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PROJECT 357

HEAZLEWOOD NICKEL - TASMANIA

AUSTRALIA

PROGRESS REPORT

June 30, 1969

JOHN F. GILFILLAN

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1. SUMMARY

Between September, 1968 and July, 1969 Amax carried out exploration for nickel over a 6 square mile area of ultramafic rocks in north-western Tasmania. The area is held under option from the Heazlewood Nickel Prospecting Syndicate, N.L. and is located 16 miles by road west of the township of Waratah and 66 miles south-west of Burnie which is on the coast.

The objectives of the exploration were to test for the presence of disseminated nickel near surface and the presence of significant segregations of nickel at depth.

The area occupies a section of a belt of Cambrian ultramafics which trends north-south for about 35 miles. The ultramafics are dyke or sill like in form and occur between Cambrian sedimentary and igneous rocks. Nickel mineralisation is essentially confined to narrow shears in the vicinity of the Lord Brassey Mine.

Geological mapping as well as determinations of ground magnetics and soil geochemistry was carried out.

Induced polarisation surveys produced numerous anomalies four of which were drilled. No sulphide mineralisation was identified from any of the holes and assays for nickel gave values not exceeding 0.24%.

2. INTRODUCTION

Nickel mineralisation has been known to occur in the Heazlewood area since the latter part of the 19th Century. Prospecting pits, trenches and adits were put into the mineralised area during that period but no production has been recorded.

In the old workings, mineralisation is confined to narrow veins approximatly ¼" wide which contain heazlewoodite (Ni_3S_2). The secondary minerals present are zaratite ($NiCO_3 . 2Ni(OH)_2 . 4H_2O$) and hellyerite ($NiCO_3 . 6H_2O$).

Following the granting of S.P.L. No. 37 of about 6 square miles to the Heazlewood Nickel Prospecting Syndicate No Liability on May 7, 1968, that Syndicate was approached by Amax for permission to undertake a field examination of the area. With confirmation of the presence of nickel sulphides in an ultrabasic environment, negotiations were entered into with the Syndicate for a three year option over the Special Prospector's Licence and the enclosed 80 acre Mineral Lease, also held by the Syndicate.

Option agreements for the exploration and purchase of the two properties were concluded on August 26, 1968 and exploration was begun by the Company in the field on September 12 of the same year.

The object of the exploration programme was to test for:

(a) the presence of previously unrecognised disseminated sulphide mineralisation near surface, and

(b) the possibility of significant segregations of sulphides at depth within the ultrabasic complex.

3. TITLE (See Appendix I)

On August 26, 1968 two Option agreements were completed between Amax Mining (Australia) Inc. and the Heazlewood Nickel Prospecting Syndicate No Liability over the following two mineral properties (held by the Syndicate) in north-west Tasmania.

1. ML31M/57, a Mineral Lease of 80 acres granted from April, 1 1960 for 21 years.
2. S.P.L. No. 37, a Special Prospectors Licence, of approximately 6 square miles, first granted on May 7, 1968 and subject to renewal at six-monthly intervals.

S.P.L. 37 surrounds ML31M/57 and the two option agreements, each of three year duration, are interdependent and may only continue as long as the S.P.L. is renewed. Amax assumed the Syndicate's responsibility to keep the properties in good standing with the Department of Mines and reserved the right to assign the whole or part of its interest in the properties to other organizations, subject to the agreement of the Syndicate.

A copy of the original S.P.L. title map is annexed in the Appendix and shows the relationship between the S.P.L. and the Mineral Lease. Since its original granting, the S.P.L. has been renewed at six-monthly intervals by the Minister for Mines, Tasmania, and at present continues in force to November 7, 1969. Further extensions of time would almost certainly be granted on application provided work is continuing on the property.

4. GEOGRAPHY (see Figures 1 and 2)

4.1 Location

The Heazlewood area of north-western Taxmania is situated at Latitude 41°27'S, Longitude 145°29'E, 16 miles by road west of the township of Waratah. Company-owned mining towns of Luina and Savage River are 5 miles east and 8 miles south-west by road respectively.

The nearest town with all facilities is Burnie (population about 15,000), about 50 road miles north of Waratah, on the north coast of the island.

4.2 Access

Access to Waratah from the north is by sealed highway from Burnie. Interstate ferry services call at Burnie and Devonport and four air services daily connect Melbourne to Wynard, 12 miles west of Burnie. The Emu Bay Railway runs through Guildford Junction, 11 miles east of Waratah.

A small, privately owned, airstrip at Waratah is suitable only for light aircraft in good weather.

The main sealed road from Waratah to Savage River passes through the Heazlewood area.

Access on the Heazlewood property is extremely restricted in wet weather. A metalled, all weather, track has been constructed from the main road near the bridge over the Heazlewood River, and extends about half a mile northwards into the Licence. From this track, two rough access tracks have been bulldozed, one up the steep hill past the old

Lord Brassey Mine and thence to various drill sites in that area; the other, further to the west, and more or less along the old pack track to the osmiridium fields, follows Roaring Meg Creek to a drill site 9,000 feet north of the road. The main, centrally located, track has been extended for tracked vehicles only to a point about 13,000 feet north of the road.

Access problems are related almost entirely to the steep terrain and the depth of water logged soil and mud found on these hill slopes.

4.3 Topography

The area in which the licence occurs, sometimes called the "Bald Hills", is an elevated but deeply dissected button-grass covered plateau which is characteristic of the terrainal expression of the ultrabasic rocks in the area. Although relatively open by comparison with local rain forest, the hills are nevertheless heavily covered in many places by low scrub consisting largely of bauera and ti-tree.

Eucalyptus forest occurs along the Heazlewood River and dense myrtle rain forest with associated under-scrub is found at the northern end of the Licence.

The plateau is about 800 feet above river and road level. On this plateau peat and button-grass combine to make an almost impassable bog in wet weather.

4.4 Climate

Climate is controlled by the prevailing westerly winds of the 40° south latitudes. Average annual rainfall - see Table I and II - is about 86" with rain falling almost daily for months on end in some years. Light winter snows fall on the hills over about 2,000 feet above sea level during the winter months. Rain falls throughout the summer with January, February and March the dryest months.

Temperatures are generally mild with only occassional extremes.

4.5 Logistics

Staff accommodation, office and storage space have been obtained in Waratah.

Manpower employed on the project has consisted of:

Geologists	2 to 3
Field Assistants	2
Bushmen	Up to 6
Students	4 (short period only)

Bushmen were locally employed and field assistants were employed within Tasmania.

Transport of men and equipment has been effected with:

1 Dodge 106 Utility
1 Landrover S.W.B.
1 Car or Station Waggon - hired locally as required.

1 Trailer hired locally as required.

1 Bombardier J-5 Tracked Personnel Carrier.

Grid cutting and pegging entailed the survey, cutting and pegging of a three mile north-south baseline with traverses offset at 500' intervals and pegged at 100' intervals for 1 mile east and 1 mile west of the baseline. Total line cutting and pegging to date is approximately 59 miles.

One ½ mile of all-weather road was constructed and about 3½ miles of track for 4-wheel drive vehicles or Bombardier were formed with bulldozers.

About 45 line miles of ground magnetics, 6,600 line feet of Induced Polarisati on coverage with 100' electrode spacings, and 37,400 line feet with 300' electrode spacings constituted the geophysical program.

Soil samples for geochemical analyses were taken over 31,320 line feet on 6 traverses.

Contracting and consulting services were obtained as follows:

Petrology and Mineragraphy:	Sampey Exploration Services-Brisbane.
	Dr. K. Williams - Canberra.
	McPhar Geophysics Pty.Ltd.-Adelaide.
Analyses and Assays:	McPhar Geophysics Pty. Ltd.-Adelaide.
	Geochemical & Mineralogical Laboratories Pty. Ltd.-Sydney

Geoyphysics - I.P.	McPhar Geophysics Pty.Ltd.- Adelaide
Diamond Drilling:	A.S. James Pty.Ltd. - Melbourne
Bulldozing and General Contracting:	J. Fagan - Waratah.

5. GEOLOGY AND MINERALISATION

5.1 Geology

5.1.1 Regional

An ultrabasic complex occurs in a narrow belt trending discontinuously north-south for about 35 miles in western Tasmania. The belt reaches its maximum width of about five miles at its northern end, near Heazlewood.

The ultrabasic rocks, described as being of Cambrian age, occur in sill-like and dyke-like form, generally within Cambrian igneous and sedimentary rocks. In places they appear to be tabular intrusives; elsewhere evidence has been presented to suggest a submarine volcanic origin.

At Heazlewood, the ultrabasic suite lies between Cambrian igneous and sedimentary rocks to the east, and a narrow belt of presumably Cambrian sediments and amphibolites to the west. Further west again lie the Proterozoic sediments in which occur the iron formations of Savage River.

About four miles south of Heazlewood, the ultrabasic belt has been intruded by the Devonian Meredith Granite (adamellite) batholith.

Partly overlying, probably at an unconformity, to the south-east of Heazlewood, are sandstones of Silurian age.

5.1.2 Prospect Area (see Figures 3 and 4)

Within the Licence and Mineral Lease are a variety of rocks belonging to an ultrabasic assemblage. During this exploration program 22 rock samples were thin sectioned for petrological description and identification - see Appendix II. A large number of examinations of rock thin sections has been made by M. Rubenach of the University of Tasmania, who has assisted in the identification of rocks in the field.

Cambrian rocks of igneous origin in the area range in composition from peridotites, dunites and serpentinites through hartzburgites and bronzitites to gabbros, rodingites and dolerites. The occasional occurrence of dykes of albitite (?) and possibly granitic material have been noted. Hornfels, amphibolites and altered sediments also occur and are probably members of the Cambrian sequence. It has been suggested that the hornfels may be the product of alteration of spillites.

Younger rocks in the area are of very limited extent and are not significant economically. They include Silurian (?) sandstones which overlie, probably at an unconformity, the Cambrian rocks in the south-east corner of the Licence. This contact is probably, at least in part, faulted.

Remnants of an older Tertiary laterite are preserved on the ultrabasics in the north-western corner of the Licence. The laterites are probably on the now dissected remains of a peneplain and are found in several places along the ultrabasic belt on the west coast. The laterite has been protected from erosion by isolated remnants of a younger Tertiary basalt which appears to overlie it.

Because of the complexity of the geology, and the practical need to produce a working geological map (Figure 3), rock types have been grouped to some extent and, in general, no distinction has been drawn between the hartzburgites known to occur in the area, and the peridotites, where these have been serpentinised together, and the hartzburgites and pyroxene-rich rocks where there has not been strong serpentinisation. Rock units in Figure 3 are largely the result of field identification with the assistance of the few petrographic examinations undertaken.

Serpentinisation appears to have been focused on the peridotite, dunites and hartzburgites and has resulted from hydrothermal alteration. Calcium metasomatism presumably accompanied serpentinisation and is apparent in the form of grossularitisation. Shearing is widespread. Some degree of serpentinisation has altered the bronzitites in places.

The grossularitisation has altered, in particular the less basic rocks such as the gabbros, to give a rodingite assemblage. These gabbros exhibit a wide range of grain sizes and appear to be now largely grossularite, pyroxene and chlorite. This rock type is commonly found in the many dykes cutting the serpentinite, particularly in the vicinity of the Lord Brassey Mine.

The complexity of the mass, caused by many variations in rock type, possibly multiple layering, folding, faulting and serpentinisation, have made a detailed structural analysis of the area impossible in the available time. Field observations by Company geologists and Mr. Rubenach from the University of Tasmania (pers. Comm.) give evidence

Of folding within the complex. Geophysical data is also consistent with this. Rubenach has tentatively suggested that a roughly north-south trending anticlinal axis passes through the area near the Lord Brassey Mine and curves to the north-east as it continues northwards. Synclinal axes may parallel this fold on either side.

The University of Tasmania ran a gravity traverse along the Savage River road and, although the results of this survey may be questioned, the computed thickness of the complex was some 15,000'.

A north-west/south-east trend of faulting is apparent in the area. Several faults have been postulated (Figure 3) and several others are suspected.

5.2 Mineralisation

Mineralisation found to date on the Licence and Lease has not been widespread. In fact, no new mineralisation of economic significance has been disclosed during the course of this programme.

Mineralisation is probably of at least two generations - those directly related to the Cambrian ultrabasics themselves; viz. nickel, chromite and osmiridium; and those related to a later, probably Devonian, genetic event, viz. copper, lead and zinc.

5.2.1 Nickel

Nickel mineralisation is confined to narrow shears in serpentinite. Veins up to about 1" width have been seen in the old Lord Brassey Mine.

Mineralisation of this type appears to be confined to the environs of the Lord Brassey Mine, with one exception which is only 1,500' to the north-east.

Secondary mineralisation is minor with emerald-green zaratite (basic nickel carbonate) and, to a much lesser extent, pale blue hellyerite ($NiCO_3 . 6H_2O$) deposited along veins and on some open heads within the adit workings.

Sulphide mineralisation is mainly heazlewoodite (Ni_3S_2), which has, at least near the surface, undergone partial alteration to millerite (NiS) with minor associations of violarite ($(Ni, Fe)_3 S_4$) and perhaps bravoite ($(Ni, Fe)S_2$). Magnetite is apparently ubiquitous and heazlewoodite sometimes occurs as inclusions within the magnetite.

Williams (1958) described the presence of pentlandite in the mineralisation. This is usually in subordinate amounts to the heazlewoodite.

Deposition controls for the mineralisation are not apparent. The mineralisation is largely confined to shears and fractures trending north-west/south-east (Figures 4 and 5) and this direction sub-parallels the observed fault trend. No apparent relationship exists between this mineralisation and the compositional banding with trends north-south (Figure 4). Disseminated nickel mineralisation is not apparent in the 101 samples taken throughout the Lord Brassey Mine - Figure 5.

Jupps Adit (Figure 6) which is in sheared serpentinite appears to have been put in with the intention of intersecting nickel mineralisation which outcrops on the

surface about 170' from its mouth. No mineralisation was detected in the adit.

The nickel content of the ultrabasic rocks, as evidenced from the mine samples and the diamond drill sludge samples, is rarely above 0.2% Ni.

5.2.2 Chromite

Surface mapping has shown veins of chromite with north-easterly trends, mainly in the north-east quarter of the licence. Analyses of sludge samples from D.D.H. H1 (see Figure 7) showed significant amounts of Cr_2O_3 in the serpentinite. Since no separate chromium mineral was recognised in two polished sections taken from this core, it is presumed that the chromium is contained within the magnetite which constitutes some 4% of the rock.

5.2.3 Osmiridium

Mapping has shown that the old alluvial osmiridium workings are geographically confined to the dunite belt. This suggests that the dunite is probably the source of this mineral rather than the peridotites found elsewhere.

5.2.4 Base Metals

Two zones with minor base metal content occur on the Licence. The larger zone is probably associated with a belt of hornfelsic rock which enters the property from the South from a much larger zone in which there are several worked copper occurrences. In this area, near the Heazlewood River, several adits were driven to test the narrow shears infilled with poor lead-zinc mineralisation. Lode zones are rarely more than several inches wide and little or no stoping was carried out. The deposits are not significant economically.

The smaller zone, Figure 11, east of the Lord Brassey Mine, occurs along the edge of a 20' to 40' wide band of sediments enclosed within the serpentinites. This area has also been prospected with an adit and various pits and trenches.

5.3 Geochemistry

Geochemical methods of exploration have not been widely used in this program to date. Experimental work showed that the application of geochemical techniques could be used to assist with geological mapping of the dunites, peridotites and serpentinites. However, for the initial purposes of the program sufficient outcrop was available to permit mapping with an acceptable degree of accuracy.

Sampling was carried out on all or part, of traverses 00N, 3000N, 3500M, 4000N 9000N, 10,500N, and 11000N. Samples were taken using a Dormer soil auger with extension handle.

As far as possible, all samples were taken from the soil-weathered rock interface which, from a practical standpoint, was the limit of hand augering. In very few cases could augering be continued to the full extended length of the auger - 10 feet. Analyses were carried out by atomic absorption.

Traverse 00N was sampled to test the geochemical effect of different rock types and a known, but weak, zone of mineralisation. Analyses for nickel (Figure 12a) are clearly related to the geology with enrichment at 1500E where minor base-metal mineralisation is known to occur. A simple visual comparison of analyses with the geology shows the method is useful to determine the general location of serpentinite. The sandstone contact at 3750E is sharply defined.

Copper analyses (Figure 13) showed markedly higher values in the hornsfelsic rocks from 1500W to about 00 and again from 3300E to 3700E. The zone of mineralisation from 1500E to 2000E has not shown up clearly. Nickel and copper values are not readily relatable.

Zinc values (Figure 14) show greatest variation in the tectonically disturbed and weakly mineralised zone east of the baseline. Anomalous values at the western end of the line have not been explained. The zinc values show general agreement with the nickel but do not emphasise so clearly the geological rock units.

Lead soil contents (Figure 15) are quite erratic and no explanation is offered and no visible correlations can be applied except in the vicinity of the fault at 2200E.

The choice of Ni, Cu and Pb and Zn was influenced by known mineralisation in this area.

Traverse 3500N was sampled to give a suite of results close to known sulphide mineralisation (Jupps Mine area) and cobalt was introduced as a possible means of distinguishing between sulphide and silicate nickel.

Nickel values (Figure 19) are again in excellent general agreement with the geology with the exception of the sample at 4500E which resampling suggested was originally caused by a poor sample. No conclusion can be drawn from the nickel values in the vicinity of Jupps Mine, i.e. from 700E to 1700E. There is generally fair correlation between the Ni, Co and Zn analyses undertaken (see Figures 20 and 21). The outstanding feature of the traverse is the anomalous zone from 2500W to 4000W. This is related to the geology and is strongly reflected by the cobalt and nickel values.

Confirmation of the anomalous zone from 2000W to 4500W was sought at parallel traverses 3000N and 4000N. On both traverses (see Figures 16, 17 and 18 and 22, 23 and 24, respectively) the different elements show excellent agreement and the anomaly is strongly confirmed on traverse 4000N; more weakly on traverse 3000N. Some westward displacement of the anomaly is presumed on account of the steep terrain.

Traverse 9000N (Figure 25) has been sampled for nickel only from 2000W to 5280W. The area was selected because of the presence of very minor pyritic sulphides in the serpentinite and a very substantial magnetic anomaly. The geology is again reflected in the results with two very high values.

being recorded from "rock samples" from a small laterite zone.

Geochemical determinations for copper were made on samples from sections of traverses showing higher than normal nickel values. These were consistently low and did not show any relationship to the nickel values (Figures 22,25 & 27).

Assay determinations for copper and nickel made on samples taken over magnetically anomalous zones on 10500N gave values which correspond well with the rock type but which weren't anomalous (Figure 26).

On 11000N (Figure 27), the sample from 1500W to 5000W the laterite gave surprisingly low value while the dunite reflected its composition with some very high nickel contents.

5.4 Geophysics

5.4.1 Magnetics (see Figures 28 and 29-50)

Ground magnetic coverage was completed on all lines from 00N to 10500N and contoured. A Sharpe MF1 Magnetometer was used throughout the survey.

In general, the magnetics are a direct reflection of the geology with the magnetite-rich peridotite and serpentinite controlling the distribution of the stronger anomalies. Most of the magnetic picture may be ascribed directly to the presence of the magnetite in these rocks.

Drilling of H1 and H4 in zones of strong magnetitic disturbance suggest that although the known heazlewoodite occurrence is with magnetite, the magnetite is ubiquitous in particular rock types and, at best, it can only be said that some magnetite sometimes has heazlewoodite associated with it.

5.4.2 Induced Polarisation (Figure 51)

An Induced Polarisation survey was carried out by McPhar Geophysics Pty. Ltd. Coverage is shown in Table 3. The specific intention of the survey was twofold.

1. To try to detect near surface localised mineralisation; and
2. To test for deeper bulk mineralisation.

Electrode spreads were initially planned to be 100' and 300'. As the survey progressed and many large, deep anomalies were located, more emphasis was placed on the wider separations. The lines surveyed were selected to cover the following areas:

1. The known mineralised zone near the Lord Brassey Mine which was covered from 3500N to 6000N (Figures 51-59).

2. The area with a strong geochemical anomaly at about 3500W on lines 3500N and 4500 (Figures 51 and 53).

3. A zone with much rodingite dyking just west of the baseline at 7000N (Figure 60).

4. The western side in an area of intense magnetic disturbance and moderately high nickel values, on lines 8500N to 9500N (Figures 61,62,63,64).

5. Resulting from 1 above, lines 5000N and 5500N were run west of the baseline to cover a strongly anomalous zone at depth.

The two outstanding features of the survey were:

1. The high background I.P. effects found whenever the survey crossed serpentinite. This is best illustrated on the eastern end of lines 4000N (Figure 52) at about 1900E and 4500N (Figures 53 and 54), also at about 1900E. At these points the geological mapping showed a change in rock type from serpentinite on the west to serpentinised peridotite, which is much less altered, in the east.

   It is thought likely that this high background with frequency effects ranging from about 5% to 10% is due to some 4% to 5% disseminated and veined magnetite. This view is supported by laboratory I.P. tests on rock and drill core samples.

2. The multitude of anomalies, large and small, which apparently have no surface expression. These anomalies fall into two categories: those which occur as far as can be seen entirely within the serpentinite mass and those which appear to be related to a contact between two rock types. The anomaly between 900E and 1000E on line 4500N (Figure 53) typifies the former group while those at 500W on 5000N (Figure 57) and about 3800W on 9000N (Figures 62 and 63) the latter.

Continuation of the I.P. survey over the whole area would certainly have produced a multitude of further anomalous zones of a similar nature.

At this stage it was decided to draw up a drilling program to test a number of I.P. anomalies in different geological and magnetic situations.

6.5 Diamond Drilling

Four drill holes were sunk for a total of 2,783 feet of drilling. Contractors A.S. James Pty. Ltd. of Melbourne supplied a F25A Mindrill rig with wireline equipment and drilled BQ size throughout.

D.D.H. H1 (Figure 7 and Appendix III) was collared at 5000N, 200W and drilled west at -55°. An acid tube survey showed a steepening of angle as the hole progressed. The hole was terminated at 783 feet.

The purpose of this bore hole was to test a massive anomaly found by the I.P. survey at some depth at about 450W to 600W on line 5000N (Figure 57). The anomaly appeared to be situated on, or close to, a contact between serpentinite and pyroxenite. There was no surface indication of mineralisation. The drill hole passed through the expected contact at about 500 feet and was continued to 783 feet without intersecting any sulphides. Geological and magnetic correlation of surface rocks and drill core suggest and east dipping contact between the serpentinite and the pyroxenites.

Sludge and some split core samples were taken from 500 feet to the end of the hole and analysed for nickel and sulphur (Figure 7). Nickel values are only background for serpentinites. Sulphur values are not significant and are unreliable because of the sulphur content in the drilling mud used throughout this hole.

Four samples were taken from the core from below 500 feet and tested for I.P. effects (Figure 7). Two of these were mineragraphically examined and no sulphides were reported (Appendix II). Magnetite content was found to be between 4% and 5%.

It would appear that the anomalous zone was tested by this drill hole, however, the results are hard to equate with the magnitude of the I.P. anomaly. The cause for this discrepancy is not apparent.

D.D.H. H2 (figure 8 and Appendix III) was collared at 4500N 800E and commenced drilling at -50° to the east. The hole steepened as it progressed and was stopped at 400 feet.

This hole was selected to test a sharp, near surface, I.P. anomaly in serpentinite (Figure 53 and 54). The anomalous zone is situated beneath the Lord Brassey Mine and about 200 feet along the projected strike for the mineralised veins and shears seen in the mine.

The hole passed through serpentinite with pyroxenite bands or dykes for its whole length and no sulphide mineralisation was seen. Sludge and some core samples were taken from 100 feet to the end of the hole and gave no indication of the presence of nickel. Shearing and magnetite are recorded in the log. No other cause for the anomaly was seen.

D.D.H. H3 (Figure 9 and Appendix III) was collared at 5599N 2250E and commenced drilling west at -50°. The site was selected to test a broad I.P. anomaly between 1800E and 2100E on line 5500N (Figure 58). This anomaly coincides with a known heazlewoodite occurrence at the surface in a zone of shearing in serpentinite.

Sludge samples were taken from 1500 feet to the completion of the hole at 800 feet and show no nickel values above normal background for the serpentinite intersected throughout the whole length of the hole.

D.D.H. H4 (Figure 10 and Appendix III) was collared at 9000N 4520W and commenced drilling east at -50°. The site was selected to test an I.P. anomaly between 4000E and 4300E on line 9000N. The rock traversed was principally brecciated serpentinite which contained veins and disseminated specks of magnetite and chrome bearing spinels. Split core samples were assayed and gave values for nickel of 0.22% or less.

Laboratory I.P. determinations were made on core samples taken at approximately 50 foot intervals (Figure 9). Two samples were mineragraphically examined and no sulphides were reported (Appendix II).

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TABLE I

RAINFALL RECORDS - WARATAH

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1954	101	521	740	605	1077	956	735	1229	773	561	412	499	8209
1955	437	301	205	794	953	545	1393	1831	425	942	1009	472	9307
1956	674	219	218	1235	729	1200	900	1231	740	758	991	973	9868
1957	438	299	564	1056	1314	674	303	409	643	810	799	787	8096
1958	411	242	615	389	2122	795	954	1254	269	1352	709	458	9569
1959	147	604	246	810	346	688	664	1338	416	669	314	800	7042
1960	279	565	246	1195	1380	740	1040	561	581	720	867	114	8288
1961	86	226	202	790	726	1062	808	579	528	569	415	560	6551
1962	180	559	648	250	950	1965	920	1152	854	900	696	198	9272
1963	358	261	527	395	327	513	924	885	1106	167	539	287	6289
1964	704	717	565	451	1127	911	1499	1518	1322	564	616	793	10791
1965	330	191	726	563	1458	1089	840	391	907	366	612	317	7790
1966	271	159	487	877	944	395	1227	605	550	393	566	358	6832
1967	442	189	316	450	273	436	715	772	709	643	788	643	6376
1968	183	440	394	970	1610	1235	1057	1511	1107	1260	1675	280	11722
1969	478	643	403	830									

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Avera
Av. All Yrs.	461	361	510	686	800	911	949	930	911	834	669	576	85.

TABLE II

WET DAYS - WARATAH

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1954	11	23	30	26	26	30	30	29	28	23	25	24	305
1955	24	19	22	21	29	30	31	31	29	31	30	19	316
1956	21	12	20	30	30	25	26	31	27	26	28	29	305
1957	23	14	20	27	31	27	30	28	28	30	27	N.R.	-
1958	17	15	23	20	30	28	29	27	25	23	18	17	272
1959	7	15	18	19	27	26	27	28	27	22	16	26	258
1960	11	18	17	27	26	23	29	29	23	21	28	8	260
1961	9	12	15	20	29	22	25	22	17	25	16	18	230
1962	12	17	16	23	28	28	29	29	21	26	21	14	264
1963	15	15	16	25	25	19	29	25	23	21	18	11	242
1964	22	16	19	21	29	20	28	29	25	23	20	26	278
1965	15	10	23	20	24	22	26	21	23	16	19	15	234
1966	11	13	16	24	23	22	25	21	22	16	18	17	228
1967	17	8	19	19	13	22	24	24	24	21	19	N.R.	-
1968	11	17	17	26	30	25	31	28	28	27	25	18	283
1969	17	19	19										

N.R. - Not Recorded

TABLE III

INDUCED POLARISATION COVERAGE

Traverse	From	To	Spread
3500N	2000W	4100W	300'
4000N	2700E	4100W	300'
4500N	3000E	00	100'
4500N	900W	2700E	300'
4500N	3500W	2000W	300'
5000N	100E	1700E	100'
5000N	1800W	3000E	300'
5500N	1800W	3000E	300'
6000N	00	3000E	300'
7000N	2200W	500E	300'
8500N	4500W	3000W	300'
9000N	4400W	2400W	100'
9000N	5200W	2200W	300'
9500N	5200W	2200W	300'

MINERAGRAPHIC DESCRIPTION OF SAMPLES S 776 AND S 777.

Ore minerals present:

magnetite, in veins;
?chromite - magnetite, in scattered individual grains;
magnetite, fine-disseminated, residual.

At least part of the gangue mineral is carbonate, the host rock is serpentinite.

An examination of a polished section of both specimens reveals that the opaque minerals in each have essentially the same composition, and relationships. These minerals consist of magnetite, and composite grains of magnetite - spinel - group-mineral. They may be differentiated into three separate generations, equivalent to the three generations of opaque minerals found in thin sections S774 and S775. - (Mineralogical report no. 28.)

These three generations are:

1. Subhedral roughly equidimensional, single grains, average diameter about 0.2mm. These are irregularly and randomly scattered throughout the serpentinite rock matrix. In thin section (S773 to S775) these were found, (in part at least), to be transluscent - red-brown. They make up a maximum of 10% of the polished sections examined.

   In polished section these grains consist mainly of a mineral which has optical properties very similar to chromite. (Dark grey colour, isotropic, red-brown internal reflection). The grains have a crude subhedral spinel form. These properites, the mineral form and association suggest that the mineral is chromite, however this identification could not be confirmed optically.

   An analysis of this rock for chromium showed that it contained only 0.5% Cr (see enclosed geochem. results sheet). If the mineral described above was chromite, then this assay would be expected to be higher. It is therefore probably not chromite, but a positive identification can be made by X-ray diffraction if required.

   The ? chromite grains almost invariably contain irregularly intergrown inclusions of magnetite. In some of these grains magnetite is more abundant than the ?chromite. This variation is reflected in the magnetic susceptibility of these grains, since in a crushed sample of this rock, they show variable strength of attraction to a hand magnet.

   In S776 these ?chromite-magnetite grains are scattered through most of the section as described above. In part of the section however these grains are concentrated

../2

1. (cont'd)

into a rather loosely formed granular aggregate, which has a carbonate gangue.

This ?chromite-magnetite is an inherent component of the original rock from which this serpentinite derived. The aggregate of these grains in S776 may be part of a primary differentiated band of magmatic segregation type mineralisation.

2. The second generation magnetite forms very fine grains. These are commonly slightly elongated, and are distributed along relict cleavage planes and around the relict margins of the original pre-serpentinite mineral. Such a distribution causes this magnetite to form trains, and patchy, extremely fine network structures throughout the rock.

This magnetite is a residual product formed during the alteration of the pre-existing mafic mineral to serpentine.

3. The third generation of ore minerals consists of magnetite which is localised in irregular veins up to 2mm wide, and which randomly cut through the rock. This magnetite forms aggregates within the veins of fine, angular, and apparently brecciated, grains.

It is interpreted that this generation magnetite is epigenetic, possible introduced after the formation of the serpentinite.

I R Pontifex.

I.R. PONTIFEX

IRP/BA

Encl.

033

995035

D.D.H. H4 - 20'6"

S-773

Rock Name:	Brecciated serpentinite.	
Components:	Serpentine	85-90%
	Actinolite-tremolite and associated ? talc	3-5%
	Opaques, individual scattered grains (?spinel)	3-5%
	Opaques, fine grains in veins	3-5%

This section consists almost entirely of serpentine, most likely the mineral antigorite. It occurs in patches of minute flakes which grade imperceptibly into platey to fibrous aggregates in which individual flakes have a more-or-less parallel arrangement.

The massive serpentine aggregate is cut by abandant irregularly oriented stringers and veins consisting partly of an extremely fine, fibrous-acicular mineral, almost certainly actinolite-tremolite. The actinolite tremolite is associated with subordinate serpentine and minor, fine carbonate and/or talc. The abundant veins indicate that this rock has been severely tectonically disturbed, many of the veins are roughly parallel and suggest that the rock has been sheared.

The rather heterogeneous, felted mass of serpentine gives no indication of the composition or texture of minerals from which this mineral may have derived.

Opaque mineral grains are scattered throughout the section, these fall into two distinctly different types which indicates two different generations.

(a) Subhedral, equidimensional, single grains, average diameter about 0.15mm. These are transluscent-brown. They are evenly scattered throughout the serpentine groundmass. Some have a spinel-like form.

(b) Much fine, more-or-less angular opaque grains which may be flakey. These occur in irregular clumps and trains, ranging from dust size to 0.1 mm. These opaques are mainly restricted to the abundant veins cutting the section. An examination of these under stereobinocular microscope indicates that they are mainly magnetite.

D.D.H. H4 - 400'

S-774

Rock Name:	Brecciated serpentinite.	
Components:	Serpentine	85-90%
	Serpentine-mainly chrysotile, veins	5%
	'Opaques', individual scattered grains (?spinel)	3-5%
	Opaques, fine grains in veins	3-5%
	Opaques, very fine, residual in altered mineral	1-2%

../2

S- 774 (cont'd)

Macroscopically this specimen is darker green than the rather bleached looking specimen S-773; the mineralogy of both sections however is essentially the same. This section, S-774, consists almost entirely of massive, felted aggregate of serpentine. A character of this serpentine, not obvious in S-773, is that it contains abundant inclusions of minute elongated opaque grains which in a given aggregate are all oriented within one or two sets of common parallelism. These appear to mark relict cleavages of pre-existing minerals, most likely pre-existing pyroxenes, since in several areas these opaques form a strongly developed schiller structure. The relict outlines of pre-existing minerals are marked in some places by a train of very fine opaque minerals of the same generation.

This rock is cut by abundant randomly oriented stringers and veins which consist mainly of chrysotile. Some of these have a continuous core of opaque mineral, others have a margin of opaque mineral. In some veins, fine opaque minerals form cross-vein lamellar. These opaque minerals are analogous to the type (b) described in S-773.

A third type (or generation) of 'opaque' mineral grains in this specimen is equivalent to the type (a) in S-773. This forms individual, roughly equidimensional rounded grains up to 0.2mm which are randomly scattered through the serpentine aggregate. They have diffuse, corroded-looking margins, most are transluscent-dark brown and are probably a variety of spinel.

D.D.H. H4 - 796'6"

S-775

Rock Name:	Serpentinite.	
Components:	Serpentine	95%
	'Opaques' individual scattered (?spinel) grains	2-3%
	Opaques, fine grains and aggregates in veins	2%
	Opaques, residual, minute disseminated grains	1-2%

The composition of this section is essentially the same as that of S-774. The rock consists almost entirely of massive serpentine which in this section shows a fairly well-developed "mesh" and "hour glass" structure, which appear to be inherited from the morphology of a largely pyroxene aggregate which has subsequently been serpentinised. Minute opaque mineral grains which form a schiller structure in places are disseminated. The section is cut by two roughly parallel stringers of chrysotile and associated fine opaque minerals of the characters described as occuring in veins in S-774.

../3

S775(Cont'd)

Subrounded, more-or-less equidimensional individual 'opaque' grains up to 0.2 mm across are scattered through the section, and these are the same generation opaques as similar grains described in the sections S-774 and S-773. Many of these grains have a spinel type form, and are transluscent-brown.

I.R. PONTIFEX

IRP/BA

NICKELIFEROUS SPECIMEN FROM HEAZLEWOOD, TASMANIA

A small sample of lode material from "a trench and adit about 1500 feet north-east of the Lord Brassey Mine, Heazlewood" was submitted by Amax Mining (Australia) Inc. for mineragraphic examination.

The sample consists of a fragment of serpentinite (principally antigorite) with thin coatings and irregular narrow veinlets, up to 1 mm. wide, of emerald-green zaratite (basic nickel carbonate of variable composition). Irregular veinlets and patches, up to 5 mm. wide and several cm. long, of intergrown magnetite and nickel sulphides are abundant.

The nickel sulphides consist of heazlewoodite (Ni_3S_2) which is extensively - much of it completely - altered to millerite (NiS). The altered heazlewoodite occurs as granular aggregates, up to several millimetres across, with individual grains up to 0.3 mm. in diameter. Fractures and grain boundaries are filled with antigorite, minor chlorite and occasionally zaratite, suggesting that serpentinisation and oxidation both post-dated crystallisation of the sulphides.

Intergrown with the heazlewoodite-millerite aggregates are irregular patches, from a few microns up to 0.1 mm. wide, of violarite($(Ni,Fe)_3S_4$), possibly with some minor inclusions of bravoite ($(Ni,Fe)S_2$); the latter are only a few microns wide and are impossible to distinguish with certainty from the violarite.

The magnetite invariably contains abundant tiny inclusions, usually less than 30 microns across, of heazlewoodite. Although

there can be no doubt of the high nickel grade of this sample overall, it is necessary to point out that these small inclusions might pose metallurgical problems which would need to be considered when evaluating gross assay data. It would be premature, however, to estimate their significance on the basis of a single sample.

The mineralogy suggests that the sample submitted is a partly oxidised equivalent of a primary heazlewoodite-pentlandite assemblage. Although no pentlandite is present in the two polished sections examined, it has been reported from the Lord Brassey Mine, and it is known from other occurrences to alter to violarite in oxidised zones (e.g. at Kambalda). Heazlewoodite is a rare mineral and its behaviour under oxidising conditions is not known; however the textural associations in this sample support the suggestion that it alters initially to millerite, with the released nickel being available for crystallisation of zaratite.

Other minerals previously reported from the Lord Brassey Mine, including awaruite, chalcopyrite and the secondary nickel carbonate hellyerite, were not identified in this sample.

K.L. Williams
November, 1968

039

995040

S-Z Exploration Services.

REFERENCE NO. B604.

SAMPLE NO. H1 583.

POLISHED SECTION:

97%	Sheared serpentinite - very friable material.
1-2%	Magnetite - 0.1 - 0.5mm. Octahedra, (euhedral to subhedral).
1-2%	Magnetite - 0.5 - 2mm. Very irregular streaky patches often intergrown with silicates.

No sulphides observed.

Magnetite occurs in two generations: the euhedral generation probably representing the magnetite which was originally present in the rock before serpentinisation, and the streaky irregular patches representing magnetite formed during serpentinisation and later shearing.

040

995041

McPHAR GEOPHYSICS PTY. LTD.

2nd May, 1969

EXAMINATION OF DRILL CORE "AMAX NO. H1+700"

This specimen is a serpentinite rock. A darkish green matrix made up of serpentine minerals contains scattered cloudy white patches which are possibly highly altered felspar crystals.

The matrix contains disseminated magnetite grains and also thin stringers of magnetite. In the polished section examined, the larger magnetite grains measure up to 0.8mm in maximum dimension, they have a enhedral to sub hedral form and an apparent random distribution. Magnetite also occurs in finer, dust-like grains, these commonly form small aggregates throughout the matrix.

Thin discontinuous stringers of magnetite, generally about 0.3mm wide and up to 3mm long are common throughout the section. These are roughly parallel, and occur along foliation planes; they are made up of aggregates of fine magnetite.

A visual estimate of the total magnetite content in the section examined is about 5%.

It is suggested that the coarse magnetite grains are primary, and crystallised with the original rock. The fine magnetite, (including that forming the stringers) is probably secondary, and developed during the serpentinisation of the original rock.

Magnetite was the only opaque mineral recognised in the polished section.

I.R. PONTIFEX.

041

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APPENDIX I

995042

P.O. Box 65, Kedron 4031

Phone: 57 6082 Brisbane
Cables: "Exserv" Brisbane

PETROGRAPHIC REPORT
(Igneous and Metamorphic Rocks)

Lab. Ref: B427 Spec. No: 1

HAND SPECIMEN DESCRIPTION:

Type: Igneous

Colour: dark greenish grey Int. Rock Col. Code:

Grain Size: medium Texture: equigranular

Structure: massive

Minerals Visible: Orthopyroxene

FIELD NAME: Pyroxenite (?Bronzitite)

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	*Species*				
Orthopyroxene	Bronzite	75	0.5 - 4.0	1.5	Subhedral t granular
Amphibole	? Cummingtonite or Anthophyllite	10	0.1-0.3		fibrous aggregates
Mica	Talc	10	0.1		scaly aggregates
Felspar	Plagioclase (labradorite)	3	0.5 - 1.0		subhedral t interstiti
Clinopyroxene	diopside	1	0.3		anhedral
Opaques	magnetite ± ilmenite	1	0.01 - 0.3	discrete subhedral granule	
				granular aggregat along grain boundaries.	

Rock Texture: Structureless equigranular aggregates of polygonal bronzite grains with minor interstitial plagioclase and fine-grained alteration products.

Alteration: Veinlets of fibrous intergrown cummingtonite and talc locally developed. Gra boundaries lined with granular ? magnetite and minor talc and amphibole.

General Remarks: Bronzite exhibits exsolution lamellae of clinopyroxene.

Petrogenesis: Fairly typical ultramafic intrusive rock which has been subjected to relatively minor hydrothermal alteration.

Name BRONZITITE

042

S-Z EXPLORATION SERVICES

995043

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PETROGRAPHIC REPORT
(Igneous and Metamorphic Rocks)

Lab. Ref: B427 Spec. No: 2

HAND SPECIMEN DESCRIPTION:

Type: igneous

Colour: dark greenish black Int. Rock Col. Code:

Grain Size: medium Texture: equigranular

Structure: massive

Minerals Visible: pyroxene: cross cutting veins of serpentine

FIELD NAME: Partly serpentinised bronzitite

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	Species				
Orthopyroxene	Bronzite	90-95	0.5 - 3.0	1.5	granular
Olivine	Forsterite	1	0.5		anhedral
Talc		2	0.1		scely aggregate
Amphibole	? Cummingtonite	3	0.1 - 0.5		fibrous to prismatic
Serpentine	(in veinlet)	1			fibrous
Diopside ?		? tr.	0.5		anhedral
Opaques	? magnetite	<1	0.05 - 0.1		subhedral (octahedra) to granular

Rock Texture: structureless equigranular aggregate of polygonal bronzite grains

Alteration: partly altered to serpentine, talc and amphibole along grain boundaries. Alteration less than in sample No. 1.

General Remarks: Some grains of pyroxene show strain extinction & exsolution lamellae, cross cutting serpentine vein present.

Petrogenesis: Ultramafic intrusive which has been subjected to negligible hydrothermal alteration.

Name: BRONZITITE

043

S-Z EXPLORATION SERVICES

995044

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PETROGRAPHIC REPORT
(Igneous and Metamorphic Rocks)

Lab. Ref: B427 Spec. No: 3

HAND SPECIMEN DESCRIPTION:

Type: altered igneous

Colour: dark green Int. Rock Col. Code:

Grain Size: fine Texture: inequigranular

Structure: massive

Minerals Visible: serpentine, bastite, chrysotile veinlet

FIELD NAME: serpentinite

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	Species				
Serpentine	mesh structure of clinochrysotile	80			
	and/or lizardite veins criss-crossing				
	almost isotropic material				
	bastite (?antigorite replacing ortho-				
	pyroxene)	15	1 - 6	2	subhedral
Opaques	magnetite (slightly altered to	2	0.05 - 0.3		discrete
	leucoxene)		subhedra & fine granular trai		
	+ minor haematite		along grain boundaries		
carbonate or talc		tr			
Chalcedony		tr	in veinlets	0.2mm	wide
? Amphibole	? tremolite	< 5		fibrous	aggregates

Rock Texture: Structureless intergrown aggregate of massive serpentine with criss-crossing veinlets of ? clinochrysotile. Outlines of olivine grains only faintly visibl

Alteration: Olivine and orthopyroxene completely replaced by serpentine.

