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DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOPHYSICAL SURVEY OF THE MARIPOSA AREA, ZEEHAN

TASMANIA.

RECORDS 1950, NO. 34

1. INTRODUCTION

The Zeehan silver-lead-zinc field is in the West Coast Region of Tasmania. Since about 1909 activity on the field has been declining and at present very few people are engaged in active mining. A company known as Zeehan Exploration Ltd. was formed by Broken Hill South Ltd. and North Broken Hill Ltd. to carry out an extensive prospecting survey of the area. Following on the geophysical work carried out for Zeehan Explorations in 1947-1948 (Langron 1950), the Bureau was requested to carry out a survey on the Mariposa lease held by North Broken Hill Ltd. This lease lies on a direct line between Mt. Zeehan and Mt. Dundas, and straddles the main Zeehan-Queenstown road south of where the road crosses the Dundas Rivulet six miles from the Zeehan railway station. The area covered by the geophysical survey lies to the west of the road and access to it is by foot along the Mariposa tram line for half a mile heading west and then north for half a mile. The location of the area is shown on Plate 1.

The work was performed between January and March, 1950.

2. GEOLOGY

(a) General

The Mariposa lease covers a bed of westerly dipping limestone located on the eastern side of the Zeehan syncline. The western limit of the syncline is in the Austral-Oceana area. (Plate 1). The limestone is covered by a swamp, and contact with Crotty sandstone to the west occurs at the base of a sandstone hill, 200 feet high and with a slope of up to 30 degrees. This hill is covered by dense horizontal scrub interspersed with bauera, and drops sharply to the west to the Dundas Rivulet. The dip of the limestone to the west is thought to be 60 degrees or greater.

✓

To the east, the limestone is in contact with the Dundas Series of slates and mudstones. Concerning faulting which has taken place in the Mariposa area the following statements are quoted from Loftus Hills (1949):-

"A pronounced fault of great meridional length, running slightly west of north, lies about 1,300 feet east of the mine workings. It probably slightly transgresses the limestone".

"A succession of transverse faults offset the limestone and overlying beds at the mine workings and northwards thereof".

(b) Mining.

Early in 1891 an outcrop of ore was discovered in the limestone at the foot of the sandstone hill. Both northern and southern extensions were found along the line of strike. Adits and shallow winzes cut the line of lode but the only extensive exploration took place near the outcrop. The Mariposa shaft "was sunk through 25 feet of sandstone then soft black sand and mud full of pyrites and nodules of galena to 95 feet, after which hard blue limestone came in..... The soft black stuff passed through in the shaft may be really portion of the limestone from which the calcareous matter has been dissolved out". (Montgomery 1893, quoted by Loftus Hills). At the 140 foot level an east cross-cut went 21 feet before cutting the lode. Later development drove northwards along the 140 foot level for a distance of 435 feet. Five cross-cuts were put into the lode "proving the width to be 5 to 13 feet of milling ore". (Mine report, 1897). The dip of the lode is recorded as about 80 degrees to the west. No stoping at all seems to have been carried out. Since 1909 it is doubtful if any further mining work was done and now only the site of the old shaft and barren dump sites at the mouths of collapsed adits remain. The outcrops have been totally removed.

Recently aerial photographs were taken, a map of the area prepared and the photographs interpreted for geology. This information and Dr. Hills' recommendations are contained in a report issued in 1949. On the basis of this report diamond drilling into

the line of lode was commenced at the beginning of 1950 and proceeded concurrently with the geophysical work.

By the end of March, seven holes had been finished, all of which intersected mineralization at a depth of 90 to 230 feet generally below the line of the old northward drive. (See table, Plate 4). *Core* recovery in parts was poor owing to broken ground and the incidence of vugs in the mineralized zone.

Plate 2 shows surface geology, mine workings (in plan) and location of drill holes.

3. OUTLINE OF GEOPHYSICAL WORK.

(a) General.

The purpose of the survey was to examine the Mariposa area for possible magnetic and gravity effects associated with the known mineralization and thence to determine the extent of this mineralization; and also to investigate the swamp covered limestone area for hidden mineralization. Further, it was considered that the results of the survey and the behaviour of the instruments in the difficult terrain would serve as a guide to the usefulness of the magnetic and gravity methods in other similar prospecting areas in the Zeehan field.

(b) Surveying.

A base line was laid out approximately 170 feet east of the Mariposa shaft and approximately parallel to the line of lode for a distance of 700 feet north and 300 feet south of the shaft. Cross traverses were extended for 700 feet on either side. East of the base line the traverses cross the limestone swamp and extend to the rising ground of the Dundas Series, and west of the base line they extend for 100 feet beyond the crest of the sandstone hill. Pegs were spaced at 25 feet intervals. The levels required for the gravity survey were referred to a base datum station with nominal elevation of 600 feet.

Traverses were cleared of scrub, vines and roots to give easy access and security on the steep slippery slopes. In places steps were cut or rough ladders used. The cutting and

surveying of these traverses occupied most of the time of the party although North Broken Hill Ltd. provided a surveyor, his assistant, and one or two scrub-cutters.

(c) Magnetic Method.

In the magnetic method an observation of the vertical component of the earth's magnetic field is made at each station of the area and the value expressed relative to that at an arbitrarily selected base station. Anomalous variations in the field may be caused by the presence in the rocks of magnetic materials. At Oceana the mineralization contained slightly magnetic material probably in the iron carbonate, and this produced a small well defined anomaly over what was proved to be an ore body. (Langron, 1950). It was thought that the magnetic method might similarly provide indications of mineralization in the Mariposa area.

