COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES.

GEOLOGY AND GEOPHYSICS

RECORDS 1957, No. 44

GEOPHYSICAL SURVEY OF THE GREAT LAKE NORTH AREA, TASMANIA

by

W. A. WIEBENGA and E. J. POLAK

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ABSTRACT

Results are given of a geophysical survey carried out by the Commonwealth Bureau of Mineral Resources in the Great Lake North Area, Tasmania, on behalf of the Hydro-Electric Commission of Tasmania. The Commission plans to construct an intake tunnel, 23,000 feet long, from the Great Lake North to the slopes of the Great Western Tiers, penstock lines, a vertical pressure shaft feeding an underground power station, and a tail-race tunnel to the Palmer River.

The survey, in which seismic, resistivity, magnetic and gravity methods were used, was made over the western part of the intake-tunnel line, the portal and penstock lines, and the tail-race tunnel line. The objects of the survey were to determine the thickness of the surface and weathered layers and to detect any shear zones which might exist.

Results of the survey were satisfactory, particularly along the intake-tunnel line and over the portal and penstock lines. Estimates are made of the thicknesses of the surface and weathered layers, some shear zones were located in the intake-tunnel area, and information was obtained regarding the boundaries of certain sub-surface formations.

The accuracy of the depth estimates is indicated, and is considered adequate for the purpose of the investigation.

1. INTRODUCTION

The Hydro-Electric Commission of Tasmania proposes to build near Blackwood, about 36 miles south of Launceston (see Plate 1), a power station using a water drop of about 2,700 feet and with an output of 480,000 H.P. The water from this power station will subsequently be fed into the existing Trevallyn power station.

The scheme (Plate 1) consists of an intake tunnel, 23,000 ft. long, from the Great Lake to the slopes of the Great Western Tiers, penstock-lines, a vertical pressure shaft feeding an underground power station, and a tail-race tunnel to the Palmer river.

During the investigation for a suitable site for a power station, the area was geologically mapped by the Commission's geological staff (McKellar, 1956), test holes were drilled, and a gravity survey was carried out (Chamberlain 1952).

Later, the Commission applied to the Bureau of Mineral Resources for a geophysical survey to be made over part of the intake tunnel, penstock lines and tail-race tunnel. The application was agreed to, and the survey was made during the period February to May, 1956. A preliminary report on the survey (Wiebenga and Polak, 1956) was forwarded to the Commission in August, 1956.

The purposes of the geophysical investigation were :-

(a) To determine the depth of weathering and to detect any shear-zones over 5,600 ft. of the western part of the intake tunnel (from 700 to 6,300 ft.).

(b) To determine the thickness of the scree and to detect any shear-zones within the portal area (19,700 to 23,550 ft.) at the eastern end of the tunnel.

(c) To determine the thickness of the soil and the weathered layer, and possibly the type of rock below the weathered layer, within the penstock lines area (23,550 to 28,400 ft.).

(d) To detect any faults and shear zones along the tail-race tunnel (28,400 to 38,000 ft.).

The survey was carried out by a geophysical party consisting of E.J. Polak, party leader and geophysicist, J. Cleary, geophysicist, and K. Mort, field assistant. In April, J. Cleary was replaced by A. Stocklin, geophysicist.

The Commission provided additional assistants and undertook the topographical survey of the traverses.

Stations or locations along the traverse on Plates Nos. 1 to 4 indicate the horizontal distance from a zero reference point about 700 feet south-west from where the tunnel crosses the shore of the Great Lake.

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On Plates Nos. 5 to 8, station numbers with prefix A indicate the position of the station relative to station A28400 situated 90 feet down hill from D.D.H. 5034. On this section of the traverse the distances between stations (50 ft.) were measured along the slope.

The relation between the two methods of plotting is shown diagrammatically on Plate 5.

It is desired to acknowledge the co-operation of the Engineer and his staff at Blackwood Creek, and of the staff of the Personnel, Stores and Surveying Branch of the Commission's head office in Hobart.

2. GEOLOGY

The geology of the area (McKellar, 1956) is shown on Plate 1. Results from D.D.Hs. 5001, 5073 and 5042 indicate that, at its western end, the intake tunnel will be in dolerite for the first 5000 ft. and will then pass into Triassic sediments (Newtown Coal Measures and Tiers Sandstones).

Several faults are shown on H.E.C. Geological Plan A3172 in the Intake Tunnel Area; these were indicated by gravity survey only.

Little is known of the geology from station 8,750 to station 20,000 (beginning of the portal area). The geological data available suggest that the sedimentary rocks, as shown in the section on Plate 1, are near-horizontal and are covered by a sheet of dolerite which extends east to D.D.H. 5033.

In the portal area, the rocks are obscured by scree, but it is known that the dolerite ends west of D.D.H. 5032 (near station 21,450). The outlet of the intake tunnel will be in Cluan Sandstone (Triassic).

The upper part of the penstock lines will be in Ross Sandstone (Triassic) and the lower part in Ferntree Mudstone (Permian). A series of faults with northerly strike, near station 27,000, has been proved by geological evidence and one fault was subsequently proved by diamond drilling.

The upper part of the vertical pressure shaft will be in Permian Weston Mudstone (Woodbridge Group). The lower part of the shaft and the tail-race tunnel will be in rocks of the Permian Golden Valley Group.

Table 1 shows the stratigraphy in the area of the survey and the physical properties of the rocks as derived from the seismic survey and density determinations (Hale, 1956).

3. METHODS

The following methods of survey were used in the investigation :-

STRATIGRAPHY AND PHYSICAL CONSTANTS

TABLE 1.