General Remarks:

Petrogenesis: Probably derived from peridotite with about 85% olivine, 15% bronzite by hydrothermal alteration.

SERPENTINITE

S-Z EXPLORATION SERVICES

995045

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PETROGRAPHIC REPORT

(Igneous and Metamorphic Rocks)

Lab. Ref: B427 Spec. No: 4

HAND SPECIMEN DESCRIPTION:

Type: igneous

Colour: mottled dark green & white Int. Rock Col. Code:

Grain Size: medium Texture: equigranular

Structure: massive

Minerals Visible: altered ? plagioclase; pyroxene

FIELD NAME: melagabbro

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	Species				
Orthopyroxene	Bronzite	75-80	0.5 - 4.0	1.5	subhedral to granular
Plagioclase	labradorite	5	1 - 2		interstitial
Clay minerals	(altered plagioclase)	10		cloudy	aggregates
Talc		4	0.01	scaly	aggregates
Amphibole	? cummingtonite	1-2	0.1		fibrous
Diopside		2	0.5 - 2.0	1.0	anhedral
Opaques	magnetite	1	0.05-0.2		subhedral to granular

Rock Texture: Structureless equigranular aggregate of polygonal bronzite grains and altered plagioclase

Alteration: parallel system of minute fractures lined with talc developed. Felspar highly altered.

General Remarks: clay minerals may be weathering product rather than the result of hydrotherma alteration.

Petrogenesis: Exsolution lamellae of clinopyroxene in orthopyroxene.

Ultramafic intrusive which has been subjected to minor hydrothermal alteratio

Name: FELSPATHIC BRONZITITE

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PETROGRAPHIC REPORT

(Igneous and Metamorphic Rocks)

Lab. Ref: B427 Spec. No: 5

HAND SPECIMEN DESCRIPTION:

Type: ? igneous (altered)

Colour: dark blackish green Int. Rock Col. Code:

Grain Size: medium to fine Texture: inequigranular

Structure: massive

Minerals Visible: serpentine, pyroxene and/or bastite

FIELD NAME: Serpentinite

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	Species				
Serpentine	clinochrysotile/lizardite veinlets	70			
	replacing olivine				
	isotropic interstitial serpentine	10			
Orthopyroxene	enstatite-bronzite	10	0.5 - 3.0	1.5	subhedral
					anhedral
Olivine	Forsterite	3	0.2 - 1.0		subhedral
					anhedral
Diopside		1	0.5		anhedral
Opaques	magnetite ± ilmenite	5	0.01 - 0.4		discrete granu
			to irregular		dusty granular
			aggregates		

Rock Texture: relict olivine grains and larger bronzite grains are surrounded by altered isotropic to cryptocrystalline serpentine. Olivine grains replaced by

Alteration: veinlets of ? clinochrysotile . Cores of fresh olivine often remain.

General Remarks: Orthopyroxene exhibits exsolution lamellae of clinopyroxene

Petrogenesis: ultramafic intrusive (peridotite) which has been almost completely serpentinised

Name: SERPENTINISED PERIDOTITE.

046

S-Z EXPLORATION SERVICES

995047

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Cables: "Exserv" Brisbane

PETROGRAPHIC REPORT
(Igneous and Metamorphic Rocks)

Lab. Ref: B427 Spec. No: 6

HAND SPECIMEN DESCRIPTION:

Type: Igneous

Colour: dark green Int. Rock Col. Code:

Grain Size: coarse Texture: equigranular

Structure: massive

Minerals Visible: pyroxene: bronzite ± diopeide

FIELD NAME: pyroxenite

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	Species				
Orthopyroxene	Bronzite	80	2-10	4	subhedral
					anhedral
Diopside		3-5	2 - 6		anhedral
Talc		5-7	0.01		granular scaly aggregates
? Cummingtonite		2-3	0.1-0.2		fibrous to prismatic
Felspar	plagioclase (labradorite)	1	2		interstitial
Quartz		<1	2		interstiti (filling cavity)
Opaques	? magnetite	<1	0.01-0.03		granular trails along cleavages, fractures & grain boundaries.

Rock Texture: inaequigranular coarse grained aggregate of bronzite

Alteration: altered to fine grained granular talc & ? cummingtonite along veinlets. Felspar altered to cloudy material.

General Remarks:

Petrogenesis: ultramafic intrusive; relatively unaltered.

BRONZITITE.

047

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PETROGRAPHIC REPORT

(Igneous and Metamorphic Rocks)

Lab. Ref: B 487 Spec. No: C 1

HAND SPECIMEN DESCRIPTION:

Type: Intermediate - Basic intrusive

Colour: Medium Grey-Green Int. Rock Col. Code:

Grain Size: Coarse grained Texture: Holocrystalline

Structure: -

Minerals Visible: Felspar

FIELD NAME: Diorite

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	Species				
Felspar	Plagioclase - acid labradorite (An 50-60)	45	0.2 - 2.0	1.0	Anhedra
	Potash felspar	10	0.15 - 1.5	0.8	Anhedra
Pyroxene	Augite	10		0.6	Anhedra
Amphibole	Actinolite (uralite)	24	0.06 - 2.0	1.0	Anhedra
Chlorite	(mainly alteration of amphibole)	10			irregular
Opaques	? magnetite	1		0.08	granular

Rock Texture: Holocrystalline, Allotriomorphic - granular

Alteration: Felspars are extensively (up to 80%) altered to sericite + minor chlorite and of the amphibole has been chloritised.

General Remarks: The amphibole appears to be secondary, (uralite) formed by hydrothermal alteration of most of the pyroxene.

Petrogenesis: The rock is a gabbro which has been somewhat hydrothermally altered causing sericitisation of felspars and uralitisation of pyroxene.

Name: ALTERED GABBRO.

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PETROGRAPHIC REPORT

(SEDIMENTARY ROCKS)

Lab. Ref: B487 Specimen No: C 4

Hand Specimen Description: Structure: -

Colour: Pinkish Brown Minerals Visible: -

Grain Size: Fine Grained Hardness: Mod. Hard.

FIELD NAME: ? DOLOMITE

Microscopic Description:

Minerals Present Group	Species	Est. Vol. %	Roundness *	Sphericity +	Size Range
Carbonate	? Dolomite	85			0.01 - 0.1 mm
Quartz	(Microcrystalline Chert)	14			Microcrystalline
Haematite		1			up to 0.08 mm
Rock Fragments:					
Matrix/Cement:					

* very angular.....1. angular.....2. sub-angular.....3. sub-rounded.....4. rounded.....5. well rounded.....6.
\+ equant.....1. elongate.....2. bladed.....3. platy.....4. irregular.....5.

Alteration Products:

Texture: Granular

Sorting: - Average Grain Size: 0.02 mm

Environment of Deposition: -

Provenance: -

Diagenesis: The rock is a dolomite which appears to have formed by dolomitisation of a siliceous sedimentary rock - probably a chert as traces of this can be seen in areas incompletely replaced.

General Remarks: Dolomite is the most probable carbonate species, however siderite could also be a possibility, although there is little sign of the iron staining which frequently accompanies siderite.

NAME DOLOMITE.

049

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PETROGRAPHIC REPORT

(Igneous and Metamorphic Rocks)

Lab. Ref: B487 Spec. No: C10

HAND SPECIMEN DESCRIPTION:

Type: Ultrabasic intrusive

Colour: dark grey-green Int. Rock Col. Code:

Grain Size: fine grained Texture: ? holocrystalline

Structure: -

Minerals Visible: Serpentine

FIELD NAME: Serpentinite

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	Species				
Serpentine	Antigorite	80		0.08	fibrous
Chlorite	irreg. patches & veinlets	10	microcryst		fibrous
Amphibole	tremolite	7		0.25	fibrous
Opaques	? Chromite	3		0.40	subhedral
Pyrite		trace			granular
limonite	staining	trace			

Rock Texture: Rock consists mainly of a fine grained fibrous network of serpentine.

Alteration: Slight surface weathering of the rock has occurred with slight limonite staining probably due to groundwater effects.

General Remarks:

Petrogenesis: The rock is a serpentinite, formed by hydrothermal alteration of an ultrabasic intrusive such as a peridotite or dunite. However, because all trace of the original texture and mineralogy has been obliterated, the nature of the original rock could not be determined.

Name: SERPENTINITE.

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PETROGRAPHIC REPORT

(Igneous and Metamorphic Rocks)

Lab. Ref: B487 Spec. No: C11

HAND SPECIMEN DESCRIPTION:

Type: Altered basic igneous rock or hornfels

Colour: dark gray-green Int. Rock Col. Code:

Grain Size: fine-medium Texture: holocrystalline

Structure: Rock cut by several veins.

Minerals Visible:

FIELD NAME: ? hornfels

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	*Species*				
Amphibole	Actinolite	65		0.2	irregular
Felspar	Plagioclase (albite-oligoclase)	25		0.25	anhedral
? Prehnite	mainly in veins	7		0.25	granular
Quartz		3		0.12	granular

Rock Texture: Recrystallised granular hornfelsic texture.

Alteration: Felspars show moderate alteration to sericite.

General Remarks: The ? prehnite is mainly confined to the veins which are visible in the hand specimen.

Petrogenesis: The rock is a low grade hornfels derived by contact metamorphism of a basic rock - probably a basic lava.

Name: ACTINOLITE - PLAGIOCLASE HORNFELS

051

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PETROGRAPHIC REPORT
(Igneous and Metamorphic Rocks)

Lab. Ref: B487 Spec. No: C14

HAND SPECIMEN DESCRIPTION:

Type: Ultrabasic intrusive

Colour: dark green-grey Int. Rock Col. Code:

Grain Size: fine-medium grained Texture: holocrystalline

Structure: -

Minerals Visible: serpentine

FIELD NAME: Serpentinite

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	Species				
Serpentine	antigorite + minor chrysotile	92		0.1	fibrous
Carbonate	? magnesite	3		0.2	irregular
Chlorite		2	Microcryst	-	fibrous
Opaques	? Chromite	3		0.08	granular subhedral

Rock Texture: Holocrystalline composed mainly of a fibrous network of serpentine

Alteration: All minerals are fresh in appearance

General Remarks: A relict texture suggesting a dunite is visible.

Petrogenesis: The rock is a serpentinite, formed by hydrothermal alteration of an ultrabasic intrusive, probably a dunite in this case, as relict outlines of olivine crystals are visible

Name: SERPENTINITE

052

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PETROGRAPHIC REPORT

(Igneous and Metamorphic Rocks)

Lab. Ref: B498 Spec. No: C21.

HAND SPECIMEN DESCRIPTION:

Type: Altered igneous

Colour: Brown Int. Rock Col. Code:

Grain Size: Very fine Texture: indistinct

Structure: Massive

Minerals Visible: Serpentine, magnetite

FIELD NAME: Altered Serpentinite

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	Species				
Serpentine	brownish serpentine + colourless variety (both probably clinochrysotile)	95-100		<0.1	fibrous
Opaques	magnetite ± ilmenite	1-2	0.1 - 0.3	0.2	irregul to granu

Rock Texture: Structureless aggregate of colourless and limonite stained serpentine showing mesh textures with minor irregular magnetite.

Alteration:

General Remarks: Opaques tend to occur in trails along fractures delineating out? of original ?olivine grains.

Petrogenesis: Probably derived from dunite by hydrothermal alteration.

Name: Serpentinite.

053

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PETROGRAPHIC REPORT

(Igneous and Metamorphic Rocks)

Lab. Ref: B498 Spec. No: C22

HAND SPECIMEN DESCRIPTION:

Type: Altered igneous

Colour: Mottled light & dark green Int. Rock Col. Code:

Grain Size: Coarse Texture: equigranular

Structure: Massive

Minerals Visible: Pyroxene, altered felspar

FIELD NAME: Altered gabbro

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	Species				
Grossularite		55			
Pyroxene	diopsidic clinopyroxene	35	1 – 8	5	subhedral
	hypersthene	1-2	1.0-2.0	1.5	subhedral
Alteration products:	various unidentifiable cloudy phases ± chlorite	5			
Opaques	magnetite ± ilmenite	3	0.5-4.0	2.0	interstiti

Rock Texture: Coarse grained structureless aggregate of diopsidic pyroxene with interstitial grossularite

Alteration:

General Remarks: probably highly altered; pyroxene and opaques the only original phases. Grossularite very unusual

Petrogenesis: very similar to C24.

As for C24: probably a rodingite type of rock.

Name: Grossularitized ? gabbro.

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PETROGRAPHIC REPORT

(Igneous and Metamorphic Rocks)

Lab. Ref: B498 Spec. No: C24

HAND SPECIMEN DESCRIPTION:

Type: Igneous (altered)

Colour: Mottled whitish & blackish green Int. Rock Col. Code:

Grain Size: /Coarse Texture: Equigranular, hypidiomorph

ructure: Massive

Minerals Visible: Pyroxene, ? altered ? felspar

FIELD NAME: Altered gabbro

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	*Species*				
Grossularite		65			
Pyroxene	Hypersthene	15-20	1.0-4.0	2.0	subhedr
	Diopsidic augite	5-10	0.5-2.0	1.5	subhedr
Chlorite +	various other alteration products	5		0.1	scaly
Opaques	magnetite ± ilmenite	2-3	0.5-1.5	1.0	intersti irregula
	leucoxene	tr.			
Green hornblende		1-2	0.5-2.0	1.5	prismati

Rock Texture: Coarse grained aggregate of subhedral pyroxene grains surrounded by isotropic, Ca garnet, with minor opaques and

Alteration: various alteration products.

General Remarks: Probably highly altered: the pyroxene and the opaques being only original minerals.
The presence of ?grossularite is most unusual.

Petrogenesis: Possibly represents an eucrite or a hypersthene gabbro, in wh the plagioclase has been directly or indirectly replaced by grossularite (calcite may have been an intermediate alteration product.) The mineral assemblage is suggestive of a rodingite association.

Name. Grossularitised ?gabbro

055

995056

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PETROGRAPHIC REPORT

(Igneous and Metamorphic Rocks)

Lab. Ref: B498 Spec. No: C26

HAND SPECIMEN DESCRIPTION:

Type: ? Meta igneous

Colour: Mottled dark & light green Rock Col. Code:

Grain Size: medium to fine Texture: indistinct

ructure: massive

Minerals Visible: ? Serpentine

FIELD NAME: ? altered serpentinite

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	Species				
Serpentine	Clinochrysotile ± antigorite	65		<0.1	fibrous
Clinopyroxene	Diopsidic variety	2-3	0.5-1.0	0.7	subhedr
Grossularite		20	1 - 4	2	irregul
Unknown	cloudy alteration products	10-15			
Magnetite		tr.		0.1	granula

Rock Texture: Structureless aggregate of mesh-textured and veined serpentin with irregular patches of grossularite, and scattered grains

Alteration: of pyroxene. Considerable alteration and recrystallisatio has occurred.

General Remarks: Grossularite is very unusual in a rock of this type.

Petrogenesis: May have been a dunite or peridotite (possibly felspathic) which has been grossularitised, due to replacement of ?plagioclase either directly or indirectly by grossularite.

Name: Serpentinised grossularitised ultrabasic rock.

056

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995057

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PETROGRAPHIC REPORT

(Igneous and Metamorphic Rocks)

Lab. Ref: B498 Spec. No: C 27

HAND SPECIMEN DESCRIPTION:

Type: Metamorphic or meta igneous

Colour: Light green Int. Rock Col. Code:

Grain Size: very fine Texture: indistinguishable

Structure: massive, with veins of ?slickensided material

Minerals Visible: ?chlorite, altered ?antigorite along joints

FIELD NAME: ?low grade metamorphic rock or highly altered serpentinite

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	Species				
?Amphibole	(?tremolite) or ?Wollastonite	75	0.1 - 0.3	0.2	indistin ragged prismati aggregate
Chlorite		15		0.1	scaly to granular
Serpentine	? clinochrysotile	5			in veins
? Grossularite		5		0.1	granular
? Diopside		tr.			
Chalcedony		tr.			in veins

Rock Texture: Weakly lineated, very indefinite, finegrained aggregate of ragged ?amphibole, with interstitial granular chlorite and grossularite

Alteration: Very intergrown texture, some patches almost glassy. Probably represents almost complete alteration of another rock.

General Remarks: A very puzzling rock.

Petrogenesis: Two possible origins are indicated for this rock: a) a highly altered and metasomatised serpentinitic rock, or contact rock near serpentinitic rocks. b) a type of very impure calc-sil rock.

Name: ?Calc silicate hornfels (altered).

057

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PETROGRAPHIC REPORT
(Igneous and Metamorphic Rocks)

Lab. Ref: B498 Spec. No: C29.

HAND SPECIMEN DESCRIPTION:

Type: ?metamorphic or altered igneous

Colour: Green Int. Rock Col. Code:

Grain Size: medium to fine Texture: indistinct

Structure: Massive to weakly layered

Minerals Visible: ?actinolite ?chlorite

FIELD NAME: ?

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	Species				
Amphibole ?	(?tremolite) or ?Wollastonite	40	0.1 - 0.4	0.3	ragged prismati
Serpentine	clinochrysotile ± antigorite	40		0.1	fibrous intergr
? Grossularite		15-20	0.1-0.2		irregula granula
Chlorite		tr.			
Magnetite		tr.			

Rock Texture: Structureless, indefinite, fine-grained, very intergrown aggreg of amphibole or wollastonite and serpentine with minor chlori

Alteration: Probably highly altered.

General Remarks: Similar to C27: origin very puzzling.

Petrogenesis: As for C27. Two origins are again indicated: appears to be hi altered serpentinite in part, and calc-silicate rock in part. May represent a serpentinite which has been subjected to calc metasomatism, and subsequently recrystallised.

Name: ? Calc Silicate Rock (derived from ? Serpentinite).

058

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PETROGRAPHIC REPORT
(Igneous and Metamorphic Rocks)

Lab. Ref: B 604 Spec. No: H.I. 405

HAND SPECIMEN DESCRIPTION:

Type: ? igneous

Colour: dark greenish grey Int. Rock Col. Code: 5G 4/1

Grain Size: medium to fine Texture: equigranular

Structure: structureless, with v. dark green fault gouge - like material & slickensides (along joints.

Minerals Visible: ? amphibole, plagioclase

FIELD NAME: ? metadolerite

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	Species				
Plagioclase	Bytownite ~ An 80	40	0.2 - 0.8		subhedral
					granular
Clinopyroxene	diopsidic	30	0.5 - 1.0		subhedral
					subophiti
Orthopyroxene	Bronzite	5-7	0.5 - 1.5		subophiti
					to irreg
...tered orthopyroxene	(chloritic material?)	20			
Magnetite ±	ilmenite	tr	0.1 - 0.2		granule
Leucoxene		tr			
Alteration products along joints (? vermiculite, ? hydromuscovite etc.) (would require Xray work for accurate identification)		4			
? Serpentine		tr.			

Rock Texture: medium to fine grained granular, structureless.

Alteration: Extensively altered: orthopyroxene 4/5 altered (but clinopyroxene fresh) plagioclase ± altered to clay minerals & minor sericite ± prehnite.

General Remarks: Orthopyroxene contains irregular exsolved patches of clinopyroxene.

Petrogenesis: possibly represents a more felspathic variant associated with intrusive ultrabasic rocks, or a later intrusion (e.g. dyke) which has been subsequently hydrothermally altered and extensively sheared.

Name: ALTERED MICROGABBRO

995060
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059

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PETROGRAPHIC REPORT

(Igneous and Metamorphic Rocks)

Lab. Ref: B 604 Spec. No: H.I. 583

HAND SPECIMEN DESCRIPTION:

Type: metamorphic - altered igneous

Colour: greenish black Int. Rock Col. Code: 5GY 2/1

Grain Size: extremely fine Texture: -

Structure: sheared & slickensided

Minerals Visible: Serpentine? whitish mineral along shears

FIELD NAME: Sheared serpentinite

MICROSCOPIC DESCRIPTION:

Minerals Present		Est. Vol. %	Size Range (mm)	Av. Size (mm)	Texture
Group	Species				
Serpentine	clinochrysotile ± antigorite	85-90	0.1 - 0.2		fibrous t lamellar intergrow
	Bastite (antigorite after ? orthopyroxene)	5	1-4		anhedral bent
	?chlorite	< 1	0.1 - 0.3		
Magnetite		1-2	0.1 - 0.5		subhedral granular
		2	1-4		streaky, irregular patches.

Rock Texture: Consists mainly of a complex mesh-like framework with subparallel veinlets. Magnetite occurs in streaky patches along subparallel fractures.

Alteration: Completely altered and serpentinised.

General Remarks: No relict textures are visible (e.g. outlines of original olivine grains) ra irregular veinlets of finer grained, recrystallised antigorite occur paralle to the shears.

Petrogenesis: Probably represents a serpentinite which has been sheared and slightly recrystallised. Ultimately derived from dunite or peridotite with approx. 5 - 10% pyroxene by serpentinisation.

Name: SERPENTINITE

060

995061

APPENDIX II

2 MILES.

JONES TRACK

WARNER CK.

BURGESS CK.

S.P.L.37
HEAZLEWOOD
IN FORCE UNTIL

NICKEL PROS. SYN. N/L
7 - 11 - 68

6 S.M.

3 MILES

3 MILES

S.P.L. HEAZLEWOOD LICKEL

31M 80
57
HEAZLEWOOD
NICKEL PROSP.
SYN.
M.L.

276 40
91M

CK.

10M 80
39

2/4
91MC

NICKEL

75.0.25

4.2.39
MC

HEAZLEWOOD RIVER

3165 77
MC

275
91MC

2 MILES

2A.M.

20M.

995062

APPENDIX III

70-644

061

AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H. 1

roject 357/HEAZLEWOOD | Co-ordinates 5,000N, 200W | Declination 55° | Drilled by A.S. JAMES PTY. LTD. | Page 1 of 10

ocation HEAZLEWOOD | Elevation APPROX. 1,290' | Bearing 270° | Drill MINDRILL F25A | Date commenced March 17, 1969

Logged by J.F.G./J.P.M. | Date completed April 16, 1969

NW.PS CORE RECOVERY: 86%

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni
0	16'8"	16'8"	5'11"	38%	BQ		Rubble on site - boulders of serpentinised, grossularitised,				
							possibly felspathic ultrabasic rock and serpentinite.				
6'8"	42'	25'4"	15'	59%			Serpentinite - some grossularitisation, spotty, green and white.				
							Shearing at 47° to core.				
at	42'						1" vein of coarse grossularitised gabbro or rodingite. Lies at				
							60° to core but not in plane of shear.				
2'	43'	1'	8"	66%			Serpentinite - spotty green, black and white-grey.				
3'	44'	1'	1'	100%			Serpentinite - possibly serpentinised, fine grained,				
							Pyroxenite dyke - grey to brown-grey-green. Course grained				
							compositional layer at 45° to core.				
4'	44'3"	3"	3"	100%			Gabbro - coarse grained, grossularitised (rodingite).				
4'3"	45'	9"	9"	100%			Serpentinite - very broken and sheared. Some altered pyroxenite (?).				
5'	45'3"	3"	3"	100%			Rodingite - coarse grained, altered gabbro.				
5'3"	46'6"	1'3"	1'3"	100%			Serpentinite - strong shear at 50° to core at 46'9". Mottled				
							green and grey-green with white veinlets.				
6'6"	47'3"	9"	9"	100%			Serpentinised pyroxenite - strongly sheared in many directions.				
							Terminates on shear at 20° to core				
							in direction opposing that at 46'9"				
7'3"	48'9"	1'6"	1'6"	100%			Serpentinite - spotty green, grey-green and white. Med. grained.				
8'9"	51'9"	3'0"	2'0"	66%			Serpentinite - fine grained - grey-white, talcy.				

995063 70-644 062

AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H. 1

Project 357/HEAZLEWOOD | Co-ordinates 5,000N, 200W | Declination 55° | Drilled by A.S. JAMES PTY. LTD. | Page 2 of 10

Location HEAZLEWOOD | Elevation APPROX. 1,290' | Bearing 270° | Drill MINDRILL F25A | Date commenced March 17, 1969

Logged by J.F.G./J.P.M. | Date completed April 16, 1969

N.W.P.S

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni
1'9"	52'0"	0'3"	0'3"	100%	BQ		Serpentinite - spotty black and white, grossularitised, veins of rodingite.				
2'0"	53'4"	1'4"	1'4"	100%			Serpentinite and rodingite - strongly sheared. Rodingite veins more of less random through zone.				
3'4"	56'0"	2'8"	2'3"	85%			Serpentinite - light grey-green, strongly sheared at 30° and 15° to core. Compositional banding at 15° to core. Talcy.				
6'0"	61'3"	5'3"	3'9"	71%			Serpentinite - soft-black, fine grained.				
1'3"	62'4"	1'1"	1'1"	100%			Serpentinite - as above but sheared with veins of calcite and dolomite.				
2'4"	65'4"	3'0"	2'9"	92%			Rodingite and grossularitised gabbro dykes in sheared talcy serpentinite.				
5'4"	69'0"	3'8"	3'8"	100%			Serpentinite - granular-pale green and white, may be after peridotite or dunite. Occasional dolomite filled shear at 47° to core in various orientations.				
9'0"	70'9"	1'9"	1'9"	100%			Serpentinised pyroxenite - spotty black-grey and white, medium-fine grained - pyroxenes still visible. Compositional layer at 47° to core.				
0'9"	72'4"	1'7"	1'7"	100%			Serpentinite - granular - pale green and white.				
2'4"	72'11"	7"	7"	100%			Serpentinite - black veined at 55° to core with calcite and dolomite in shears.				

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AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H. 1

Project 357/HEAZLEWOOD Co-ordinates 5,000N, 200W Declination 55° Drilled by A.S. JAMES PTY. LTD. Page 3 of 10

Location HEAZLEWOOD Elevation APPROX. 1,290 Bearing 270° Drill MINDRILL F25A Date commenced March 17, 1969

Logged by J.F.G./J.P.M. Date completed April 16, 1969

N.W.P.S

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni
72'11"	77'2"	4'3"	4'2"	99%	BQ		Serpentinite - pale grey-green with white calcite and dolomite in filling of breccia and shears. May be fault zone of about 75'.				
77'2"	88'6"	11'4"	10'9"	95%			Serpentinite - black-dark green, fine grained. Sheared at 15°, 30° and 45° to core. Several minor open calcite infilled shears. Slickensides on some shears.				
88'6"	88'8"	2"	2"	100%			Rodingite - coarse grained altered gabbro dyke.				
88'8"	102'8"	14'	13'6"	90%			Serpentinite - black - dark green, fine grained. Minor veins and shears at 10°-15°, 25°-30°, 45°-50°, 70°. Calcite and dolomite infilling. Some vughy shears.				
02'8"	103'	4"	4"	100%			Rodingite - very coarse grained - altered gabbro.				
03'	104'6"	1'6"	1'6"	100%			Serpentinite - black - dark green - fine grained.				
04'6"	105'	6'	6"	100%			Gabbro - dyke with brecciated serpentinite at 35°. To Core.				
05'	106'5"	1'5"	1'5"	100%			Serpentinite - black - fine grained - possibly after peridotite				
06'5"	107'	7"	7"	100%			Serpentinite - breccia, grey with calcite veins and pale green translucent irregular patches of talc (?). May have been narrow pyroxenite dyke.				
07'	110'	3'	3'	100%			Serpentinite - black - fine grained, altered peridotite?				
10'	110'3"	3"	3"	100%			Serpentinite breccia - grey with calcite and pale green talc masses. May have been narrow pyroxenite dyke.				

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AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H. 1

Project 357/HEAZLEWOOD | Co-ordinates 5,000N, 200W | Declination 55° | Drilled by A.S. JAMES PTY. LTD. | Page 4 of 10

Location HEAZLEWOOD | Elevation APPROX. 1,290 | Bearing 270° | Drill MINDRILL F25A | Date commenced March 17, 1969

Logged by J.F.G./J.P.M. | Date completed April 16, 1969

N.W.P.S

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni
110'3"	136'6"	26'3"	26'3"	100%	BQ		Serpentinite black -fine grained - altered peridotite(?). Bleached zone 117'-118'2". Calcite veining, joints-shears at from 25°-60° to core. Bleaching at 128'. Slickensides on some joints.				
136'6"	136'10"	4"	4"	100%			Rodingite coarse grained altered gabbro.				
136'10"	137'5"	7"	6"	86%			Serpentinite black fine grained.				
137'5"	139'6"	2'1"	2'1"	100%			Rodingite - extremely variable both in grainsize and amount of pyroxene, 2 prominent shears @ 50°&40° to core @ 137'7", 138'1". Shears slickensided and associated with translucent talc material.				
139'6"	151'8"	12'2"	12'2"	100%			Serpentinite black fine grained, some shearing at various angles and minor magnetite				
151'8"	153'1"	1'5"	1'5"	100%			Rodingite (altered gabbro) with coarse and fine remnant pyroxene.				
153'1"	153'10"	9"	9"	100%			Serpentinite - black fine grained.				
153'10"	155'5"	1'7"	1'7"	100%			Rodingite - brecciated and sheared, some serpentinite fragments and green talc on shears. Large remnant pyroxenes				
155'5"	163'9"	8'4"	8'	98%			Serpentinite - black with dark brown mottling fine grained, shears @ 20° 30° 80°, ½" band rodingite 161', 30°.				
163'9"	164'3"	6"	6"	100%			Rodingite with inclusions of serpentinite and large altered pyroxenes.				

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AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H. 1

Project 357/HEAZLEWOOD | Co-ordinates 5,000N, 200W | Declination 55° | Drilled by A.S. JAMES PTY. LTD. | Page 5 of 10

Location HEAZLEWOOD | Elevation APPROX. 1,290 | Bearing 270° | Drill MINDRILL F25A | Date commenced March 17, 1969

Logged by J.F.G./J.P.M. | Date completed April 16, 1969

N.W.P.S

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni
64'3"	184'6"	20'3"	19'	94%	BQ		Serpentinite - black fine grained with rodingite lenses @ 166'(10") 178'(1") very broken.				
84'6"	193'3"	8'9"	6'8"	76%			Rodingite - coarse isolated crystals of pyroxene in groundmass of grossularite				
93'3"	197'6"	4'3"	4'3"	100%			Pyroxenite - fine grained altered containing minor veins and patches of grossularite. Acid Tube survey at 200' showed dip of 59½°.				
97'6"	205'	7'6"	7'6"	100%			Altered Pyroxenite - fine grained light coloured containing veins and patches of grossularite.				
05'	210'2"	5'2"	5'2"	100%			Serpentinite - dark fine grained with light coloured patches and veins which become dominant in last 1'5". 2" vein of coarse rodingite at 207'6".				
10'2"	212'7"	2'5"	2'5"	100%			Rodingite - coarse grained altered gabbro with serpentinite inclusions.				
12'7"	229'8"	17'1"	15'2"	89%			Serpentinite - dark fine grained with fine remnant pyroxenes and minor rodingite inclusions and veins.				
29'8"	246'11"	17'3"	17'3"	100%			Rodingite - medium to coarse grained altered gabbro.				
46'11"	249'5"	2'6"	2'6"	100%			Serpentinite - both numerous relict pyroxenes and small irregular patches of grossularite.				

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AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H.1

Project 357/HEAZLEWOOD | Co-ordinates 5,000N, 200W | Declination 55° | Drilled by A.S. JAMES PTY. LTD. | Page 6 of 10

Location HEAZLEWOOD | Elevation APPROX. 1,290 | Bearing 270° | Drill MINDRILL F25A | Date commenced March 17, 1969

Logged by J.F.G./J.P.M. | Date completed April 16, 1969

N.W.P.S

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni
249'5"	261'1"	11'8"	11'8"	100%	BQ		Rodingite - coarse and medium grained altered gabbro with bands composed predominantly of pyroxenite or serpentinised pyroxenite. 250'-250'3" serpentinised pyroxenite, 253'10"-256'5" 2'7" medium to fine grained pyroxenite serpentinised in part also at 257'8"-258'8" and 260'3"-26'1"				
261'1"	266'9"	5'8"	5'8"	100%			Serpentinite - dark fine grained (8" layer of rodingite at 261'9" - 262'5") with numerous small irregular patches of grossularite.				
266'9"	267'6"	9"	9"	100%			Rodingite - medium-coarse grained altered gabbro				
267'6"	270'1"	2'7"	2'7"	100%			Serpentinite - dark fine grained with small irregular patches of grossularite & occasional relict pyroxenes. 2" vein of coarse pyroxene at 268'.				
270'1"	275'4"	5'3"	5'3"	100%			Rodingite - medium to coarse grained altered gabbro with 2" veins of serpentinised pyroxenite at 270'8" and 271'5".				
275'4"	276'4"	1'	1'	100%			Serpentinite - with rounded altered crystals of pyroxene.				
276'4"	278'2"	1'10"	1'10"	100%			Altered Pyroxenite - light coloured fine grained containing veins and small irregular patches of grossularite. Compositional banding at 45° to core.				
278'2"	280'9"	2'7"	2'7"	100%			Serpentinite - dark fine grained containing medium grained rounded and veined altered pyroxenes and small irregular patches of grossularite. ½" vein of pyroxene at 279'2"				

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AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H. 1

Project 357 - HEAZLEWOOD | Co-ordinates 5,000N, 200W | Declination 55° | Drilled by A.S. JAMES PTY. LTD. | Page 7 of 10

Location HEAZLEWOOD | Elevation APPROX. 1,290' | Bearing 270° | Drill MINDRILL F25A | Date commenced March 17, 1969

Logged by J.F.G./J.P.M. | Date completed April 16, 1969

N.W.P.S

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni
280'9"	281'6"	9"	9"	100%	BQ		Altered pyroxenite - light coloured fine grained with veins of grossularite.				
281'6"	283'	1'6"	1'6"	100%			Serpentinite - dark coloured, containing numerous large altered and veined crystals of pyroxene. 282'9"-283' fine grained pyroxenite altered with phenocrysts of pyroxene and grossularite.				
283'	294'	11'	11'	100%			Rodingite - medium to coarse altered gabbro cut by numerous small veins < 1mm wide of green talc and several larger veins > 2mm wide of quartz or grossularite. 5" layer of serpentinised pyroxenite at 295'9".				
294'	308'6"	14'6"	13'6"	93%			Serpentinite - dark coloured containing large crystals of veined and altered pyroxene and numerous small irregular patches of grossularite, core very broken from 300'-308'6". 1' band of medium pyroxenite in groundmass of light green talc at 303'6".				
308'6"	320'6"	12'	10'5"	87%			Pyroxenite - fine to medium grained. Altered light grey in colour containing bands of rodingite at 321', 2"; 322', 1'6".				
320'6"	330'	9'6"	6'	63%			Serpentinite - containing large altered and veined pyroxenes 3" band of Rodingite at 329'3"				
330'	331'	1'	4"	33%			Rodingite - coarse altered gabbro.				
331'	341'	10'	6'	60%			Pyroxenite - fine grained pale green strongly altered containing numerous small irregular patches of grossularite and bands of rodingite at 335'9", 4"; 334'9", 8".				

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AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H. 1

Project 357/HEAZLEWOOD Co-ordinates 5,000N, 200W Declination 55° Drilled by A. S. JAMES PTY. LTD. Page 8 of 10

Location HEAZLEWOOD Elevation APPROX. 1,290 Bearing 270° Drill MINDRILL F25A Date commenced March 17, 1969

Logged by J.F.G./J.P.M. Date completed April 16, 1969

N.W.P.S

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni	S	Cr_2O_3	Type
341'	357'	16'	11'3"	70%	BQ		Serpentinite black fine grained containing large altered and veined crystals of pyroxene							
357'	371'6"	14'6"	8'	55%			Rodingite - medium grained altered gabbro. 6" vein of pale green very fine grained altered pyroxenite at 362'. Acid tube survey at 400' showed dip of 58°.							
371'6"	477'	105'6"	103'	98%			Microgabbro altered - fine grained grey in colour. Numerous small fractures filled with dark green talc. Many small irregular patches of grossularite and some larger patches and veins (sample from 405' for petrographic examination) Brecciated zone 459'-464'							
477'	502'6"	25'6"	24'	94%			Pyroxenite - medium-coarse grained light green and pale brown, considerable alteration by dark green serpentinite, occasional patches of grossularite. Very occasional flecks of pyrite on shears.							
502'6"	522'	19'6"	18'6"	95%			Serpentinite - black fine grained with numerous large pyroxene crystals and clusters of crystals which are veined and partly replaced by the serpentine; occasional small irregular patches of grossularite.	S-874	500	510	0.03%	0.08%		Sludge
								S-875	510	520	0.04%	0.11%		Sludge
522'	552'	30'	21'	70%			Serpentinite -black fine grained with occasional small altered crystals of pyroxene. 1'6" band of medium-fine grained pyroxenite at 534' shears and fractures filled with green talc or asbestos	S-876	520	530	0.04%	0.09%		Sludge
								S-877	530	540	0.04%	0.12%		Sludge

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AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H. 1

Project 357/HEAZLEWOOD Co-ordinates 5,000'N, 200'W Declination 55° Drilled by A.S. JAMES PTY. LTD. Page 9 of 10

Location HEAZLEWOOD Elevation APPROX. 1,290' Bearing 270° Drill MINDRILL F25A Date commenced March 17, 1969

Logged by J.F.G./J.P.M. Date completed April 16, 1969

N.W.P.S

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni	S	Cr_2O_3	Type
							3" band of soft sheared serpentinite and talc at 543'.	S-878	540	550	0.08%	0.11%	0.71%	Sludge
52'	552'10"	10"	10"	100%	BQ		Pyroxenite - fine grained fractured and altered with veins of	H.1.544 at 544: (P)a 7.4; FE 8.5, MF1070						
							grossularite.	S-879	550	560	0.09%	0.10%		Sludge
							Acid tube survey at 600' showed dip of 62°.							
52'10"	770'	217'2"	176'5"	82%			Serpentinite - dark green brown with small irregular veins of							
							magnetite and isolated grains. 568'6"-574'6", 6' highly fractured	S-880	570	580	0.11%	0.25%		Sludge
							and sheared zone containing talc. 574'6"-576', 1'6" fine grained	S-881	580	590	0.10%	0.14%		Sludge
							pyroxenite veined and altered. 580'-85', 585'- 90'- Assay samples	S-873	580	585	0.18%	<0.01%		Core
							603'- 604'6" 1'6" fine grained pyroxenite altered and veined.	S-872	585	590	0.21%	<0.01%		Core
							605'-606'6" 1'6" highly fractured and sheared talcose zone, also at:							
							610'-610'6", 611'9"- 612', 615-615'8", 641'6"-642', 659'-660',	S-882	590	600	0.11%	0.20%	0.69%	Sludge
							661'8"-662', 670'-672'6" (674'8" and at 681', 3" blob of altered							
							pyroxenite) 676' - 676'3", 678'6" - 679'6". 682'6" coarse	H.1.600 at 600' (p)a 27; F.E.13.6 MF 501						
							pyroxenite veined and altered with grossularite and serpentinite.	S-883	600	610	0.14%	0.03%		Sludge
							Sheared Zones at 696'4" - 697', 700'6" - 701'3",	S-884	610	620	0.14%	0.04%		Sludge
							(704' - 714' most of core lost, very soft) 720'10" - 721'4".	S-885	620	630	0.15%	0.07%		Sludge
							Fine pyroxenite altered 701'3" - 701'9" - and at 765' - 766',	S-886	630	640	0.14%	0.07%		Sludge
							(767'4" - 768' coarse grained)	S-887	640	650	0.15%	0.13%	1.33%	Sludge
							Core very broken from 738' - 753'	H.1.650 at 650 (p)a 16; F.E.9.1; M.F.562						

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AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H. 1

Project 357/HEAZLEWOOD Co-ordinates 5,000'N, 200'W Declination 55° Drilled by A.S. JAMES PTY. LTD Page 10 of 10

Location HEAZLEWOOD Elevation APPROX. 1,290 Bearing 270° Drill MINDRILL F25A Date commenced March 17, 1969

Logged by J.F.G. / J.P.M. Date completed April 16, 1969

N.W.P.S

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni	S	Cr_2O_3	Type
							Fractured and sheared talcose zones at 760'6" - 761', 763'6" -	S-701	640	645	0.21%	<0.01%		Core
							764', 766'8" - 767'.	S-702	645	650	0.24%	<0.01%		Core
							Acid tube survey at 770' showed dip of 60½°	S-703	Clean drilling mud			<0.01%	0.23%	
770'	776'	6'	4'2"	70%			Pyroxenite fine grained altered with bands of serpentinite at	S-888	650	690	0.16%	0.11%		Sludge
							770'1":3", 772':2'	S-889	690	700	0.13%	0.10%	1.13%	Sludge
776'	783'	7'	7'	100%			Serpentinite dark brown with numerous minor veins of serpentine	H.1.700 at 700 (p)a 16; F.E.10.2; M.F. 633						
							minerals and minor magnetite. Sheared talcose zone at 776'6",	S-890	700	710	0.19%	0.08%		Sludge
							1'6"	S-891	710	716	0.13%	0.07%		Sludge
								S-892	716	720	0.20%	0.07%		Sludge
							END OF HOLE	S-893	720	730	0.22%	0.06%		Sludge
								S-894	730	740	0.20%	0.07%		Sludge
								S-895	740	744	0.21%	0.07%		Sludge
								S-896	744	750	0.19%	0.08%	0.73%	Sludg
								S-897	750	753	0.20%	0.07%		Sludg
								S-898	753	760	0.19%	0.05%		Sludg
								S-899	770	780	0.18%	0.06%		Sludg
								S-900	780	783	0.19%	0.04%		Sludg

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AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H2

Project 357/HEAZLEWOOD | Co-ordinates 4,500N 800E | Declination 50° | Drilled by A.S. James Pty. Ltd. | Page 1 of 3

Location HEAZLEWOOD | Elevation Approx. 1,535' | Bearing 90° | Drill Mindrill F25A | Date commenced April 21, 1969

N.W.P.S CORE RECOVERY 87.5% | Logged by J.P.M. | Date completed May 3, 1969

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni	S		Type
0	27'3"	27'3"	20'6"	75%	BQ		Serpentinite, brown, fine grained, weathered, occasional small blebs of grossularite to 1mm. Small veins and specks of darker serpentinite material containing some magnetite. ¾" vein talcose material with magnetite at 25'							
27'3"	94'	66'9"	61'6"	93%			Serpentinite, black, with numerous small blebs of grossularite to 1mm. 3" vein of light coloured talcose minerals at 33' and at 45'2", ½"; 77'; ½", 76'10", ½"; 92'6", 1". Magnetite in veins and shears associated with green talcose material from 48'6".							
94'	106'8"	12'8"	10'	78%			Serpentinite, black, with numerous small blebs of grossularite and numerous large poikilitic altered remnant pyroxene crystals. Veins of milky green talcose material at 94'8", ½" and 95', ½". 2" vein of light green altered pyroxene and talcose minerals at 97'							
106'8"	128'	21'4"	20'10"	97%			Serpentinite, black, with occasional large relict crystals of grossularite and some larger patches. Numerous small veins of asbestos to 2 mm. and veins of green talcose material. Little magnetite in some of the talc veins. Sheared zone with zaratite? at 121' - 122'	4292	100	110	0.19%	0.07%		Sludge
								4293	110	120	0.17%	0.06%		Sludge
								4294	120	130	0.16%	0.03%		Sludge
128'	144'	16'	15'9"	98%			Serpentinite, black, with numerous altered poikilitic pyroxenes and numerous small blebs of grossularite. 6" band of fine medium grained altered pyroxenite at 141'6"	4295	130	140	0.16%	0.03%		Sludge
								4296	140	150	0.14%	0.03%		Sludge
								S. 708	150	155	0.02%	<0.01%		Core