A Watts' vertical force variometer 15977 with a sensitivity of 1 division = 32.8 gamma was used. Some of the readings in the area were affected by the presence of the diamond drill and its associated pumps, pipes and dumps of drill steel. Towards the end of the survey a worn knife edge prevented complete coverage of the area by the variometer.

(d) Gravity Method.

To test the possibility of using the gravity method, density determinations were made on rock samples with the following results.

Crotty sandstone (surface)	2.5
Limestone	2.7
Dundas Mudstone	2.5

Tests on core from DDH 4 showed that the density of the limestone was generally 2.7, but rose sharply to 3.3, ten feet before the hole entered the mineralised portion. No samples of the mineralised ore were available for testing but it seems reasonable to suppose that its density would be at least 3.3. Beneath the mineralised area, the density was again 2.7, and rose to 2.9 over the last ten feet of the hole. Core from this section consisted of limestone and clay with fine grained mineralisation along a clay

filled fissure. These results indicate that the density of the mineralised portion may be expected to be greater than that of the limestone by at least 0.6, so that a lode of sufficient size would give a positive gravity anomaly at the surface.

At each of the stations on the area the gravitational force was measured relative to that at a selected base station. The gravimeter used was the Heiland No.58 fitted with a water-proof perspex cover. Its sensitivity was 0.1067 milligal per scale division. In an endeavour to obtain firm foundations on the swampy soil a special tripod with long legs was used and it was usually necessary to push the feet of the tripod down to a depth of about 12 inches. Despite these precautions movements of personnel and vibrations of the diamond drill were transmitted through the mud and readings were often difficult to obtain. Base readings were taken at hourly intervals and readings on traverses with unsatisfactory end closures were repeated until consistent. Weather, contrary to expectations, was almost free of rain. Trouble was experienced on two days from overheating of the meter in the warm sunshine.

The observed gravity values were corrected for differences in elevation and latitude of the stations from the base, and also for the terrain effect due to nearby hills and valleys.

On the basis of the density determinations referred to above, the elevation correction factor corresponding to a specific gravity of 2.5 was adopted. This factor was in agreement with that determined by the mathematical application of a method of three-station groups (Sharpe, 1945). Using the levels of all the stations and of a traverse along the Queenstown road, together with air photographs, a contour map was drawn of the area. Terrain corrections were then applied. These should be reasonably accurate over the limestone area and the eastern slopes of the sandstone, but are liable to be inaccurate near the top of the hill and to the west of it.

The reduced gravity values obtained by correcting the observed values for elevation, latitude, and terrain may show regional anomalies such as could be related to major features in

the underlying geological structure, or localised anomalies which are of interest in mineral prospecting as they may be caused by zones of mineralization which, owing to mineral content, have a higher density than that of the surrounding formation. It was found in the Oceana survey that some of the anomalies investigated were caused by the occurrence of a zone of siderite which is of higher density than the country rock limestone (Langron, 1950). The siderite was the gangue material in which was found argentiferous galena.

The satisfactory testing of the gravity method over the known mineralisation in the Mariposa area presented some difficulties. The lode occurs at the foot of a steep hill and near or underneath an overlying sandstone bed. This meant that the readings on each traverse were taken on a slope rising away from the expected mineralized zone. Furthermore, the gravity picture could be complicated by the occurrence of black pug presumably of low density, which, being adjacent to or intermingled with the mineralization, would tend to decrease the density contrast between the mineralized zone and the limestone.

4. RESULTS AND INTERPRETATION

(a) Magnetic.

The magnetic profiles (Plate 6) show no well defined anomalies but rather narrow zones of magnetic disturbance in the vicinity of the shaft and zone of mineralization. It is not possible to decide whether these disturbances are due to the mineralization or to drilling equipment, old mining iron, etc.

(b) Gravity.

The gravity profiles (Plate 3) represent the reduced gravity values. The profiles show a pronounced general decrease in values to the west and superimposed on this trend a definite positive anomaly just west of the baseline. There is also a general decrease in values northward from O O traverse. The density difference at the sandstone-limestone contact could explain portion of the westerly trend but it is more likely a regional effect connected with the synclinal structure. In order to 7

examine the results for local anomalies it is necessary to remove these regional trends. For this purpose a regional contour pattern was produced by a process of severe smoothing of the contours drawn from the original reduced values. From the regional contours, smooth regional profiles were derived and are shown by broken lines on Plate 3. The differences between regional and reduced values have been plotted as residual gravity profiles, variations in which should be due to purely local effects. The profiles of these residual values and contours at intervals of 0.1 milligal are shown on Plate 4.

It should be noted that this method of removing regional effects is far from satisfactory, as it introduces a considerable subjective element. However, the labor involved in applying any of the more systematic methods would be unwarranted, as the data available are inadequate due to the lack of accurate terrain corrections, and to the fact that the observations do not cover a sufficient area.

Examination of the contours shows seven anomaly centres. (1) and (2) are centres of an elongated positive anomaly the axis of which is parallel to, but about 50 feet east of the line of mineralization as intersected by the drill holes. The peak of anomaly (1) occurs near traverse N3. The old drive passed under this traverse at a depth of 100 feet below datum. Diamond drill holes NBH DD4 and DD5 passed under the anomaly at depressions of 45 degrees and 35 degrees respectively and both made ore intersections.