System	Group	Formation	Rock Type	Seismic Velocity (ft. per sec.)	Young's Modulus (in c.g.s. units) (x 10^{11})	Density	Poisson's Ratio
Recent to Pleistocene			Scree	2,500 - 5,100			
			Soil	1,000 - 2,000			
			Glacial deposits	5,000 - 6,000			
Jurassic			Dolerite weathered	5,000 - 6,000			
			Jointed	10,000 - 15,000	2.1 - 5.0	2.9(1)	.26(2)
			Unweathered	17,000 - 22,000	6.3 - 13.0	2.9(1)	.26(2)
Triassic		Newtown	Sandstone, siltstone				
		Coal Measures	Shale				
	Knocklofty	Tiers	Siltstone, shale				
		Cluan	Sand-siltstone	6,300 - 7,000	.68 - .9	2.6(3)	.3(2)
		Ross	Sandstone	9,000 - 10,000	1.4 - 1.6	2.6(4)	.3(2)
		Jackey	Shale				
Permian	Ferntree	Eden	Mudstone				
		Blackwood	Conglomerate				
		Drys	Mudstone	5,500(W) 9,500(U)	.53 - 1.65	2.6(4)	.3(2)
		Palmer	Sandstone	5,300(W) 10,500(U)	.47 - 1.83	2.45(4)	.3(2)
		Springmount	Mudstone	7,500(W) 10,000(U)	1.0 - 1.8	2.6(4)	.3(2)
		Risdon	Sandstone	7,900(W) 14,000(U)	1.04 - 3.5	2.45(4)	.3(2)
	Woodbridge	Weston	Mudstone	6,500(W) 9,000(U)	.77 - 1.46	2.6(4)	.3(2)
		Dabool	Sandstone				
		Meander	Mudstone				
	Liffey	Greekton	Sandstone				
		Woodside	Sandstone				
		Kopanica	Shale				
		Flattop	Sandstone				
	Golden Valley	McRae	Mudstone				
		Billop	Sandstone				
		Brumby	Mudstone				
		Quamby	Mudstone				
		Stockers	Tillite				
Pre-Cambrian							

Note: (W) = Weathered (1) = Measured by Jaeger and Jopling (1955) (3) = Measured by H.E.C.
(U) = Unweathered (2) = Estimated from Birch, Schairer and Spicer (1950) (4) = Estimated.

(a) Radioactive.

(b) Magnetic.

(c) Resistivity.

(d) Seismic refraction.

(e) Gravity.

(a) <u>Radioactive Method</u>.

Under favourable conditions, it is possible for radon to be concentrated in sheared and fractured zones, resulting in an increase in the natural radioactivity over such fractures. In the present survey, however, deep soil or scree obscured or dispersed the effect from any possible radon concentration and no results of interest were obtained in the tests by this method.

(b) <u>Magnetic Method</u>.

The measured magnetic intensity at any point on the earth's surface is mainly the resultant of two vectors, namely an induced magnetic intensity vector in the approximate direction of the earth's magnetic field, and a remanent magnetic intensity vector inherent to the rock and which may be in any direction. Magnetic measurements can, in some areas, indicate such features as faults and boundaries between near-surface formations, and it is sometimes possible to obtain rough depth estimates from such measurements.

(c) <u>Resistivity Method</u>.

Different rock types possess different electrical resistivities which may be explained by variations in the lithology of the rocks. Hard non-porous and unweathered rocks generally have a high resistivity. Shearing and fracturing result in localized weathered zones which, because of the consequent increase in the amount of saline solutions, cause a decrease in resistivity. In general, it may be said that the resistivity of a rock is inversely proportional to its porosity and to the salt content of the pore solutions.

In the Wenner method of resistivity measurements, four electrodes are equally spaced in a straight line. In the technique known as resistivity traversing, which was used in the present survey, the four electrodes are moved as a whole along a traverse and readings are taken at consecutive stations. In the interpretation, absolute values of resistivity are not as important as sudden changes in resistivity; such changes usually indicate a change in rock type, e.g. from unweathered rock to sheared or fractured and weathered rock, or from sandstone to shale.

(d) <u>Seismic Refraction Method</u>.

The seismic method of exploration depends on the contrast in the velocity of elastic waves through different rock formations. Such waves have higher velocities in unweathered rocks than in their weathered and fractured counterparts. The velocity in soil and scree is considerably lower than in weathered and fractured rock.

The method of differences (Heiland, 1946, p. 548 and Boniwell, 1952) was used in the present survey, and the following types of spread were shot :-

(i) Weathering Spreads. These were used to obtain the seismic wave velocity and thickness of the soil and near-surface layers. Geophone interval was 10 ft. and shot points were at distances of 5, 10, 20 and 50 ft. from both ends of the spread.

(ii) Normal Spreads. The geophone interval was 50 ft. and shot points were at distances of 20, 50, 200 and 400 ft. or more from both ends of the spread.

(iii) Broadside Spreads. This type of spread was used on steep slopes and the geophones were spaced at 5 -ft. intervals. The shot points were up to 1,200 ft. distant along a line at right angles to the spread from its mid-point.

In the portal area, where the excessive thickness of scree necessitated the placing of the shot as far as 2,000 ft. from the first geophone, the method of step-out times (Wiebenga, Dyson and Hawkins, 1956) was substituted for the method of differences.

The geophysical equipment used in the seismic survey consisted of a Heiland six-channel refraction recorder and Technical Instruments Company geophones with a natural frequency of about 19 cycles per second.

(e) Gravity Method.

The gravity method depends on the density contrast between different types of rock (Nettleton, 1940). In the Great Lake North area, there is a large difference in density between the igneous rock (dolerite) and Triassic sedimentary rocks, as shown by density determinations on cores from D.D.Hs. 5001, 5042, 5030 and 5031.

The gravity survey was done in 1952 (Chamberlain, 1952), but the results have been re-interpreted using later drilling information as a control. The basis for the re-interpretation is indicated later in this report, in the section on results.

The total length, in feet, of the traverses surveyed and the length in each area are shown in Table 2 :-

TABLE 2.