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AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H2

Project 357/HEAZLEWOOD | Co-ordinates 4,500N, 800E | Declination 50° | Drilled by A.S. James Pty. Ltd. | Page 2 of 3

Location HEAZLEWOOD | Elevation Approx. 1,535' | Bearing 90° | Drill Mindrill F25A | Date commenced April 21, 1969

Logged by J.P.M. | Date completed May 3, 1969

N.W.P.S

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni	S		Type
44'	158'	14'	13'10"	99%	BQ		Pyroxenite fine-medium grained altered. Light grey-light green.	4297	155	165	0.13%	0.04%		Sludge
							Veins of opaque talcose material at 152'9", ¼": 154'0", ¼":							
							156'6", 2"							
							Strongly altered and veined with talcose material 153'6"-157'							
58'	163'8"	5'8"	5'8"	100%			Serpentinite, mottled grey and black with numerous strongly							
							altered pyroxenes. Pyroxene rich zone 160'-161'6" green and white							
							talcose material 160'9", 2". Grossularite band 163'6", 1"							
63'8"	168'8"	5'	5'	100%			Pyroxenite medium fine grained, altered, grey							
68'8"	177'	8'4"	7'10"	94%			Serpentinite, black, with numerous medium grained crystals of	4298	165	175	0.11%	0.06%		Sludge
							altered pyroxene and small blebs of grossularite. Pyroxene rich							
							bands at 172'6", 5": 169'8", 1'.							
							Occasional small veins of asbestos and talcose material							
77'	316'	139'	118'4"	85%			Serpentinite, black-dark brown with small blebs of grossularite	4299	175	185	0.15%	0.04%		Sludge
							and small veins and shears containing green talcose material and	4300	185	195	0.12%	0.08%		Sludge
							magnetite. Occasional large poikilitic pyroxenes from 260'.	S.901	195	205	0.18%	0.05%		Sludge
							Fractured zones at 199'0", 1': 204'0", 1': 207'0", 6": 208'3", ½".	S.902	205	210	0.18%	0.04%		Sludge
							Pyroxenite rich zone at 214'6", 9": 281'0" 6": 288'6", 1'6":	S.903	210	220	0.19%	0.03%		Sludge
							310'0", 1": 311'7", 1": 312'0", 6": 313'5", 5". Veins of	S.904	220	230	0.15%	0.09%		Sludge
							grossularite at 289'6", 1": 293'6", ½".	S.905	230	240	0.16%	0.07%		Sludge
							Acid tube survey at 200' showed dip of 56½°.	S.906	240	250	0.18%	0.03%		Sludge

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AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H2

Project 357/HEAZLEWOOD Co-ordinates 4,500N, 800E Declination 50° Drilled by A.S. JAMES PTY. LTD. Page 3 of 3

Location HEAZLEWOOD Elevation Approx. 1,535' Bearing 90° Drill Mindrill F25A Date commenced April 21, 1969

Logged by J.P.M. Date completed May 3, 1969

N.W.P.S

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION
316'	400'	84'	69'6"	83%	BQ		Serpentinite, black, with numerous small blebs of grossularite and many medium-large altered pyroxene crystals. Pyroxene and grossularite rich zones at 331', 2": 333', 3": 334'; 1'10": 348'10", 6": 351'10", 3": 359'6", 7" 363', 6": 367', 8": 368'6", 6": 372', 2". Occasional magnetite in veins with talcose material and in shears. Fractured zone at 339'. Acid tube survey at 353' showed dip of 57°. END OF HOLE

ASSAY DATA Sample	From	To	Ni	S	Type
S.907	250	260	0.17%	0.04%	Sludge
S.706	260	265	0.19%	<0.01%	Core
S.707	265	270	0.18%	<0.01%	Core
S.908	270	280	0.16%	0.03%	Sludge
S.909	280	290	0.17%	0.03%	Sludge
S.910	290	300	0.17%	0.03%	Sludge
S.911	300	310	0.17%	0.06%	Sludge
S.912	310	320	0.16%	0.02%	Sludge
S.913	320	330	0.16%	0.02%	Sludge
S.914	330	340	0.14%	0.02%	Sludg
S.915	340	350	0.16%	0.03%	Sludg
S. 916	350	360	0.15%	0.02%	Sludg
S.917	360	370	0.15%	0.02%	Sludg
S.918	370	390	0.17%	0.02%	Sludg
S.704	390	395	0.18%	0.03%	Core
S.705	395	400	0.20%	0.04%	Core

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AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H 3

Project 357/HEAZLEWOOD | Co-ordinates 5,500 N, 2,250 E | Declination 50° | Drilled by A. S. JAMES PTY. LTD. | Page 1 of 4

Location HEAZLEWOOD | Elevation 1,300' APPROX | Bearing 270° | Drill MINDRILL F 25 A | Date commenced May 6, 1969

Logged by J.P.M. | Date completed May 29, 1969

N.W.P.S CORE RECOVERY 93%

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni	S		Type
0"	9'	9'	7'	78%	BQ		Serpentinite, brown in colour, weathered and broken							
9'	122'6"	113'6"	98'	86%			Serpentinite, greenish brown to black in colour, limonite and occasional magnetite on shear surfaces. Small veins up to ½" wide commonly banded with an outer zone of black talcose minerals, and an inner zone of green talcose minerals or carbonates and magnetite							
122'6"	124'	1'6"	1'6"	100%			Feldspathic Pyroxenite, strongly altered and veined, light grey in colour. Contains veins of green talcose minerals.							
124'	139'	15'	15'	100%			Serpentinite, black in colour with small veins at various angles commonly banded with an outer zone of black talcose minerals and an inner zone of green talcose minerals and magnetite.							
139'	139'4"	4"	4"	100%			Feldspathic Pyroxenite, light grey in colour, strongly altered and veined.							
139'4"	293'	153'8"	142'4"	93%			Serpentinite, dark brown in colour with small zoned veins of talcose minerals and magnetite. Zones of soft sheared talcose minerals at: 157'6½":2"; 162':1"; 278'5":2"; 287'6":1". Zones of strong alteration containing veins of asbestos and magnetite at: 180'1":6"; 192'2":1'8"; 196'6"; 256'10":1"; 258'8":8"; 259'10":¾".	S 919	150'	160'	0.16%	0.03%		Sludge
								S 920	160'	170'	0.17%	0.01%		Sludge
								S 921	170'	180'	0.15%	0.02%		Sludge
								S 922	180'	190'	0.17%	0.02%		Sludge
								S 923	190'	200'	0.15%	0.01%		Sludge
293'	293'8"	8"	8"	100%			Feldspathic Pyroxenite, grey to light green in colour, strongly altered.	S 924	200'	210'	0.19%	0.01%		Sludge
								S 925	210'	220'	0.20%	<0.01%		Sludge

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AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H 3

roject 357/HEAZLEWOOD Co-ordinates 5,500 N, 2,250 E Declination 50° Drilled by A.S. JAMES PTY. LTD. Page 2 of 4

ocation HEAZLEWOOD Elevation 1,300' APPROX. Bearing 270° Drill MINDRILL F 25 A Date commenced May 6, 1969

Logged by J.P.M. Date completed May 29, 1969

N.W.P.S

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni	S		Type
93'8"	800'	506'4"	477'9"	94%	BQ		Serpentinite, yellow-green, dark brown-black in colour. Magnetite	S 926	220'	230'	0.19%	0.04%		Sludg
							in veins associated with green talcose minerals, and occasional	S 927	230'	240'	0.19%	<0.01%		Sludg
							small veins of asbestos. Zones of soft sheared talcose minerals	S 928	240'	250'	0.19%	0.02%		Sludg
							at: 321'4":1'6"; 341':1"; 458':6"; 652'8":1"; 655':1'6";	S 929	250'	260'	0.18%	0.01%		Sludg
							672'6":6"; 706':1'6"; 708'6":1'6"; 715'6":6"; 766':5"; 784'5":6";	S 930	260'	270'	0.16%	0.01%		Sludg
							790':1"; 794'3":2"; 796'9":8"; 798'8":1". Veins of strongly altered	S 931	270'	280'	0.18%	0.01%		Sludg
							Feldspathic Pyroxenite at: 548':1"; 549'6":6"; 623'9":1";	S 932	280'	290'	0.14%	<0.01%		Sludg
							659'6":2"; 669'6":6"; 670'6":6"; 683':2".	S 933	290'	300'	0.14%	0.01%		Sludg
								S 934	300'	310'	0.15%	0.01%		Sludg
							END OF HOLE	S 935	310'	320'	0.15%	0.01%		Sludg
								S 936	320'	330'	0.15%	0.01%		Sludg
								S 937	330'	340'	0.16%	0.03%		Sludg
								S 938	340'	350'	0.15%	0.03%		Sludg
								S 939	350'	360'	0.15%	0.01%		Sludg
								S 940	360'	370'	0.14%	0.01%		Sludg
								S 941	370'	380'	0.14%	0.01%		Sludg
								S 942	380'	390'	0.14%	<0.01%		Sludg
								S 943	390'	400'	0.15%	<0.01%		Sludg
								S 944	400'	410'	0.14%	<0.01%		Sludg
								S 945	410'	420'	0.13%	0.01%		Sludg

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AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H 3

Project 357/HEAZLEWOOD Co-ordinates 5,500 N, 2,250 E Declination 50° Drilled by A.S. JAMES PTY. LTD. Page 3 of 4

Location HEAZLEWOOD Elevation 1,300' APPROX. Bearing 270° Drill MINDRILL F 25 A Date commenced May 6, 1969

Logged by J.P.M. Date completed May 29, 1969

N.W.P.S

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni	S		Type
								S 946	420'	430'	0.13%	0.01%		Sludge
								S 947	430'	440'	0.13%	0.01%		Sludge
								S 948	440'	450'	0.13%	<0.01%		Sludge
								S 949	450'	460'	0.13%	0.02%		Sludge
								S 950	460'	470'	0.13%	0.03%		Sludge
								S 951	470'	480'	0.12%	0.02%		Sludge
								S 952	480'	490'	0.12%	0.03%		Sludge
								S 953	490'	500'	0.12%	0.02%		Sludge
								S 954	500'	510'	0.13%	0.02%		Sludge
								S 955	510'	520'	0.13%	0.02%		Sludge
								S 956	520'	530'	0.12%	0.03%		Sludge
								S 957	530'	540'	0.12%	0.02%		Sludge
								S 958	540'	550'	0.12%	0.02%		Sludge
								S 959	550'	560'	0.13%	0.03%		Sludge
								S 960	560'	570'	0.13%	0.02%		Sludge
								S 961	570'	580'	0.13%	0.02%		Sludge
								S 962	580'	590'	0.13%	0.02%		Sludge
								S 963	590'	600'	0.12%	0.03		Sludge
								S 964	600'	610'	0.12%	0.03%		Sludge
								S 965	610'	620'	0.11%	0.02%		Sludge

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AMAX MINING (AUSTRALIA) INC.

DIAMOND DRILL LOG

HOLE No. H 3

oject 357/HEAZLEWOOD Co-ordinates 5,500 N, 2,250 E Declination 50° Drilled by A.S. JAMES PTY. LTD. Page 4 of 4

ocation HEAZLEWOOD Elevation 1,300' APPROX. Bearing 270° Drill MINDRILL F 25 A Date commenced May 6, 1969

Logged by J.P.M. Date completed May 29, 1969

N.W.P.S

Depth (ft.) From	Depth (ft.) To	Interval (ft.)	Core Recovered (ft.)	% Recovery	Core Size	Core Angle	DESCRIPTION	ASSAY DATA Sample	From	To	Ni	S		Type
								S 966	620'	630'	0.11%	0.02%		Sludge
								S 967	630'	640'	0.11%	0.03%		Sludge
								S 968	640'	650'	0.11%	0.02%		Sludge
								S 969	650'	660'	0.10%	0.02%		Sludge
								S 709	660'	680'	0.12%	0.02%		Sludge
								S 710	680'	690'	0.13%	0.01%		Sludge
								S 971	690'	700'	0.15%	0.02%		Core
								S 711	700'	710'	0.12%	0.02%		Sludge
								S 712	710'	720'	0.13%	0.02%		Sludge
								S 713	720'	730'	0.13%	0.01%		Sludge
								S 714	730'	740'	0.14%	0.01%		Sludge
								S 715	740'	750'	0.14%	0.02%		Sludge
								S 716	750'	760'	0.14%	0.01%		Sludge
								S 717	760'	770'	0.14%	0.02%		Sludge
								S 718	770'	780'	0.14%	0.01%		Sludge
								S 719	780'	790'	0.15%	0.01%		Sludge
								S 720	790'	800'	0.14%	0.01%		Sludge

Vol. No. 2

995079

REPORT ON THE BALD HILL COMPLEX,

TASMANIA

by

M. RUBENACH

JANUARY, 1970

The Bald Hill Complex consists of the order of 10,000 ft. of layered ultramafics and feldspathic ultramafics. They are all accumulates, and deformed textures in thin section can be related to probable re-intrusion along the basalt contact or axial plane cleavages on NE trending folds. The sequence (essentially dunites at base, followed by pyroxenites and then by interlayered harzburgites, dunites, troctolites, pyroxenites, and with finer-grained pyroxenites, harzburgites, feldspathic pyroxenites and harzburgites with minor norites and gabbros at the top of the exposed sequence) has been discussed in the petrology report.

The ultramafic complex is overlain by about 10,000 ft. of dolerites and volcanics ranging from puritic to dacitic in composition. Most of the volcanics are basic and intermediate and are often altered to spilites. The dolerites definitely intrude the ultramafics as intrusive contacts and dolerite and granophyre dykes within the ultramafics have been found. The relationship of the volcanics and ultramafics where no dolerites are interposed between them is complicated. There may be an unconformity between them but outcrop is poor and sufficient mapping has not been done in order to sort out the relationship.

The total igneous complex, including the volcanics and dolerites, would have formed a roughly lenticular mass (this is only a tentative suggestion). This association of accumulative ultramafics with minor gabbroic rocks makes them very similar to the New Zealand ultramafics as described by Challis (J. Petrology & Tectonophysics 1969). They could have a similar origin as is suggested by Challis, i.e. accumulation of ultramafics in sub-volcanic magma chambers

while liquid fractions were drawn off forming overlying volcanic flows. However, the volume of basic material, gabbros, dolerites and volcanics included, still seem to be small with respect to the volume of ultramafics. More layered gabbros are associated with some of the other ultramafics in Tasmania, but the volume is still low. Also the differentiation trend of the Serpentine Hill rocks in Tasmania lies much closer to the FeO - MgO tie-line than comparable rocks from Bushveld, Stillwater and Skaergaard. Hence an alternative hypothesis, which is suggested by Maxwell and by Moores (abstracts and personal communications) for the eastern Mediterranean complexes, involving crystallization of the layered rocks from a near ultramafic magma under a carapice of volcanics and dolerites might also be closer to the truth.

As mentioned above, the Bald Hill rocks are very similar to the New Zealand and the eastern Mediterranean complexes. All of these are formed chains of complexes in eugeosynclinal troughs. Unfortunately nothing of much use has been published on the complexes from Greece, Syria and Turkey, but papers are in press (e.g. Moores on the Vourinon Complex, Greece, to be published as Special Paper 118 of Geological Society of America). I am not sure how many of these complexes are accumulates. I have not heard of significant nickel sulphide deposits being associated with either the New Zealand or the eastern Mediterranean rocks.

The Bald Hill Complex has many of the characteristics of the "Alpine Ultramafics" of Thayer. It occurs in eugeosynclinal sediments; it consists of layered ultramafics with associated gabbros, although typically present, being volumetrically low compared with Stillwater, Bushveld etc.; it contains dyke swarms of pegmatitic gabbros with some dioritic and granophyric

rock; it contains podiform chromite bodies (although these are very rare and small) as distinct from the stratiform chromitites of Bushveld, etc. However, Thayer goes on to say that all these "Alpine" bodies show deformed textures and formed by crystal mesh emplacement. In the Tasmanian and several other cases it has been demonstrated that the ultramafics are essentially accumulates and that deformation zones can be associated with faulting, folding or re-emplacement after partial serpentinization. Despite this, the rest of Tayer's classification could be quite valid. Also it could be that many "Alpine Ultramafics" of deformed serpentinite belts were derived from layered complexes similar to Tasmania, New Zealand, etc. Some however, are of undisputed deepseated origin, expecially the high-temperature Alpine types such as the Lizard (D. H. Green, 1964, P. Petrology) and Tinaquillo.

The chemistry of pyroxenes from the Tasmanian ultramafics is extremely similar to pyroxenes from the Bushveld. They show identical differentiation trends on the Wollanstonite, enstatite, ferrosilite diagram, although differentiation in the Tasmanian rocks stops at about the normal composition for hypersthene-pigeonite inversion. What is more important is that the Al contents are almost identical for any particular $\frac{MgO}{MgO + FeO + Fe_2O_3}$ value. In other words they crystallised at comparable depths within the earth's crust, since the Al_2O_3 content is pressure dependent. Using the method of O'Hara (in the book "Ultramafics and Related Rocks" - Wyllie), computed pressures for crystallization (using only Mg rich rocks with olivine, orthopyroxene, clinopyroxene and feldspare present) are of the order of 5 Kb.

The ultramafic complexes in Tasmania occur in rocks of probable Lower Cambrian age. They are unconformably overlain by Middle and Upper Cambrian sediments (not at Bald Hill though, where the stratigraphy is monotonous and no fossils have been found)

and ultramafic detritus is abundant in some Middle to Upper Cambrian sediments. This would require the ultramafics to be brought up and exposed to erosion by faulting and/or serpentinization and solid flow of serpentinite during the eugeosynclinal deposition. I think recognition of this type of phenomenon, which appears to be very common for ultramafics in eugeosynclines (see Tectonophysics, 1969) is important if one is looking for nickel sulphides formed by magmatic segregation. Such deposits could be left at depth for example, while parts of the ultramafics are re-implaced at higher levels. Even at Bald Hill where a "Complete-looking" sequence can be mapped, the lower contact is very sheared and serpentinised and in places contains up to 300 ft. of foliated amphibolites. I am sure this shearing and the formation of amphibolites is due to re-implacement of serpentinite. Petrologically the amphibolite has replaced both primary ultramafics and sediments, and this could occur by Ca metasomatism (the Ca can be deomonstrated to have possibly come from serpentinisation of ultramafics within the complex) during serpentinisation and re-intrusion (see Coleman on the New Zealand Ultramafics in a Bulletin of Geol. Survey of America). So if Ni sulphides segregated the base of the original intrusion (which may not have been the case anyway) they could be left behind somewhere during re-injection.

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995084

M. RUBENACH
December 1969

GEOLOGY OF THE BALD HILL COMPLEX

To the west of the Amax lease, the succession of rock types in the Bald Hill Complex seems to be relatively simple. The succession along section XY on Figure 2 is given below:

Fine grained feldspathic pyroxenite unit (FP)
Medium grained pyroxenite and olivine pyroxenite unit (P)
Coarse grained pyroxenite unit
Basal dunite unit (SD) ——— fault contact

The basal dunite unit consists of entirely or partly serpentinised dunite with minor interlayered pyroxenites and harzburgites. This unit runs onto the lease area in the NW corner (area A of Figure I). It is faulted against the coarse pyroxenite unit, and this fault appears to run onto the lease area as F1 . Hence the area B of entirely serpentinised pyroxenites and harzburgites may represent the coarse pyroxenite unit. Also most of the coarse pyroxenites and harzburgites in the fault block area marked E on Figure I could belong to the coarse pyroxenite unit.

The next unit, the medium-grained pyroxenite and olivine pyroxenite unit, consists of interlayered pyroxenites, olivine pyroxenites and harzburgites. These appear to give way, apparently along strike, to interlayered pyroxenites, feldspathetic pyroxenites and olivine pyroxenites near the fault F2 on Figure 2. The more feldspathic zone is marked as MP on Figure 2.

Along section XY, the medium-grained pyroxenite unit is faulted against the highest unit of this section, the fine-grained feldspathic pyroxenite unit, FP. This area is marked as D on Figure I. These form the core of a synform S1 (which was determined from layering). The maximum of the Bouger anomaly along the road through the Bald Hill Complex corresponds to the position of the synformal axis as predicted from the layering. Also, the most iron rich pyroxenes occur in the feldspathic pyroxenite unit indicating that these are the highest in the differentiation sequence along XY.

The fine-grained feldspathic pyroxenite unit consists of interlayered pyroxenites, feldspathic pyroxenites, olivine feldspar pyroxenites, norites, with minor gabbros, harzburgites, lerzholites etc., all of which are relatively fine grained.

Rock of areas F, G, H, I, & J of Figure I are much more puzzling and it is clear that my mapping is not sufficiently detailed to sought out the structure and the succession. These areas consist of a very large variety of layered ultramafics which are in general richer in olivine and feldspar at the expense of orthopyroxene in comparison

with the rocks to the W of the lease. The divisions marked on Figure 2 are subjective and it is the best guess I can make from the mapping I have done and examination of the thin sections and hand specimens. The major rock types are harzburgites, pyroxenites, troctolites, feldspathic harzburgites and feldspathic dunites. Any combination of these may occur interlayered with each other in any particular area, although the troctolite areas (I on Figure 1) contain very few pyroxenites or harzburgites. The sub-division is made simply on what appears to be the dominant rock type, so the boundaries are usually gradational and may be quite arbitrary. The amount of serpentinization is a problem, as in the field there is a tendency to confuse highly serpentinised harzburgites and serpentinised dunites for example.

To make matters more difficult, the rocks in areas F to J seem to be more complexly folded than those to the west. The layering is often very steep and the dips and strikes may be quite variable over a small area. It is not known how much effect serpentinization and solid flow of serpentinites has had in complicating the structure, so I will not discuss this until I have examined some areas in detail.

From the layering it would appear there could be an anticlinal structure in the mine area, marked as A2 on Figure 2. However, the layering is quite steep and it is possible that the antiformal structure could be due to forcing or wedging apart of layers by serpentinisation as is illustrated below:

However, a pyroxene from specimen B202 gives the highest $\frac{MgO}{FeO}$ value in the lease area suggesting that the rocks in the vicinity of the Lord Brassey are faitly low in the differentiation sequence. Thus an anticlinal structure is possible, but by no means established. The troctolites on the W of the structure do not appear on the east, but this would be explained away by "facies variation" which is discussed later in this report.

Another problem in interpreting the geology in the lease area can be appreciated by looking at the analyses of orthopyroxenes in the area H of Figure I. The $\frac{10\ Mg\ O}{FeO}$ value for the 4-phase peridotite B 484 (at 8,000N, 4,200W) is much higher than that for B695 (8,400N, 00)

which in hand specimen is a very similar rock. This would be explained by a synclinal strucutre S2 as shown on Figure 2. This presence of such a syncline is supported by the presence of a small body of fine-grained feldspathic pyroxenites and gabbros (G on Figure I) which are identified petrologically to the rocks forming the top of the sequence to the south (i.e. those in area D of Figure 1). However, there is no evidence from the layering etc. that a syncline is present in the vicinity of S2. Still another way of explaining these facts is that there could have been multiple intrusions or injections of magmas during the formation of the Bald Hill Complex. These pulses would have to be on a large scale since the majority of rocks in the Bald Hill Complex are accumulates and hence need a relatively large volume of magma to crystallise from. In order to try and sort all this out for more detailed field work than I have done so far (and probably will be able to do as time is short for me) would need to be done. The 50 odd analyses I will be doing soon would also be a help in sorting out this complex picture.

The dolerite intruded the ultramafics. Intrusive contacts can be seen in the SE corner of the lease and the small bodies of dolerite within the harzburgites and feldspathic harzburgites look like dykes. The hypersthene dolerite bodies, which may or may not be related to the normal dolerites, are probably dykes.

Intruding the harzburgites, feldspathic harzburgites and to a less extent the troctolitesare numerous bodies, irregular networks of veins, dykes, sill, etc. of pegmatitic gabbros. These are very abundant in the vicinity of the mine and to the northwest of the mine. Most of these have altered to rodingites (garnet-pyroxene rocks) during serpentinization of the harzburgites. They are possibly formed by squeezing out of the interstitial fluids by "filter press action" during the formation of the ultramafics by crystal settling.

Also commonly occuring in the vicinity of the mine (especially) south of) are dykes and sills of fine-grained gabbros. These could be related to the dolerites, the hypersthene dolerites, or the ultramafic sequence but without analysis I have no idea of what their origin is.

With the exception of course of the various intrusive phases the textures of the primary ultramafics in the lease area show they are without a doubt accumulates, i.e. formed by crystal settling under gravity. There is no evidence at all that they were emplaced as a crystal mush or by solid flow, and the chemical compositions of the pyroxenes are almost identified to these from Bushveld and Stillwater in contrast to those of "Alpine" ultramafics derived more directly from the mantle. Hence if nickel sulphides as segregation products did occur one would expect to find them at the base of the dunite horizon. However, the heazlewoodite mineralisation may simply be due to serpentin-

azation of harzburgites which contain up to 0.5% NiO in the olivine (electron probe analyses). Presumably heazlewoodite could form and be localized in small veinlets and pods during the alteration process in which the sulphur vapour pressure would have to be relatively low.

PETROLOGY OF INDIVIDUAL SPECIMENS

DUNITES (A OF FIGURE I)

These are invariably serpentinised, consisting of a mesh-texture serpentinite containing small cores of olivine within the mesh, and perhaps containing small amounts of pyroxene or altered pyroxene. No thin sections have been cut from these rocks on the lease area, but they are very characteristic in hand-specimen and are continuous with the dunites to the W and S.W. where I have done more detailed work on them. There are some interlayered pyroxenites and harzburgites in the dunite horizon. These are relatively unserpentinised, and, in contrast to most of the rocks in overlying horizons, are highly deformed. In fact the whole of the dunite horizon is probably highly deformed, but the deformation is virtually impossible to pick up in the almost completely serpentinized rocks. Minor pods and lenses of chromitite occur within the dunite horizon, and the osmiridium of Bald Hill seems to be restricted to this horizon.

SERPENTINISED PYROXENITES (AREA B OF FIGURE I)

The area B of Figure I consists of serpentines which are often deeply weathered. These are usually sheared and quite variable in colour and surface appearance. I think most of them are probably derived from alteration of medium to coarse pyroxenites and harzburgites and may represent the same horizon as the horizon of coarse pyroxenites which overlies the dunites to the SW of area B.

B 487 (9,000N, 4,500W)

Very weathered serpentinite with a crude mesh texture.

B 488 (10,000N, 3,500W)

This is a serpentinite with a very crude mesh structure but containing abundant plates (probably pseudomorphous after orthopyroxene) which are mainly replaced by fibrous serpentine.

B 495 (13,000W, 1,900W)

Serpentinite with a crude mesh texture but also many structures which appear to be bastite pseudomorphs (after orthopyroxene) being replaced by the mesh. Rare bastites remain, and the rock is probably a serpentinised pyroxenite or harzburgite.

B 498 (13,000W, 1,200W)

Very weathered serpentinite with a crude mesh texture. Rare bastites remain. The original rock was probably a harzburgite or a pyroxenite.

B 501 (12,000W, 1,300 W)

This is a weathered serpentinite consisting of irregular fibruous plates of serpentine and patches of mesh texture. Scattered chromites occur. The original rock was probably a pyroxenite or a harzburgite.

B 505(a) (1,200N, 3,900W)

Serpentinite, consisting mainly of irregular fibrous plates with a number of bastite pseudomorphs up to 2 mm in size. Very scattered chromite grains. The original rock was probably a pyroxenite.

ROCKS OF AREA D OF FIGURE I

These consists of interlayered gine-grained pyroxenites, feldspathic pyroxenites, norites, olivine pyroxenites, harzburgites, gabbros and other ultramafic types. The layering is very difficult to pick up and many of these types possibly grade into each other rather than being layers of a definite composition. Alignment of pyroxene grains (igneous lamination) is very common and is probably due to convection currents acting during the crystal settling.

B1 (00N, 1,250W)

Pyroxenite, averages 1.25 mm. but varies from 0.5 to 2.0 mm.
98% orthopyroxene partly altered along grain boundaries and cracks to talc, serpentine and tremolite.
A little interstitial clinopyroxene.

B6 (200N, 1,500W)

Feldspathic pyroxenite, averages 1.5 mm.
80% subhedral to euhedral orthopyroxene, often very elongate and aligned.
15% interstitial partly saussuritized plagioclase (An 51)
5% interstitial clinopyroxene
½% interstitial chromite

B8 (750N, 2,000W)

Highly altered gabbro. Averages 1.5 mm.
Composed of 50% saussuritized plagioclase and 50% light brown amphibole which has probably replaced clinopyroxene. Some uralitic amphibole after orthopyroxene.

B14 (1,300W, 1,900W)

Gabbro, averaging 0.75 mm.
65% saussuritized plagioclase.
35% clinopyroxene partly replaced by light greenish bornblende.
This may be an intrusive rock, but the alingment of grains suggests that it is an accumulate.

B 29 (00N, 2,400W)

Norite, averages 1 mm.
55% orthopyroxene, partly replaced by talc and tremolite.
40% plagioclase, partly in large poikolitic grains enclosing many pyroxenes and partly as subhedral grains (An 64).
5% interstitial clinopyroxene, rare large grains.

B166 (250N, 3,800W)

Feldspathic pyroxenite, averaging 1.5 mm.
70% subhedral orthopyroxene
25% plagioclase (An 63). Interstitial, partly saussuritized
5% interstitial clinopyroxene
Rare chromite.

B 167 (200N, 3,500W)

Feldspathic pyroxenite, averaging 1 mm.
80% subhedral to euhedral orthopyroxene partly replaced by tremolite and talc.
18% plagioclase, An 63, partly sgussuritized, largely interstitial.
2% interstitial plinopyroxene.

B 168 (200N, 3,400W)

Feldspathic pyroxenite, averages 1 mm.
70% orthopyroxene, subhedral to euhedral, some very elongate (length & width up to 5.1)
30% plagioclase, partly as poikolitic patches up to 1.5 cm., and partly as subhedral grains. Saussuritised in patches. An 48 in poikolitic patches, but up to An 64 in rest of grains.
A few % of interstitial plinopyroxene.

B 265 (250N, 1,750W)

Feldspathic pyroxenite, averages 1.5 mm.
70% subhedral aligned elongate orthopyroxenes.
25% interstitial saussuritized plagioclase.
A few % of olivine up to 3 mm., some as glomeroporphyritic patches.
Rare interstitial clinopyroxene.
Very rare spinel.

ROCKS OF AREA E OF FIGURE I

These are mainly coarse to medium pyroxenites and harzburgites. They have been partly serpentinised or altered to amphibole rocks and have been slightly deformed in places. They were almost certainly accumulates originally.

B 15 (1,500N, 1,400W)

This was an orthopyroxenite averaging 2-3 mm. now completely replaced by uralitic amphibole.

B 185 (6,500N, 3,000W)

This rock consists mainly of mesh-textured serpentinite with a strong lineation. However, patches of bastite pseudomorphs after orthopyroxene occur and these are "interlocked" with mesh textured serpentine which is almost certainly after olivine. Hence the original rock was a harzburgite.

B 204 (4,000N, 2,400W)

This rock consists of light coloured amphibole as elongate irregular laths up to 3 mm. long. These possibly have replaced orthopyroxene.

B 206 (4,000N, 2,400 W)

This rock is a harzburgite, consisting of scattered large orthopyroxene grains (up to 1 cm.) containing rounded olivine inclusions in a groundmass (1 mm.) of olivine, orthopyroxene and a little clinopyroxene and chromite, which is partly replaced by talc and serpentine.

B 480 (8,000N, 5,280W)

This is a serpentinized websterite or werhlite.

It consists of 35% partly altered grains of clinopyroxene averaging 2 mm. in a groundmass of serpentine. The serpentine varies between a very crude mesh and an irregular platy type, and may be replacing olivine, orthopyroxene, or both.

ROCKS OF AREA F OF FIGURE I

This area is the apparent transition zone from the pyroxenites and olivine pyroxenites in the area and the W and the harzburgites, dunites, troctolites etc. of areas H, I, J. It includes interlayered pyroxenites, harzburgites, norites, gabbros, and rarer troctolites. These, of course, all have accumulate textures.

B499 (1,200N, 300W)

Altered troctolite.

Contains 70% mesh-textured serpentinite after olivine grains 1-2 mm. in size. The interstitial feldspar has altered and a cloudy brown material that is near isotropic and may be hydrogrossular. Rare chromite grains are present.

B 615 (520N, 250W)

Pyroxene rich harzburgite, averages 4 mm. but very variable.

70% orthopyroxenes up to 5 mm, subhedral, contain inclusions of olivine grains of various sizes.

25% olivine as "rounded" inclusions in orthopyroxene and interstitial to the orthopyrozenes. Partly serpentinised.
1% interstitial saussuritized feldspar.
2% scattered euhedral chromite
A little interstitial clinopyroxene.

B 617 (500N, 100W)

Bronzite gabbro, averages 2 mm.

30% subhedral orthopyroxene.
40% saussuritized plagioclase.
30% anhedral clinopyroxene as separate grains and also partly wrapping around orthopyroxenes.

B 618 (750N, 700E)

Fine-grained gabbro, averaging 0.3 mm.

70% anhedral to subhedral clinopyroxene.
30% saussuritized plagioclase.
The rock looks more like an accumulate than a later intrusive gabbro.

It contains patches of coarser (about 0.6 mm. grainsize) patches of pyroxenite consisting mainly of clinopyroxene but containing some orthopyroxenes.

B 626 (1,000N, 1,200 E)

Feldspathic pyroxenite, averaging 1 mm.

70% subhedral orthopyroxene.
25% saussuritized plagioclase, with rare patches of albite.
5% clinopyroxene, mainly interstitial.

ROCKS OF AREA G OF FIGURE I

These are very similar to those of area D.

B 209 (5,900N, 1,750W)

Pyroxenite, averaging 2 mm.
90% subhedral orthopyroxene
10% clinopyroxene, mainly interstitial
A little interstitial saussuritized plagioclase.

B 477 (6,000N, 1,050W)

Bronzite gabbro, averaging 1 mm.
Plagioclase An 68, 40% of rock, subhedral and anhedral. Partly saussuritized.
25% anhedral orthopyroxene with poikolitic inclusions of feldspar and more rarely of clinopyroxene. Partly altered to amphibole
35% anhedral clinopyroxene with rare feldspar inclusions. Partly altered to amphibole.

AREA C OF FIGURE I

No slides have been cut from the lease rocks in this area. The rocks are mainly medium-grained pyroxenites, feldspathic pyroxenites and harzburgites.

FINE-GRAINED INTRUSIVE GABBROS

In the lease area south of 7,000N, a number of specimens of fine-grained gabbros have been found. The field relationships to the other rocks are not known. As described above many fine-grained gabbroic rocks have accumulate textures and so are part of the layered sequence. However some of these rocks have odd textures although there seems to be a gradation sometimes towards accumulate textures. I think that some (B200 and B208 for example) could be later intrusives, mainly because of the clinopyroxene in B208 has a very much lower $\frac{MgO}{FeO}$ ratio than nearby accumulate rocks. In fact the composition of the clinopyroxene of B208 is more similar to that of B619 (an intrusive pegmatitic gabbro) than the normal accumulate rocks.

B200 (3,000N, 200E)

Altered fine-grained gabbro, averaging 0.5 mm.
70% clinopyroxene, anhedral grains
30% saussuritized plagioclase.

B208 (5,900N, 1,750W)

Fine-grained gabbro, averaging 0.4 mm.
45% anhedral clinopyroxene. These grains are "rounded" laths and rarely have poikolitic inclusions of plagioclase.
50% subhedral and anhedral plagioclase (An54).
5% orthopyroxene.
The texture of this rock is not obviously accumulate, but it also has no ophitic textures which characterise the dolerites, which are also clinopyroxene-plagioclase rocks.

B463 (4,250N, 1,300E)

Rodingite of 85% isotropic material, probably hydrogarnet. Part of this is light brown and clear and part is very cloudy. Very small fibres of tremolite are scattered throughout the hydrogarnet 15% pyroxene now altered to brown fibrous tremolite, chlorite and serpentine. Averages 0.75 mm.

Rare magnetite grains up to 1 mm.

B632 (400N, 2,400E)

This comes from a definite dyke intruding serpentinised harzburgite. It consists of a fine-grained mess of saussurite and tremolite. Relic grains of altered orthopyroxene and clinopyroxene up to 1 mm. in size are present. Pennimite veins are common.

B625 (1,000, 1,200E)

A rodingite consisting of 20% anhedral clinopyroxene, 5% orthopyroxene (largely altered to uralite) with the rest of the rock isotropic hydrogrossular.

B701 (6,000N, 600E)

A rodingite, consisting of 10% orthopyroxene, partly altered to serpentine and tremolite, 8% clinopyroxene, 2% magnetite with the feldspar (70%) having been replaced by colourless hydrogrossular. The pyroxenes are anhedral, and range from 1-4 mm. in size.

PEGMATITIC GABBROS AND RODINGITES

Veins of rodingitized pegmatitic gabbros are commonly found in rocks of areas H, J and to a lesser extent I in Figure I. They rarely occur above 7,000N. Most of them are coarse-grained, but variable in grainsize and usually form very irregular veins and dykes which intrude the normal layered rocks. They could have formed by filter-press action, that is by squeezing out of fluid interstitial to the settled crystals due to the load of the overlying crystals. They would have been altered to rodingites (i.e. feldspar replaced by hydrogrossular) by Ca-metasomatism during serpentinization. In some of the specimens the alteration has resulted in a mess of saussurite and tremolite. B619 represents a relatively fresh pegmatitic gabbro that has not been altered to a rodingite. The others were probably similar originally, although only a few of these veins and dykes probably contained magnetite.

B619 (750N, 700E)

Magnetite gabbro. Most grains are between 18.3 mm in size.
35% anhedral clinopyroxene
10% anhedral orthopyroxene
45% subhedral to anhedral plagioclase (An46), mainly altered to saussurite and to a brown mineral (chlorite?) which has grown in sheaf and bow-tie like structures.
10% magnetite which has crystallised interstitially between the pyroxenes and feldspar.

B65 (4,500N, 800E)

Highly altered gabbro
This is a hard very light grey rock consisting of fibrous or felty tremolite in a groundmass of antigorite (?) and chlorite.

B436 (3,000N, 2,200E)

This specimen is of the contact of an altered baggro and a "serpentinite". The "serpentinite" at the contact actually consists of abundant fine-grained laths of light brown hornblende in a matrix of chlorite (?) The altered gabbro consists of scattered light brown hornblendes and feldspar now psuedomorphed by a colourless mineral with anomalous blue interference colours (does not seem to be chlorite - could be a hydrogarnet) and patches of minerals that may be fine-grained sericite or epidote group minerals or both.

995098

MISCELLANEOUS ALTERED ROCKS

B58 (600N, 1,100W)

This appears to have been a gabbro or norite which is now altered to a saussurite amphibole rock. It is veined by albite and contains patches of quartz. It looks like the quartz and albite have been introduced by metasomatism.

B620 (1,000N, 1,000E)

Dolomite rock. This occurs within an intensely serpentinised and sheared zone.

It consists mainly of fine-grained dolomite, with patches and veins of coarser dolomite and patches of fibrous talc. It contains a little magnetite and is limonite stained. It does not look like a sedimentary dolomite and I would guess that it formed by metasomatism of a dolerite or gabbro during the intense serpentinization.

B623 (1,000N, 1,100E)

Dolomite-chlorite rock.
This consists mainly of fine-grained dolomite with some dolomite veins and small patches or large flakes of penninite. An origin similar to B620 is suggested.

ROCKS OF AREA "H" OF FIGURE I

These rocks consist of interlayered feldspathic harzburgites, harzburgites, pyroxenites, and various gabbroic types. The first two types are more abundant but there is a gradation between the various rocks. All are accumulates, and no deformed rocks have been found so far. In these rocks the olivine is partly or entirely replaced by serpentine, but the pyroxenes are usually quite unaltered.

B 471 (9,010N, 020W)

This rock is a norite, averaging 1mm in grainsize. It consists of 50% subhedral to euhedral orthopyroxene, 40% plagioclase (composition An 70) which is also subhedral to euhedral, and 10% anhedral clinopyroxene. The first two minerals, and possibly the clinopyroxene, crystallised and settled at approximately the same time (i.e. all belong essentially to the cumulus phase).

B 484 (8,000W, 4,200N)

This rock could be called an olivine-enstatite gabbro or alternatively a 4-phase peridotite. It averages 1.5 mm. in grainsize. It contains 45% olivine partly replaced by mesh-textured serpentine, 10% interstitial anhedral clinopyroxene, 15% anhedral orthopyroxene (not interstitial) and 30% plagioclase now replaced by a cloudy near isotropic material (possibly hydrogrossular).

B 485 (8,000N, 2,500W)

This is a layered peridotite, averaging 1.5 mm. in grainsize. It contains an orthopyroxene layer 1 cm. thick. The rest of the rock consists of 55% olivine partly replaced by mesh textured serpentinite, 25% clinopyroxene as intersticial grains, 15% subhedral orthopyroxenes which commonly contains poikilitic inclusions of olivine, and 5% interstitial plagioclase which has been replaced by a very low birefringent mineral that looks like chlorite.

B 500 (1,200N, 1,000W)

This is a serpentinite containing a number of bastites up to 1.5 mm. in size in a crude mesh texture. The general appearance of the serpentinite is suggestive of an accumulative texture with olivine interstitial to larger subhedral orthopyroxenes.

088

995100

B 695 (8,400N, 00)

Olivine-bronzite gabbro, or 4 phase peridotite. Average 2.5 mm.
35% subhedral plagioclase (An 64).
35% opx. up to 5 mm in size, after containing poikolitic inclusions of olivine and plagioclase.
25% partly serpentinised olivine.
2% anhedral clinopyroxene

ROCKS OF AREA I OF FIGURE I

These consist dominantly of interlayered troctolite, feldspathic dunite and dunite, locally grading to feldspathic harzburgites or harzburgites. They are usually almost entirely serpentinised, the plagioclase altering to hydrogrossular or saussurite. Thickness of layers varies upwards from ½ in., and there is often a tendency towards igneous lamination (i.e. further tabular minerals to lie parallel to the plane of the layering).

B 490 (11,000 N, 800 W).