Theoretical examination has been made of the anomaly along N3 traverse but interpretation is made difficult by the fact that readings were taken on a slope and therefore at an increasing distance from the anomalous zone. A preliminary examination indicates that the anomaly could be caused by a tabular body dipping steeply to the west, extending 400 feet deep and reaching to within 20 feet of the surface at a point corresponding to the peak of the anomaly. However a hypothetical body of this form would be displaced to the east of the known mineralization, and in order to reconcile the interpretation with the known mineralization as shown

in DD4, DD5 one needs to consider either one body passing steeply through the major ore intersections with a change of dip to reach the surface underneath the peak of the anomaly; or a body dipping at 70° passing through the end of DD4 and the mineralization of DD5 and continuing to the surface, with a secondary body with similar dip passing through the mineralization shown in DD4, its upper limit being below the line of DD5.

The line of anomaly (2) is displaced about 100 feet east of that of anomaly (1). The contour pattern suggests that one of the transverse faults mentioned by Loftus Hills crosses the area close to the Mariposa shaft and has caused a lateral displacement of the geological features and hence of the gravity indications. The northern portion of anomaly (2) has been tested by NBH DD10, situated ^{near} on traverse S1. The recovery from this hole was small and showed scattered mineralization in a position which suggests that, south of the Mariposa shaft the lode tends to swing to the west, i.e. that it follows the same trend as the gravity indications. The magnitude of anomaly (2) appears to be increasing to the south towards the site of the South Nevada workings.

Anomalies (3), (4) and (5) occur over the sandstone in proximity to the brow of the hill. In this region terrain correction can not be relied on for accuracy. The anomalies could be due to consistent errors in estimating the height of the unsurveyed country to the west.

Anomaly (6) is a broad anomaly that becomes apparent after the regional correction has been applied. There is surface evidence that the ground underneath the anomaly contains some sandstone. This would complicate the gravity picture but the existence of a sandstone-limestone contact would be favourable for ore occurrence. The anomaly could be due to a ^{dense} mineralized body at a depth of 200 to 250 feet. However, it is at least equally likely that the presence of the anomaly is due to incomplete removal of regional effects, because of lack of control due to the fact that the site is close to the edge of the surveyed area.

Anomaly (7) is a negative localized one. It is probably caused by a large cavity in the limestone fairly close to the surface. Cavities in the limestone are quite a feature of the Zeehan field and any gravity indications are likely to be modified by the occurrence of vugs in close proximity to the mineralization.

5. RECOMMENDATIONS

Although it is difficult to find a satisfactory interpretation of the main gravity indication, anomaly (1), consistent with the drilling results, it is considered significant that anomalies (1) and (2) form a continuous feature which closely follows the known line of mineralization. As this gravity feature extends beyond the limits of the present drilling it provides sufficient justification for extending the drilling at least another 300 feet to the north. If this testing is carried out the drill holes should be depressed 45 degrees and, if possible, continued until the sandstone contact is reached. The increasing magnitude of anomaly (2) towards the south is a point in favour of further drilling south of NBH DD10. In this case the collars should be placed 50 to 100 feet east of the baseline.

Anomalies (3) and (5) are uncertain and of small magnitude and would warrant investigation only if a definite decision to mine the area were made. Anomaly (4) is of fairly large magnitude but the survey was not continued sufficiently far to the south to close the anomaly contours and terrain and regional corrections on the edge of a survey's grid are subject to inaccuracy. At the present stage of investigations this anomaly does not justify a drilling recommendation.

It is likely that anomaly No.6 is caused by the method of treating the data, rather than by any definite subsurface geological condition. No testing of it can be recommended.