Survey	Intake	Portal	Penstock	Tail-Race	Total
Radioactive	4800	3850	4800	-	13,450
Magnetic	4800	3850	4900	-	13,550
Resistivity	5600x	750	4850	9600xx	20,800
Seismic	4800	3850	4600	-	13,250

x Electrode spacing 25, 50, 100 and 200 ft.
xx Electrode spacing 50, 100 and 200 ft.

4. RESULTS

Recorded seismic velocities for the various rock types in the Great Lake North area are included in Table 1.

The interpretation of the results is shown on Plates 2 to 8.

(A) Intake Tunnel.

Plate 2 shows the results and interpretation of the geophysical survey in the Intake-tunnel Area between stations 700 and 6,300.

Plate 3 shows a more detailed interpretation of the seismic data between stations 700 and 5,500.

Plate 4 shows a re-interpretation of the gravity data between stations 0 and 19,400.

Information regarding the presence and location of fault and shear zones west of station 5,500, where the intake tunnel will be not more than 300 ft. below the surface, will assist in planning the tunneling operations. Three geophysical methods were used and the combined evidence from all three is considered to be fairly reliable.

(i) Magnetic Survey (Plate 2).

Shear zones may be indicated on the magnetic profile by a decrease in vertical magnetic intensity because deeper weathering in shear zones causes demagnetisation of igneous rocks containing magnetite (Manley, 1955).

Cores from D.D.H. 5001 (Jaeger and Joplin, 1955) show the following high, but variable, values of magnetic susceptibility and remanent magnetism :-

Magnetic susceptibility: 0.55×10^{-3} to 3.0×10^{-3} c.g.s.e.m. units.

Remanent magnetism: 0.24×10^{-3} to 4.0×10^{-3} c.g.s.e.m. units.

The remanent magnetisation vectors in the lower part of the hole are approximately opposite in direction to the remanent magnetisation vectors in the top part of the hole.

The low values on the magnetic profile may therefore be the result of either demagnetisation, local change in magnitude of the magnetic susceptibility of dolerite, or a change in direction of the remanent magnetism.

The sudden decrease in magnetic intensity at Station 5100 is the result of the thinner dolerite cover there.

(ii) Resistivity Survey (Plate 2).

Because sheared rock provides better access to surface solutions than unsheared rock, the weathered layer in shear zones is usually thicker than it is outside the shear zones. Also, the porosity of weathered rock is higher than that of unweathered rock, and the salinity of the pore solutions is higher than that of surface solutions.

These conditions, all related to shearing and weathering, explain adequately why shear zones are usually indicated by low resistivity. The reverse is not always true, however. Zones of low resistivity, especially if they are limited to the near surface, are not necessarily indicative of shear zones. They may, for example, be caused by local accumulations of soil.

(iii) Seismic Survey (Plates 2 and 3).

Shear-zones are characterised by local thickening of the weathered rock, accompanied by lower seismic velocities in the sheared, unweathered rock.

The discussion under (i), (ii) and (iii) shows how the presence and location of shear zones were deduced from the observed data. It is assumed that sheared and fractured zones detected near the surface extend in depth to tunnel level.

(iv) The gravity profile between 0 and 19,400 (Plate 4).

Thinning of the dolerite cover east of station 5000 was predicted by an earlier gravity survey (Chamberlain, 1952) and was confirmed by D.D.Hs. 5073 and 5042. This thinning is also indicated on the magnetic profile by a sudden decrease in the value of the vertical magnetic intensity.

Since the date of the earlier gravity survey, additional information has become available as a result of recent geological investigations and diamond drilling. It was considered that this additional information could be profitably used in a re-interpretation of the earlier gravity data.

For the calculation of Bouguer and terrain corrections the density of the dolerite was taken as 2.95 (Jaeger and Joplin, 1955). To ensure that the contact between the dolerite and sedimentary rocks was below the reference level along the profile, a level of 3,900 ft. above datum was taken as reference.

The resultant gravity profile between stations 0 and 19,000 is shown on Plate 4, together with a detailed profile between stations 6,000 and 19,000.

By applying the above corrections to the gravity data, the variations in thickness of the dolerite may be deduced directly from variations in the gravity profile.

An apparent discrepancy is revealed if the difference between the corrected Bouguer gravity values near D.D.Hs. 5002 and 5033, is compared with the difference in elevation of the dolerite/sediment contact at these drill holes. This discrepancy is probably due to a regional gravity trend, which, unfortunately, is not clearly indicated on Plate 4 because of the lack of sufficient data.

The variations in the gravity profile near stations 9,000, 14,000 and 16,000 suggest sudden changes in the thickness of the dolerite. On Plate 4, these changes in thickness have been interpreted as faults F1, F2 and F3, but this interpretation is by no means certain.

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An alternative interpretation is a change in elevation of the surface of the sedimentary rocks.

(B) Portal and Penstock Lines (Plates 5, 6 and 7).

Plate 5 shows the results and interpretation of the geophysical survey in the Portal and Penstock Lines Area between stations 19,700 and 28,400. Plates 6 and 7 show in detail the interpretation of the seismic data between stations 19,700 and 23,550, and between stations 23,600 and 28,200 respectively. It was impossible to survey the portion of the penstock line between 28,200 and 28,400, as the area was disturbed by road building.

The geophysical features are discussed below, beginning at the western end.

The vertical magnetic intensity profile between stations 19,700 and 22,400 is relatively uniform, with only a few comparatively small features. This uniformity may be due partly to demagnetisation of the dolerite scree boulders as a result of weathering, and partly to a "random" orientation of the magnetic intensity vectors of the dolerite boulders within the scree. This implies the presence of remanent magnetisation (Irving, 1956).

The shape of the vertical magnetic intensity profile between stations 20,900 and 21,200 resembles that of the theoretical curve obtained over the edge of a slab of magnetised material. This suggests that the magnetic feature probably coincides with the eastern boundary of the dolerite layer. The seismic results support this opinion, and the data from D.D.Hs. 5033 and 5032 confirm that the eastern boundary of the dolerite is between these two drill holes.