Altered troctolite, averaging about 1 mm. for size of the original minerals.
40% mesh textured serpentinite with patches of fine-grained chlorite(?) with anomalous blue interference colours. This has replaced grannular olivine grains of order of 1 mm. in size.
60% plagioclase that has been completely replaced by hydrogrossular.

B 494 (1,300N, 600W)

Altered feldspathic dunite.
90% mesh-textured serpentinite, which has replaced olivine.
10% intersticial patches of order of 0.75 mm. size of almost isotropic chlorite(?) or hydrogrossular(?) which has replaced plagioclase

ROCKS OF AREA J OF FIGURE I

These consist of interlayered harzburgites, feldspathic harzburgites, olivine pyroxenites and pyroxenites, with rarer dunites, troctolites, norites and gabbros. Harzburgites, of varying grainsize and olivine/pyroxene ratio are the most dominant. Invariably the olivine is almost entirely and completely replaced by black serpentinite. Many of the coarser ones are obviously poikilitic, consisting in hand specimen of scattered large orthopyroxenes containing numerous rounded black inclusions of serpentinised olivine in a groundmass of dark serpentinised olivine. Small altered plagioclase grains or inclusions may be present. In thin section all these rocks are obvious accumulates (i.e. formed by crystal settling) and are almost entirely undeformed.

B 60 (approx. 3,300N, 400E)

This rock is a bronzite gabbro. It consists of 60% plagioclase (An 64) which is subhedral to euhedral and averages 0.5 mm. in size.
25% orthopyroxene, subhedral to anhedral, ranging from 0.5 mm. to 4 mm. and contains abundant feldspar inclusions.
15% clinopyroxene, partly replaced by light grain amphibole, anhedral, up to 2 mm. in size.

Orthopyroxene and plagioclase crystallised and settled approximately at the same time (i.e. belong to the cumulus phase).

B 61 (4,500 N, 800E)

This thin section includes a contact of a rodingite with a serpentinite.

The serpentinite consists essentially of a mesh texture after olivine grains of 1.5 mm. grainsize, but interstitial to the original grains was a small amount plagioclase and pyroxene now altered to chlorite and was a small amount plagioclase and pyroxene now altered to chlorite and serpentine respectively. Near the contact the serpentine is recrystallised to a type of mesh texture with the moreprominent fibrous veins paralleling the contact. The original rock was probably a dunite containing a small amount of pyroxene and feldspar.

The rodingite probably consists of hydrogrossular. Some patches are yellowy brown in colour, almost isotropic and obviously pseudomorphous after plagioclase grains. Other patches are colourless, isotropic and contains veins of a cloudy isotropic varirty which is white in reflected light. Some patches of chlorite in the rodingite may be replacing pyroxene.

The rodingite was probably a vein of pegmatitic gabbro which intruded the dunite. During serpentinisation calcium metasomatism occured replacing the plagioclase in the gabbro by hydrogrossular and the pyroxene by chlorite.

(4,500N, 800E)

This is a serpentinised pyroxene dunite, averaging 1.5 mm. in original grainsize. It consists of a mesh texture serpentine after olivine with intersticial platy serpentine after pyroxenes. Scattered chromite grains are present.

B 66 (4350N, 800E)

Olivine rich harzburgite, with average original grainsize about 2 mm. 85% mesh textured serpentine after olivine with rare olivine particles in some of the cores of the mesh.

About 10% scattered subhedral orthopyroxenes partly replaced by fibrous tremolite or bastite serpentinite. These contain small inclusions of chromite, olivine and more rarely olivine rimmed by clinopyroxene. Thin bands of clinopyroxene partly enclosed some orthopyroxenes adjacent to serpentinised olivine grains.
A few % chromite grains and a few patches of interstitial hydrogrossular (after plagioclase) also occur.

B 173 (1,400N, 4,500E)

Altered harzburgite consisting of 50% partly serpentinised equigranular olivines surrounded by interstitial orthopyroxene now replaced by tremolite and pyroxene.

B 202 (4,400N, 900E)

Feldspathic pyroxene rich harzburgite. Grainsize averages 1.75 mm. 65% subhedral to euhedral orthopyroxene, 25% partly serpentinised olivine, 5% interstitial plagioclase now replaced by a yellow brown near-isotropic mineral (hydrogrossular?) and a few % fine grained interstitial clinopyroxene.

B 203 (2,700N, 1,400E)

This is a fine-grained (Av. 0.3 mm.) pyroxenite consisting of 95%

subhedral orthopyroxene and 5% interstitial saussuritized plagioclase.

B 408 (1,050N, 1,500E)

This is a layered "harzburgite" containing alternate bands of serpentine and pyroxenite 3-10 mm. in thickness.

The pyroxene bands consist mainly of aligned orthopyroxenous with a little interstitial clinopyroxene. These are partly serpentinised and replaced by tremolite near the serpentine bands.

The serpentine consists of a crude mesh-texture which might be replacing olivine although this is not obvious. Small euhedral chromites are common in the serpentine bands.

B 409 (1,050N, 1,500E)

Pyroxenite, averaging 2,5 mm. in grainsize.

Composed of anhedral orthopyroxene, but there is no direct evidence of deformation. The orthopyroxene contains rare inclusions of clinopyroxene and olivine, and there is a little interstitial clinopyroxene and serpentine which may have replaced olivine. Very scattered chromite is present.

B 433 (3,000N, 1,500E)

This is a fine-grained gabbro averaging 0.4 mm. It consists of 45% anhedral clinopyroxene occasionally intergrown with plagioclase in subophitic-like textures. Altered in places to hornblende and,more rarely, chlorite.

45% plagioclase (An 58) mainly altered to saussurite.
10% Uralite, probably after orthopyroxenes.

This rock may be part of the layered sequence or it could be an intrusive dyke. Unless the outcrop is good and unambiguous it is very difficult to be sure of the origin of these fine-grained clinopyroxene-rich rocks.

B 434 (3,000N, 2,000E)

Fine-grained feldspathic pyroxenite, averaging 0.35 mm.

This consists of 65% subhedral and euhedral laths of orthopyroxene in a mass of saussuritized plagioclase. Much of the pyroxene has altered to uralite.

Some clear albite is present. In contrast with B434 the texture of this rock shows that it almost certainly belongs to the layered sequence.

B 445 (3,500N, 2,100E)

4-phase peridotite, averaging 2 mm.

30% subhedral plagioclase partly replaced by saussurite
20% anhedral orthopyroxene
20% partly serpentinised olivine
30% anhedral to subhedral clinopyroxene, in places replaced by a very light coloured amphibole.

B 405 (4,000N, 950E)

A fine-grained pyroxenite, average 0.6 mm. but up to 1.5 mm.

65% subhedral orthopyroxene laths.
25% interstitial plagioclase, An 64, saussuritised in patches.
10% clinopyroxene, mainly interstitial but some larger anhedral crystals.

B 734 (5,250N, 1,000E)

Olivine orthopyroxenite, averaging 2 mm.

80% subhedral orthopyroxene. Inclusions of clinopyroxenes common.
17% olivine as large ovoid patches up to 1 cm. long, each consisting of either 1, 2, or 3 grains. These are partly serpentinised and oriented parallel to the igneous lamination (i.e. indicative of scouring by convection currents during crystal settling).

30% clinopyroxene, interstitial or as inclusions in orthopyroxene.

DOLERITES

A large mass of dolerites with some basic volcanics occurs to the E of the lease-area. Part of this mass occurs within the lease-area K on Figure I. In addition small plugs or dykes occur within the main mass of the ultramafics.

The main mass, and also of course the small bodies, of dolerite are most probably intrusive into the ultramafics. The dolerite is generally altered, but is easily distinguished from the ultramafics and fine-grained gabbros in thin section as ophitic and subophitic textures are always present. Pyroxenes and plagioclase in the gabbro described above never interlock in these ophitic or subophitic textures. I think the dolerites are Cambrian since they are commonly associated with the ultramafics in Tasmania and also occur as detritus in M-€* sediments in the Adamsfield area. They are augite dolerites, and never contain orthopyroxene or pigeonite as does the Jurassic dolerite of Tasmania.

B424 (1,500N, 3,685E)

Altered dolerite. The original grainsize averaged 1.5 mm.
The rock is composed of saussuritized feldspar and augite now replaced by fine-grained randomly orientated light brown amphiboles.
Subophitic textures are preserved.

B428 (2,500N, 1,900E)

Altered dolerite.
Contains 40% very light brown hornblende which has psuedomorphed augite or replaced it as fine-grained randonly oriented fibres.
60% very cloudy feldspar, which is now albite (An 5).
Subophitic textures are preserved.

B470 (7,500N, 5,000E)

Dolerite, averaging 0.4 mm.
65% clinopyroxene now replaced by light green amphibole.
33% plagioclase laths (An 31), partly saussuritised.
A few percent of quartz and a little magnetite are also present.
Subophitic and ophitic textures are preserved.

* Middle Cambrian

OTHER DOLERITES (HYPERSTHENE DOLERITES)

Relatively fresh dolerites, labelled as hypersthene dolerites on Figure 2, also occur in the area. These contain a hypersthene which may show reaction relationships with the rest of the minerals. Possible relationships to the above dolerites or the fine-grained intrusive gabbros could be established when whole rock analyses have been completed. Another possibility is that they are Jurassic dolerites.

B418 (1,050N, 4,000E)

Dolerite, averaging 0.2 mm.
20% anhedral clinopyroxene.
20% brown hornblende which may replace clinopyroxene, or may be primary, or both.
50% plagioclase laths (An 62)
5% interstitial quartz
A few larger grains of hypersthene often rimmed by spinel grains (i.e. reacted with the magma).
The texture of the rock is subophitic to intersertal.

B 502

Dolerite, averaging 3/4 mm.
45% stubby plagioclase laths (Au 60).
35% anhedral orthopyroxene
20% clinopyroxene
The texture is subophitic to ophitic, unlike the textures in the gabbro previously described.

DRILL CORE PETROLOGY

Most of the rocks in the drill cores are altered to a varying extent to serpentinites, etc. Hence on the diagram I have tried to interpret what I think the original rock types was. I feel fairly confident for holes H1, H2, but H3 and H4 are highly altered and it would be very difficult to tell what the original rock was throughout most of these cores even if numerous thin sections were cut.

B712 - fine grained tremolite rock

This rock consists mainly of aligned tremolite laths or needles 0.2 mm long and some interstitial chlorite. It probably formed by deformation and alteration of a pyroxenite.

B713 - fine grained pyroxenite (average 0.2 mm.)

The rock consists of 90% subhedral opthopyroxene partly altered along grain boundaries and cracks to talc and tremolite. Clinopyroxene (5%) and saussuritized feldspar (5%) is mainly interstitial. ½% scattered chromite. The rock is a typical cumulate.

B714 - altered pegmatitic gabbro

The original rock contained 60% feldspar now altered to cloudy saussurite and fine grained prehnite. There is 20% anhedral orthopyroxene averaging 2 mm. but varying up 8 mm. Anhedral clinopyroxene averages 1.5 mm.

B715 - serpentinite

Mesh-textured serpentinite, probably replacing a dunite but this is not obvious. Chromite - 1%. Part of the thin section consists of a very fine grained felted serpentinite with some veins and patches of chlorite.

B716 - Altered feldspathic pyroxenite (Averaging 2 mm.)

The rock contains 85% subhedral to anhedral orthopyroxene which has been partly replaced by tremolite, talc and serpentine. Many of the crystals have been slightly deformed (after or during alteration) 8% clinopyroxene, largely altered to hornblende, is mainly interstitial. 7% interstitial saussuritized plagioclase.

B71 - Altered pyroxenite

Completely uralitized (replaced by fibrous tremolite) pyroxenite
Original crystals averaged 1.5 mm..

B719 Pyroxenite (Av. 1 mm.)

Most of the section consists of 92% orthopyroxene and 8% interstitial clinopyroxene. The rest shows a gradation from this into a tremolite schist.

B720 - Feldspathic pyroxenite (Averages ½ mm.)

65% orthopyroxene, subhedral
25% clinopyroxene, mainly interstitial but some ½ mm. anhedral grains. Partly altered and hornblende.
10% saussuritized plagioclase.
1% chromite.

B721 - Pegmatitic gabbro

Averages 3 mm, but grainsize varies from ½mm to 10 mm.
20% orthopyroxene, anhedral, tp to 10 mm.
30% anhedral clinopyroxene, partly altered and hornblende.
50% plagioclase, An 68 (labradorite).
A sort of granular texture, unlike the layered rocks which have typical cumulative textures.

B723 - Altered gabbro (Averages 2 mm, but variable)

50% orthopyroxene, anhedral to subhedral
20% clinopyroxene, mainly interstitial but some larger anhedral grains. The latter contain abundant orthopyroxene inclusions.
30% partly saussuritized, An 60, partly interstitial and partly as larger grains.
The texture which is essentially stubby laths of orthopyroxene with interstitial clinopyroxene and feldspar shows this rock is a cumulate (i.e. part of the layered sequence) and does not belong to the intrusive pegmatitic gabbros...

B724 - Highly altered gabbro.

Replaced by a mass of amphibole, prehnite, saussurite, uralite, serpentine, etc.

B725 - Altered gabbro (Averages 1.5 mm.)

70% plagioclase, altered to saussurite. Texture shows settling under gravity.
25% anhedral clinopyroxene. Some large grains, but most is interstitial or "moulded" against larger orthopyroxenes. The clinopyroxene contains inclusions of latered orthopyroxene and is partly replaced by tremolite.
5% orthopyroxene, replaced by talc, uralite and serpentine.
Part of the layered sequence.

B727 - Altered fine-grained gabbro (Av. 0.3 mm.)

65% plagioclase, now altered to albit (An. 8), prehnite, saussurite, etc.
35% anhedral clinopyroxene, largely altered to tremolite and is part brecciated.
This rock may be part of the layered sequence or could be one of the fine-grained intrusive gabbros. It is far too altered to tell either way.

B730 - Altered pyroxenite (Av. 3 mm.)

95% euhedral orthopyroxenes, 1 cm. down to interstitial ones of 1 mm. Largely replaced by tremolite and some platy serpentinite.
5% interstitial clinopyroxene.

B736 - Highly altered gabbroic rock

The rock is entirely altered to light brown hornblende, saussurite, serpentine, chlorite and talc.

B737 - Pyroxene-rich norite (Av. 5 mm.)

65% euhedral orthopyroxenes, ranging from ½ mm. to 2 cm.
Partly replaced by tremolite.
35% interstitial plagioclase altered in part to hydrogrossular(?) and in part to prehnite.

B738 - Altered feldspathic pyroxenite

75% subhedral to euhedral orthopyroxene up to 1 cm. in size, replaced by tremolite and serpentine.
25% plagioclase altered to prehnite with some patches of saussurite and hydrogrossular.

B739 - Coarse orthopyroxenite

95% orthopyroxene, ranging from 1 mm. to 2 cm. Anhedral to subhedral
5% interstitial olivine, partly replaced by serpentine
Scattered chromite grains, up to 1 mm.
The rock has a strange texture with the orthopyroxenes interlocking with each other in an unusual fashion.

HOLE 2

B743 - Harzburgite (Av. 1 mm.)

70% orthopyroxene as subhedral to euhedral stubby laths.
25% olivine, anhedral grains, partly altered to serpentinite
3% clinopyroxene, interstitial and wrapping around orthopyroxenes.
2% interstitial saussuritized plagioclase.

B744 - Feldspathic olivine pyroxenite (Av. 2 mm.)

70% orthopyroxene, subhedral to euhedral
15% olivine, anhedral grains, partly altered and serpentinite
3% clinopyroxene, interstitial and wrapping around orthopyroxenes.
2% interstitial saussuritized plagioclase.

B744 - Feldspathic olivine pyroxenite (Av. 2 mm.)

70% orthopyroxene, subhedral to euhedral
15% olivine, anhedral grains.
8% interstitial saussuritized plagioclase
7% clinopyroxene, mainly interstitial but some larger grains poikilitically including orthopyroxene and olivine grains.

B745 - Feldspathic poikolitic harzburgite (serpentinized)

60% orthopyroxene up to 1 cm. in size - largely replaced by bastile serpentinite or tremolite and riddled with poikilitic olivine inclusions which have altered to mesh-textured serpentinite.
30% olivine, altered to mesh-textured serpentinite
5% interstitial feldspar, now replaced by hydrogarnet.
One large clinopyroxene crystal molded against an orthopyroxene
1% chromite grains

HOLE 3

B747 - Serpentinised dunite (?)

Mesh textured serpentinite, probably (but not obviously so) replacing olivine. In patches, it seems that the original rock consisted of olivine grains 1-2 mm. in size surrounded by interstitial pyroxene.
1% scattered chromite grains.

B751 - Altered harzburgite (for 2½ mm.)

This rock consisted of about 70% orthopyroxene and 30% interstitial olivine and is now largely altered to serpentine, tremolite, talc, etc.

995113

	ORTHOPYROXENES				CLINOPYROXENES			
	B484	B695	B615	B208	B484	B695	B208	B619
SiO_2	57.35	57.21	56.93	53.56	52.14	50.49	51.26	49.86
TiO_2	0.06	0.12	0.08	0.12	0.15	0.20	0.24	0.21
Al_2O_3	2.40	1.39	1.75	1.05	3.46	2.75	2.03	2.36
FeO	7.40	11.47	10.78	20.05	3.11	4.66	9.00	11.04
MnO	0.16	0.24	0.21	0.44	0.09	0.12	0.22	0.28
MgO	32.44	30.03	29.78	22.87	16.83	15.99	14.63	13.21
CaO	1.20	0.79	0.88	1.06	23.50	23.24	20.56	21.95
Na_2O	0.00	0.00	0.02	0.06	0.32	0.35	0.15	0.23
K_2O	0.00	0.00	0.01	0.00	0.02	0.03	0.03	0.05
Cr_2O_3	0.50	0.27	0.25	0.00	0.92	0.58	0.05	0.00
NiO	0.11	0.00	0.14	0.00	0.13	0.13	0.12	0.14
	101.62	101.57	100.83	99.21	100.03	98.54	98.29	99.33

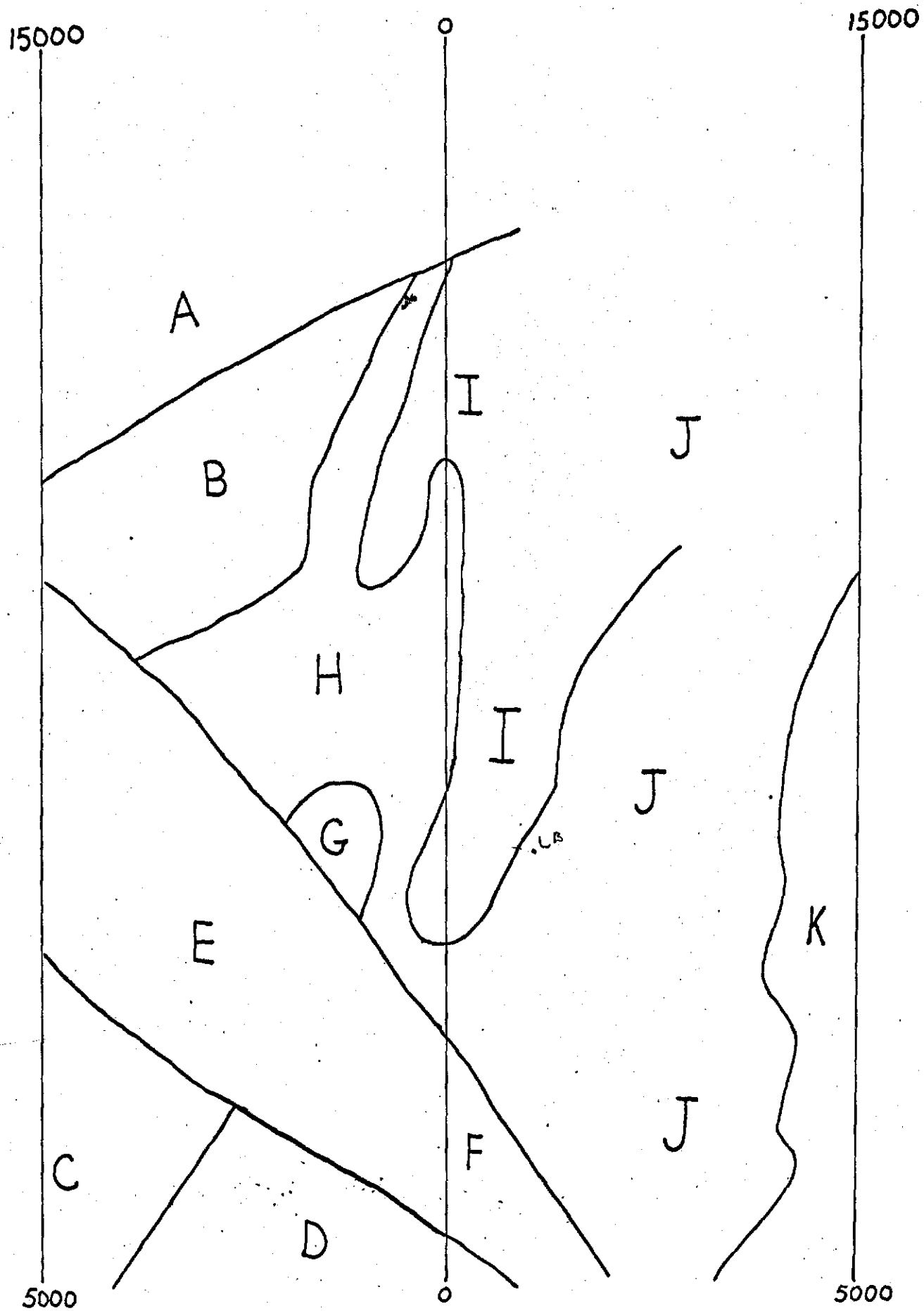
The above analyses are of pyroxenes from rocks of the lease area, done by myself using the A.N.U. electron probe. The rocks are described in the petrological report and the respective pages are referred to above. Analyses of rocks outside the lease area and 2 poor analyses are not included. Analyses of olivines are not included since they add up to 95% due to trouble with the standards. It might be of interest though that I obtained values of up to 0.5% NiO in olivines from the lease area.

III

112

995114

FIG. 1



To accompany Report:-"Geology of the Bald Hill Complex" by M. Rubenach.

70-644

LEGEND

—?—?— approximate or graditional boundary

------ boundary, nature uncertain (possible fault)

——— fault

highly sheared serpentinite

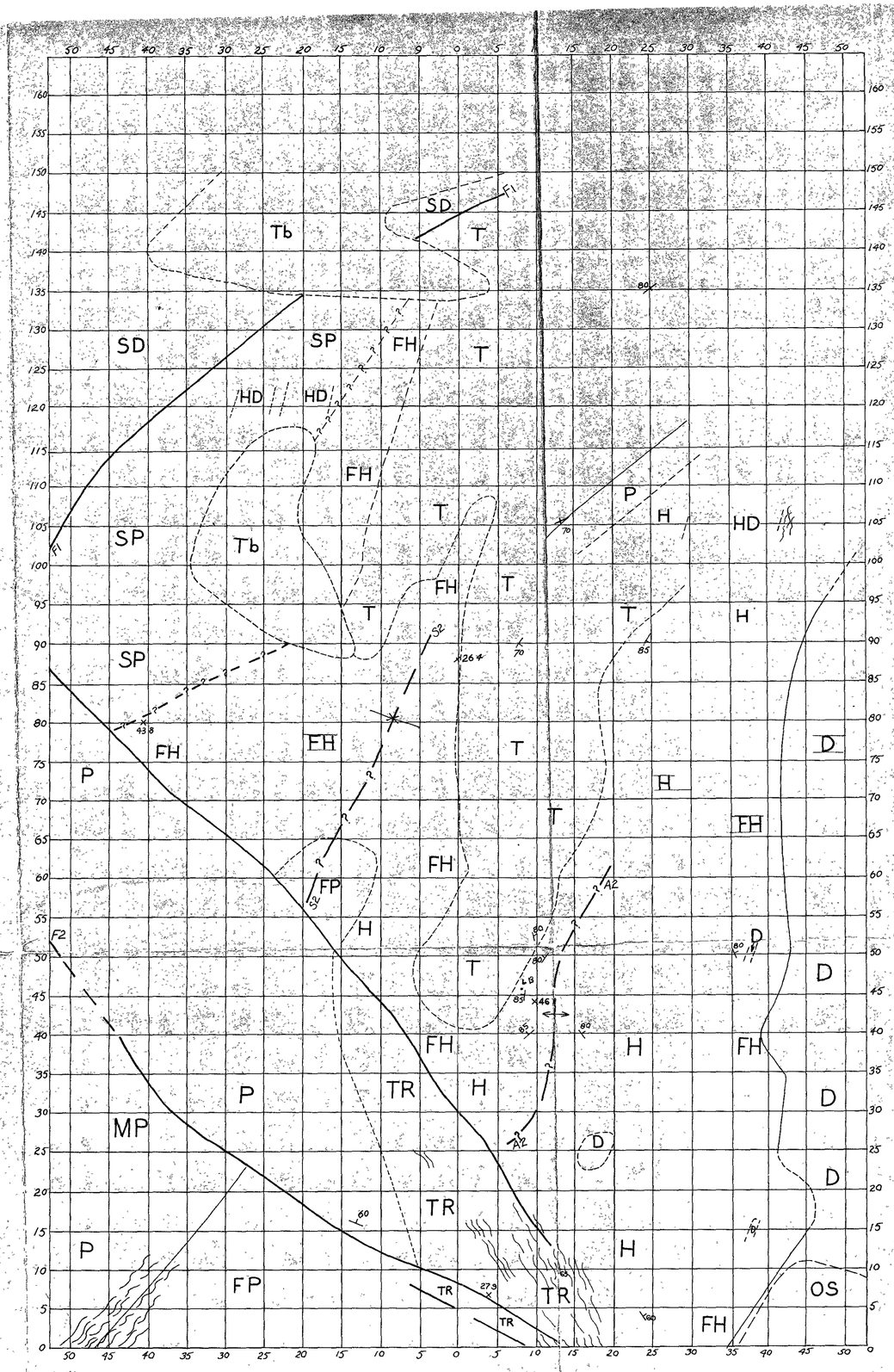
$\overset{60}{\top}$ dip of layering

X 43·8 $\frac{MgO \times 10}{FeO}$ for ortho-pyroxenes of layered rocks.

GEOLOGY OF THE BALD HILLS COMPLEX

TO ACCOMPANY REPORT BY M. RUBENACH 1969

5 cm



LEGEND

Tb	Tertiary Basalt
O-S	Ordovician – Devonian Sediments
	Bald Hill Intrusive Complex
HD	Hypersthene Dolerite
D	Dolerite
F P	Fine-grained Pyroxenites & Feldspathic Pyroxenites
MP	Feldspathic Medium-grained Pyroxenites & Harzburgites. Some Fine-grained Pyroxenites.
P	Medium to Coarse-grained Pyroxenites and Olivine Pyroxenites. Some Harzburgites.
T	Troctolites, Feldspathic Dunites & Dunites.
FH	Feldspathic Harzburgites, Harzburgites. Ortho-Clinopyroxene-Olivine-Feldspar Rocks. Some Pyroxenites.
H	Harzburgites, Pyroxene Dunites, Olivine Pyroxenites and Pyroxenites.
TR	Transition Rocks Harzburgites, Pyroxenites, Feldspathic Pyroxenites, Feldspathic Harzburgites, Gabbros Troctolites.
SP	Serpentinized Pydroxenites & Harzburgites
SD	Serpentinized Dunite Minor Hyroxenite

995115

N.B. Rocks underlined represent the dominant types of a particular group.

2320

113

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995116

REPORT ON THE NICKEL MINERALISATION

AT THE LORD BRASSEY MINE,

HEAZLEWOOD AREA, TASMANIA

by

M. RUBENACH

JANUARY, 1970

Average Nickel Content in Bald Hill Complex

Olivines	9 rocks	0.33%
Orthopyroxenes	7 rocks	0.09%
Clinopyroxenes	3 rocks	0.10%

Hence an altered pyroxene dunite should contain of the order of 0.25% to 0.30% Ni, while a harzburgite should contain about 0.20% Ni.

In the Lord Brassey Mine, the rocks are essentially serpentinised pyroxene dunites and partly serpentinised harzburgites (called serpentinite and bronzite serpentinite respectively in the report of Gilfillan and Marshall).

The nickel contents of bulk samples (presumably including the heazlewoodite veins) from the mine are set out below unsheared serpentinite (i.e. serpentinized pyroxene dunite) - 0.17%Ni - average of 64 samples, bronzite serpentinite (i.e. serpentinized harzburgite) - 0.11% Ni - average of 14 samples, sheared serpentinite - 0.28% Ni, average of 21 samples.

Sulphur contents of bulk samples from mine:

Unsheared serpentinite (serpentinised pyroxene dunite)
49 of the samples have less than 0.01% S, 11 have 0.01%, 2 have 0.02% S, one 0.04% S and one has 0.06% S.

Bronzite serpentinite (harzburgite)
11 have less than 0.01% S and e have 0.01% S.

Sheared serpentinite - the average of 19 samples is 0.05% S, while only 2 have less than $\leq$ 0.01% S.

Analyses from Drill Core Samples

Drill Hole, H1

Depth	Nickel	Sulphur
580 - 685 ft.	0.18%	0.01%
585 - 690	0.21	0.01
640 - 645	0.21	0.01
645 - 650	0.24	0.01

These rocks are sheared serpentinites, which I had said were probably serpentinized pyroxenites in my report on the drill-hole petrology. However, the nickel contents seem to be high for pyroxenites as my analyses of pyroxenes do not contain that much nickel.

Drill Hole, H2

Depth	Nickel	Sulphur
150 - 155 ft	0.02%	0.01%
260 - 265	0.19	0.01
265 - 270	0.18	0.01
390 - 395	0.18	0.03
395 - 400	0.20	0.04

The rock at 150 - 155 ft. is a medium grained harzburgite, with some pyroxene bands. The nickel content is extremely low, which may be due to several reasons, e.g. segregation of nickel sulphides or poor analysis.

The rocks 260 - 270 ft. are serpentinized pyroxene harzburgites. This is the same rock type as the serpentine in the mine, and their nickel content is slightly higher for the average mine value of 0.17%.

Rocks 390 - 400 ft. are harzburgites, and the nickel contents are comparable with the average harzburgite value computed from the electron probe analysis, i.e. 0.20%.

Drill Hole, H3

Depth	Nickel	Sulphur
690 - 700 ft.	0.05%	0.02%

I would have said this rock was a serpentinised dunite. Again the nickel content seems too low.

Drill Hole, H4

Sampling every ten feet for 800 ft. The nickel content varies from 0.13 to 0.22%, while sulphur is constant at 0.01%. The average nickel content is 0.18%. I had guessed that these rocks are serpentinised pyroxenites and olivine pyroxenites while the nickel contents are more consistent with my values for average olivine pyroxenites and harzburgites.

PETROLOGY OF DIAMOND DRILL HOLE CORE SAMPLES - 995120

- HEAZLEWOOD Ni PROSPECT

Most of the rocks in the drill cores are altered to a varying extent to serpentinite etc. Thence on the diagram (Fig A) I have tried to interpret the original rock type. I feel fairly confident for holes H1, H2 but H3 and H4 are highly altered and it would be very difficult to tell what the original rock was throughout most of these cores even if numerous thin sections were cut.

DIAMOND DRILL HOLE H1

B712 - Fine grained tremolite rock

This rock consists mainly of aligned tremolite laths or needles 0.2 mm long and some interstitial chlorite. It probably formed by deformation and alteration of a pyroxenite.

B713 - Fine grained pyroxenite (Average 0.2mm)

The rock consists of 90% subhedral orthopyroxene partly altered along grain boundaries and cracks to talc and tremolite. Clinopyroxene (5%) and re saussuritized feldspar (5%) is mainly interstitial. 0.5% scattered chromite. The rock is a typical cumulate.

B714 - Altered pegmatitic gabbro

The original rock contained 60% feldspar now altered to cloudy saussurite and fine-grained prehnite. There is 20% anhedral orthopyroxene averaging 2mm but varying up to 8mm. Anhedral clinopyroxene averages 1.5mm.

B715 - Serpentinite

Mesh-textured serpentinite, probably replacing a dunite but this is not obvious. Chromite - 1%. Part of the thin section consists of a very fine - grained felted serpentinite with some veins and patches of chlorite.

B716 - Altered feldspathic pyroxenite (Averaging 2mm)
The rock contains 85% subhedral and anhedral orthopyroxene which has been partly replaced by tremolite, talc and serpentine. Many of the crystals have been slightly deformed (after or during alteration).
8% clinopyroxene, largely altered to hornblende, is mainly interstitial.
7% interstitial saussuritized plagioclase.

B371 - Altered pyroxenite
Completely uralitized (replaced by fibrous tremolite) pyroxenite.
Original crystals averaged 1.5mm.

B719 - Pyroxenite (Average 1mm)
Most of the section consists of 92% orthopyroxene and 8% interstitial clinopyroxene. The rest shows a graduation from this into a tremolite schist.

B720 - Feldspathic pyroxenite (Average 0.5mm)
65% orthopyroxene, subhedral
15% Clinopyroxene, mainly interstitial but some 0.5mm anhedral grains. partly altered to hornblende.
10% saussuritized plagioclase.
1% chromite.

B721 - Pegmatitic gabbro.
Averages 3mm, but grain size varies from 0.5mm to 10mm.
20% orthopyroxene, anhedral, up to 10mm.
30% anhedral clinopyroxene, partly altered to hornblende.
50% plagioclase, An_{68} (labradorite).
A sort of granular texture, unlike the layered rocks which have typical cumulative textures.

B723 - Altered gabbro (Averages 2mm but variable)
50% orthopyroxene, anhedral and subhedral
20% clinopyroxene, mainly interstitial but some larger anhedral grains. The latter contain abundant orthopyroxene inclusions. 30% partly sanssuritized, An_{60}, partly interstitial and partly as larger grains.

The texture which is essentially stubby laths of orthopyroxene with interstitial clinopyroxene and feldspar shows this rock is a cumulate (i.e. part of the layered sequence) and does not belong to the intrusive pegmatitic gabbros.

B724 - Highly altered gabbro.
Replaced by a mess of amphibole, prehnite, saussurite, uralite, serpentine etc.

B725 - Altered gabbro (Averages 1.5mm)
70% plagioclase, altered to saussurite. Texture shows settling under gravity.
25% anhedral clinopyroxene. Some large grains, but most is interstitial or "moulded" against larger orthopyroxenes. The clinopyroxene contains inclusions of altered orthopyroxene and is partly replaced by tremolite.
5% orthopyroxene, replaced by talc, uralite and serpentine. Part of the layered sequence.

B727 - Altered fine grained gabbro (Averaging 0.3mm)
65% plagioclase, now altered to albite (An_8), prehnite, saussurite etc.
35% anhedral clinopyroxene, largely altered to tremolite and in part brecciated.
This rock may be part of the layered sequence or could be ore of the fine-grained intrusive gabbros. It is far too altered to tell either way.

B730 - Altered pyroxenite (Averages 3mm)
95% euhedral orthopyroxenes, 1cm down to interstitial ones of 1mm. Largely replaced by tremolite some platy serpentinite.
5% interstitial clinopyro en .

B736 - Highly altered gabbroic rock
The rock is entirely altered to light brown hornblende, saussurite, serpentine, chlorite and talc.

B737 - Pyroxene-rich norite (Averages 5mm)
65% euhedral orthopyroxenes, ranging from 0.5mm to 2cm.
Partly replaced by tremolite.

35% interstitial plagioclase altered in part to hydrogrossular (?) and in part to prehnite.

B738 - Altered feldspathic pyroxenite.
75% subhedral to euhedral orthopyroxene up to 1cm in size, replaced by tremolite and serpentine..
25% plagioclase altered to prehnite with some patches of saussurite and hydrogrossular.

B739 - Coarse orthopyroxenite.
95% orthopyroxene, ranging from 1mm to 2cm. Anhedral to subhedral.
5% interstitial olivine, partly replaced by serpentine.
Scattered chromite grains, up to 1mm.
The rock has a strange texture with the orthopyroxenes interlocking with each other in an unusual fashion.

DIAMOND DRILL HOLE HS H2

B743 - Harzburgite (Averages 1mm)
70% orthopyroxene as subhedral to euhedral stubby laths.
25% olivine, anhedral grains, partly altered to serpentine
3% clinopyroxene, interstitial and wrapping around orthopyroxenes.
2% interstitial saussuritized plagioclase.

B744 - Feldspathic olivine pyroxenite (Averages 2mm)
70% orthopyroxene, subhedral to euhedral.
15% olivine, anhedral grains.
8% clinopyroxene, mainly interstitial but some larger grains poikolitically including orthopyroxene and olivine grains.

B745 - Feldspathic poikolitic harzburgite (serpentinized)
60% orthopyroxene up to 1cm in size, largely replaced by bastite serpentinite or tremolite and riddled with poikolitic olivine includions which have altered to mesh-textured serpentinite.
30% olivine, altered to mesh-texutured serpentinite.
5% interstitial feldspar, now replaced by hydrogarnet.
One large clinopyroxene crystal moulded against an orthopyroxene
1% chromite grains.

DIAMOND DRILL HOLE H3

B747 - Serpentinized dunite (?)
Mesh textured serpentinite, probably (but not obiously so) replacing olivinie. In patches, it seems that the original rock consisted of olivine grains 1-2 mm in size surrounded by interstitial pyroxene.
1% scattered chromite grains.

B751 - Altered harzburgite (Averages 2.5mm)
This rock consisted of about 70% orthopyroxene and 30% interstitial olivine and is now largely altered to serpentine, tremolite, talc, etc.

M. RUBENACH, DECEMBER, 1969

H1

0 — Layered. Layers of order of 1ft thick at 60-70° to the hole

Tr + D — Some transgressive gabbro pegmatite veins

20

13712

Tr — serpentized; some gabbro pegmatite veins

40

P 13713 — fine-grained

tr 13714 — irregular gabbro pegmatite veins

fD 13715 — serpentized

60

N

FP + g 13716

13717

80

100

P (serpentized) — numerous veins and patches of pegmatite gabbro some areas of less altered fine-grained pyroxenite.

120

140

13719

160

180

g-peg

13720

200 **FP** — fine-grained

FP or FH

220 Serpentized

13721

240 **g peg**; some P and FP

260

FH or FP — numerous veins + dykes (up to 3ft) of gabbro pegmatite

280

13723

g-peg. — dyke

300 **FH or FP** Serpentized

13724

FP — fine-grained

320

FH or FP Serpentized — some gabbro pegmatite veins

340

H or P Serpentized

g 13725 — fine-grained

360

380

400 **FP** — fine-grained

420

440 **g** on FP 13727

460 — fine-grained

480

13730 — ↑more feldspathic

P — ↑grain size decreasing

500

H1 (CONT.)

500 **P**

520 serpentized

540

560 sheared serpentinite

13736 core of altered gabbro

580

13737, 13738 cores of coarse feldspathic pyroxenites

600

620

640

660 sheared serpentinite

680

700

720

740

760 13739 coarse pyroxenite core

780 sheared serpentinite

H2

0

20 serpentinite (slightly feldspathic

40

60

80 — shear zone

poik H partly serp.

100 **H** (pyroxene rich)

H (feldspathic pyroxene poor) — feldspathic; and contains layers of pyroxene-rich harzburgites (finer-grained) running at 45° to the hole

120

poik H

140

H — mainly pyroxene rich harzburgites layered. Some layers of order of 1" to several feet of fine-grained pyroxenite with a pronounced igneous lamination.

160

13743

13744

H — harzburgite (ol ≈ opx)

180

Serpentinite (sheared) — Serpentinite possibly after olivine rich harzburgite.

200

poik H

13745 — feldspathic

220

240 serpentinite — serpentinite after slightly feldspathic harzburgite or dunite

Grades locally and a pyroxene-poor harzburgite

260

280

H — poikolithic harzburgite with orthopyroxenes up to 1½" long

Grades locally to a slightly feldspathic harzburgite. layers of 1" or less of feldspathic olivine poor harzburgite that is not poikolithic.

Layering very steep to hole direction.

Some trangressive veins of gabbroic pegmatite.

300

320

340

360

380

400

LEGEND

——	contact
.....	approximate or gradational contact
H	harzburgite
FH	feldspathic harzburgite
N	norite
tr	troctolite
D	dunite
P	pyroxenite
FP	feldspathic pyroxenite
fD	feldspathic dunite
g	gabbro (part of layered sequence)
g-peg	pegmatic gabbros (intrusive into layered sequence)
poik H	harzburgite with poikolithic texture

H3 — all serpentinite. Could be serpentinized dunite. eg: 13747 at 26'6"

H4 — serpentinite. 13751 - highly altered pyroxene rich harzburgite at 321'6"

Other patches with pyroxenes and pyroxene pseudomorphs suggesting that the original rocks were pyroxenites or olivine pyroxenites.

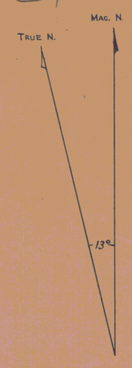
5 cm

995125 70-644.

AMAX MINING (AUSTRALIA) INC.
HEAZLEWOOD NICKEL PROJECT - TASMANIA
"Petrology of Diamond drill hole core samples." (sketch of DDH - H1+H2 showing rock types)
Date: Dec. 1970. | Scale: 1" = 20'
To accompany Report by M. Rubenach.