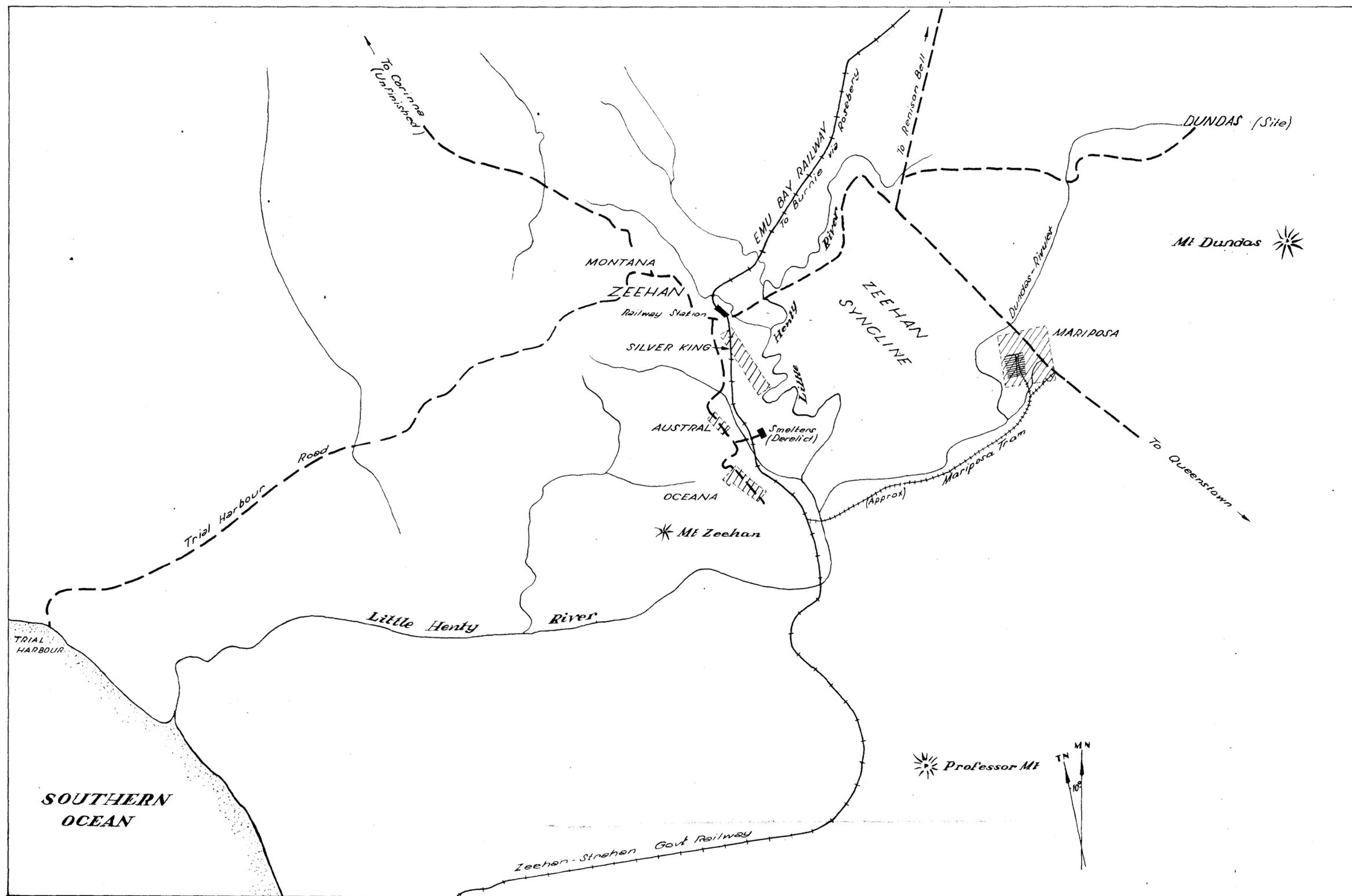
6. CONCLUSIONS

The area has been covered by a gravimetric survey and partly by a magnetic survey. No significant results were obtained from the magnetic survey, this being partly due to artificial disturbances produced by the presence of iron materials on the

surface. The Heiland gravimeter has not been designed for use in such rough country as the Mariposa area, and under these conditions of operation the maximum accuracy could not be obtained with the instrument. The large corrections necessary for rough terrain reduce the possibility of detecting anomalies such as associated with ore, and may cause the introduction of spurious anomalies. However, it is considered that the gravity results include significant anomalies which can be related to the known mineralization and which provide sufficient justification for further drilling in the area. Further testing of the anomalies found by the gravimeter should indicate the suitability of the gravity method for the investigation of other similar areas in the Zeehan field.