The irregular shape of the vertical magnetic intensity profile between stations 22,400 and 25,300 suggests the presence of magnetic minerals at or near the surface. This may be explained by the accumulation of magnetic minerals (magnetite) from weathered dolerite on ledges at the eastern slope of the mountain. The decrease in magnetic intensity at station 25,300 corresponds with the outcrop of Ross Sandstone.

The eastern edge of the scree is indicated in the 50-ft. spacing resistivity profile by a sudden decrease in the resistivity value near station 23,200. The outcropping Cluan siltstone is characterised by low, uniform resistivity values on the 50-ft. electrode-spacing profile between dtations 23,200 and 23,650. On the same resistivity profile an irregular increase in resistivity from 23,650 to 25,350 marks the outcropping Ross Sandstone.

The vertical magnetic intensity profile between stations 25,500 and 28,400 shows no features which can be correlated with geological structures. In the same area the resistivity profile for 50-ft. electrode spacing shows only minor features, whereas the resistivity profile for 200-ft. electrode spacing shows several major features. It is possible that the character of the 200-ft. electrode spacing profile indicates alternating beds of shale (low resistivity) and sandstone (high resistivity).

Plate 6 shows the interpretation of the seismic survey in the Portal Area between stations 19,700 and 23,550. The logs of D.D.Hs. 5030 and 5032 show 21 ft. and 29 ft. of weathered sediments respectively between the scree and the unweathered Cluan siltstone. It appears that the velocity contrast between the weathered and unweathered sediments and the thickness of the weathered sediments are not large enough to enable the seismic refraction method to disclose the weathered layer.

Plate 7 shows the results of the seismic refraction work in the Penstock Lines Area between stations 23,600 and 28,200. A notable feature in the profile of the unweathered rock is the indication of sandstone ledges near stations 24,200, 25,100, 25,850, 26,400 and 26,800. These ledges cause a thickening of the overburden, which increases the danger of slipping above the ledges.

(C) <u>Tail-race Tunnel.</u>

Only resistivity surveys were carried out along the tail-race tunnel and the results of these are shown on Plate 8. The Tail-race Tunnel Area is covered by alluvial deposits, and the resistivity profile for 50-ft. electrode spacing is affected very little by the deeper rocks, the resistivity values being low and fairly uniform.

The profiles for 100-ft. and 200-ft. electrode spacing show considerably more character. It was originally thought that the troughs in the resistivity curves might indicate shears, but close examination of the geological data (McKellar, 1956) shows that the troughs and peaks are more likely an indication of alternating bands of shale and sandstone in the unweathered bedrock combined with local changes in the thickness of the alluvial deposits.

The sudden decrease in resistivity near station 34,000 may indicate a fault or a buried sandstone cliff, with mudstones east of the fault or cliff.

5. <u>ACCURACY OF SEISMIC DEPTH ESTIMATES.</u>

The determinations of thickness of scree and weathered dolerite from the seismic survey along the Intake-tunnel line are considered to have an accuracy of about ± 15 per cent. Data from D.D.H.5073 were used to check the depth estimates. However, it was difficult to determine accurately the lower limit of the partly weathered (or jointed) dolerite because of the gradual transition from partly weathered to unweathered dolerite.

In the portal area, the vertical velocities were determined in three test pits between 27 and 34 ft. deep. The computed scree thicknesses were checked by D.D.Hs. 5031 and 5032 and the maximum error is less than 10 per cent. It is therefore considered that the section between D.D.H.5031 and D.D.H.5032 has been determined with a possible error of within ± 10 per cent.

The profile of the part of the portal area between D.D.H.5032 and the cliff edge, where unweathered dolerite crops out, was computed by a method of step-out times using D.D.H.5032 as a tie-point. The accuracy is considered to be high. This was confirmed at D.D.H.5033, where the seismic results indicated unweathered dolerite beneath the scree at 360 feet and subsequently the diamond drill hole showed unweathered dolerite between 362 feet and 432 feet.

No data are available to check the seismic results in the Penstock Lines Area but it is considered that the thickness of soil (low velocity layer) has been determined with an error of within ± 10 per cent of depth. The accuracy in determining the thickness of the weathered sediments below the soil layer is probably not as high and the error may be as much as ± 25 per cent of depth.

6. CONCLUSIONS.

The geophysical investigation provided the following information on the near-surface structural geology of the area :-

Intake Tunnel.

The gravity survey indicated the approximate position of the eastern boundary of the dolerite mass or dolerite plug (Plate 4); the method is not sufficiently sensitive, however, to determine the dip of the contact between dolerite and sedimentary rocks. The location of the contact is also indicated on the vertical magnetic intensity and resistivity profiles (Plate 2).

Combined evidence from the seismic resistivity and magnetic surveys indicated the probably existence and location of shear zones west of station 5,500.

The thickness of alluvium, scree and weathered or partly weathered dolerite was determined by the seismic refraction method. The combined maximum thickness is 110 to 120 feet (Plate 3).

Portal and Penstock Lines.

The thickness of scree, soil and weathered sediments was successfully determined by the seismic refraction method between stations 19,700 and 28,400, except between the edge of the dolerite sheet and 22,300 where a 20 to 30-ft. layer of weathered sediments was not detected beneath a thick layer of scree (Plates 6 and 7).

The seismic survey also disclosed the eastern boundary of the dolerite layer covering the sediments (near station 21,000), and the presence and location of sandstone ledges beneath weathered material in the Penstock Lines Area (between stations 24,000 and 27,000).

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On the profile of vertical magnetic intensity (Plate 5), the eastern boundary of the dolerite layer is clearly indicated by an anomaly near station 21,100. The thinning out of the scree with increased influence of the weathered material beneath the scree, probably containing local concentrations of magnetite, is clearly indicated near station 22,400 on the profile of vertical magnetic intensity. The base of the Ross Sandstone, determined geologically, is shown on the magnetic profile by a sudden decrease in magnetic value with a smoothing out of the profile east of station 25,300.

