	3.881
2500E	1239	1134.9	-24.25	31.534	3.752
2600E	1258	1111.6	-48.03	40.872	3.185
2000E	1313	1160.0	0	19.860	3.907
1900E	1325	1175.1	14.92	12.487	3.965
1800E	1335	1176.5	16.17	11.776	3.951
1700E	1345	1180.8	20.32	10.749	4.169
1600E	1354	1185.85	25.23	7.413	4.009
1500E	1406	1192.0	31.20	4.559	4.051
1400E	1414	1196.4	35.48	1.862	3.953
1300E	1429	1198.6	37.46	0.232	3.833
20000E	1446	1161.4	0	-	-
1200E	1504	1202.4	41.07	-0.055	4.141
1100E	1512	1203.3	42.00	-0.220	4.203
1000E	1525	1202.3	41.04	-0.239	4.102
900E	1534	1201.5	40.28	-0.602	3.954
800E	1546	1201.5	40.32	-0.640	3.950
700E	1558	1202.2	41.06	-0.834	3.987
600E	1606	1200.9	39.79	-1.131	3.800
500E	1615	1201.7	40.63	-1.491	3.814
2000E	1635	1161.0	0	-	-

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GRAVITY SURVEY WHITE SPUR LINE 34.5N *TAS-073Q*

STATION	TIME	READING	ΔG(Meter Divisions)	HEIGHT	ΔG (Milligals) @ ρ=2.67
600W	1302	1365.7	0	0.318	0.063
700W	1313	1362.6	-3.71	1.159	-0.602
800W	1332	1359.6	-7.75	1.600	-1.348
600W	1342	1367.9	0	-	0.063
700W	1344	1363.7	-1.96	1.159	-0.258
800W	1350	1359.7	-5.85	1.600	-0.329
900W	1402	1359.5	-5.82	1.283	-1.004
1000W	1419	1361.2	-3.79	0.998	-0.636
1100W	1429	1360.9	-3.90	1.727	-0.577
1200W	1438	1362.4	-2.23	1.787	-0.242
1300W	1446	1360.2	-4.27	3.298	-0.477
600W	1457	1366.5	0	-	-
500W	1507	1368.7	2.29	0.106	-0.035
400W	1515	1366.1	-0.24	0	0.462
300W	1526	1366.2	-0.04	0.378	-0.047
600W	1531	1366.2	0	-	-

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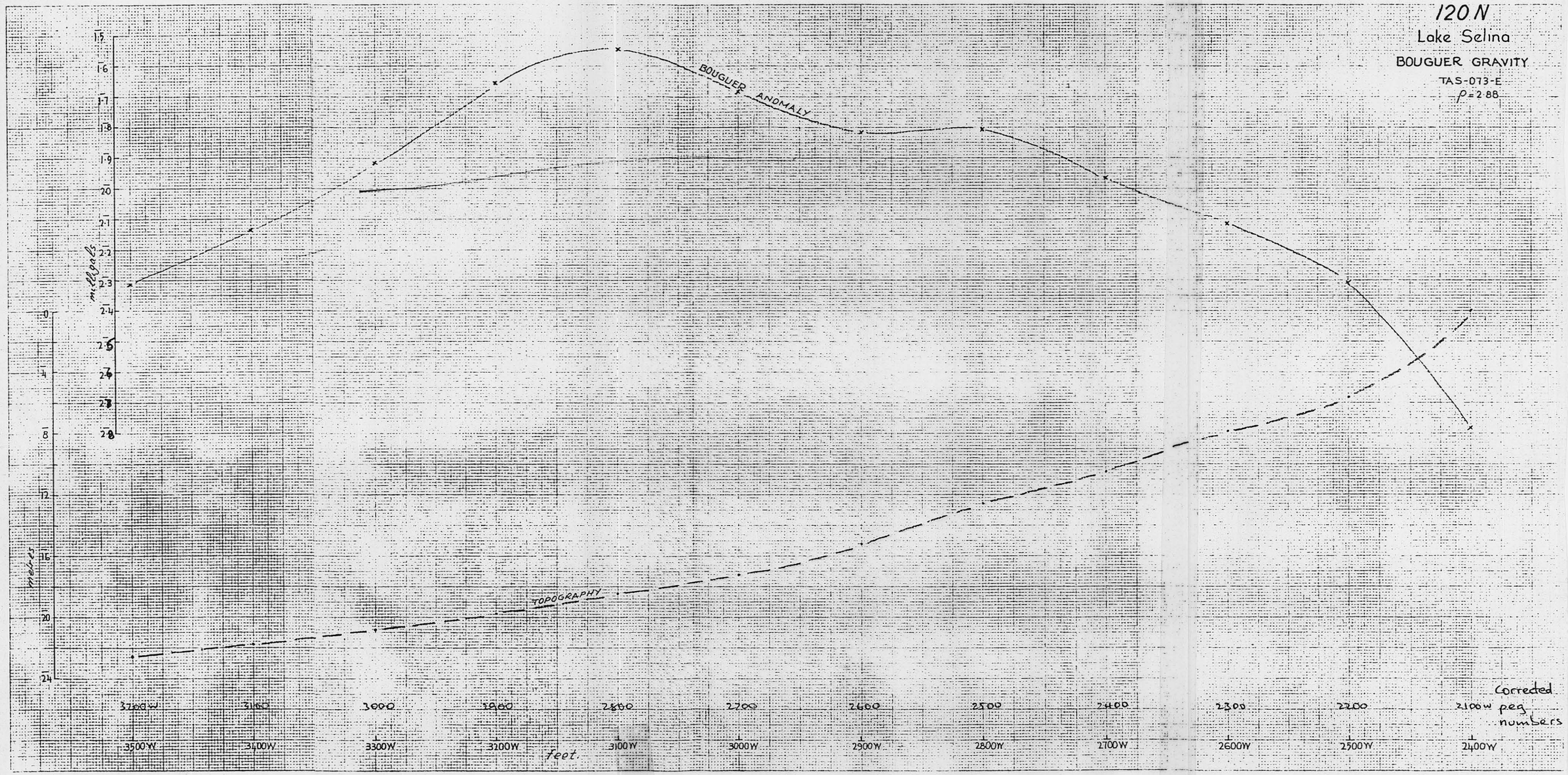
120 N