7. REFERENCES

- | | |
|--|--|
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LEGEND

- +— Railway
- — — Roads
- ++++ Tram track

SCALE

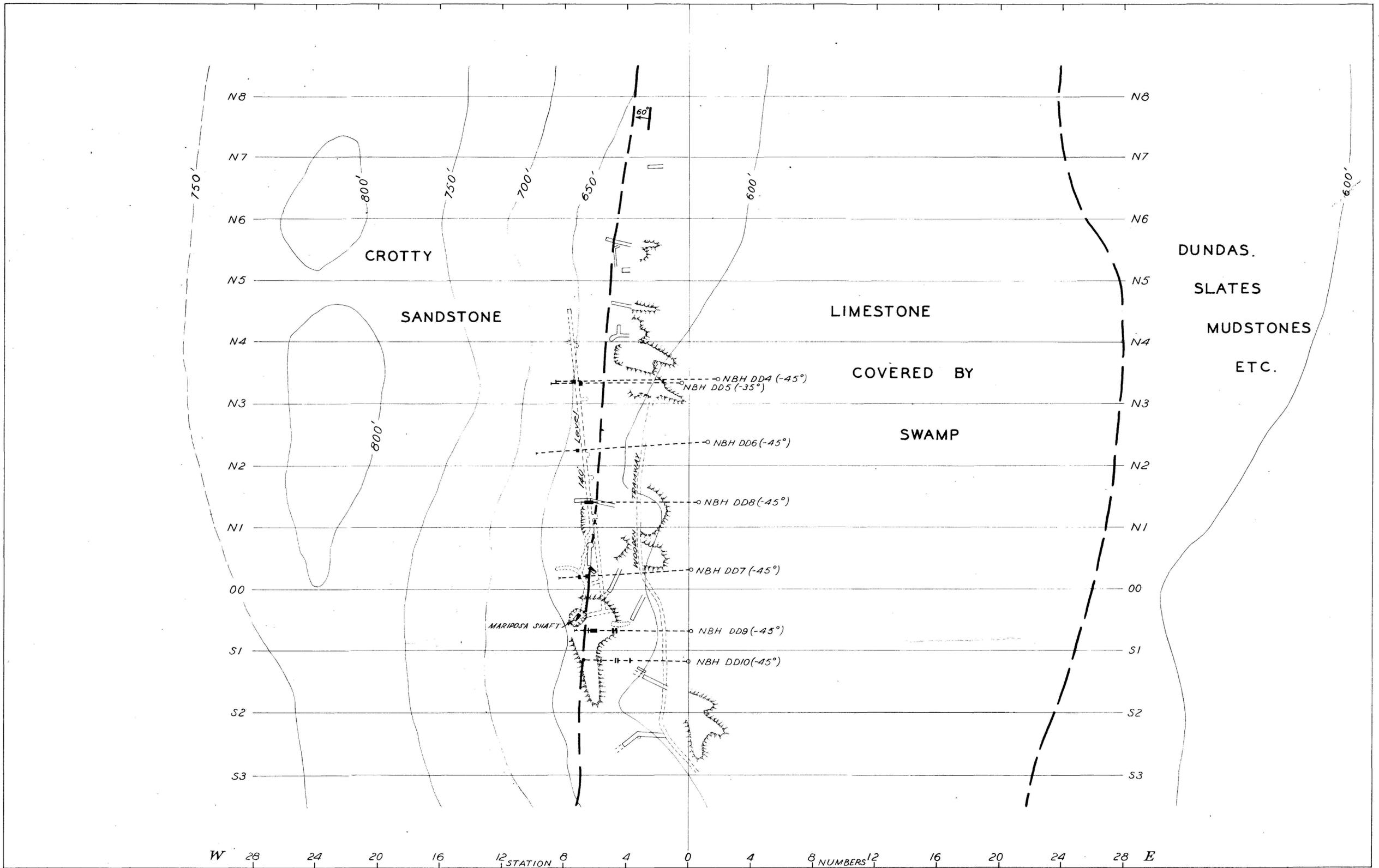


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GEOPHYSICAL SURVEY AT ZEEHAN TASMANIA

LOCALITY SKETCH MAP OF
ZEEHAN

G32-51



GEOPHYSICAL SURVEY AT ZEEHAN, TAS.