The resistivity profiles on Plate 5 do not contribute much new information. The eastern boundary of the scree and the outcrop of the Ross Sandstone are prominent on the resistivity profile for 50-ft. electrode spacing.

Tail-race Tunnel.

The resistivity survey in this area contributed little additional information, except near station 34,000, where a sudden drop in the resistivity profile for 200-ft. electrode spacing indicates the presence of a subsurface sandstone cliff or a fault, with shaly sandstone to the west and mudstones to the east.

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PLATE I
Great Lake
TUNNEL LINE No 1
INTAKE TUNNEL
PORTAL AREA
PENSTOCK LINE
TAIL-RACE TUNNEL
GREAT LAKE
SEA LEVEL
LOCATION DIAGRAM
Reference to Australian 4 mile maps
SMITHTON
DEVONPORT
LAUNCESTON
QUEENSTOWN
HOBART
PORT DAVEY
HUON
SCALE IN MILES
LEGEND
RECENT TO TERTIARY
Alluvial deposits
Scree & Talus
JURASSIC
Dolerite
TRIASSIC
Newtown Coal Measures
Tiers Sandstone
Cluan Sandstone
Ross Sandstone
Jackey Shale
PERMIAN
Blackwood Conglomerate
Palmer Sandstone
Risdon Sandstone
Ferntree Mudstone
Woodbridge Tillitic Mudstone
Liffey Sandstone
Golden Valley - Quamby Group Mudstone & Calcareous Mudstone
Stockers Tillite
Fault (from H.E.C. map)
" , position approximate (from H.E.C. map)
" indicated by gravity survey
Major gravity anomaly
Geological boundary
Tunnel line and geophysical traverse (Distance measured horizontally)
HORIZONTAL AND VERTICAL SCALES IN FEET
GEOPHYSICIST
GEOPHYSICAL SURVEY OF THE GREAT LAKE NORTH AREA, TASMANIA
GEOLOGY AND GEOPHYSICAL TRAVERSES
GEOLOGY BASED ON TASMANIAN H.E.C. MAPS
GEOPHYSICAL SECTION, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
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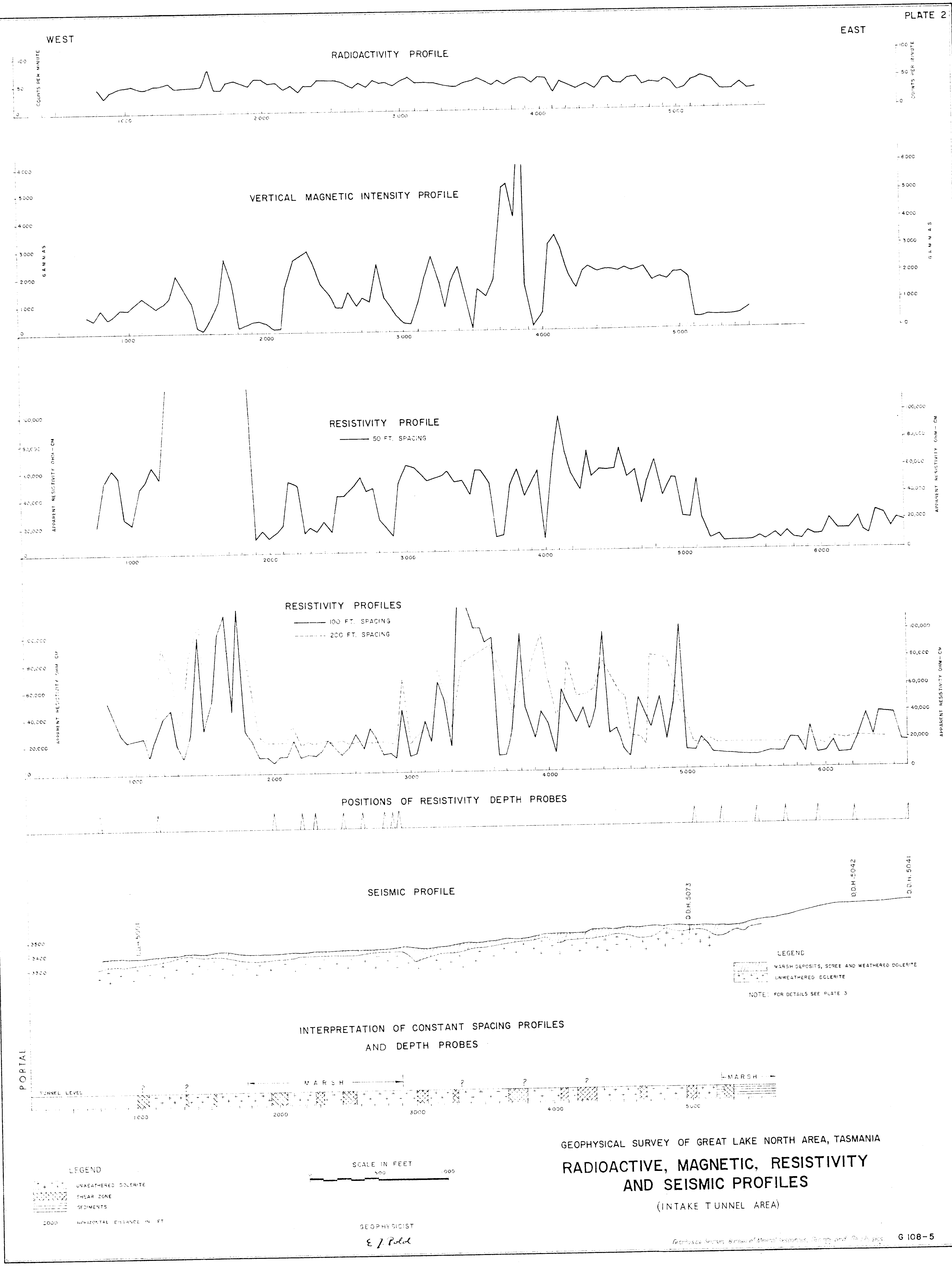
PLATE 2
WEST
EAST
RADIOACTIVITY PROFILE
COUNTS PER MINUTE
VERTICAL MAGNETIC INTENSITY PROFILE
GAMMAS
RESISTIVITY PROFILE
50 FT. SPACING
APPARENT RESISTIVITY OHM – CM
RESISTIVITY PROFILES
100 FT. SPACING
200 FT. SPACING
POSITIONS OF RESISTIVITY DEPTH PROBES
SEISMIC PROFILE
D.D.H. 5073
D.D.H. 5042
D.D.H. 5041
LEGEND
MARSH DEPOSITS, SCREE AND WEATHERED DOLERITE
UNWEATHERED DOLERITE
NOTE: FOR DETAILS SEE PLATE 3
INTERPRETATION OF CONSTANT SPACING PROFILES
AND DEPTH PROBES
PORTAL
TUNNEL LEVEL
MARSH
LEGEND
UNWEATHERED DOLERITE
SHEAR ZONE
SEDIMENTS
2000 HORIZONTAL DISTANCE IN FT.
SCALE IN FEET
GEOPHYSICIST
E. J. Polak
GEOPHYSICAL SURVEY OF GREAT LAKE NORTH AREA, TASMANIA
RADIOACTIVE, MAGNETIC, RESISTIVITY
AND SEISMIC PROFILES
(INTAKE TUNNEL AREA)
G 108-5