70-644

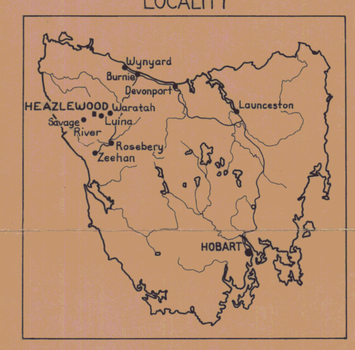
2321



LEGEND

- Tracks, roads (approx. location)
- Tracks, roads (surveyed)
- Creeks, rivers (approx)
- Creeks, rivers (surveyed)
- Bridges
- H/T Power Line
- Traverses Pegged
- Adit
- Shaft & Pit
- Trench
- Drill Hole (with dip) — H.2(-50)

Contour (Approx. only) — 1500'
{Taken from Dept. of Lands Tasmania
{Provisional Compilation Project 1539
{Scale 20 chains to an Inch



995126

5 cm

AMAX MINING (AUSTRALIA) INC.
HEAZLEWOOD NICKEL PROJECT - TASMANIA

TOPOGRAPHY

Date: June 1969	Scale: 1" = 500'
To accompany Report by:- J.F. Gilfillan + J.P. Marshall	
Datum of Levels; Sea Level	

FIG. 1

2321

70-644

TOPOGRAPHIC MAP OF NORTH-WESTERN TASMANIA

FIG. 2

BASS STRAIT
Stanley
Montagu
Smithton
Wynyard
Burnie
Somerset
Penguin
Ulverstone
Devonport
Latrobe
Forth
Ulverstone
Waratah
Zeehan
Rosebery
Strahan
Queenstown
Kingston
Hobart
Launceston
Sheffield
Kimberley
Chudleigh
Mole Creek
Deloraine
Westbury
Longford
Evandale
Perth
Ross
Oatlands
Campbell Town
Ringarooma
Derby
Scottsdale
Bridport
Beaconsfield
Exeter
Lilydale
Lebrina
Flowerdale
Boat Harbour
Table Cape
Sisters Is.
Rocky Cape
Detention River
Forest
Black River
Wiltshire Junc.
Circular Head
Perkins Bay
Duck Bay
Sawyer Bay
Robbins Island
Montagu Island
Hunter R.
Welcome R.
Arthur River
Frankland River
Nelson Bay
Temma Harbour
Haxard Bay
Pedder R.
Kenneth Bay
Sandy Cape
Johnson Bay
Lagoon River
Thornton River
Pieman River
Henty River
Macquarie Harbour
Hells Gate
Mt. Lyell
Queen River
Gordon River
Franklin River
Denison Range
Frenchmans Cap
Mt. Owen
Mt. Jukes
Mt. Read
Mt. Darwin
Mt. Sedgwick
Mt. Murchison
Mt. Zeehan
Mt. Dundas
Mt. Heemskirk
Mt. Cleveland
Mt. Arrowsmith
Mt. Roland
Mt. Claude
Mt. Vandyke
Mt. Barrow
Mt. Direction
Mt. Cameron West
Mt. Balfour
Mt. Bischoff
Mt. Black
Mt. Farrell
Mt. Lindsay
Mt. Ossa
Cradle Mtn.
Barn Bluff
Lake St. Clair
Lake Pedder
Lake Gordon
Lake Margaret
Lake Burbury
Lake Rosebery
Lake Mackenzie
Lake Barrington
Lake Parangana
Lake Mackintosh
Lake Murchison
Lake Plimsoll
Lake Meston
Lake Vera
Lake Tiberias
Lake Sorell
Lake Crescent
Lake Leake
Lake Tooms
Lake Augusta
Lake Echo
Lake Sidmouth
Lake Mackenzie
Lake Balmoral
Lake Meander
Lake Furnace
Lake Chisholm
Lake Ada
Lake Binney
Lake Ina
Lake Rowallan

2323

LEGEND

- Tracks, roads (approx. location)
- Tracks, roads (surveyed)
- Creeks, rivers (approx)
- Creeks, rivers (surveyed)
- Bridges
- H/T Power Line
- Traverses Pegged
- Prospect - Little or no production
- Alluvial Workings
- Trench
- Drill Hole (with dip) — H3 (-50)

- Geological Boundary
- Geological Boundary (approx)
- Geological Boundary (inferred)
- Unconformity (seen or inferred)
- Fault (showing relative movement) — U / D
- Fault (inferred)
- Shearing
- Bedding — 70

Samples for Petrographic examination — ④ or C27

Nickel	Ni
Lead-Zinc	Pb-Zn
Copper	Cu
Chromite Veinlets	Cr
Pyrite	Py
Pyrrhotite	Po
Magnetite Veinlets	Mt
Quartz Veinlets	Qtz

TERTIARY	
Basalt	16
Laterite	15
DEVONIAN	
Pegmatite Dykes	14
SILURIAN	
Sandstone	13
CAMBRIAN	
Hornfels	12
Fine Grained Granitic Dykes	11
Albitite Dykes	10
Coarse Altered Gabbro (Rodingite) Dykes	9
Altered "Porphyritic" (Rodingite) Dykes	8
Altered Bronzitite? (Rodingite) Dykes	7
Serpentinite	6a
Feldspathic Peridotite	6fs
Serpentinized Peridotite	6
Gabbro (Grossularitised)	5
Feldspathic Bronzitite	4fs
Bronzitite	4
Dolerite	3
Dunite (Serpentinised in part)	2
CAMBRIAN OR EARLIER	
Amphibolite	1a
Quartzite and Siliceous Dolomite	1

5 cm

70-644

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

GEOLOGICAL PLAN

Date: June 1969 | Scale: 1" = 500'

To accompany Report by J.F. Gilfillan & J.P. Marshall

Mapping by J.E. Christoffersen and Others

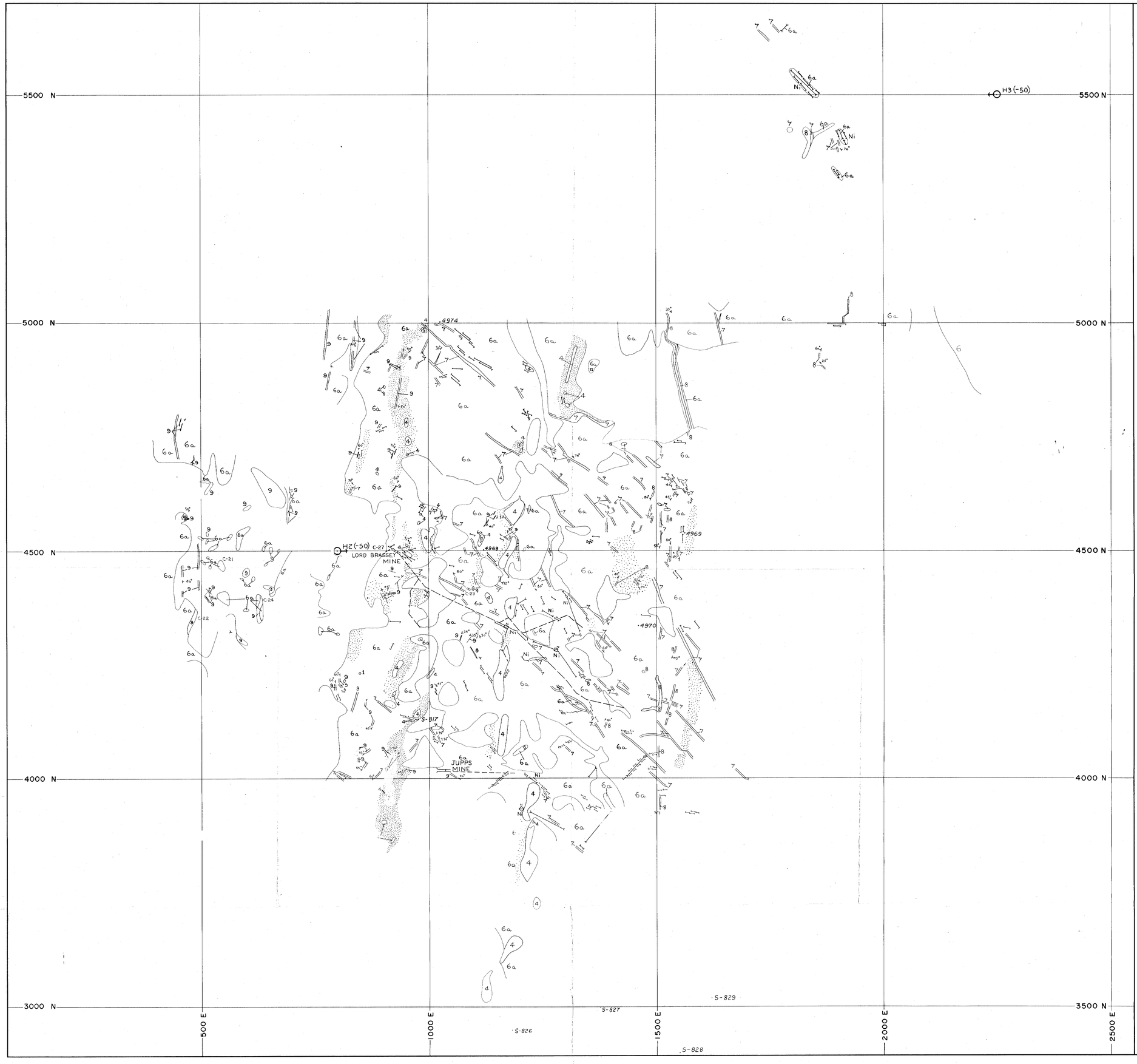
FIG. 3

2323

995128

3

70-644



LEGEND

CAMBRIAN

Coarse Altered Gabbro (rodingite) Dykes	9
Altered "Porphyritic" (rodingite) Dykes	8
Altered Bronzitite? (rodingite) Dykes	7
Serpentinite	6a
Bronzite Rich Serpentinite	6a
Serpentinised Peridotite	6
Gabbro (grossularitised)	5
Bronzitite	4

Nickel Occurrence	Ni
Shearing	
Strike-Dip of Dyke	80°
Trench	
Adit	
Shaft or Winze (not accessible)	
Petrological Specimen	C-24
Rock Chip Sample Number	4974
Drill Hole (with dip)	H2(-50)

ROCK CHIP SAMPLE ANALYSES

Sample No	ROCK	Ni (ppm)
4968	Sheared Serpentinite	1200
4969	Sheared Serpentinite	1400
4970	Serpentinite	2000
4974	Sheared Bronzitite	800
S-817	Sheared Serpentinite	1200
S-826	Sheared Serpentinite	1100
S-827	Sheared Serpentinite	2800
S-828	Sheared Serpentinite	1200
S-829	Sheared Serpentinite	820

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

GEOLOGICAL MAP

LORD BRASSEY MINE AREA

Date: June 1969 | Scale: 1" = 100'

To accompany Report by J.F. Gilfillan & J.P. Marshall

MAPPING BY J. E. CHRISTOFFERSEN

FIG. 4

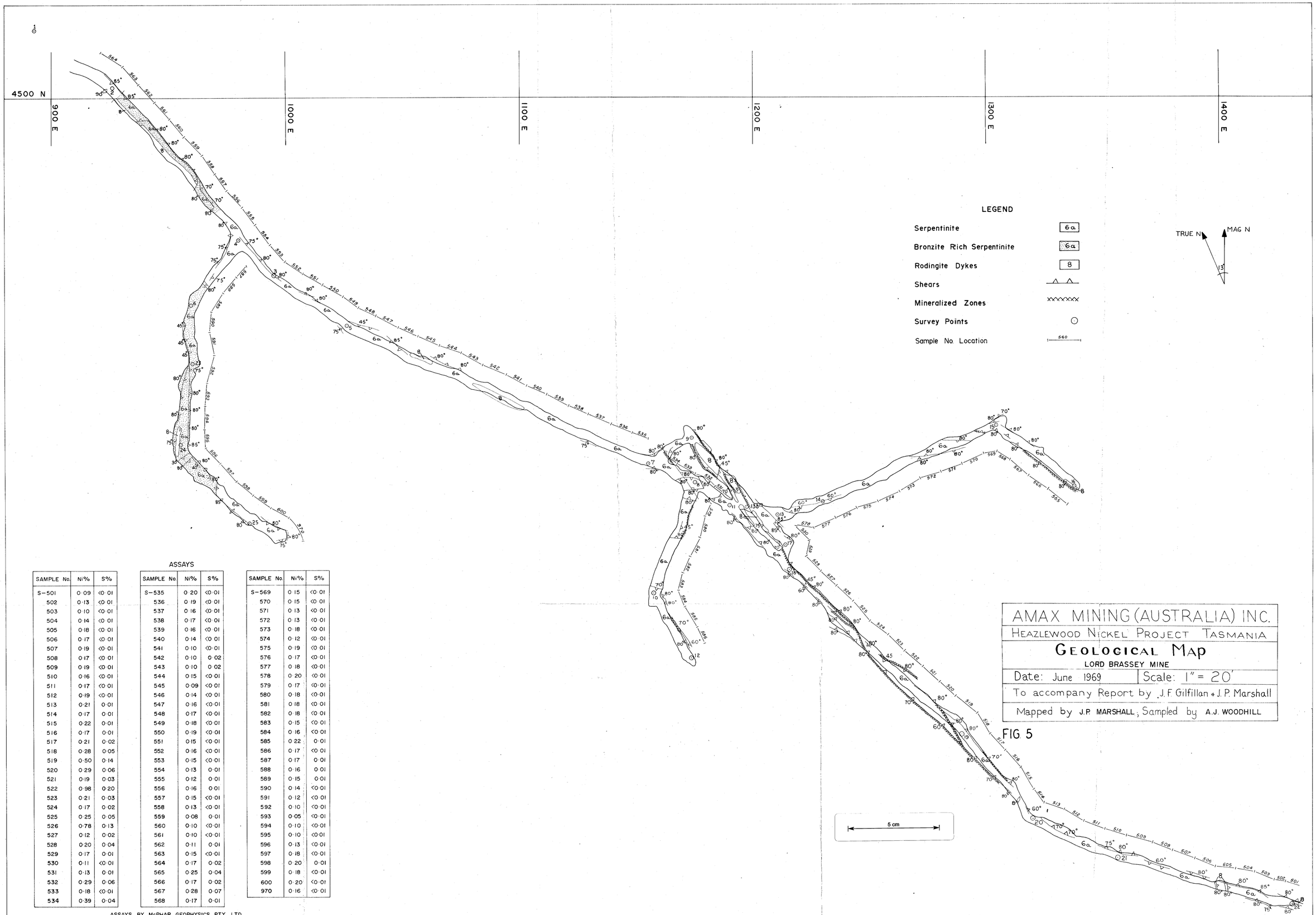
5 cm

2324

995129

4

70-644 995130



ASSAYS

SAMPLE No.	Ni%	S%
S-501	0·09	<0·01
502	0·13	<0·01
503	0·10	<0·01
504	0·14	<0·01
505	0·18	<0·01
506	0·17	<0·01
507	0·19	<0·01
508	0·17	<0·01
509	0·19	<0·01
510	0·16	<0·01
511	0·17	<0·01
512	0·19	<0·01
513	0·21	0·01
514	0·17	0·01
515	0·22	0·01
516	0·17	0·01
517	0·21	0·02
518	0·28	0·05
519	0·50	0·14
520	0·29	0·06
521	0·19	0·03
522	0·98	0·20
523	0·21	0·03
524	0·17	0·02
525	0·25	0·05
526	0·78	0·13
527	0·12	0·02
528	0·20	0·04
529	0·17	0·01
530	0·11	<0·01
531	0·13	0·01
532	0·29	0·06
533	0·18	<0·01
534	0·39	0·04

SAMPLE No.	Ni%	S%
S-535	0·20	<0·01
536	0·19	<0·01
537	0·16	<0·01
538	0·17	<0·01
539	0·16	<0·01
540	0·14	<0·01
541	0·10	<0·01
542	0·10	0·02
543	0·10	0·02
544	0·15	<0·01
545	0·09	<0·01
546	0·14	<0·01
547	0·16	<0·01
548	0·17	<0·01
549	0·18	<0·01
550	0·19	<0·01
551	0·15	<0·01
552	0·16	<0·01
553	0·15	<0·01
554	0·13	0·01
555	0·12	0·01
556	0·16	0·01
557	0·15	<0·01
558	0·13	<0·01
559	0·08	0·01
560	0·10	<0·01
561	0·10	<0·01
562	0·11	0·01
563	0·15	<0·01
564	0·17	0·02
565	0·25	0·04
566	0·17	0·02
567	0·28	0·07
568	0·17	0·01

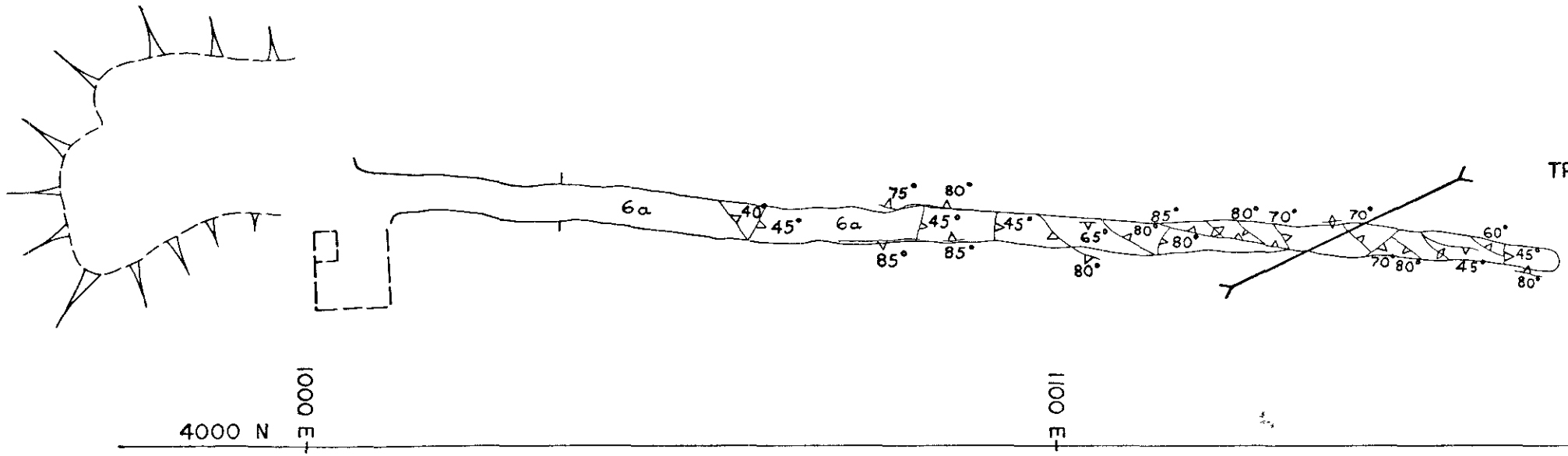
SAMPLE No.	Ni%	S%
S-569	0·15	<0·01
570	0·15	<0·01
571	0·13	<0·01
572	0·13	<0·01
573	0·18	<0·01
574	0·12	<0·01
575	0·19	<0·01
576	0·17	<0·01
577	0·18	<0·01
578	0·20	<0·01
579	0·17	<0·01
580	0·18	<0·01
581	0·18	<0·01
582	0·18	<0·01
583	0·15	<0·01
584	0·16	<0·01
585	0·22	0·01
586	0·17	<0·01
587	0·17	0·01
588	0·16	0·01
589	0·15	0·01
590	0·14	<0·01
591	0·12	<0·01
592	0·10	<0·01
593	0·05	<0·01
594	0·10	<0·01
595	0·10	<0·01
596	0·13	<0·01
597	0·18	<0·01
598	0·20	0·01
599	0·18	<0·01
600	0·20	<0·01
970	0·16	<0·01

ASSAYS BY McPHAR GEOPHYSICS PTY. LTD.
NICKEL BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
SULPHUR BY TURBIDOMETRY

AMAX MINING (AUSTRALIA) INC.
HEAZLEWOOD NICKEL PROJECT TASMANIA
GEOLOGICAL MAP
LORD BRASSEY MINE
Date: June 1969 | Scale: 1" = 20'
To accompany Report by J.F. Gilfillan & J.P. Marshall
Mapped by J.P. MARSHALL; Sampled by A.J. WOODHILL

FIG. 5

70-644



LEGEND

Serpentinite	6a
Shears	
Shaft or Winze (not accessible)	N1 N
Trench	

5 cm

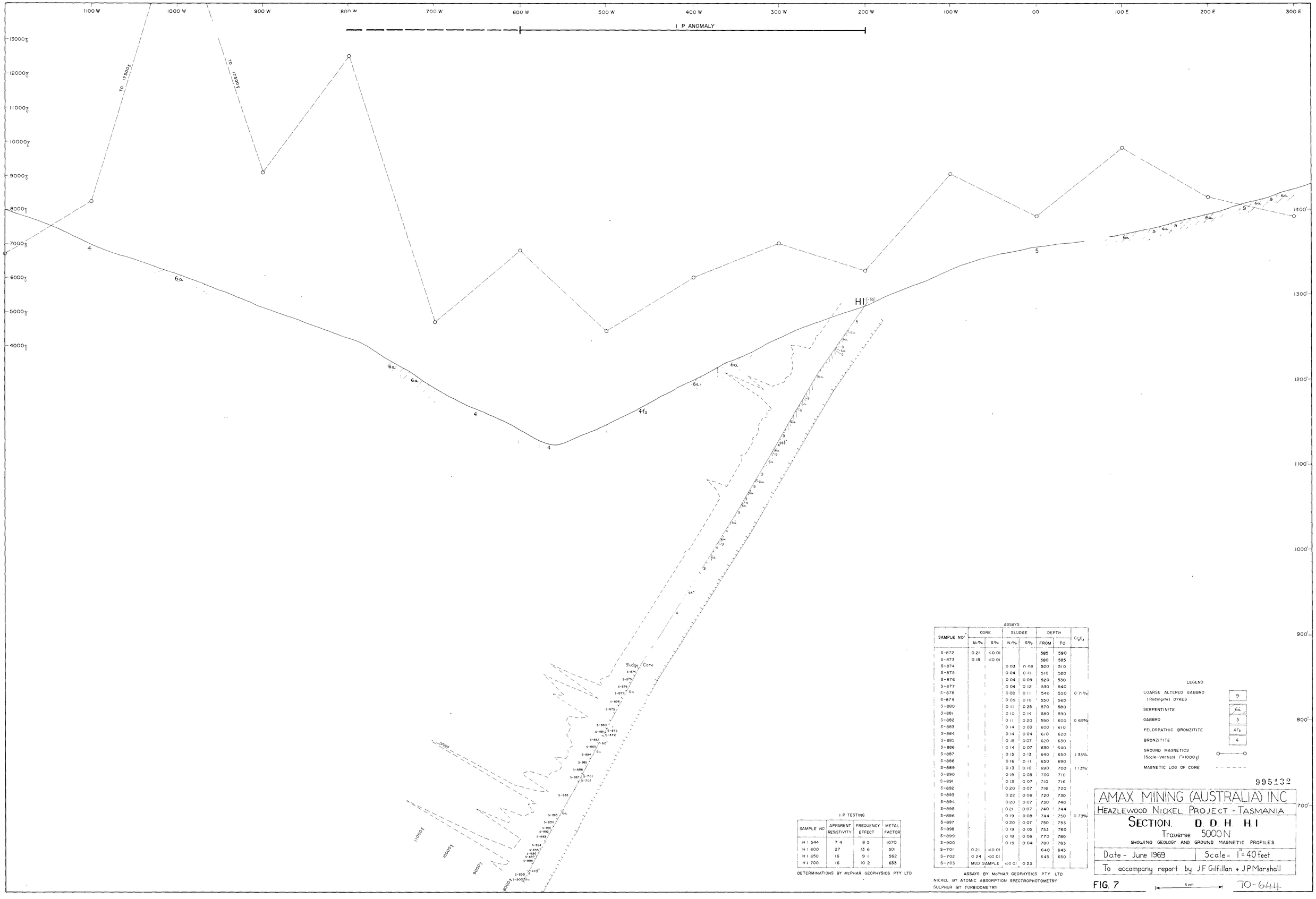
AMAX MINING (AUSTRALIA) INC	
HEAZLEWOOD NICKEL PROJECT TAS	
GEOLOGICAL MAP	
JUPPS MINE	
Date 13-2-69	Scale 1"=20'
To accompany report by	
Mapped by - J.P MARSHALL	

Ni N

995131

FIG. 6

2320



I P TESTING

SAMPLE NO	APPARENT RESISTIVITY	FREQUENCY EFFECT	METAL FACTOR
H I 544	7 4	8 5	1070
H I 600	27	13 6	501
H I 650	16	9 1	562
H I 700	16	10 2	633

DETERMINATIONS BY McPHAR GEOPHYSICS PTY LTD

ASSAYS

SAMPLE NO	CORE		SLUDGE		DEPTH		Cr_2O_3
	Ni%	S%	Ni%	S%	FROM	TO	
S-872	0 21	<0 01			585	590	
S-873	0 18	<0 01			580	585	
S-874			0 03	0 08	500	510	
S-875			0 04	0 11	510	520	
S-876			0 04	0 09	520	530	
S-877			0 04	0 12	530	540	
S-878			0 08	0 11	540	550	0 71%
S-879			0 09	0 10	550	560	
S-880			0 11	0 25	570	580	
S-881			0 10	0 14	580	590	
S-882			0 11	0 20	590	600	0 69%
S-883			0 14	0 03	600	610	
S-884			0 14	0 04	610	620	
S-885			0 15	0 07	620	630	
S-886			0 14	0 07	630	640	
S-887			0 15	0 13	640	650	1 33%
S-888			0 16	0 11	650	690	
S-889			0 13	0 10	690	700	1 13%
S-890			0 19	0 08	700	710	
S-891			0 13	0 07	710	716	
S-892			0 20	0 07	716	720	
S-893			0 22	0 06	720	730	
S-894			0 20	0 07	730	740	
S-895			0 21	0 07	740	744	
S-896			0 19	0 08	744	750	0 73%
S-897			0 20	0 07	750	753	
S-898			0 19	0 05	753	760	
S-899			0 18	0 06	770	780	
S-900			0 19	0 04	780	783	
S-701	0 21	<0 01			640	645	
S-702	0 24	<0 01			645	650	
S-703	MUD SAMPLE		<0 01	0 23			

ASSAYS BY McPHAR GEOPHYSICS PTY LTD
NICKEL BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
SULPHUR BY TURBIDOMETRY

LEGEND

COARSE ALTERED GABBRO (Rodingite) DYKES	9
SERPENTINITE	6a
GABBRO	5
FELDSPATHIC BRONZITITE	4fs
BRONZITITE	4
GROUND MAGNETICS (Scale-Vertical 1"=1000γ)	
MAGNETIC LOG OF CORE	

995132

AMAX MINING (AUSTRALIA) INC

HEAZLEWOOD NICKEL PROJECT - TASMANIA

SECTION. D. D. H. H.1

Traverse 5000 N

SHOWING GEOLOGY AND GROUND MAGNETIC PROFILES

Date - June 1969 | Scale - 1" = 40 feet

To accompany report by J F Gilfillan & J P Marshall

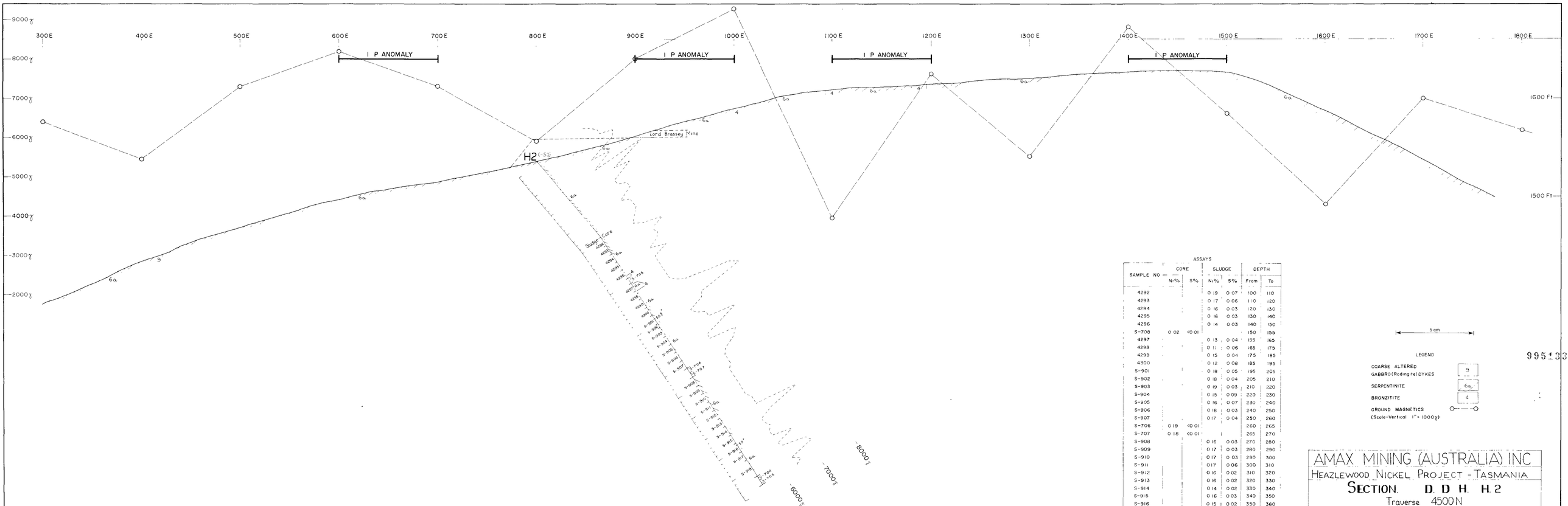
FIG. 7

5 cm

70-644

2327

70-644



ASSAYS

SAMPLE NO	CORE Ni%	CORE S%	SLUDGE Ni%	SLUDGE S%	DEPTH From	DEPTH To
4292			0 19	0 07	100	110
4293			0 17	0 06	110	120
4294			0 16	0 03	120	130
4295			0 16	0 03	130	140
4296			0 14	0 03	140	150
S-708	0 02	<0 01			150	155
4297			0 13	0 04	155	165
4298			0 11	0 06	165	175
4299			0 15	0 04	175	185
4300			0 12	0 08	185	195
S-901			0 18	0 05	195	205
S-902			0 18	0 04	205	210
S-903			0 19	0 03	210	220
S-904			0 15	0 09	220	230
S-905			0 16	0 07	230	240
S-906			0 18	0 03	240	250
S-907			0 17	0 04	250	260
S-706	0 19	<0 01			260	265
S-707	0 18	<0 01			265	270
S-908			0 16	0 03	270	280
S-909			0 17	0 03	280	290
S-910			0 17	0 03	290	300
S-911			0 17	0 06	300	310
S-912			0 16	0 02	310	320
S-913			0 16	0 02	320	330
S-914			0 14	0 02	330	340
S-915			0 16	0 03	340	350
S-916			0 15	0 02	350	360
S-917			0 15	0 02	360	370
S-918			0 17	0 02	370	390
S-704	0 18	0 03			390	395
S-705	0 20	0 04			395	400

ASSAYS BY McPHAR GEOPHYSICS PTY LTD
NICKEL BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
SULPHUR BY TURBIDOMETRY

5 cm

LEGEND

COARSE ALTERED GABBRO (Rodingite) DYKES — 9
SERPENTINITE — 6a
BRONZITITE — 4
GROUND MAGNETICS (Scale-Vertical 1" = 1000γ)

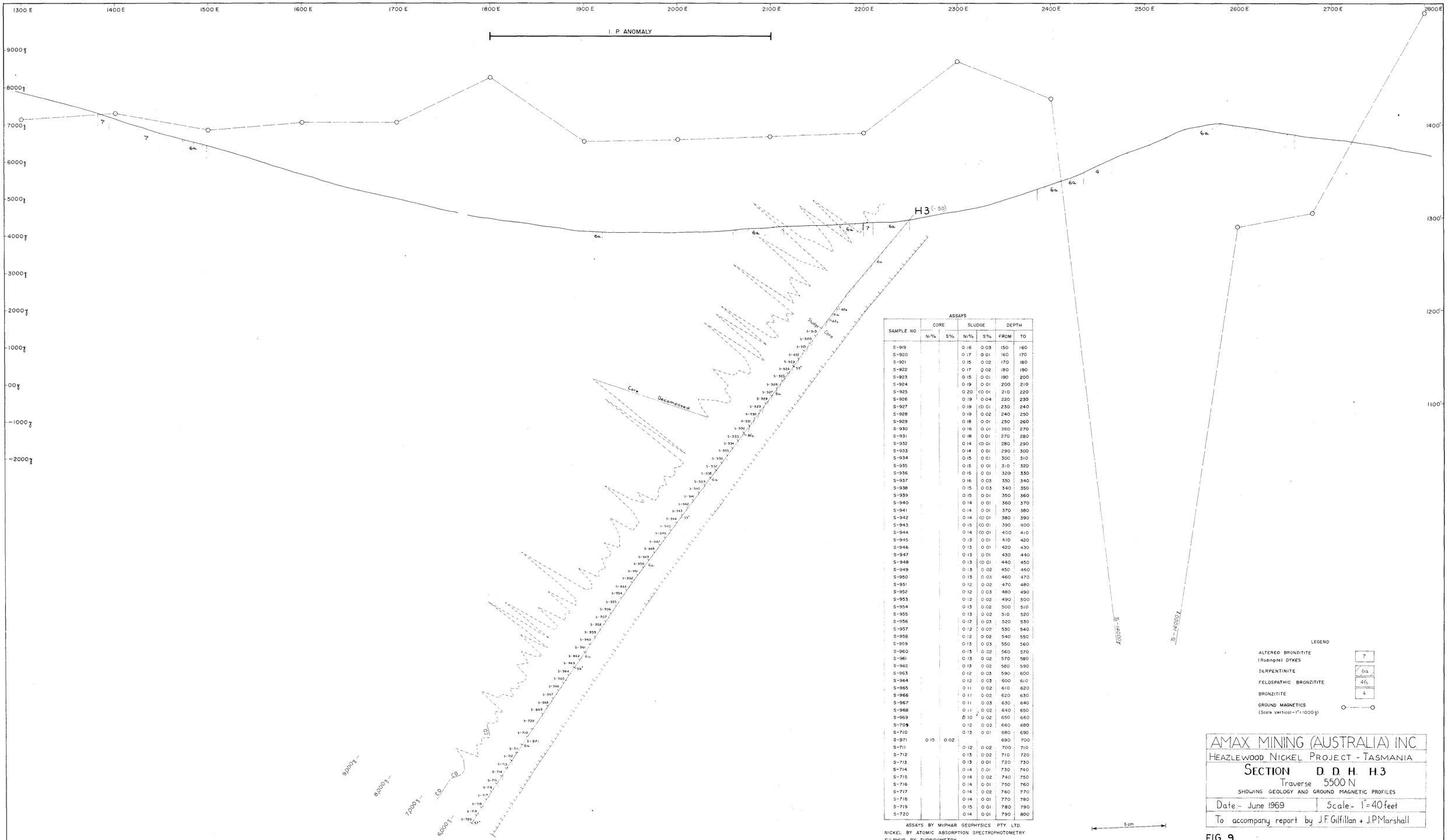
995133

AMAX MINING (AUSTRALIA) INC
HEAZLEWOOD NICKEL PROJECT - TASMANIA
SECTION. D. D. H. H.2
Traverse 4500N
SHOWING GEOLOGY AND GROUND MAGNETIC PROFILES
Date - June 1969 | Scale - 1" = 40 feet
To accompany report by J F Gilfillan & J P Marshall

FIG. 8

2328

70-6444



ASSAYS

SAMPLE NO	CORE		SLUDGE		DEPTH	
	Ni%	S%	Ni%	S%	FROM	TO
S-919			0.16	0.03	150	160
S-920			0.17	0.01	160	170
S-921			0.15	0.02	170	180
S-922			0.17	0.02	180	190
S-923			0.15	0.01	190	200
S-924			0.19	0.01	200	210
S-925			0.20	<0.01	210	220
S-926			0.19	0.04	220	230
S-927			0.19	<0.01	230	240
S-928			0.19	0.02	240	250
S-929			0.18	0.01	250	260
S-930			0.16	0.01	260	270
S-931			0.18	0.01	270	280
S-932			0.14	<0.01	280	290
S-933			0.14	0.01	290	300
S-934			0.15	0.01	300	310
S-935			0.15	0.01	310	320
S-936			0.15	0.01	320	330
S-937			0.16	0.03	330	340
S-938			0.15	0.03	340	350
S-939			0.15	0.01	350	360
S-940			0.14	0.01	360	370
S-941			0.14	0.01	370	380
S-942			0.14	<0.01	380	390
S-943			0.15	<0.01	390	400
S-944			0.14	<0.01	400	410
S-945			0.13	0.01	410	420
S-946			0.13	0.01	420	430
S-947			0.13	0.01	430	440
S-948			0.13	<0.01	440	450
S-949			0.13	0.02	450	460
S-950			0.13	0.03	460	470
S-951			0.12	0.02	470	480
S-952			0.12	0.03	480	490
S-953			0.12	0.02	490	500
S-954			0.13	0.02	500	510
S-955			0.13	0.02	510	520
S-956			0.12	0.03	520	530
S-957			0.12	0.02	530	540
S-958			0.12	0.02	540	550
S-959			0.13	0.03	550	560
S-960			0.13	0.02	560	570
S-961			0.13	0.02	570	580
S-962			0.13	0.02	580	590
S-963			0.12	0.03	590	600
S-964			0.12	0.03	600	610
S-965			0.11	0.02	610	620
S-966			0.11	0.02	620	630
S-967			0.11	0.03	630	640
S-968			0.11	0.02	640	650
S-969			0.10	0.02	650	660
S-709			0.12	0.02	660	680
S-710			0.13	0.01	680	690
S-971	0.15	0.02			690	700
S-711			0.12	0.02	700	710
S-712			0.13	0.02	710	720
S-713			0.13	0.01	720	730
S-714			0.14	0.01	730	740
S-715			0.14	0.02	740	750
S-716			0.14	0.01	750	760
S-717			0.14	0.02	760	770
S-718			0.14	0.01	770	780
S-719			0.15	0.01	780	790
S-720			0.14	0.01	790	800

ASSAYS BY McPHAR GEOPHYSICS PTY LTD.
NICKEL BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
SULPHUR BY TURBIDOMETRY

LEGEND

ALTERED BRONZITITE (Rodingite) DYKES	7
SERPENTINITE	6a
FELDSPATHIC BRONZITITE	4fs
BRONZITITE	4
GROUND MAGNETICS (Scale Vertical - 1" = 1000γ)	

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

SECTION D. D. H. H.3

Traverse 5500 N

SHOWING GEOLOGY AND GROUND MAGNETIC PROFILES

Date:- June 1969 | Scale:- 1" = 40 feet

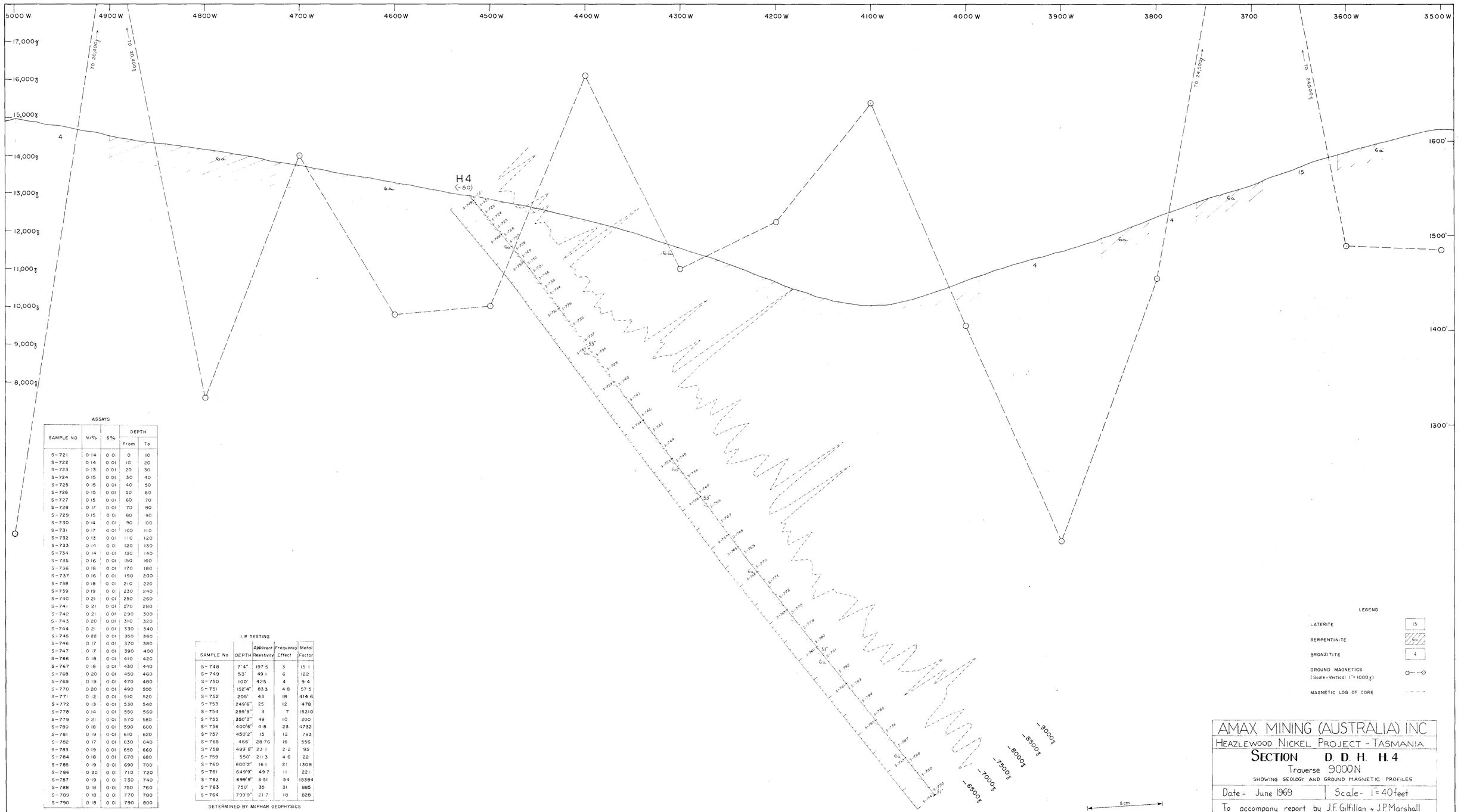
To accompany report by J.F. Gilfillan & J.P. Marshall

FIG. 9

995134

2329

70-6644



ASSAYS

SAMPLE NO	Ni%	S%	DEPTH From	DEPTH To
S-721	0·14	0·01	0	10
S-722	0·14	0·01	10	20
S-723	0·13	0·01	20	30
S-724	0·15	0·01	30	40
S-725	0·15	0·01	40	50
S-726	0·15	0·01	50	60
S-727	0·15	0·01	60	70
S-728	0·17	0·01	70	80
S-729	0·15	0·01	80	90
S-730	0·14	0·01	90	100
S-731	0·17	0·01	100	110
S-732	0·13	0·01	110	120
S-733	0·14	0·01	120	130
S-734	0·14	0·01	130	140
S-735	0·16	0·01	150	160
S-736	0·18	0·01	170	180
S-737	0·16	0·01	190	200
S-738	0·18	0·01	210	220
S-739	0·19	0·01	230	240
S-740	0·21	0·01	250	260
S-741	0·21	0·01	270	280
S-742	0·21	0·01	290	300
S-743	0·20	0·01	310	320
S-744	0·21	0·01	330	340
S-745	0·22	0·01	350	360
S-746	0·17	0·01	370	380
S-747	0·17	0·01	390	400
S-766	0·18	0·01	410	420
S-767	0·18	0·01	430	440
S-768	0·20	0·01	450	460
S-769	0·19	0·01	470	480
S-770	0·20	0·01	490	500
S-771	0·12	0·01	510	520
S-772	0·13	0·01	530	540
S-778	0·14	0·01	550	560
S-779	0·21	0·01	570	580
S-780	0·18	0·01	590	600
S-781	0·19	0·01	610	620
S-782	0·17	0·01	630	640
S-783	0·19	0·01	650	660
S-784	0·18	0·01	670	680
S-785	0·19	0·01	690	700
S-786	0·20	0·01	710	720
S-787	0·19	0·01	730	740
S-788	0·18	0·01	750	760
S-789	0·18	0·01	770	780
S-790	0·18	0·01	790	800

ASSAYS BY McPHAR GEOPHYSICS PTY. LTD
NICKEL BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
SULPHUR BY TURBIDOMETRY

I. P. TESTING

SAMPLE No.	DEPTH	Apparent Resistivity	Frequency Effect	Metal Factor
S-748	7'4"	197·5	3	15·1
S-749	53'	49·1	6	122
S-750	100'	42·5	4	9·4
S-751	152'4"	83·3	4·8	57·5
S-752	205'	43	18	414·6
S-753	249'6"	25	12	478
S-754	299'9"	3	7	15210
S-755	350'3"	49	10	200
S-756	400'6"	4·8	23	4732
S-757	450'2"	15	12	793
S-765	466'	28·76	16	556
S-758	499'8"	23·1	2·2	95
S-759	550'	211·3	4·6	22
S-760	600'2"	16·1	21	1308
S-761	649'9"	49·7	11	221
S-762	699'9"	3·51	54	15384
S-763	750'	35	31	885
S-764	799'9"	21·7	18	828

DETERMINED BY McPHAR GEOPHYSICS PTY. LTD.