MARIPOSA AREA

SURFACE PLAN,

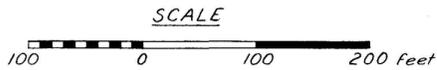
MINE WORKINGS AND DIAMOND DRILLING

G32/52

6-10-50

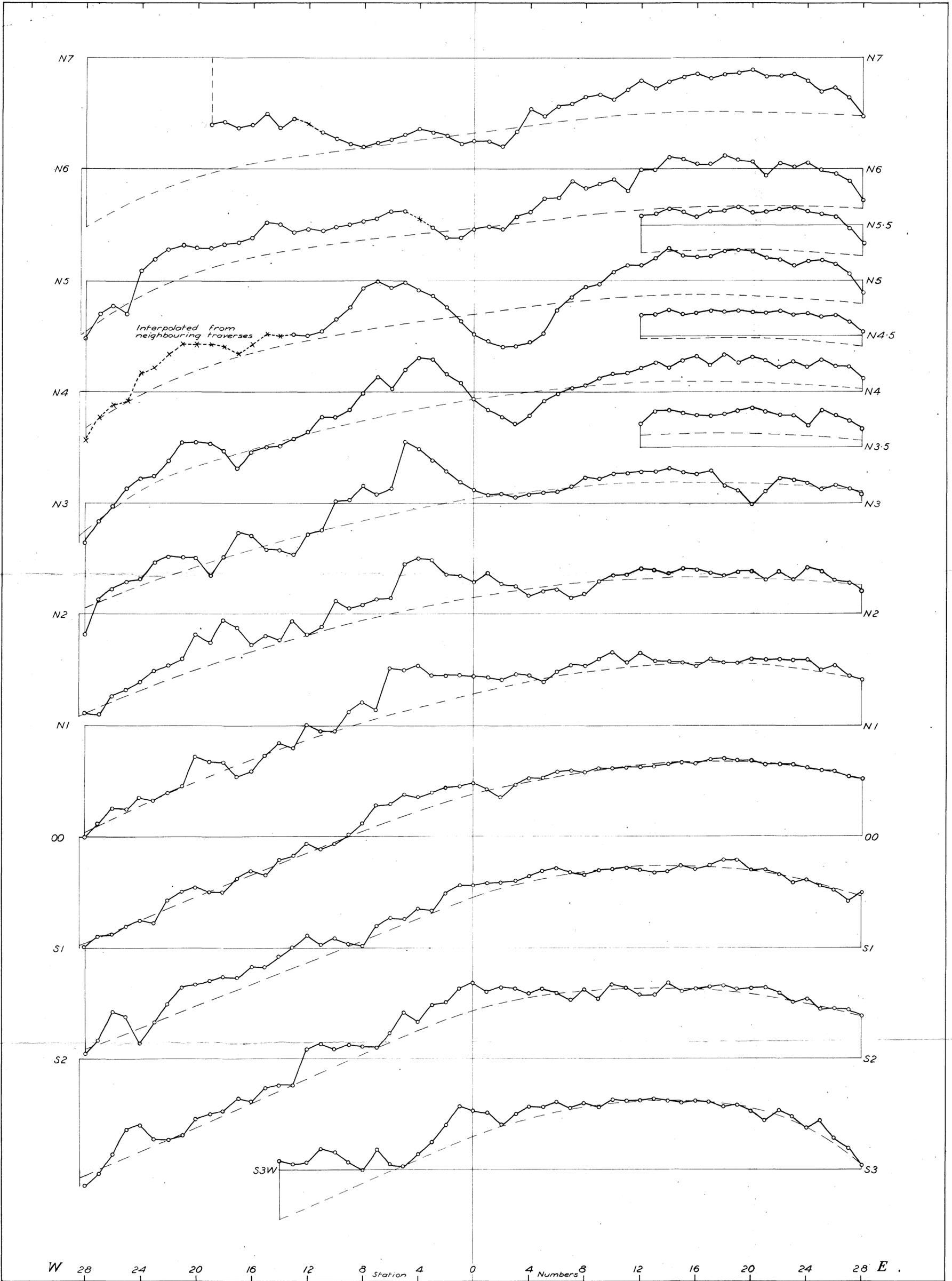
LEGEND

- Surface Contours
- Geological Contacts
- Diamond Drill Holes and Intersections



R. Philip Lake
Geophysicist





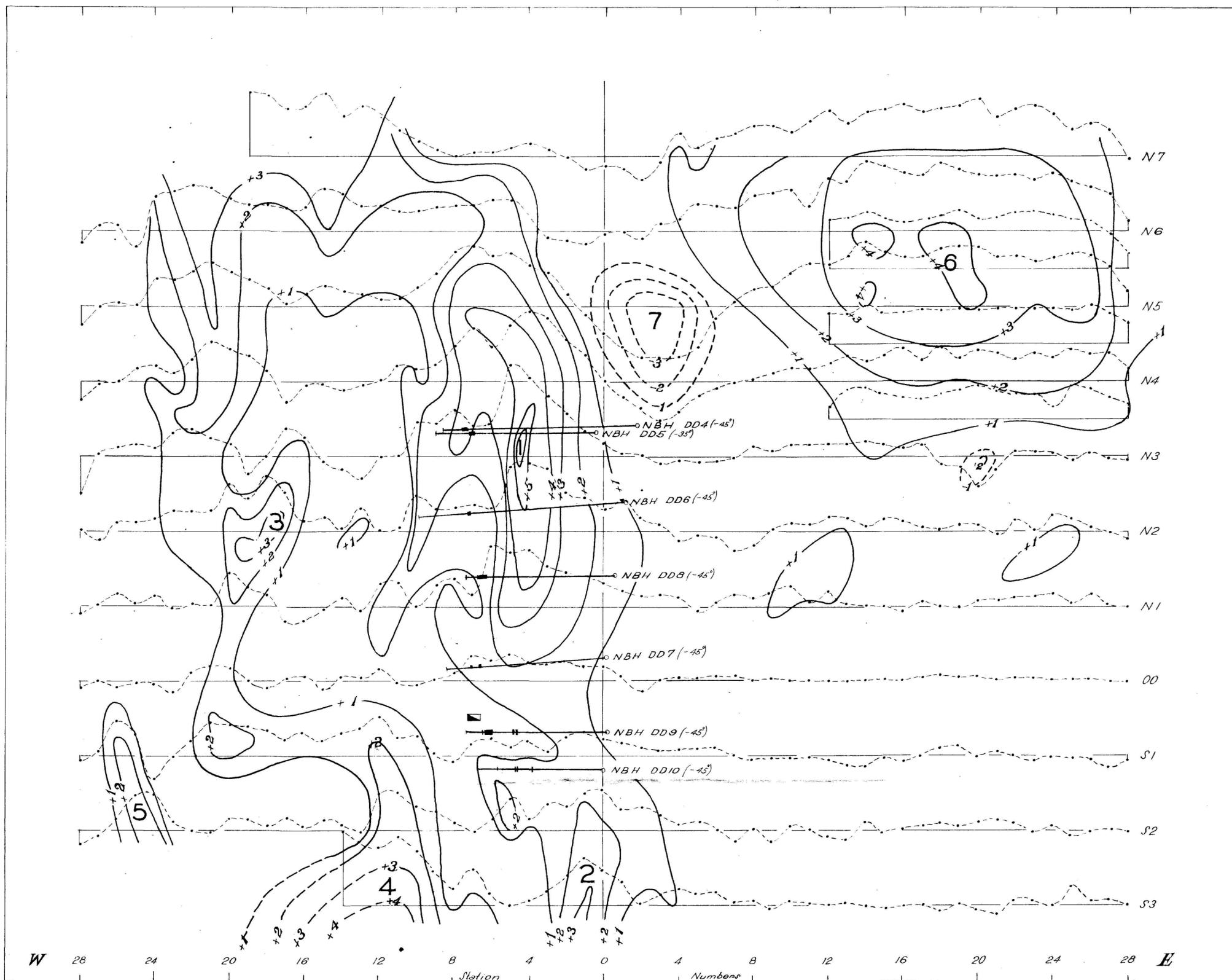
○—○ Reduced Gravity Profiles
 - - - Regional Gravity Profiles