LEGEND

(6,000)	Seismic velocity in feet per second
	Scree and weathered dolerite
	Unweathered dolerite

SCALES

Horizontal 100 0 100 200 300 400 Feet

Vertical 100 0 100 200 300 400 Feet

GEOPHYSICAL SURVEY OF THE GREAT LAKE NORTH AREA, TASMANIA

LAKE SECTION, INTAKE TUNNEL

DETAILED SEISMIC PROFILE

NOTE: Thickness of strata calculated from seismic results.
Shear zones obtained from resistivity results (see Plate 2)

GEOPHYSICIST

E. J. Polak

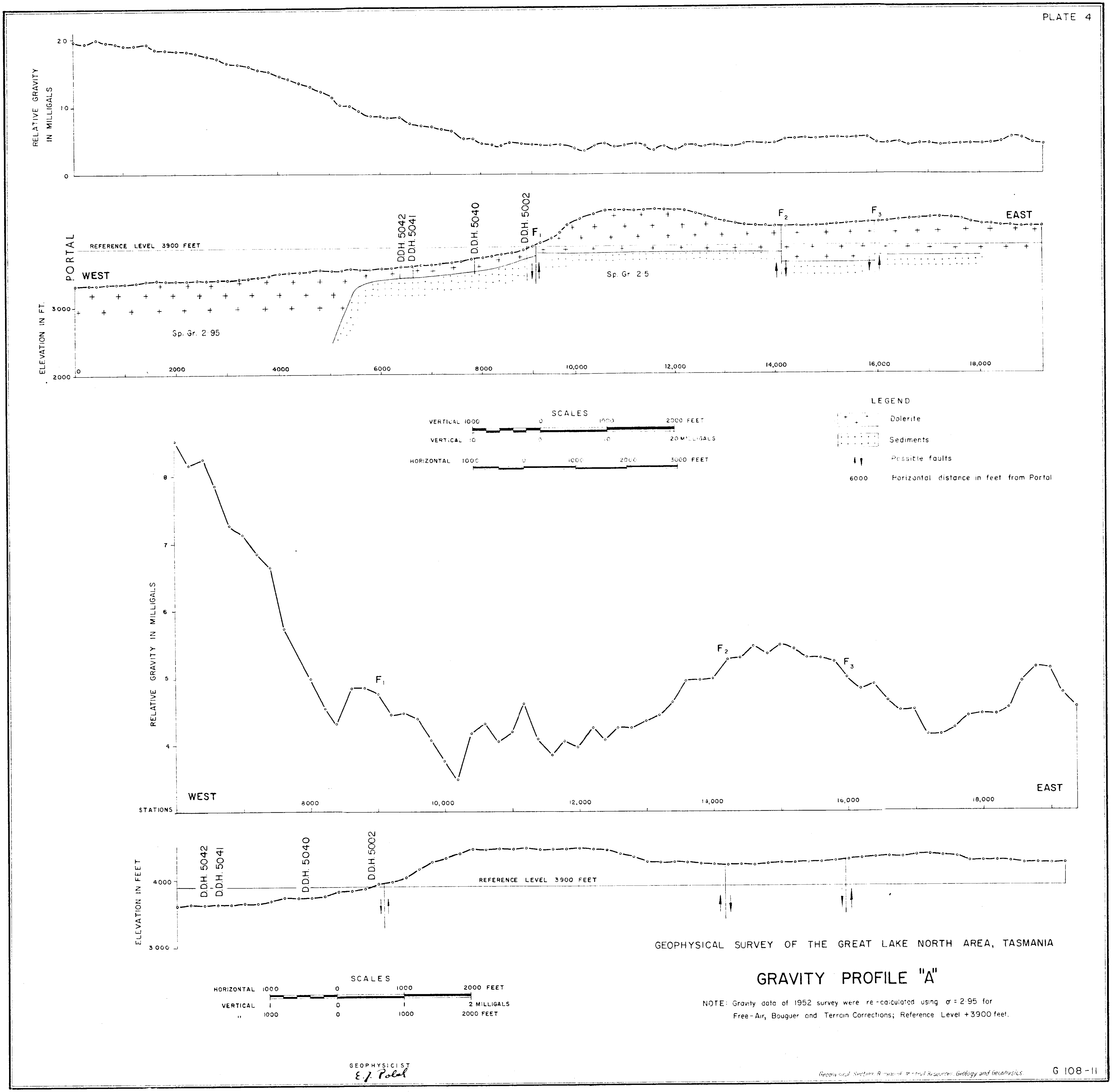
PLATE 4
RELATIVE GRAVITY IN MILLIGALS
20
10
0
PORTAL
WEST
EAST
REFERENCE LEVEL 3900 FEET
DDH. 5042
DDH. 5041
DDH. 5040
DDH. 5002
F1
F2
F3
Sp. Gr. 2·95
Sp. Gr. 2·5
ELEVATION IN FT.
3000
2000
0
2000
4000
6000
8000
10,000
12,000
14,000
16,000
18,000
SCALES
VERTICAL 1000 0 1000 2000 FEET
VERTICAL 10 0 10 20 MILLIGALS
HORIZONTAL 1000 0 1000 2000 3000 FEET
LEGEND