LEGEND

LATERITE	15
SERPENTINITE	6a
BRONZITITE	4
GROUND MAGNETICS (Scale - Vertical 1" = 1000γ)	
MAGNETIC LOG OF CORE	

AMAX MINING (AUSTRALIA) INC

HEAZLEWOOD NICKEL PROJECT - TASMANIA

SECTION D. D. H. H. 4

Traverse 9000N

SHOWING GEOLOGY AND GROUND MAGNETIC PROFILES

Date - June 1969 | Scale - 1" = 40 feet

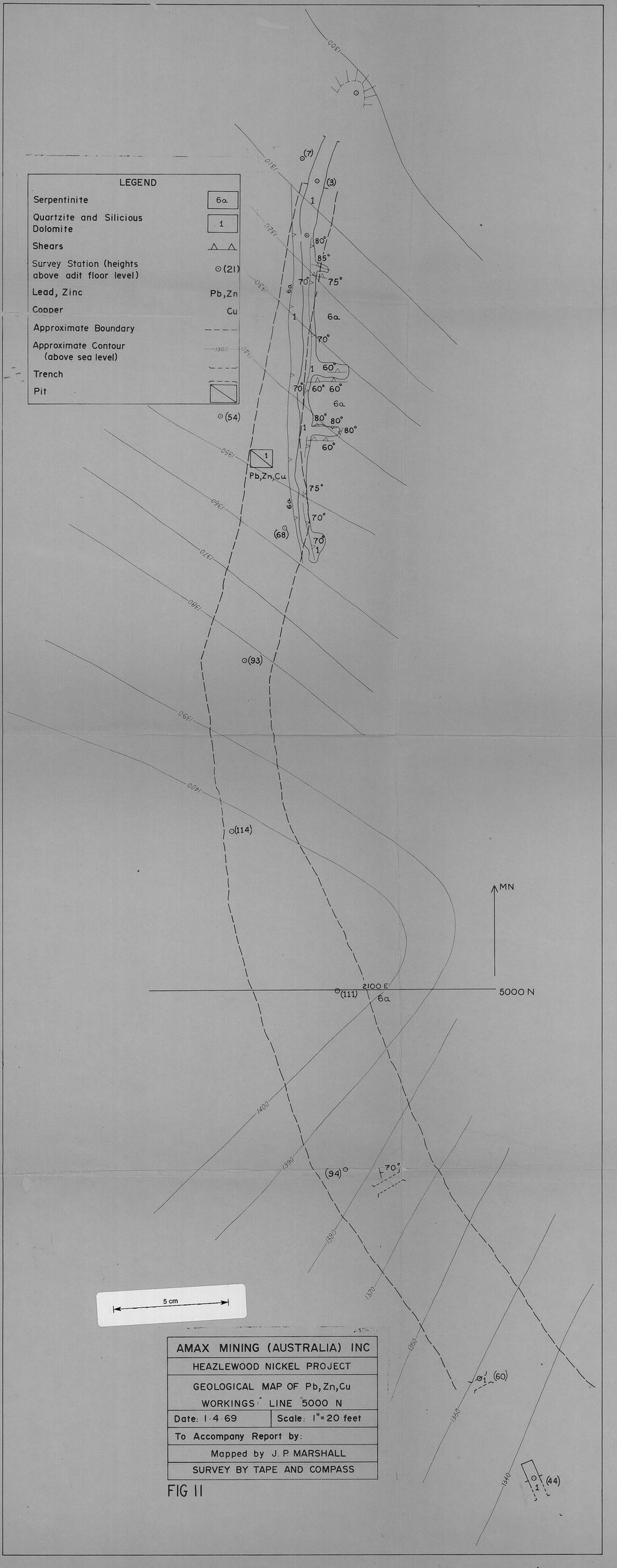
To accompany report by J.F. Gilfillan & J.P. Marshall

FIG. 10

2330

995135

70-644



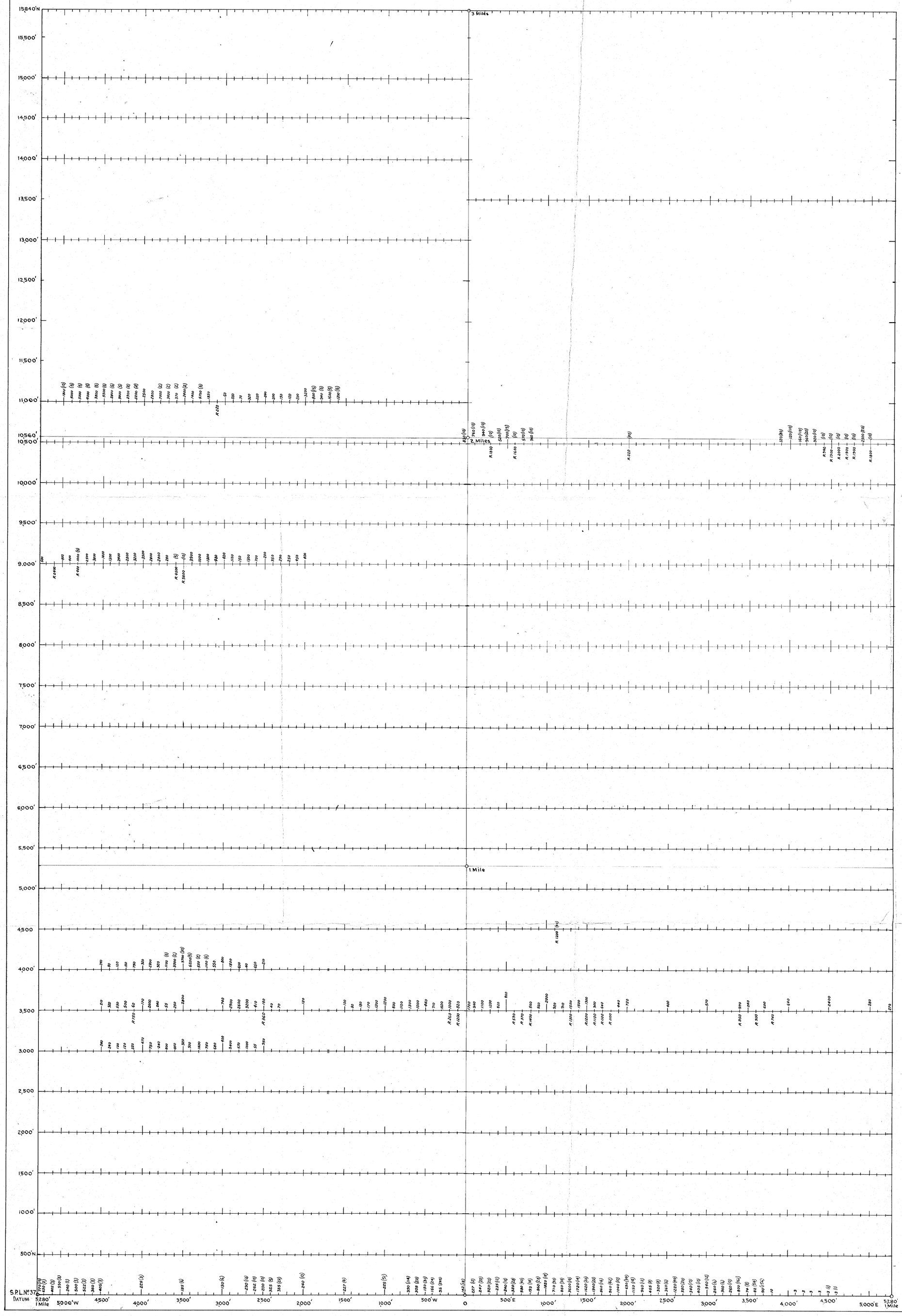
AMAX MINING (AUSTRALIA) INC	
HEAZLEWOOD NICKEL PROJECT	
GEOLOGICAL MAP OF Pb, Zn, Cu WORKINGS : LINE 5000 N	
Date: 1·4·69	Scale: 1"=20 feet
To Accompany Report by:	
Mapped by J. P. MARSHALL	
SURVEY BY TAPE AND COMPASS	

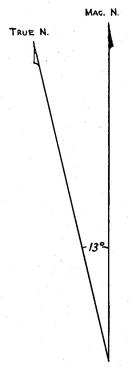
FIG 11

995136

2331

70-644





LEGEND

- Tracks, roads (approx. location)
- Tracks, roads (surveyed.)
- Creeks, rivers (approx)
- Creeks, rivers (surveyed)
- Bridges
- H/T Power Line
- Traverses Pegged
- Adit & Dump
- Shaft & Pit
- Trench

LEGEND

NICKEL P.P.M.
SOIL
ROCK CHIP
COPPER P.P.M.

1200
R 1200
(81)

5 cm

AMAX MINING (AUSTRALIA) INC.	
HEAZLEWOOD NICKEL PROJECT - TASMANIA	
GEOCHEMICAL PLAN *NICKEL AND COPPER VALUES*	
Date:	Scale: 1" = 500'
To accompany Report by	

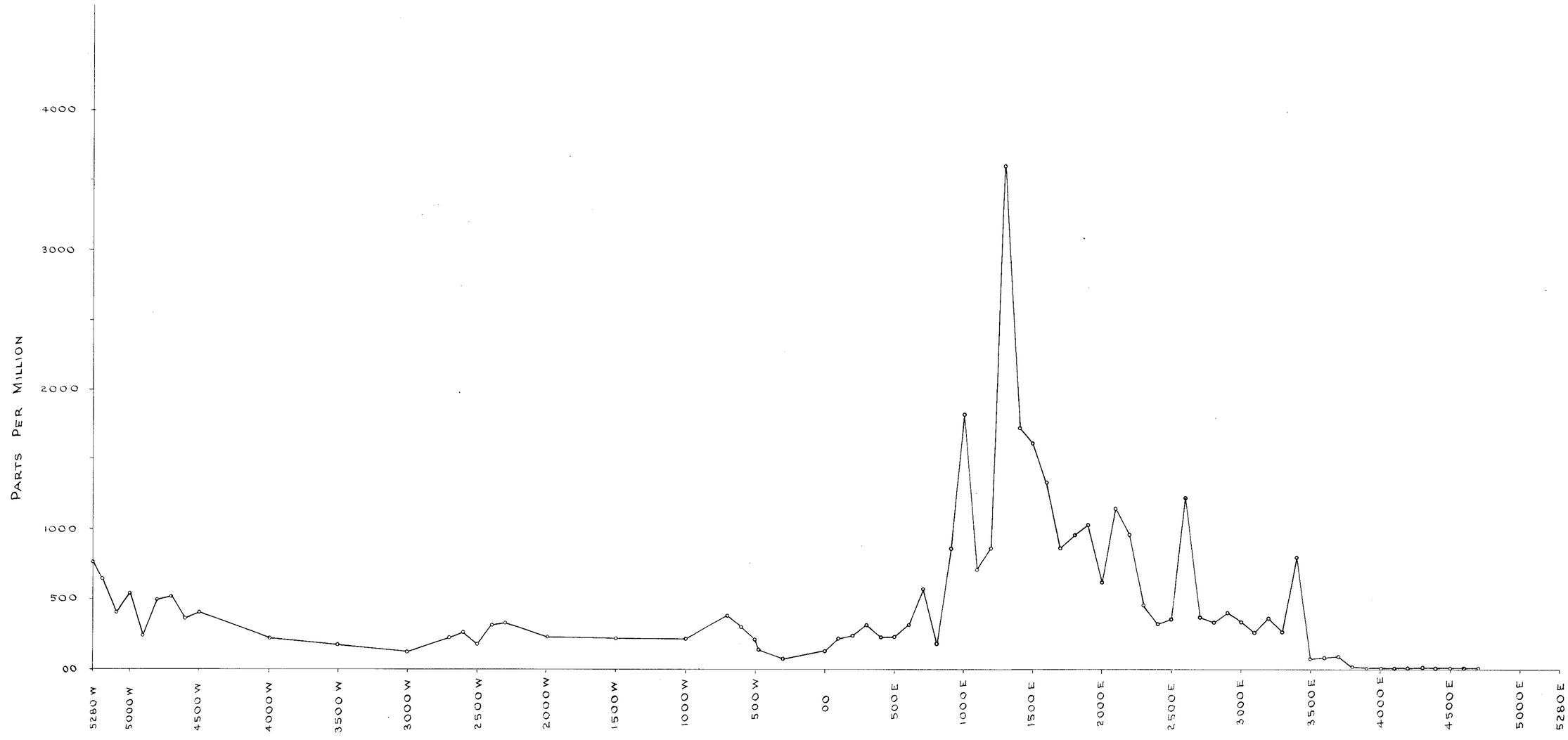
FIG. 12

995137 2332

70-6444

LEGEND

Soil sample from soil rock interface ⟜——⟜



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

GEOCHEMICAL PROFILE
NICKEL
TRAVERSE 00 N

Date: June 1969 | Scales: Vert: 1" = 500 P.P.M. Horiz: 1" = 500'

To accompany Report by J.F. Gilfillan & J.P. Marshall

FIG. 12 *a*

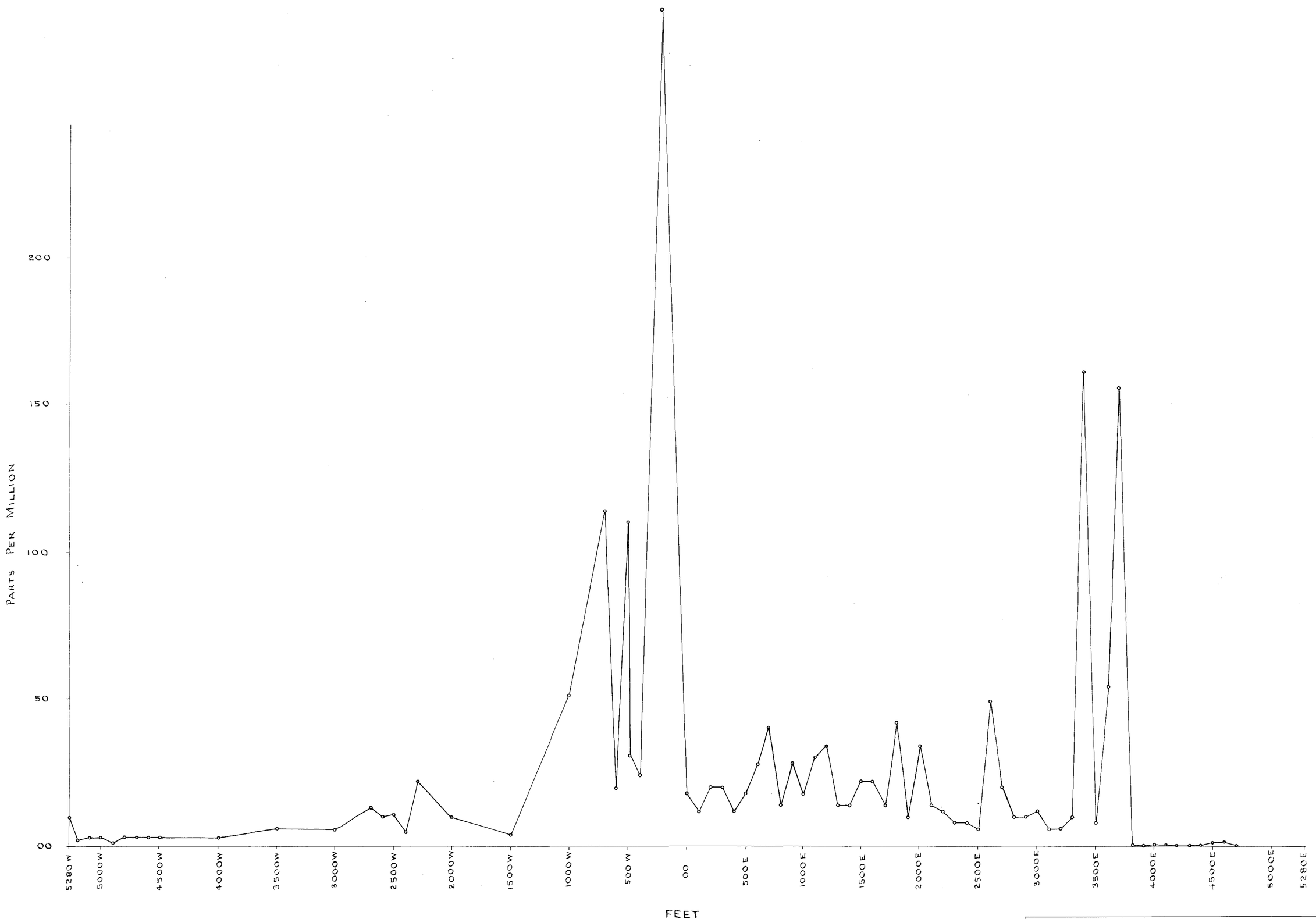
995138

2333

70-644

LEGEND

Soil sample from soil rock interface ⟜—⟜



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

GEOCHEMICAL PROFILE
COPPER
TRAVERSE 00 N.

Date: June 1969 | Scales: Vert: 1" = 20 P.P.M, Horiz: 1" = 500'

To accompany Report by J. F. Gilfillan & J. P. Marshall

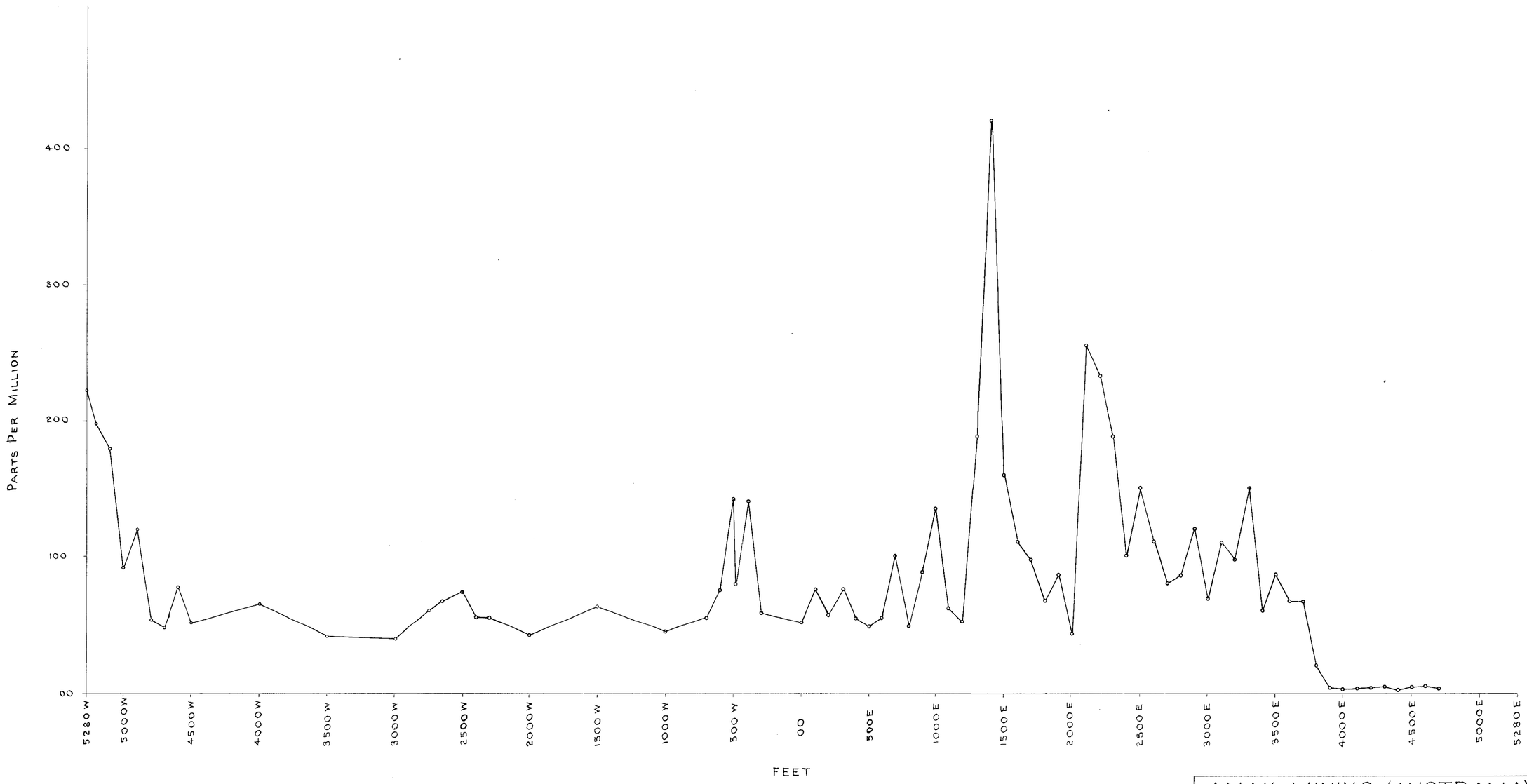
FIG. 13

995139 2334

70-6444

LEGEND

Soil sample from soil rock interface ⟜—⟜



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT TASMANIA

GEOCHEMICAL PROFILE

ZINC

TRAVERSE 00 N

Date: June 1969 | Scales: Vert: 1" = 50 P.P.M, Horiz: 1" = 500'

To accompany Report by J. F. Gilfillan + J. P. Marshall

FIG. 14

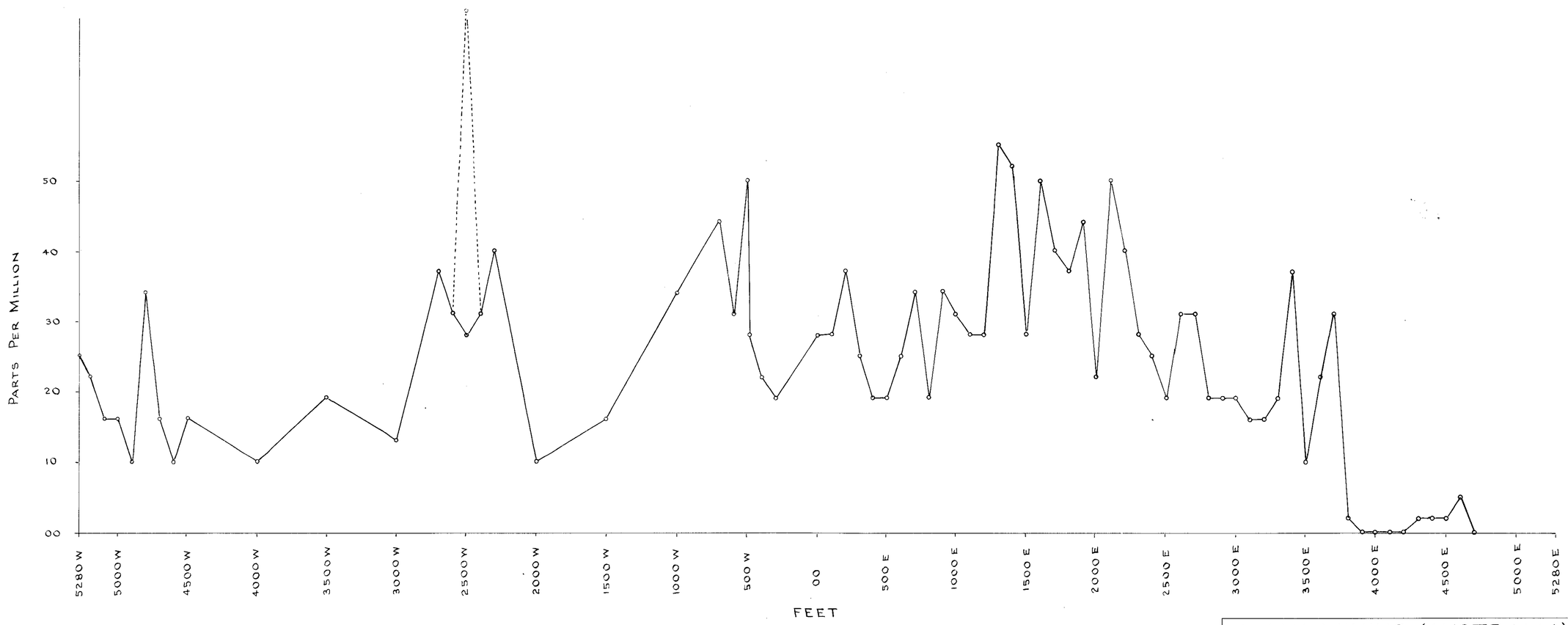
2335

995140

70-644

LEGEND

Soil sample from soil rock interface ——o——o——



5 cm

Result from earlier sample ----------

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

GEOCHEMICAL PROFILE
LEAD
TRAVERSE 00 N.

Date: June 1969

Scales: Vert : 1" = 10 P.P.M
Horiz : 1" = 500'

To accompany Report by J. F. Gilfillan & J.P. Marshall

FIG. 15

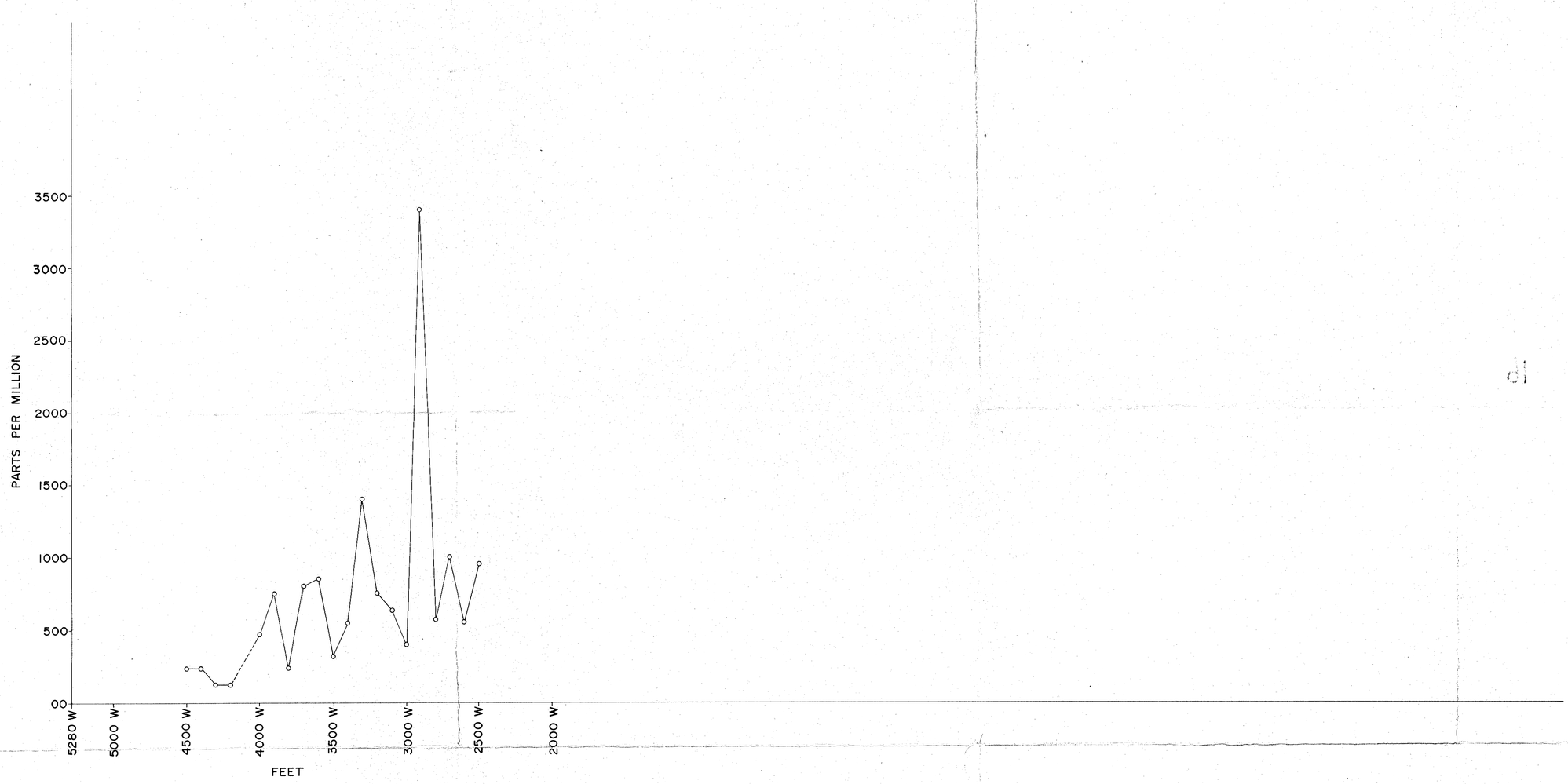
2336

995141

70-6444

LEGEND

Soil sample from soil rock interface ○——○



5 cm

5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

GEOCHEMICAL PROFILE
NICKEL
TRAVERSE 3000 N

Date:- June 1969

Scale:- Vert:- 1" = 500 P.P.M.
Horiz:- 1" = 500 Feet

To accompany report by:- J.F. Gilfillan & J.P. Marshall

FIG. 16

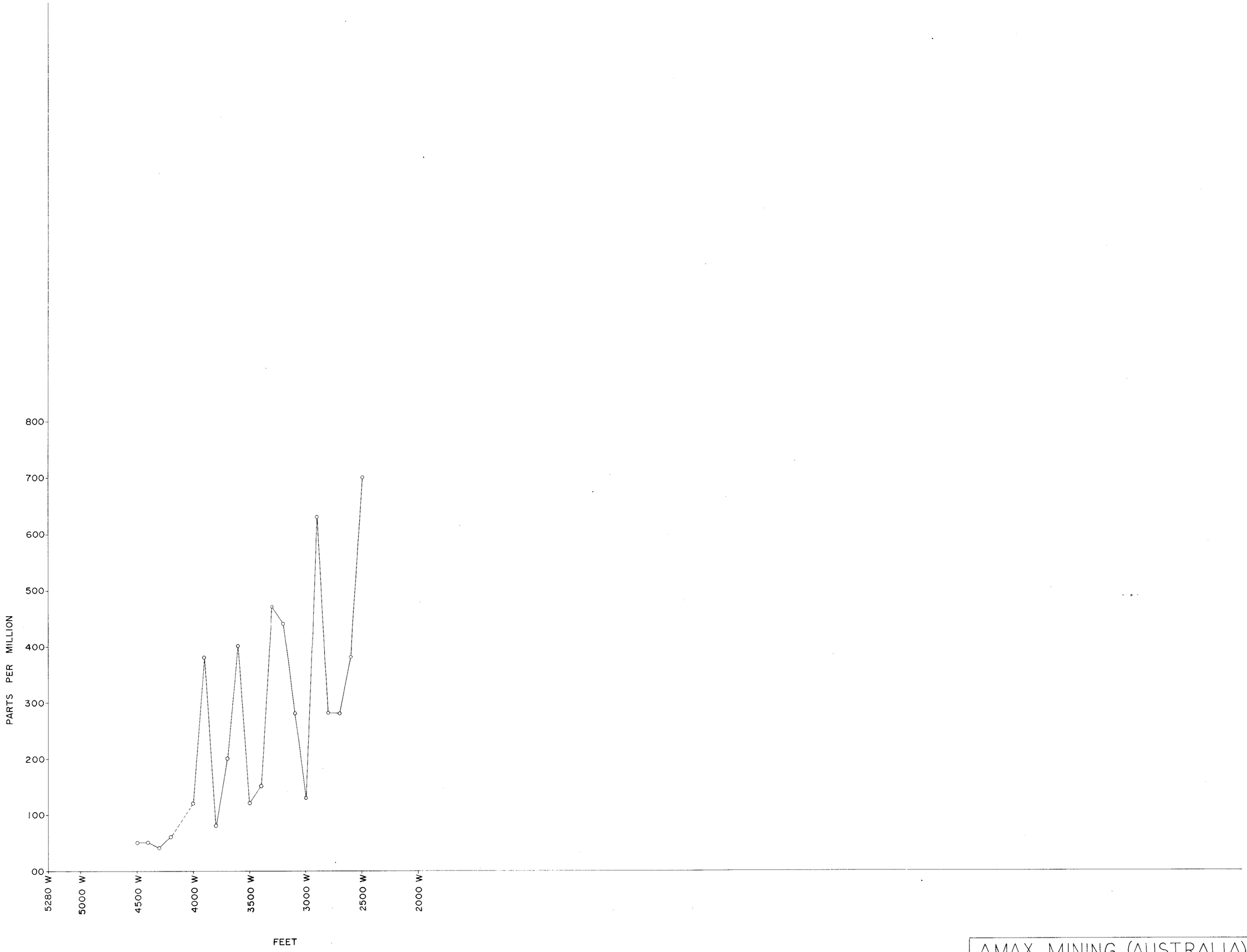
2337

995142

10-6444

LEGEND

Soil sample from soil rock interface ○———○



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

GEOCHEMICAL PROFILE
COBALT
TRAVERSE 3000 N

Date:- June 1969

Scale:- vert:- 1"=100 P.P.M.
horiz:- 1"=500'

To accompany report by J.F. Gilfillan & J.P. Marshall

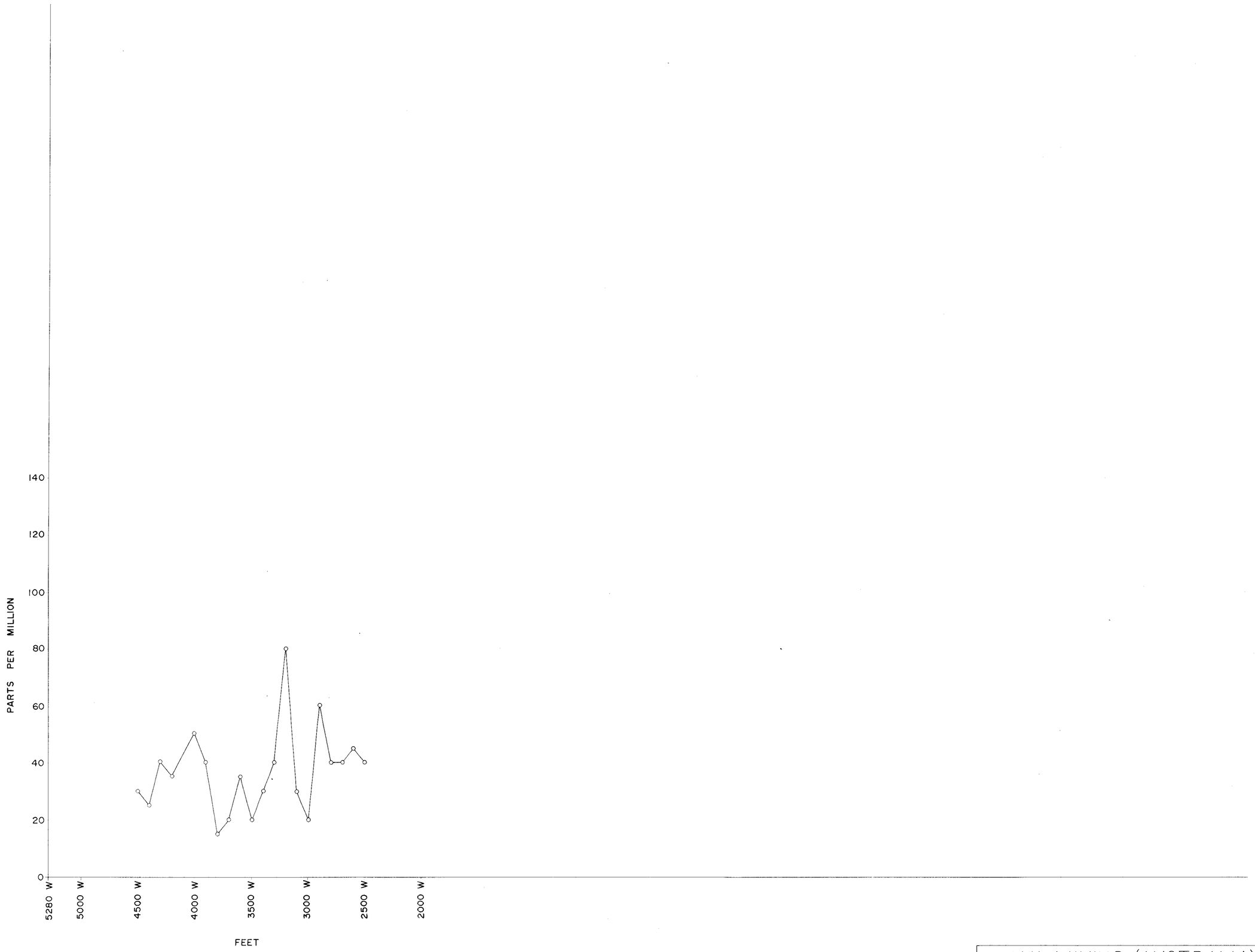
FIG. 17

2338

995143

70-6444

LEGEND
Soil sample from soil rock interface ⟜——⟜



5 cm

AMAX MINING (AUSTRALIA) INC.
HEAZLEWOOD NICKEL PROJECT - TASMANIA
GEOCHEMICAL PROFILE
ZINC
TRAVERSE 3000 N

Date:- June 1969	Scale:- Vert:- 1"=20 P.P.M. Horiz:- 1"=500'
To accompany report by J.F. Gilfillan & J.P. Marshall	

FIG. 18

2339

995144

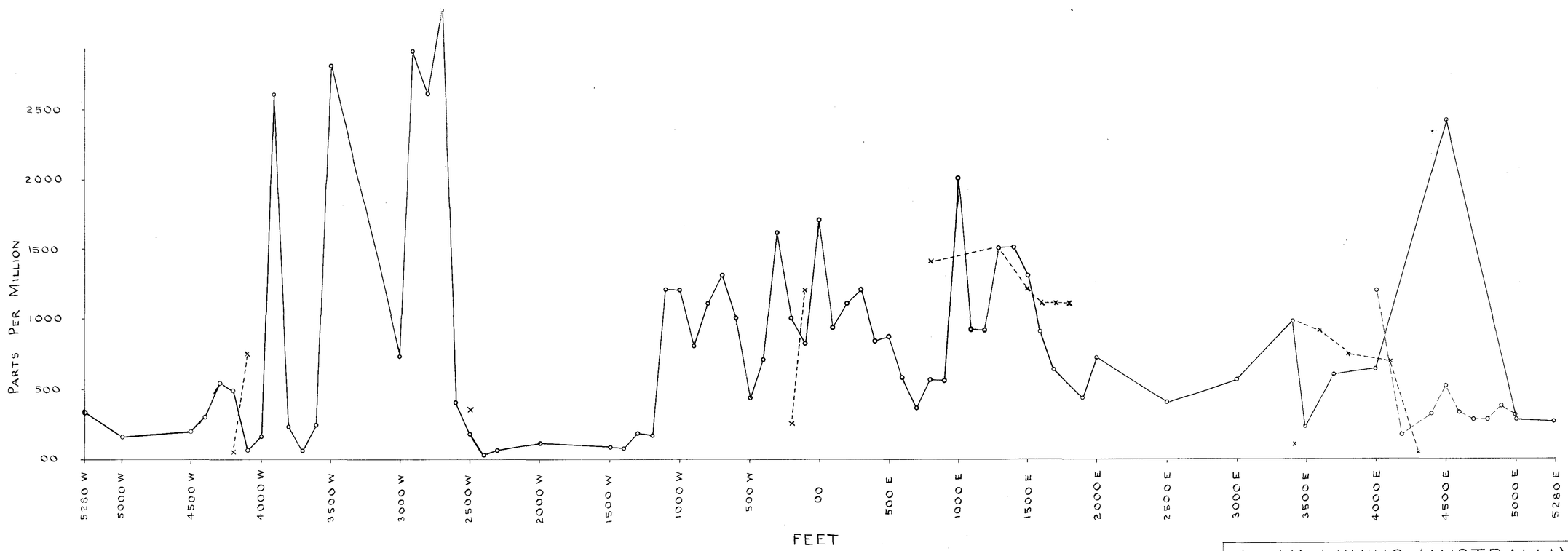
70-644

LEGEND

Soil sample from soil rock interface ——o——o——

Fresh rock chip sample x- - - - - - - x

Soil re-sample o— — — —o



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

GEOCHEMICAL PROFILE
NICKEL
TRAVERSE 3500 N

Date: June 1969 | Scale: Vert: 1" = 500 P.P.M. Horiz: 1" = 500'