Lake Selina

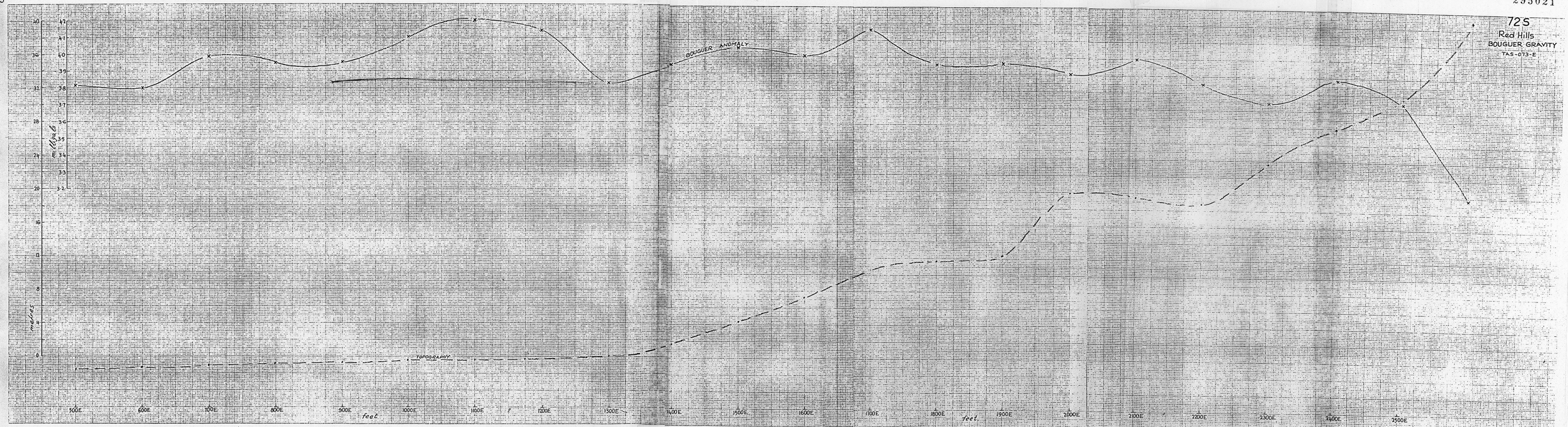
BOUGUER GRAVITY

TAS-073-E

$\rho = 2.88$



72S
Red Hills
BOUGUER GRAVITY
TAS-073-E



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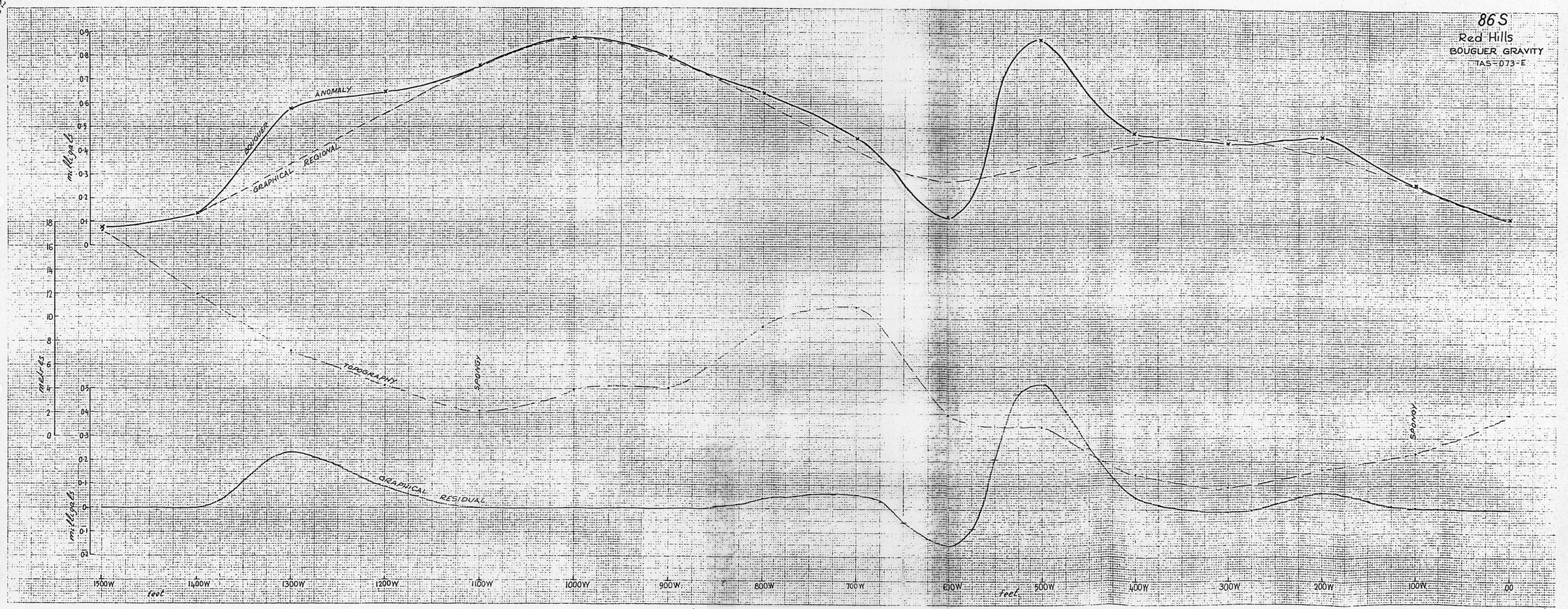
Red Hills
BOUGUER GRAVITY
TAS-073-E



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Red Hills

BOUGUER GRAVITY

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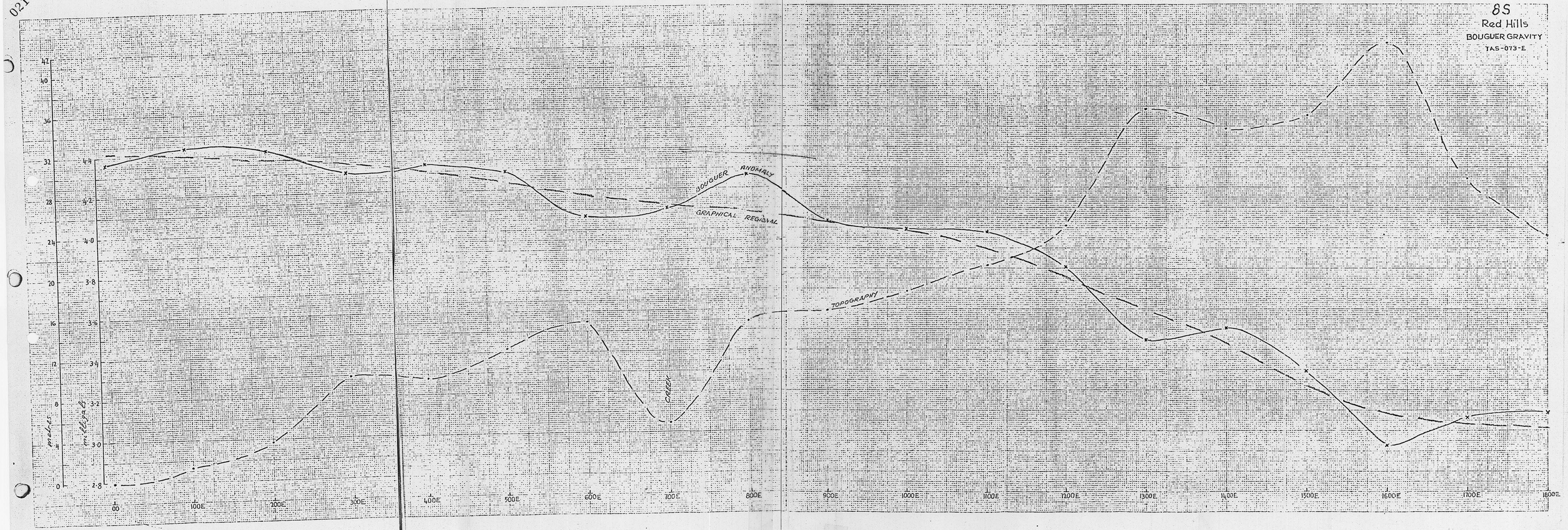

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345 N

BOUGUER GRAVITY

White Spur

TAS-073-E

0·5
0·4
0·3
0·2
0·1
0
0·1
0·2
0·3
0·4
0·5
0·6
0·7
0·8
0·9
1·0

milligals

4
3
2
1
0

metres

Bouguer anomaly

graphical regional

topography

graphical residual

ρ = 2·67

0·4
0·3
0·2
0·1
0

specific gravity

1300W 1200W 1100W 1000W 900W 800W 700W 600W 500W 400W

feet

feet

212

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36 N

White Spur

BOUGUER GRAVITY

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