Dolerite
Sediments
Possible faults
6000 Horizontal distance in feet from Portal
RELATIVE GRAVITY IN MILLIGALS
8
7
6
5
4
STATIONS
8000
10,000
12,000
14,000
16,000
18,000
ELEVATION IN FEET
4000
3000
GEOPHYSICAL SURVEY OF THE GREAT LAKE NORTH AREA, TASMANIA
GRAVITY PROFILE "A"
NOTE: Gravity data of 1952 survey were re-calculated using σ = 2·95 for Free-Air, Bouguer and Terrain Corrections; Reference Level +3900 feet.
SCALES
HORIZONTAL 1000 0 1000 2000 FEET
VERTICAL 1 0 1 2 MILLIGALS
" 1000 0 1000 2000 FEET
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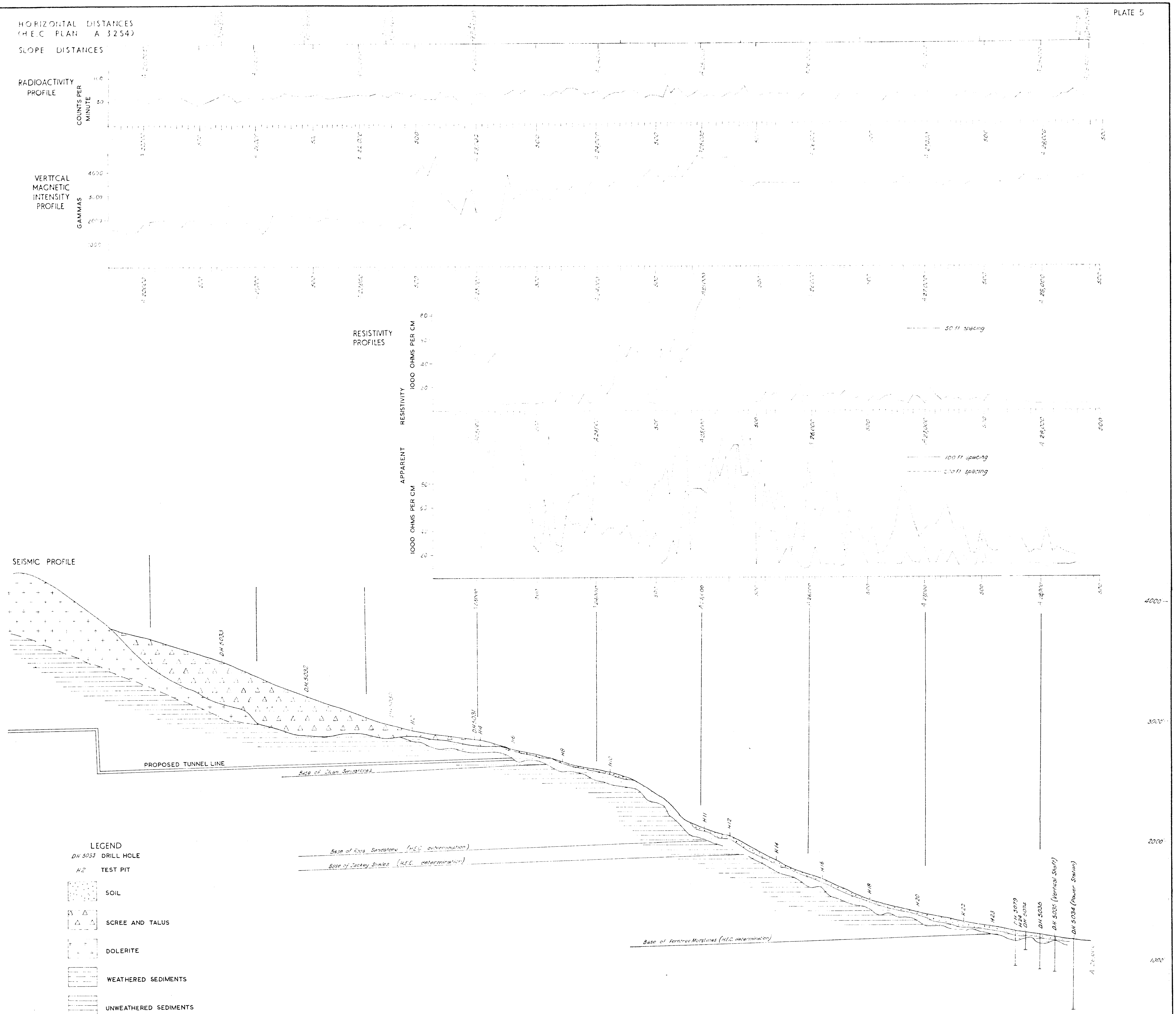
G 108-11



LEGEND

DH 5033 DRILL HOLE

H2 TEST PIT

SOIL

SCREE AND TALUS

DOLERITE

WEATHERED SEDIMENTS

UNWEATHERED SEDIMENTS

NOTE: THICKNESS OF STRATA OBTAINED FROM SEISMIC SURVEY (FOR DETAILS SEE PLATES 5 AND 6)

GEOLOGY BASED ON H.E.C. MAPS.