To accompany Report by J.F. Gilfillan & J.P. Marshall

FIG. 19

2340

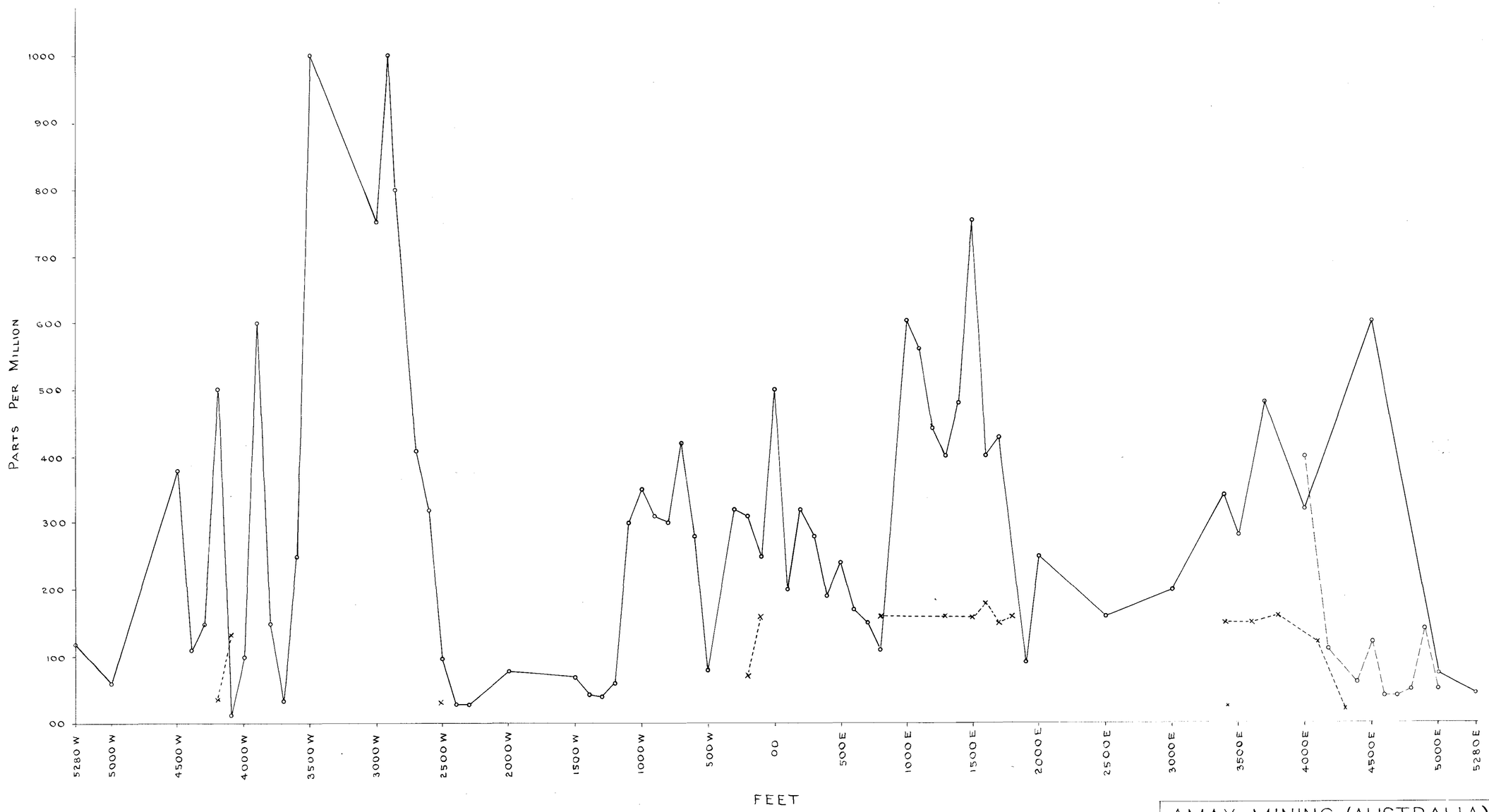
995145

LEGEND

Soil samples from soil rock interface

Fresh rock chip sample

Soil re-sample



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT TASMANIA

GEOCHEMICAL PROFILE
COBALT
TRAVERSE 3500 N

Date. June 1969

Scales: Vert: 1" = 100 P.P.M
Horiz: 1" = 500'

To accompany Report by J.F. Gilfillan + J.P. Marshall

FIG. 20

2341

995146

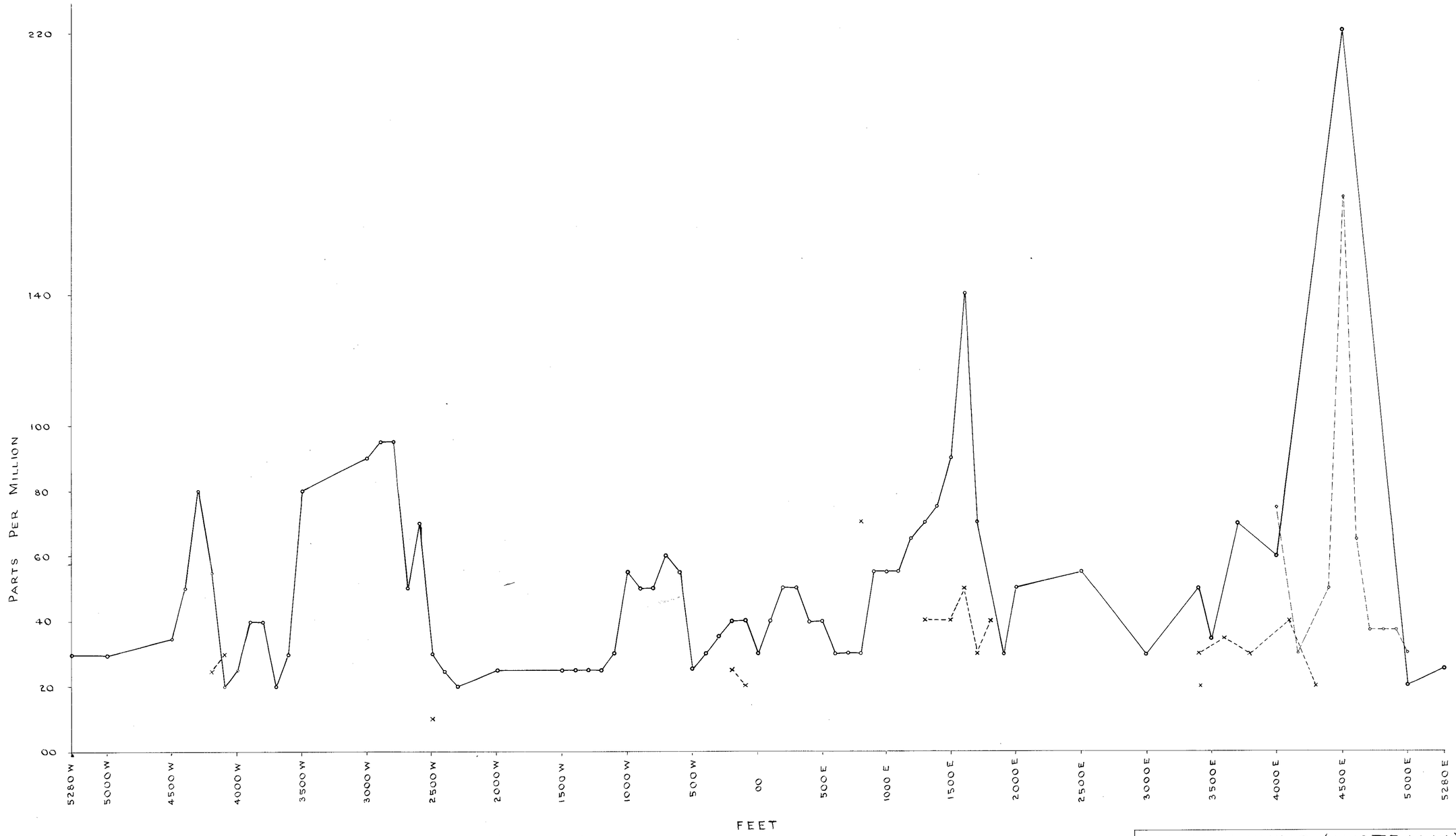
70-644

LEGEND

Soil samples from soil rock interface

Fresh rock chip sample

Soil re-sample



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

GEOCHEMICAL PROFILE
ZINC
TRAVERSE 3500 N

Date: June 1969

Scales: Vert: 1" = 20 PPM
Horiz: 1" = 500'

To accompany Report by J.F. Gilfillan & J.P. Marshall

FIG. 21

2342

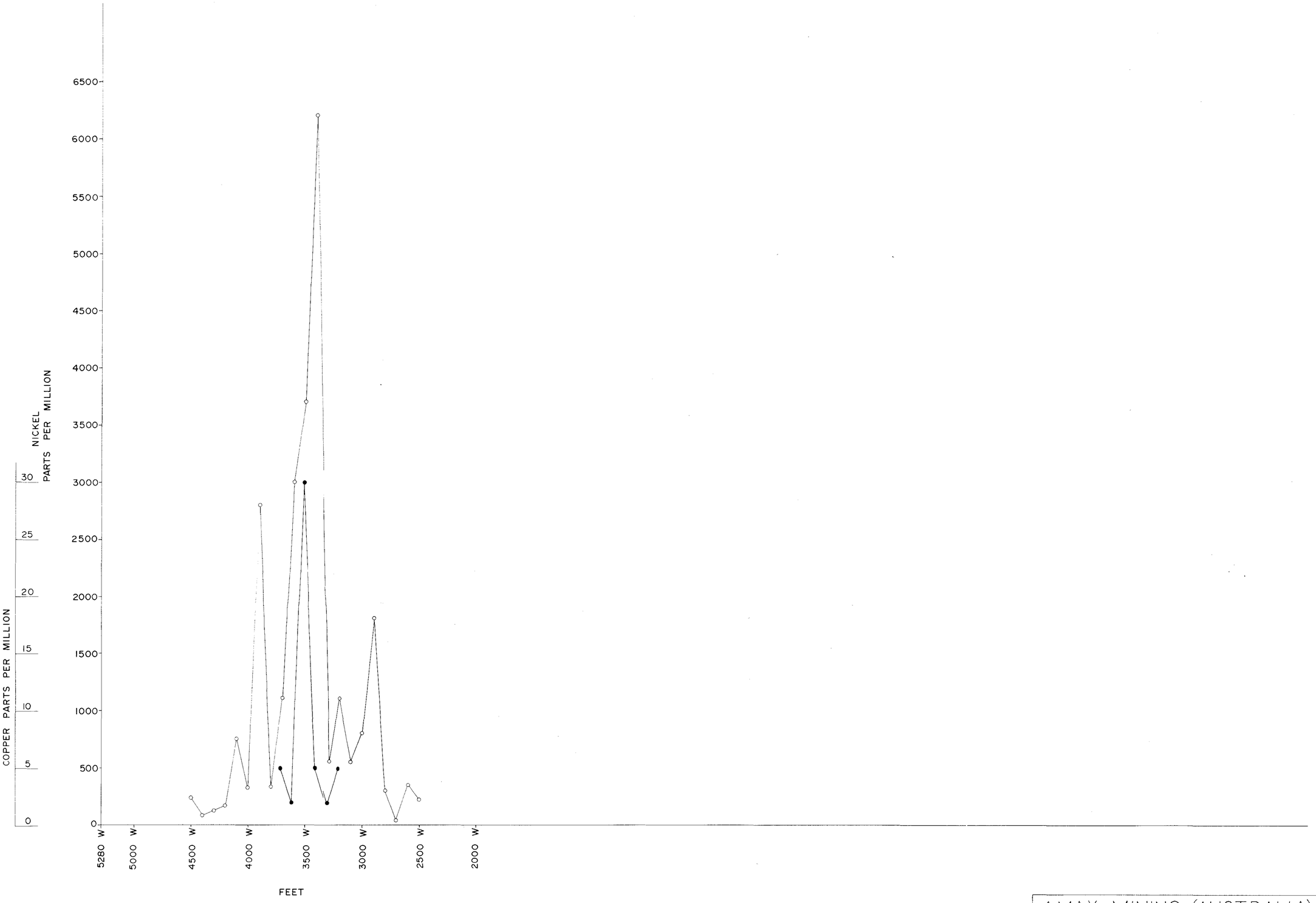
995147

70-644

LEGEND

Soil sample from soil rock interface

Copper



5 cm

AMAX MINING (AUSTRALIA) INC

HEAZLEWOOD NICKEL PROJECT - TASMANIA

GEOCHEMICAL PROFILE NICKEL TRAVERSE 4000 N

Date - June 1969

Scale - Vert - 1"=500 P.P.M. Horiz - 1"=500'

To accompany report by: J.F. Gilfillan & J.P. Marshall

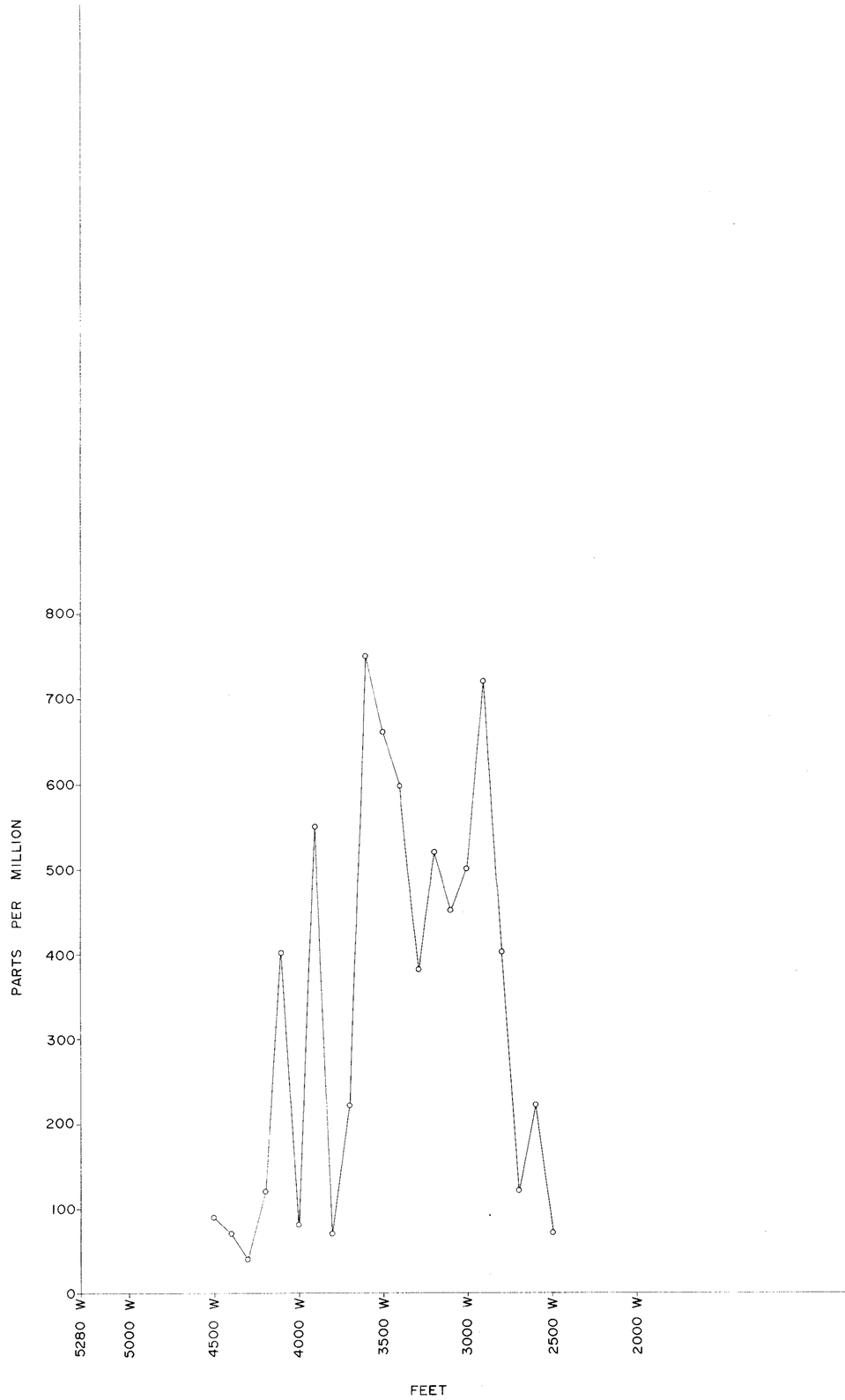
FIG. 22

2343

995148

LEGEND

Soil samples from soil rock interface



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

GEOCHEMICAL PROFILE
COBALT
TRAVERSE 4000 N

Date:- June 1969

Scale:- Vert:- 1" = 100 P.P.M.
Horiz:- 1" = 500'

To accompany report by J.F. Gilfillan & J.P. Marshall

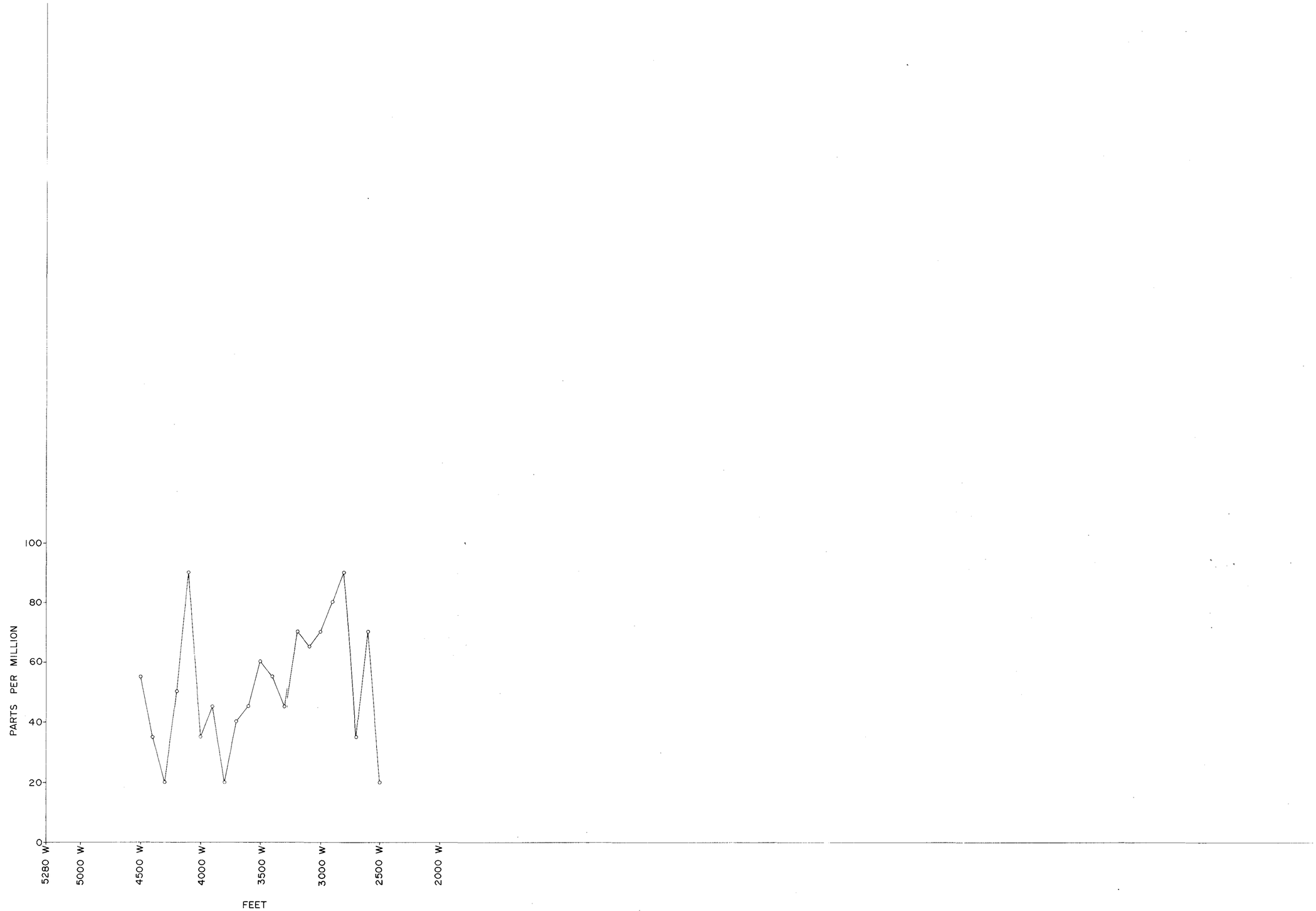
FIG. 23

2344

995149

LEGEND

Soil sample from soil rock interface ○——○



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

GEOCHEMICAL PROFILE
ZINC
TRAVERSE 4000 N

Date:- June 1969

Scale:- Vert:- 1"=20 P.P.M.
Horiz.- 1"=500'

To accompany report by J.F. Gilfillan & J.P. Marshall

FIG. 24

2345

995150

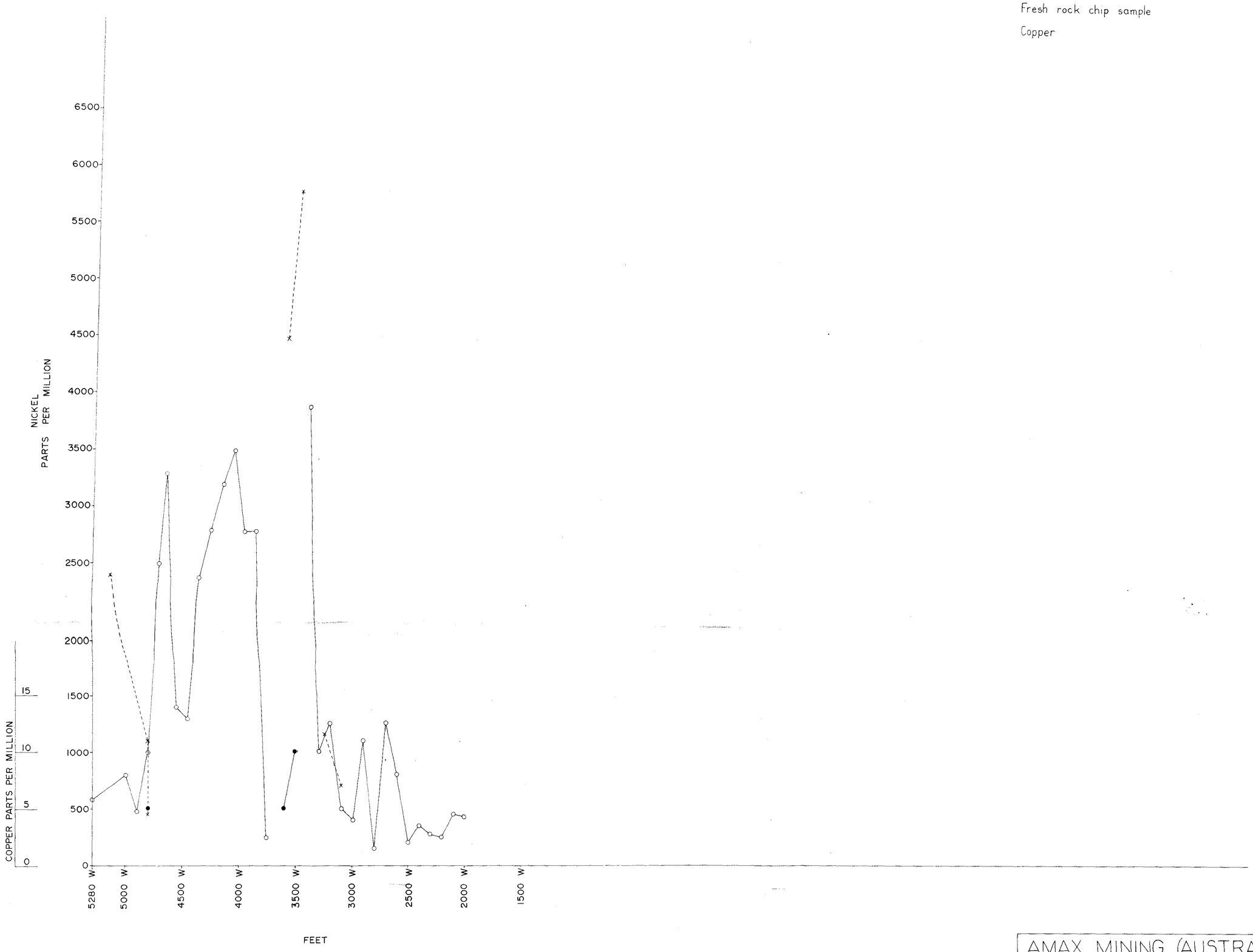
70-644

LEGEND

Soil sample from soil rock interface

Fresh rock chip sample

Copper



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

GEOCHEMICAL PROFILE
NICKEL
TRAVERSE 9000 N

Date:- June 1969

Scale:- Vert:- 1" = 500 P.P.M.
Horiz:- 1" = 500 Feet

To accompany report by:- J.F. Gilfillan & J.P. Marshall

FIG. 25

2346

995151

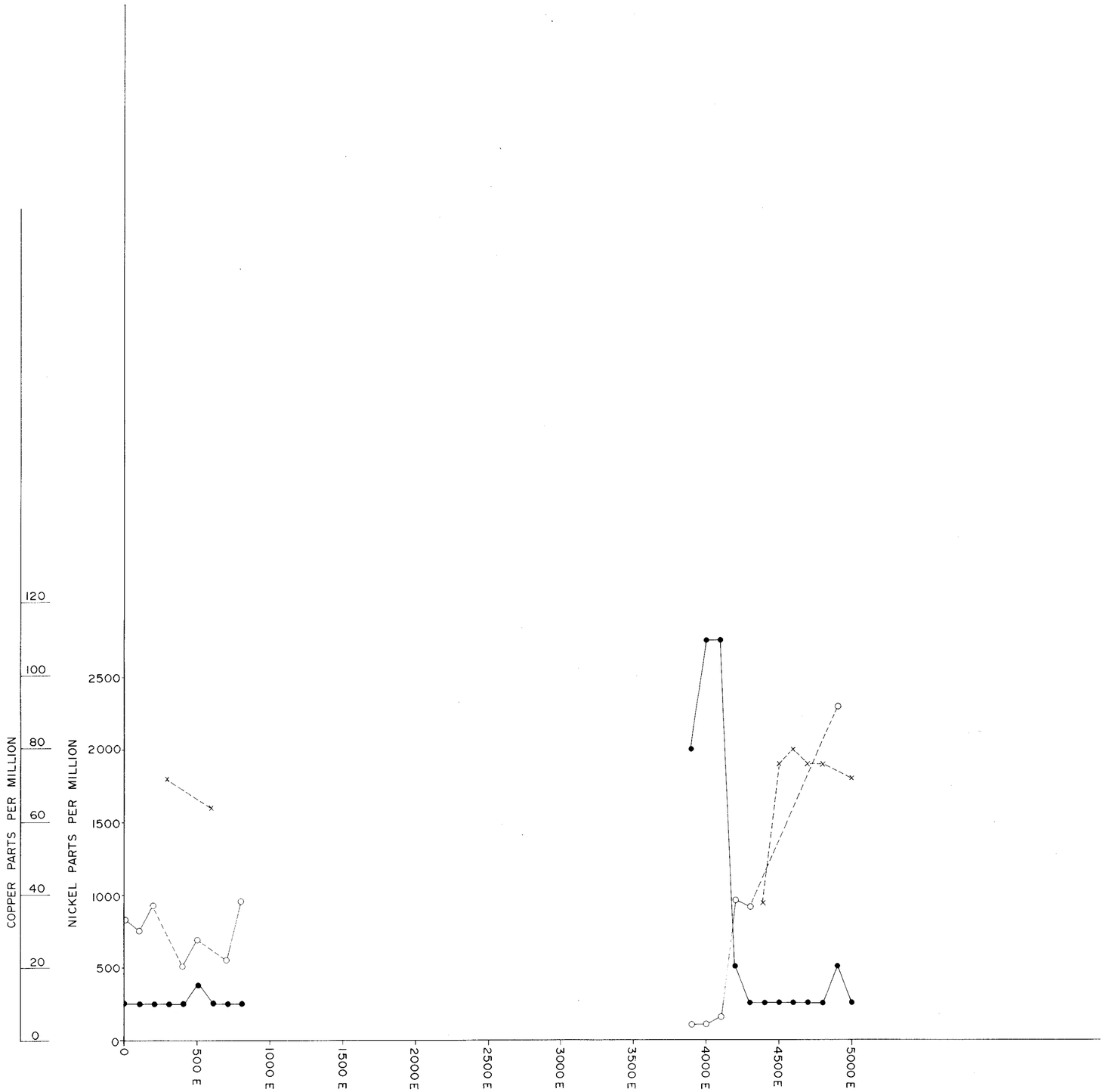
70-6444

LEGEND

Soil sample from soil rock interface ——o——o——

Rock chip sample x------x

Copper ——•——•——



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

GEOCHEMICAL PROFILE NICKEL TRAVERSE 10500 N

Date- June 1969 | Scale:- HORIZ: 1"=500 ft. VERT: 1"=500 ft

To accompany report by J. F. Gillfillan & J. P. Marshall

FIG. 26

2347

995152

LEGEND

Soil sample from soil rock interface

Copper

NICKEL PARTS PER MILLION

7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0

COPPER PARTS PER MILLION

15
10
5
0

5280 W
5000 W
4500 W
4000 W
3500 W
3000 W
2500 W
2000 W
1500 W

FEET

5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

GEOCHEMICAL PROFILE
NICKEL
TRAVERSE 11000 N

Date:- June 1969

Scale:- Vert:- 1" = 500 P.P.M.
Horiz:- 1" = 500 Feet

To accompany report by:- J.F. Gilfillan & J.P. Marshall

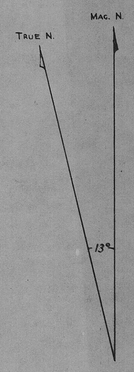
FIG. 27

2348

995153

70-644

2349



LEGEND

- Tracks, roads (approx. location)
- Tracks, roads (surveyed)
- Creeks, rivers (approx)
- Creeks, rivers (surveyed)
- Bridges
- H/T Power Line
- Traverses Pegged
- Magnetic Contour (γ)
- >1000γ
- <0γ
- Drill Hole (with dip) — H2(-50)

15840'N
15,500'
15,000'
14,500'
14,000'
13,500'
13,000'
12,500'
12,000'
11,500'
11,000'
10560'
10500'
10,000'
9,500'
9,000'
8,500'
8,000'
7,500'
7,000'
6,500'
6,000'
5,500'
5,000'
4,500
4,000'
3,500'
3,000'
2,500
2,000'
1500'
1000'
500'N

3 Miles
2 Miles
1 Mile
H4 (-48)
H3(-50)
H1(-55)
H2(-50)

S.P.L.N°37
DATUM 5280' 1 Mile 5000'W 4500' 4000' 3500' 3000' 2500' 2000' 1500' 1000' 500'W 0 500'E 1000' 1500' 2000' 2500' 3000' 3500' 4000' 4500' 5000'E 5280' 1 Mile

5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC INTENSITY CONTOUR PLAN
(VERTICAL COMPONENT)
CONTOUR INTERVAL 1000γ

Date: June 1969	Scale: 1" = 500'

To accompany Report by J. F. Gilfillan & J. P. Marshall

Magnetometer: Sharpe M.F.I

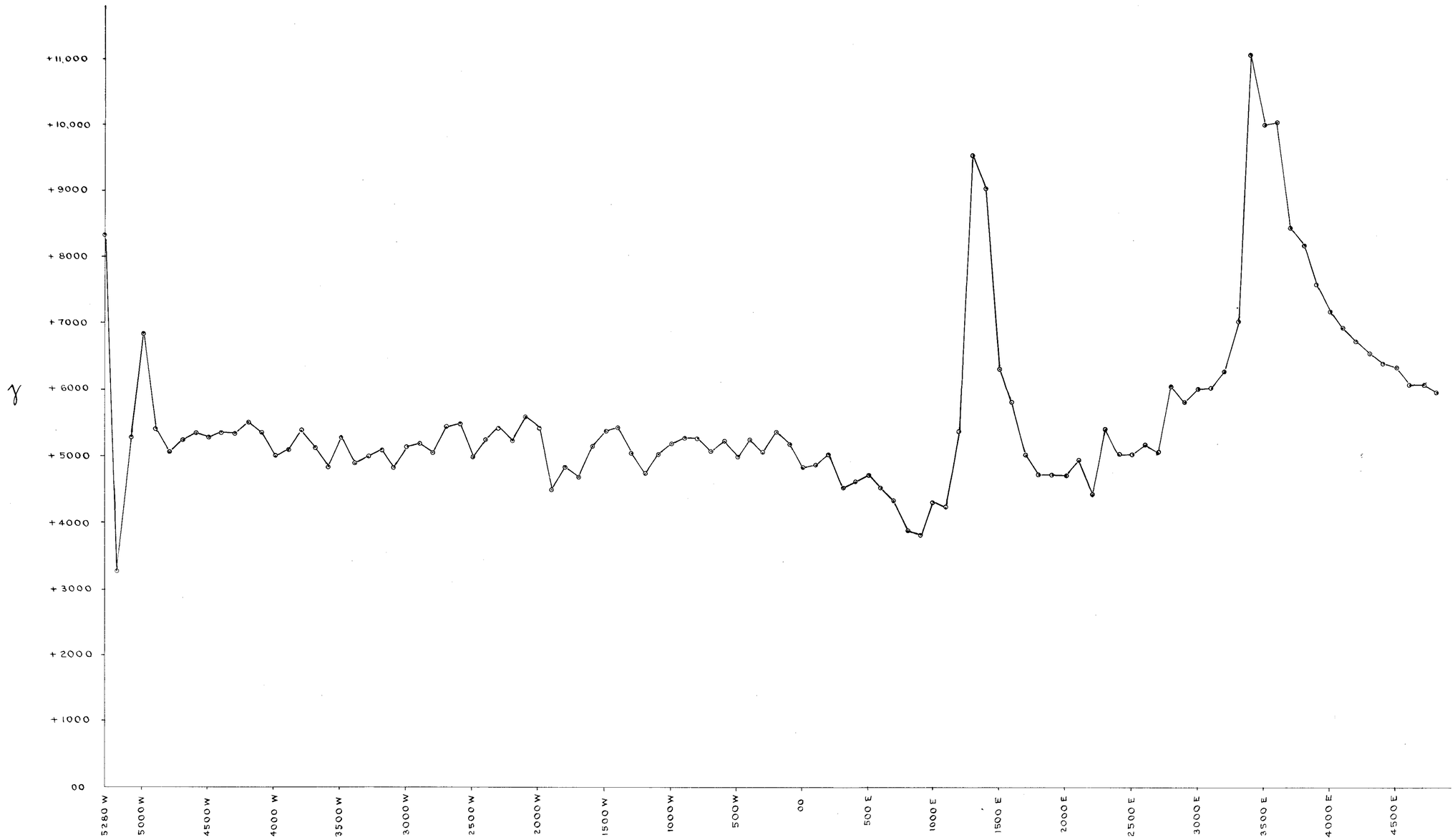
2349

FIG. 28

995154

28

70-6444



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC PROFILE
(VERTICAL COMPONENT)

TRAVERSE 00 N

Date: June 1969 | Scales: Vert: 1" = 1000γ, Horiz 1" = 500'

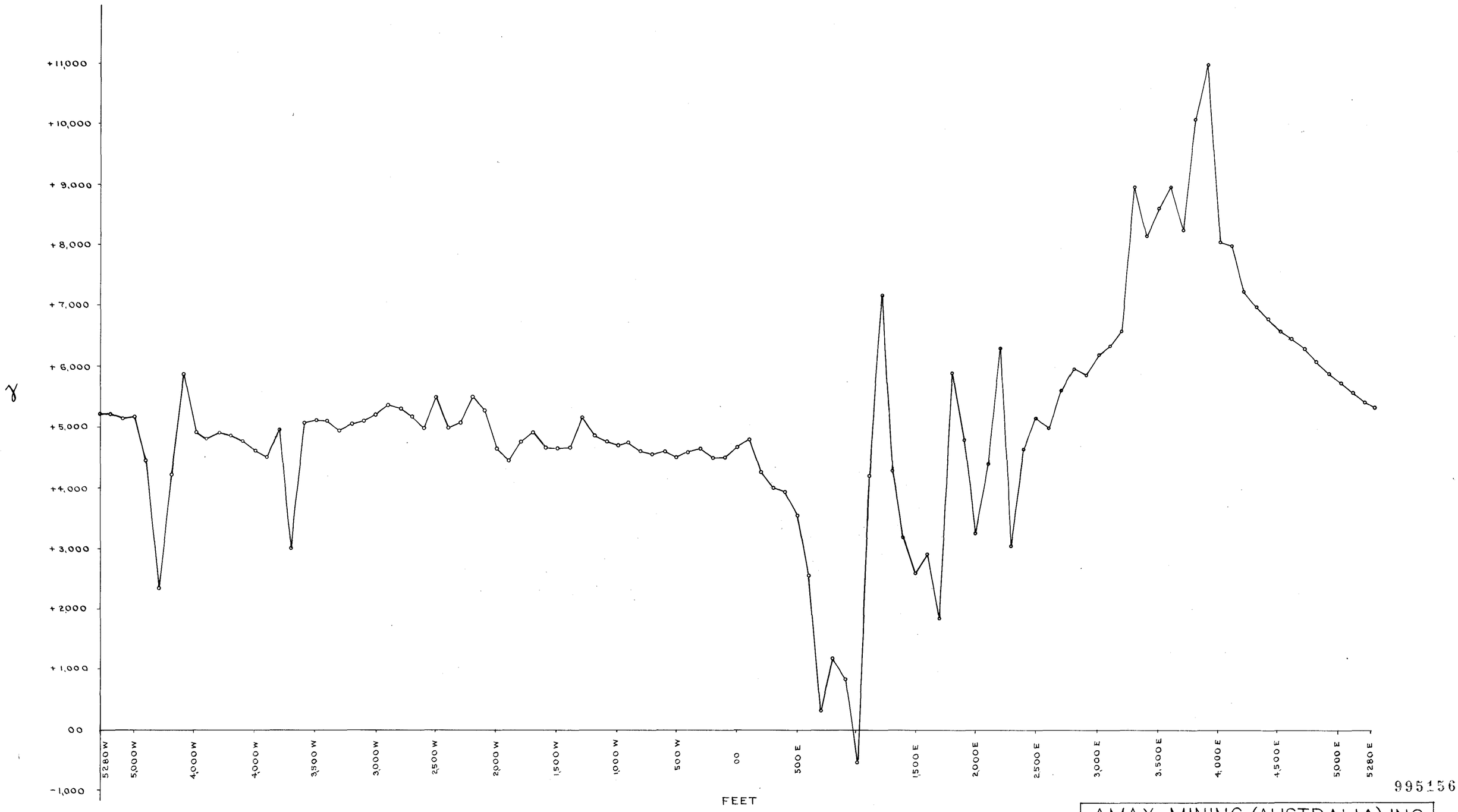
To accompany Report by J.F. Gilfillan & J.P. Marshall

FIG. 29

2350

995155

70-644



995156

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT TASMANIA

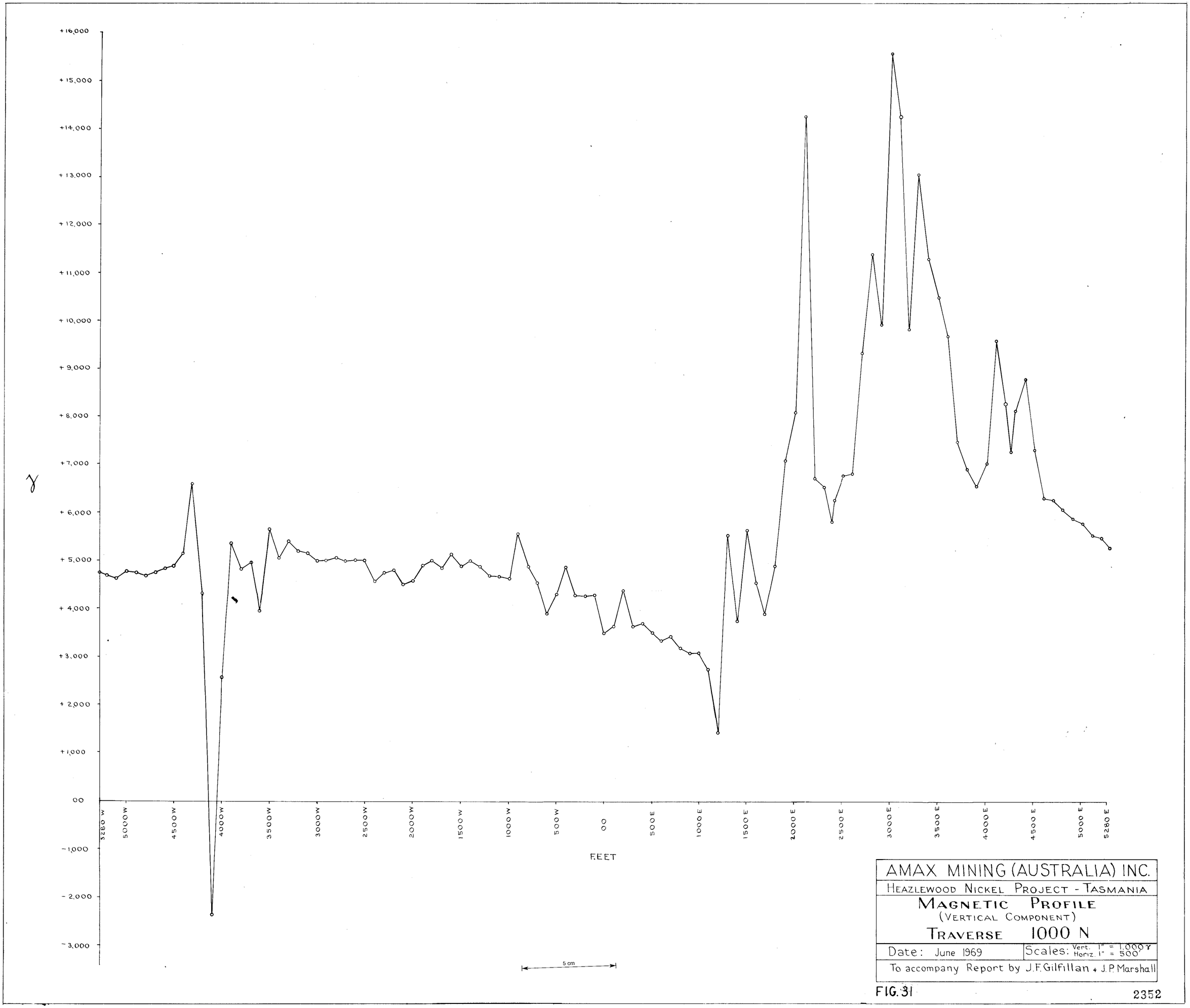
MAGNETIC PROFILE
(VERTICAL COMPONENT)
TRAVERSE 500 N

Date: June 1969 | Scales: Vert 1" = 1000γ, Horiz. 1" = 500'

To accompany Report by J. F. Gilfillan & J. P. Marshall

FIG. 30

2351



AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC PROFILE
(VERTICAL COMPONENT)
TRAVERSE 1000 N

Date: June 1969

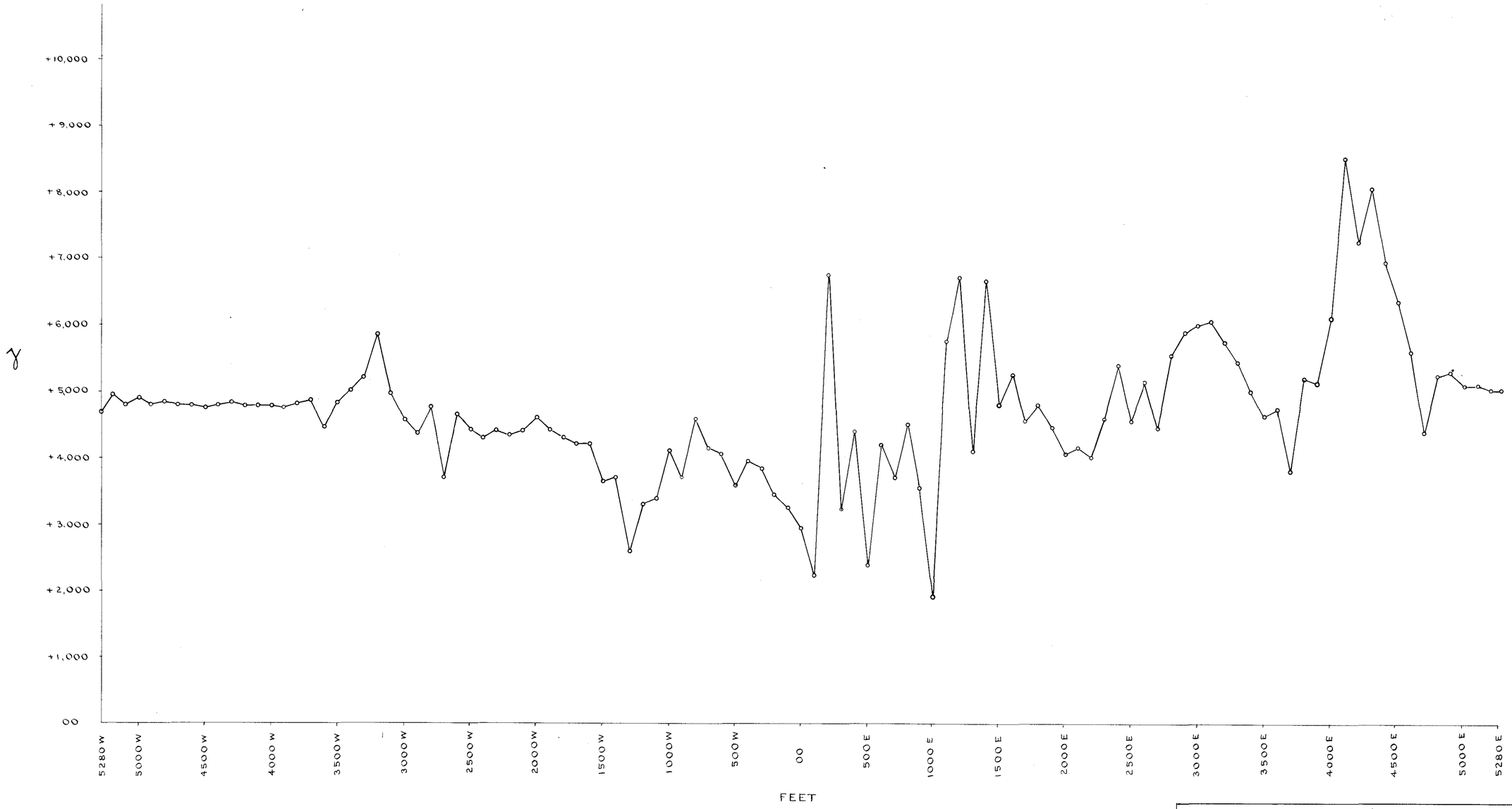
Scales: Vert. 1" = 1,000 γ
Horiz. 1" = 500'

To accompany Report by J.F.Gilfillan + J.P.Marshall

FIG. 31

2352

70-644



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC PROFILE

VERTICAL COMPONENT

TRAVERSE 1500 N.