SCALE
 Horiz. 100 0 100 200 feet
 Vert. 0.5 0 0.5 1.0 milligals

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 Geophysicist

GEOPHYSICAL SURVEY AT ZEEHAN, TAS.
 MARIPOSA AREA
 REDUCED GRAVITY AND
 REGIONAL GRAVITY PROFILES

G32/53 6-10-50



ASSAYS OF DIAMOND DRILL HOLE INTERSECTIONS

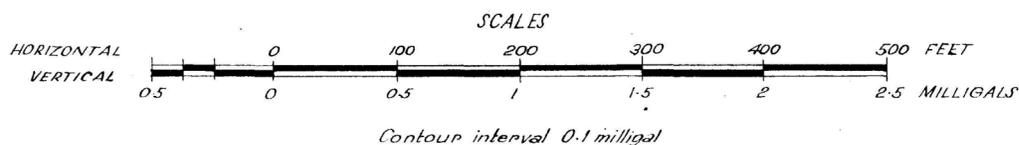
D.D.H	INTERSECTION			ASSAY		
	HOR Ft	VERT Ft	TRUE WTH Ft	LEAD Den cent	ZINC Den cent	SILVER Ozs per ton
4 (45°)	185	230	3.5	5.3	1.6	1.7
5 (35°)	175	113	5.5	9.4	2.3	2.5
6	175	205	4.0	5.5	2.2	0.75
8	160	170-180	11.3	8.3	2.5	1.8
7 A	162	167	2.6	13.8	3.4	1.5
B	175	180	2.9	0.8	0.3	0.6
9 A	113	117	1.1	5.5	1.5	8.7
B	117	121	1.8	0.4	0.4	3.2
C	150	153	7.6	4.3	1.2	0.9
D	158	161	2.1	2.4	1.2	3.3
10 A	95	95	0.9	12.3	3.7	14.4
B	110	110-115	4.5	8.3	1.5	3.0
C	115					
D	140	140	0.7	16.1	2.4	0.7