SCALE IN FEET

0 500 1000 2000

A 23,000 STATION NUMBER WITH PREFIX A INDICATES THE POSITION OF THE STATION RELATIVE TO A 28,400 (SITUATED 90 FT. DOWNHILL FROM D.H. 5034) DISTANCES ARE MEASURED ALONG THE SLOPE OF THE TERRAIN

GEOPHYSICAL SURVEY OF THE GREAT LAKE NORTH AREA, TASMANIA.
PORTAL AND PENSTOCK AREAS

RADIOACTIVE, MAGNETIC, RESISTIVITY AND SEISMIC PROFILES

GEOPHYSICIST

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PLATE 6

GEOPHYSICAL SURVEY OF THE GREAT LAKE NORTH AREA, TASMANIA
PORTAL AREA
DETAILED SEISMIC PROFILE

SCALES IN FEET
HORIZONTAL 100 0 100 200 300
VERTICAL 100 0 100 200 300

SCREE AND TALUS
DOLERITE
WEATHERED SEDIMENTS
PARTLY WEATHERED SEDIMENTS
UNWEATHERED SEDIMENTS

(4500) SEISMIC VELOCITY IN FT/SEC

A 19,700 STATION NUMBER WITH PREFIX A INDICATES THE POSITION OF THE STATION RELATIVE TO STATION A 28.400 (SITUATED 90 FT. DOWNHILL FROM D.H. 5034) DISTANCES ARE MEASURED ALONG THE SLOPE OF THE TERRAIN

GEOPHYSICIST
E. J. Polak

G 108-8

GEOPHYSICAL SECTION, BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

PLATE 7

GEOPHYSICAL SURVEY OF THE GREAT LAKE NORTH AREA, TASMANIA

PENSTOCK LINE

DETAILED SEISMIC PROFILE

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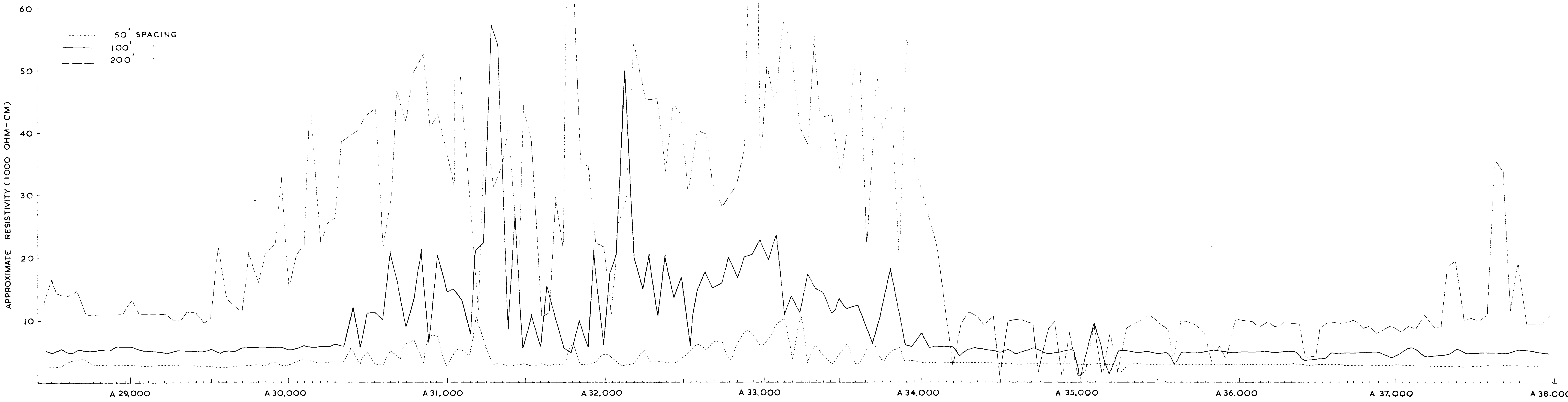
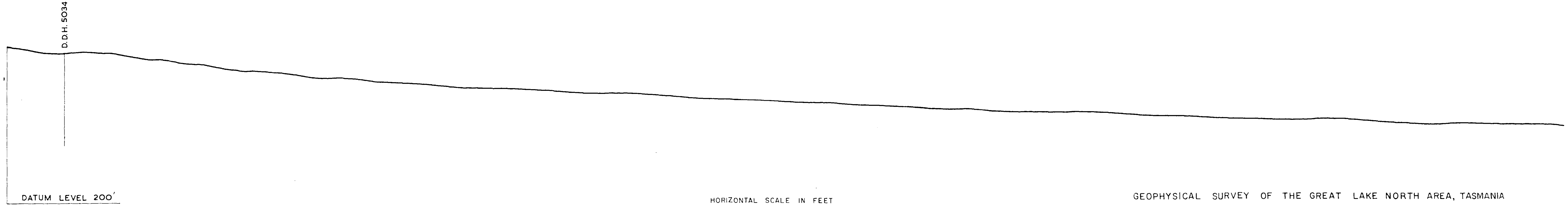
PLATE 8





A 29,000 STATION NUMBER WITH PREFIX A INDICATES THE POSITION OF THE STATION RELATIVE TO STATION A 38,400 (SITUATED 90 FT. DOWNHILL FROM D.H. 5034)

DISTANCES ARE MEASURED ALONG THE SLOPE OF THE TERRAIN

HORIZONTAL SCALE IN FEET

400 0 400 800 1200 1600

GEOPHYSICAL SURVEY OF THE GREAT LAKE NORTH AREA, TASMANIA

TAIL - RACE TUNNEL

RESISTIVITY CONSTANT SPACING PROFILES

GEOPHYSICIST

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