GEOPHYSICAL SURVEY AT ZEEHAN, TASMANIA

MARIPOSA AREA

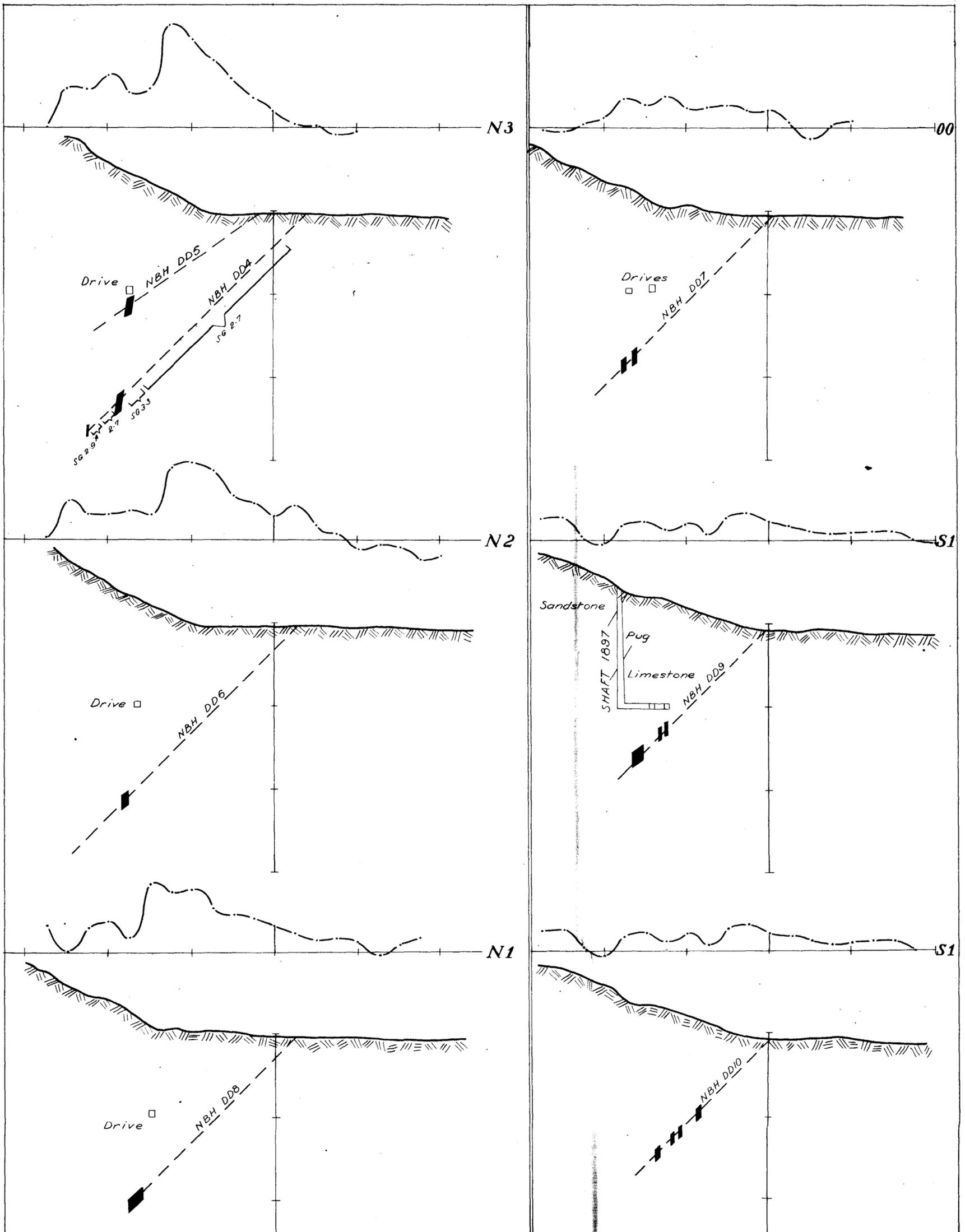
PLAN SHOWING

RESIDUAL GRAVITY PROFILES AND CONTOURS,
RESULTS OF DIAMOND DRILLING



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Geophysicist

G32-54

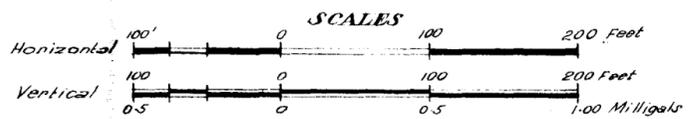


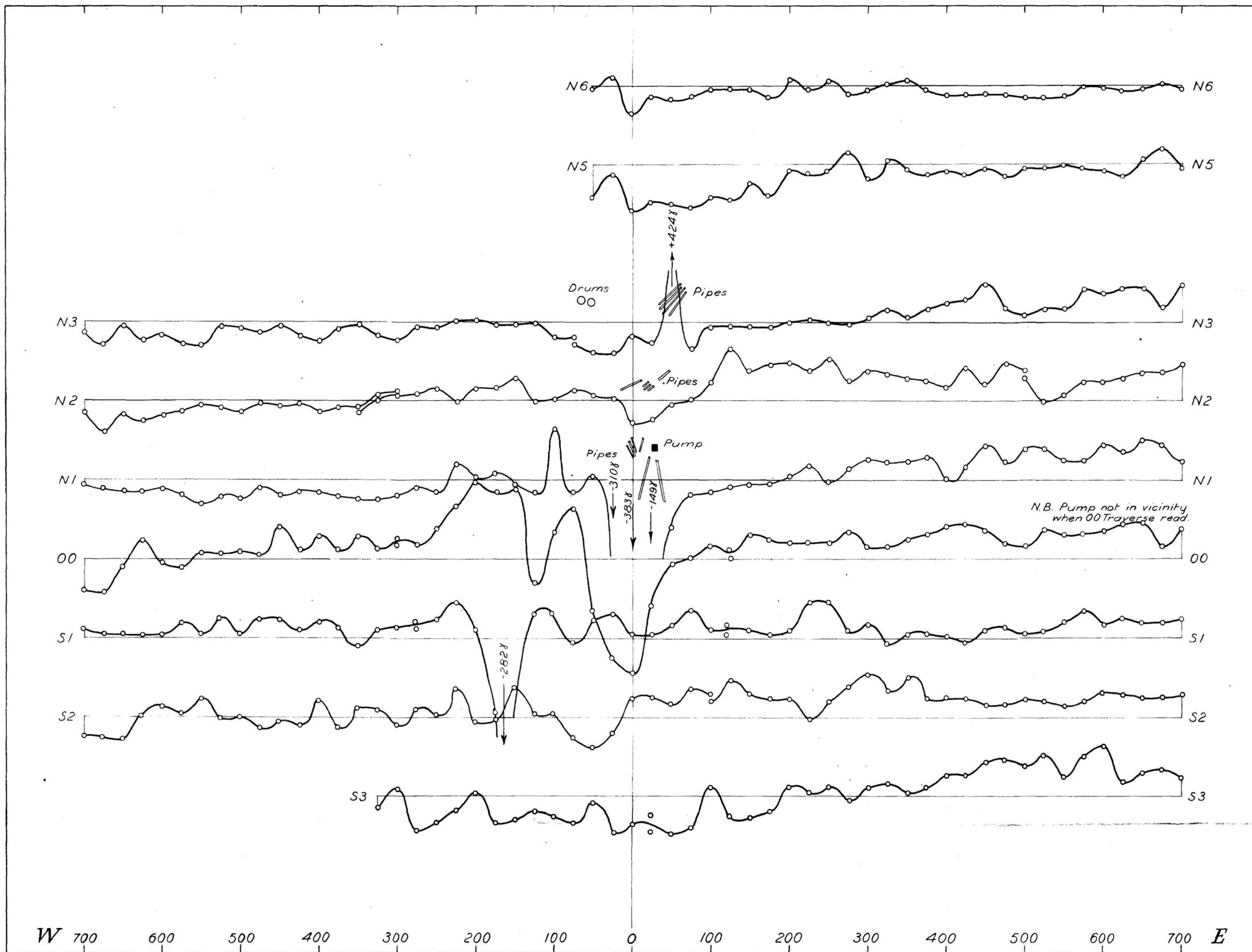
GEOPHYSICAL SURVEY AT ZEEHAN TASMANIA
 MARIPOSA AREA
**VERTICAL SECTIONS THROUGH
 DIAMOND DRILL HOLES**
 SHOWING
 RELATIONS TO GRAVITY ANOMALIES.

LEGEND

- Observed residual gravity anomaly
- Surface
- Drill hole with one intersection

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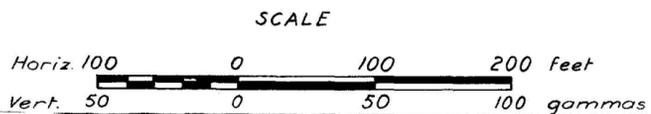




GEOPHYSICAL SURVEY AT ZEEHAN, TAS.

MARIPOSA AREA

MAGNETIC VERTICAL FORCE PROFILES



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G32/56