Date: June 1969

Scales: Vert. 1" = 1000γ Horiz. 1" = 500'

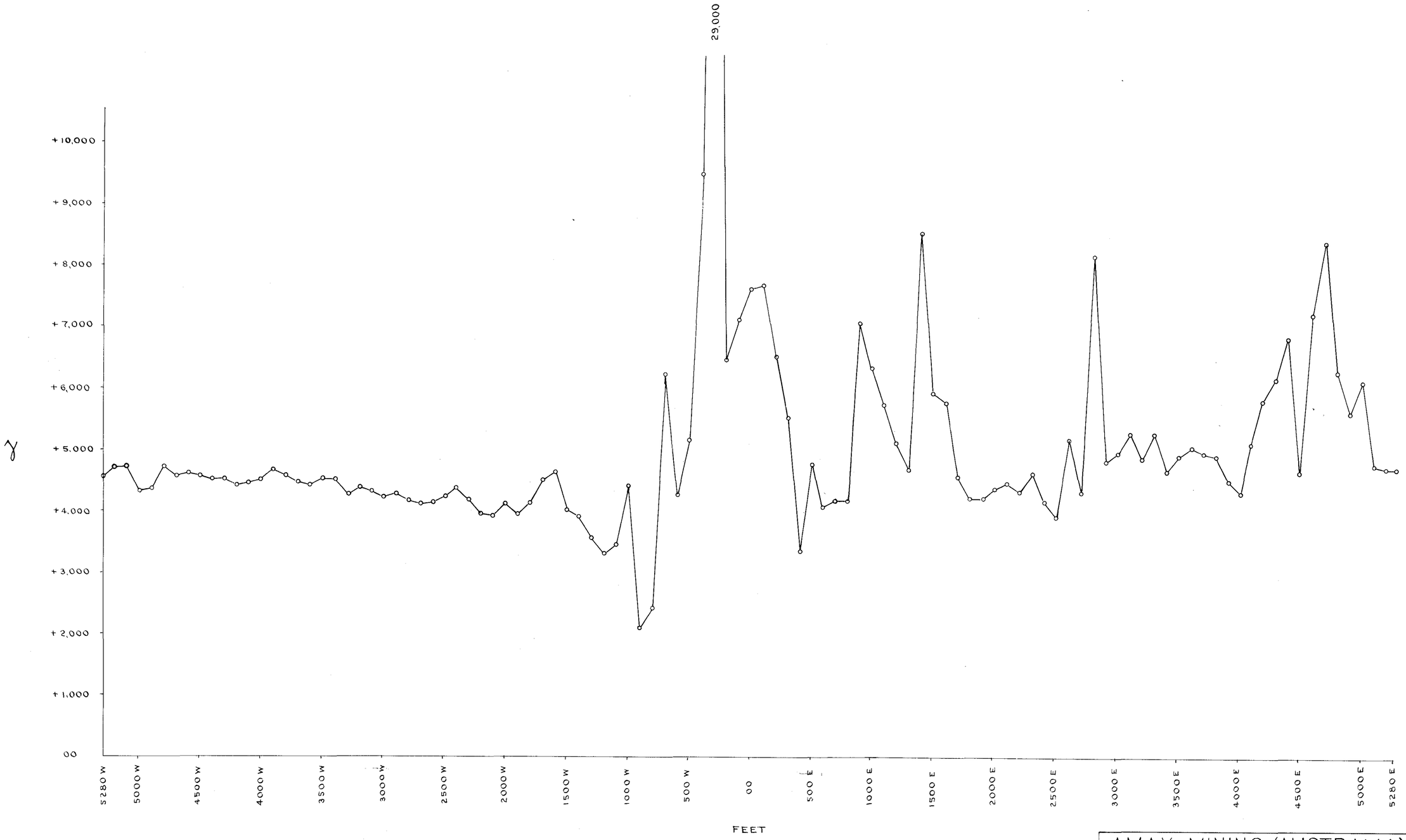
To accompany Report by J.F. Gilfillan & J.P. Marshall

FIG. 32

2353

995158

70-644



AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC PROFILE
(VERTICAL COMPONENT)

TRAVERSE 2000 N

Date: June 1969 | Scales Vert 1" = 1000 γ, Horiz 1" = 500'

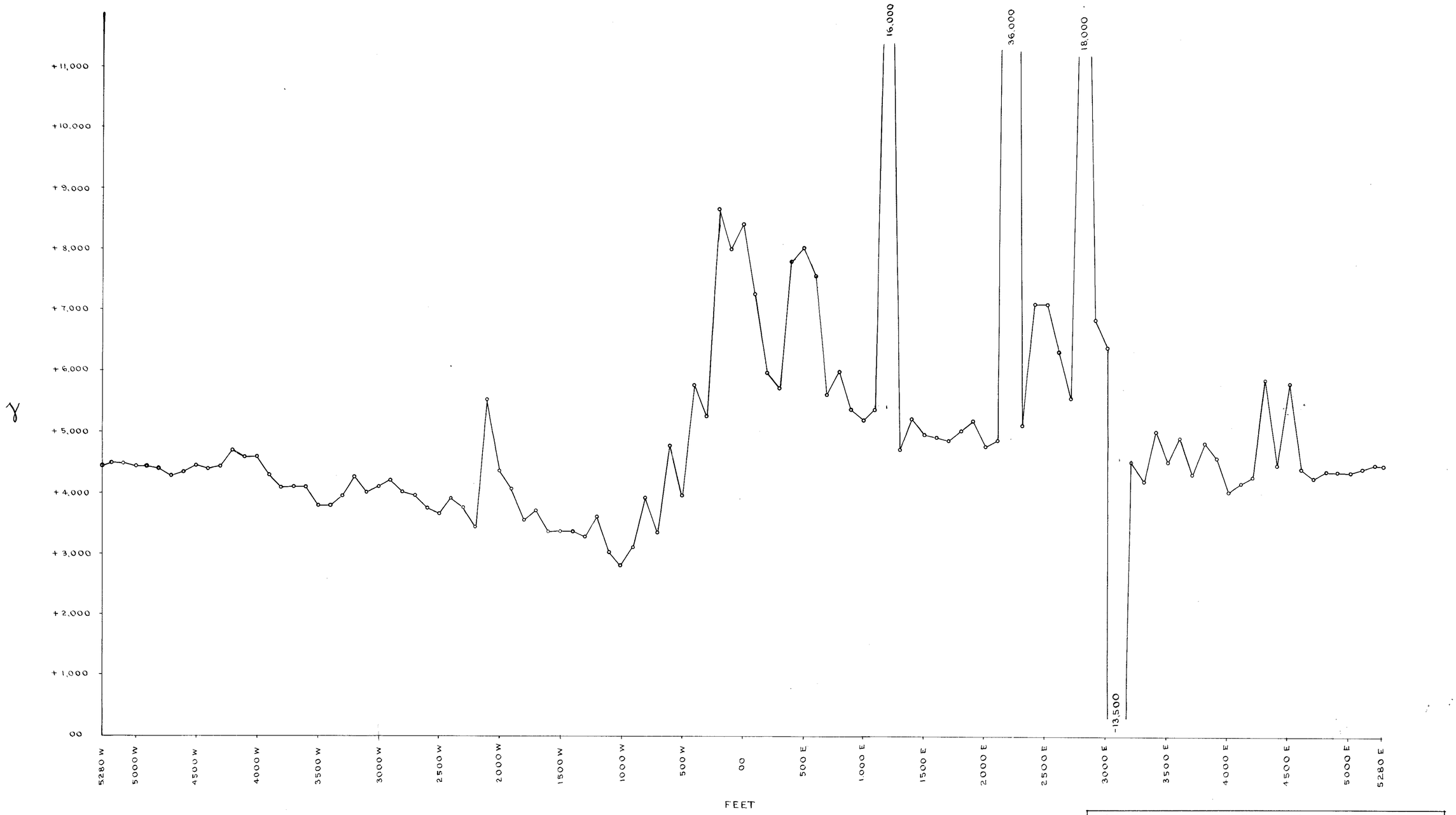
To accompany Report by J. F. Gilfillan & J. P. Marshall

FIG. 33

2354

995159

70-644



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC PROFILE

VERTICAL COMPONENT

TRAVERSE 2500 N

Date: June 1969

Scales: Vert: 1" = 1000 γ
Horiz: 1" = 500'

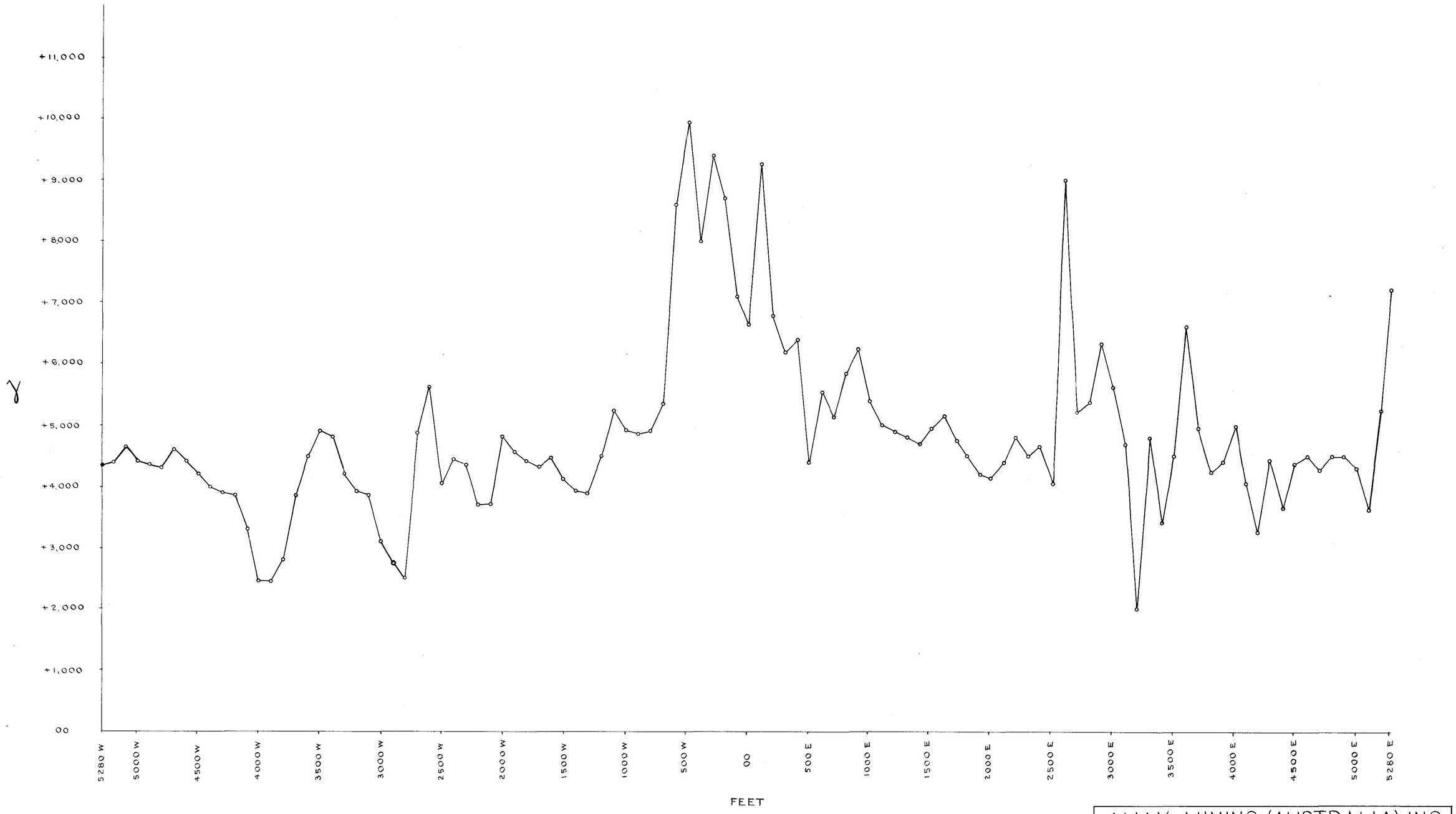
To accompany Report by J. F. Gilfillan & J. P. Marshall

FIG. 34

2355

995160

70-644



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT TASMANIA

MAGNETIC PROFILE

VERTICAL COMPONENT

TRAVERSE 3000 N

Date: June 1969

Scales Vert 1" = 1000 γ
Horiz 1" = 500'

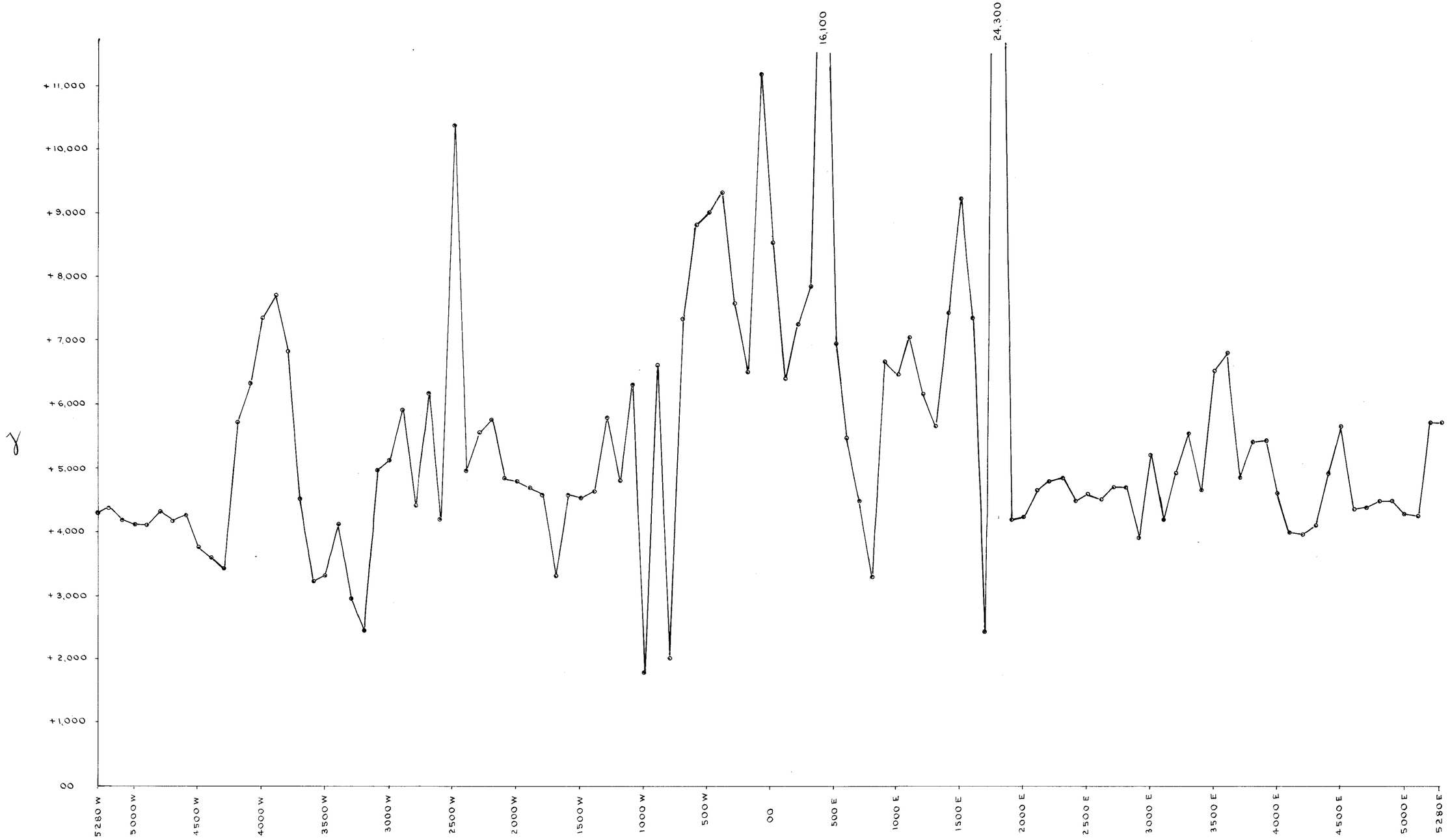
To accompany Report by J. F. Gilfillan & J.P. Marshall

FIG. 35

2356

995161

70-644



AMAX MINING (AUSTRALIA) INC

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC PROFILE
(VERTICAL COMPONENT)

TRAVERSE 3500 N

Date: June 1969

Scales: Vert: 1:1000 γ
Horiz: 1:500'

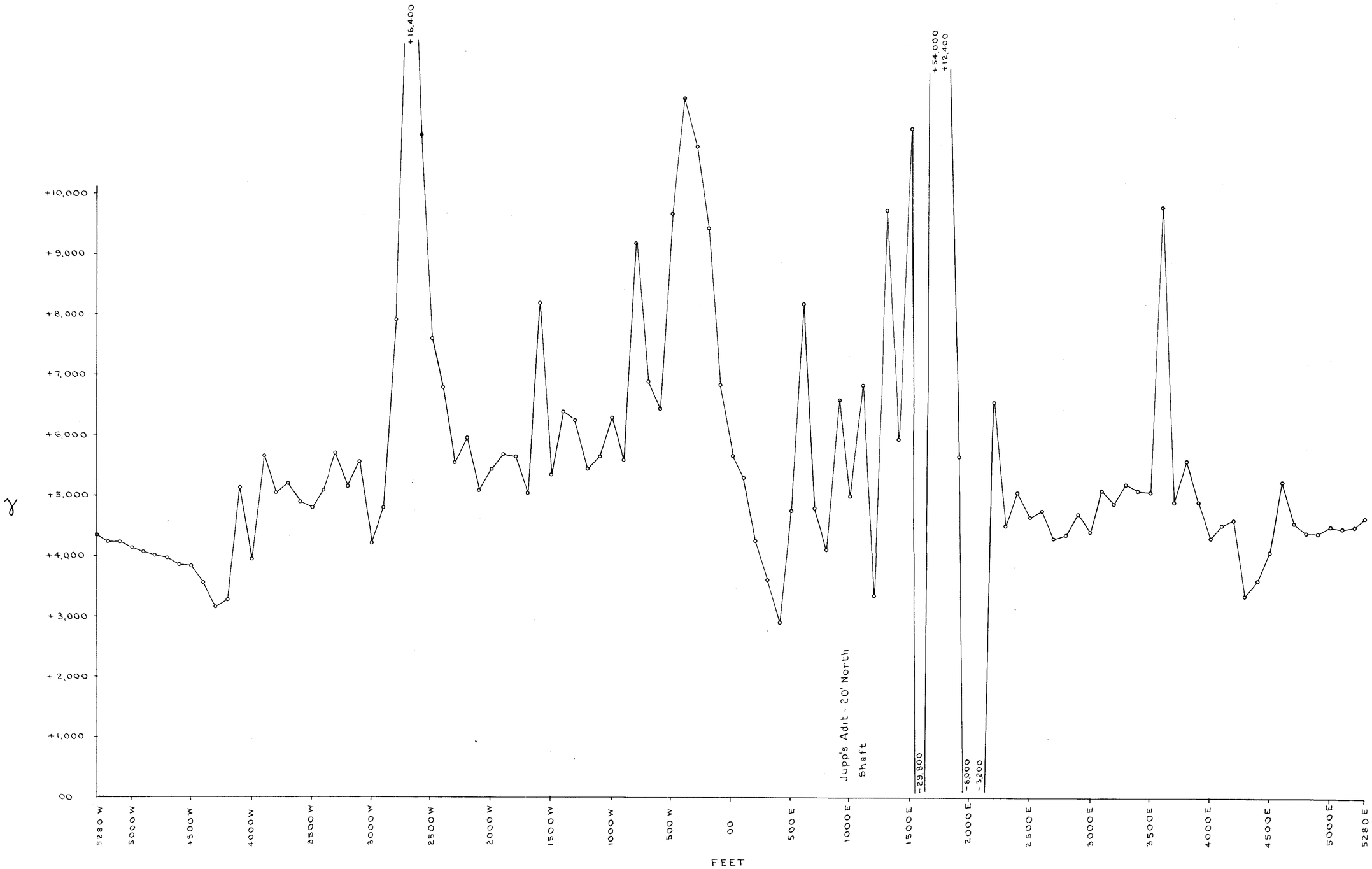
To accompany Report by J. F. Gilfillan & J. P. Marshall

FIG. 36

2357

995162

70-644



AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC PROFILE

VERTICAL COMPONENT

TRAVERSE 4000 N

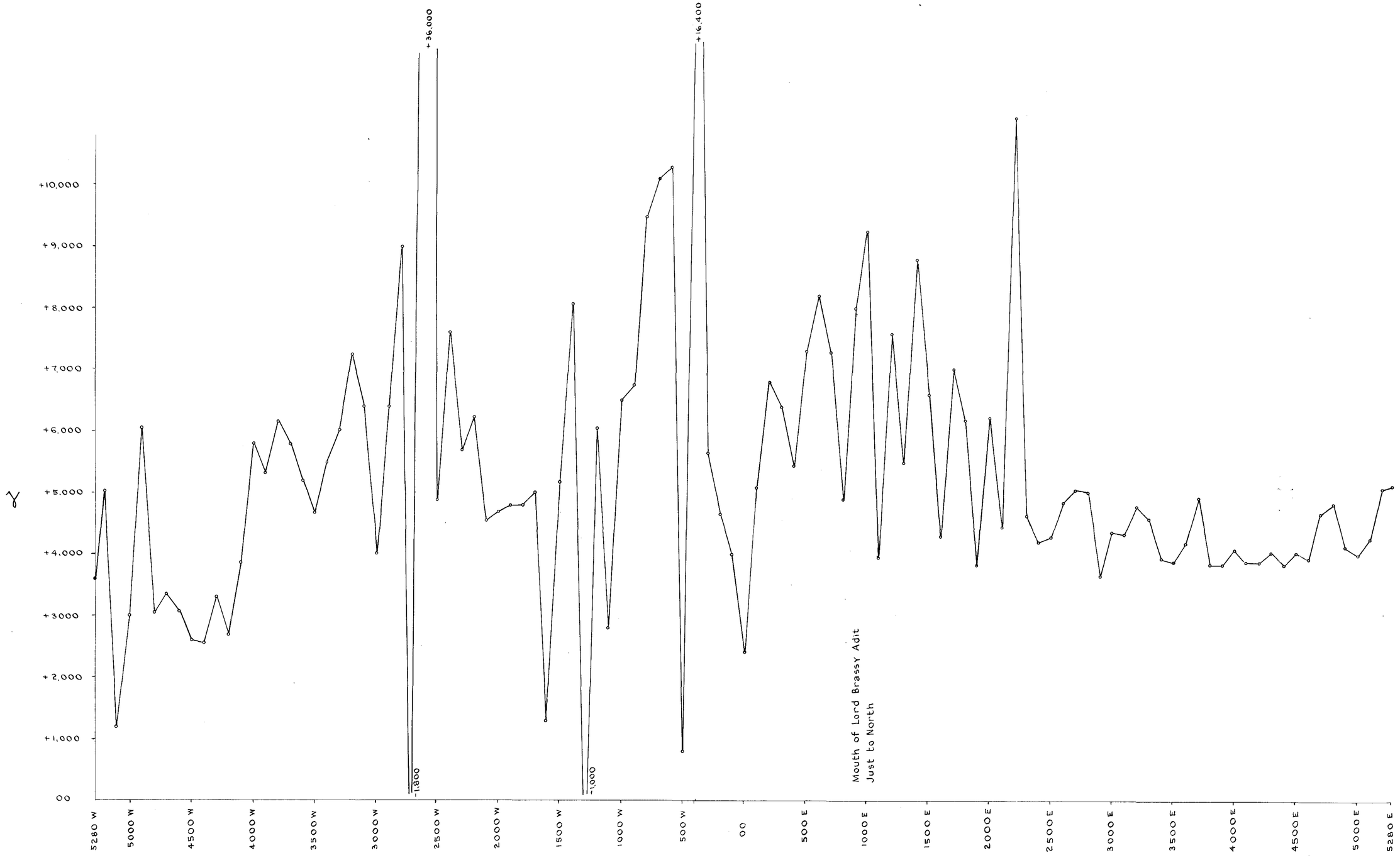
Date: June 1969 | Scales: Vert: 1" = 1000 γ, Horiz: 1" = 500'

To accompany Report by J. F. Gilfillan & J. P. Marshall

FIG. 37

2358

995163



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC PROFILE

VERTICAL COMPONENT

TRAVERSE 4500 N

Date: June 1969

Scales: Vert: 1" = 1000 γ
Horiz: 1" = 500'

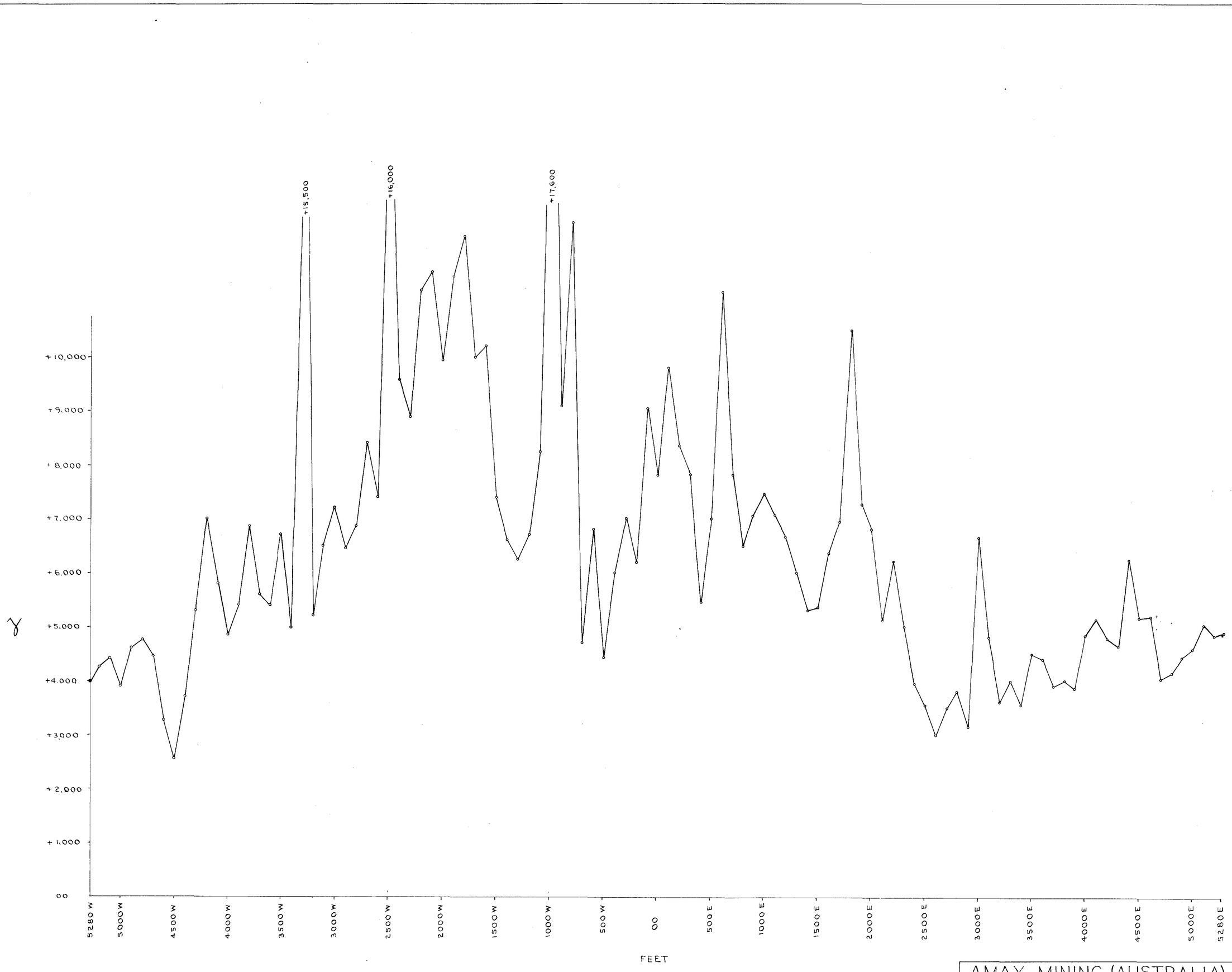
To accompany Report by J F. Gilfillan & J.P.Marshall

RUES

FIG. 38

2359

70-644



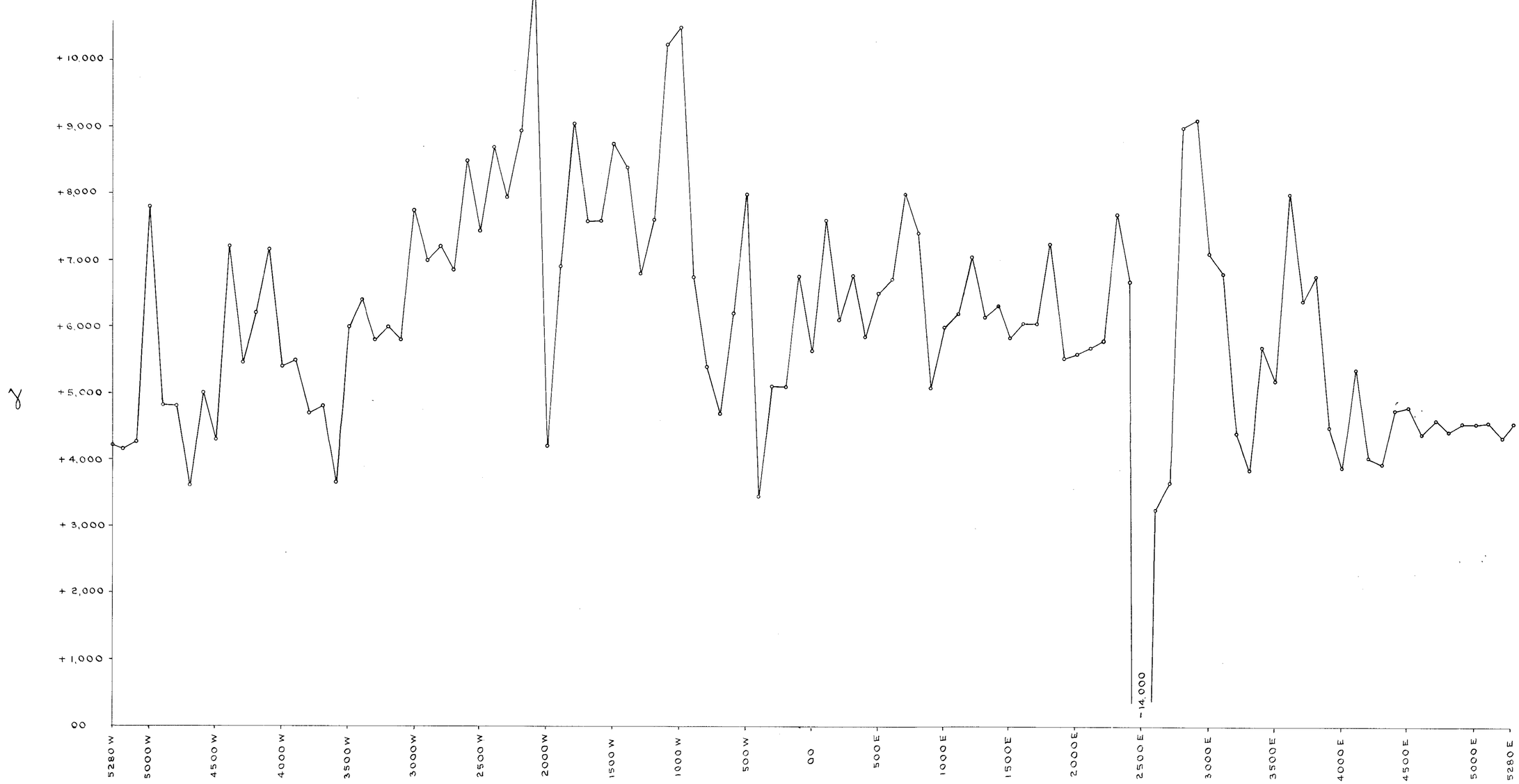
AMAX MINING (AUSTRALIA) INC.	
HEAZLEWOOD NICKEL PROJECT - TASMANIA	
MAGNETIC PROFILE VERTICAL COMPONENT TRAVERSE 5000 N	
Date: June 1969	Scales: Vert: 1" = 1000 γ Horiz: 1" = 500'
To accompany Report by J. F. Gilfillan & J.P. Marshall	

FIG. 39

2360

995165

70-644



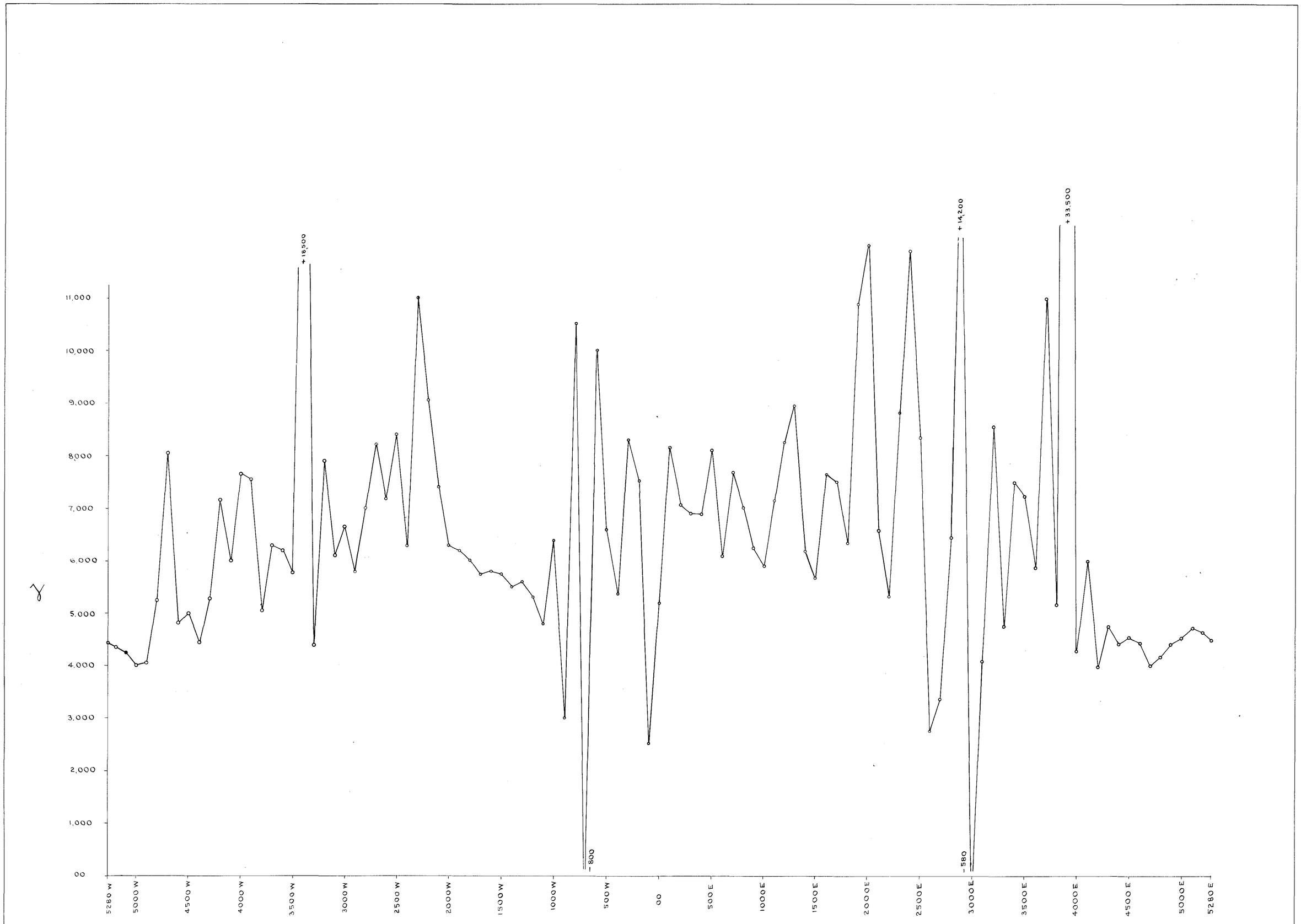
AMAX MINING (AUSTRALIA) INC.	
HEAZLEWOOD NICKEL PROJECT - TASMANIA	
MAGNETIC PROFILE VERTICAL COMPONENT TRAVERSE 5500 N	
Date: June 1969	Scales: Vert: 1" = 1000 γ Horiz: 1" = 500'
To accompany Report by J.F. Gilfillan & J.P. Marshall	

FIG. 40

2361

995166

70-644



AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC PROFILE

VERTICAL COMPONENT

TRAVERSE 6000 N

Date: June 1969 | Scales: Vert: 1" = 1000 γ, Horiz: 1" = 500'

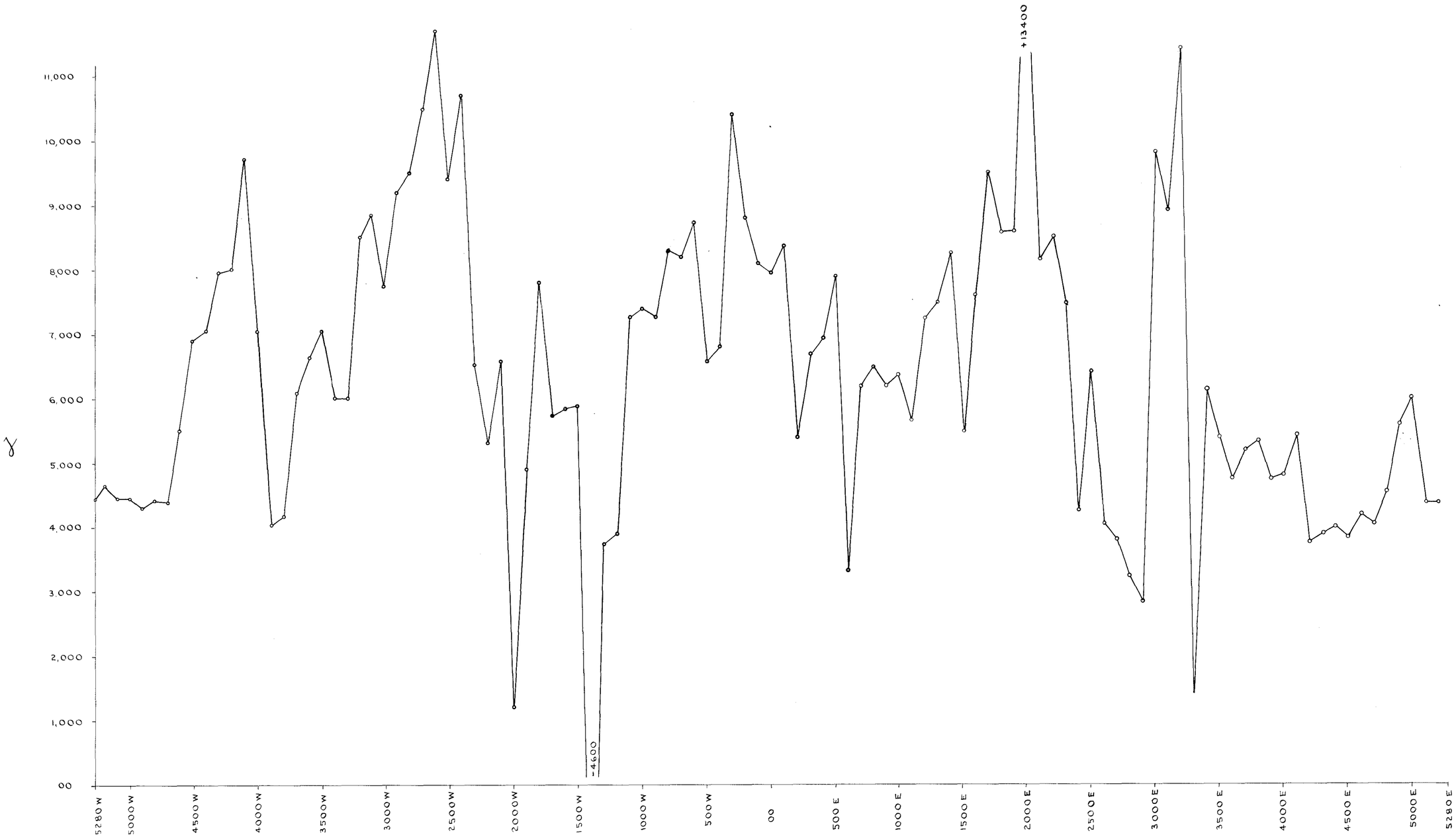
To accompany Report by J.F. Gilfillan & J.P. Marshall

FIG. 41

2362

995167

70-6444



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC PROFILE

VERTICAL COMPONENT

TRAVERSE 6500 N

Date: June 1969

Scales Vert: 1" = 1000 ϒ
Horiz: 1" = 500'

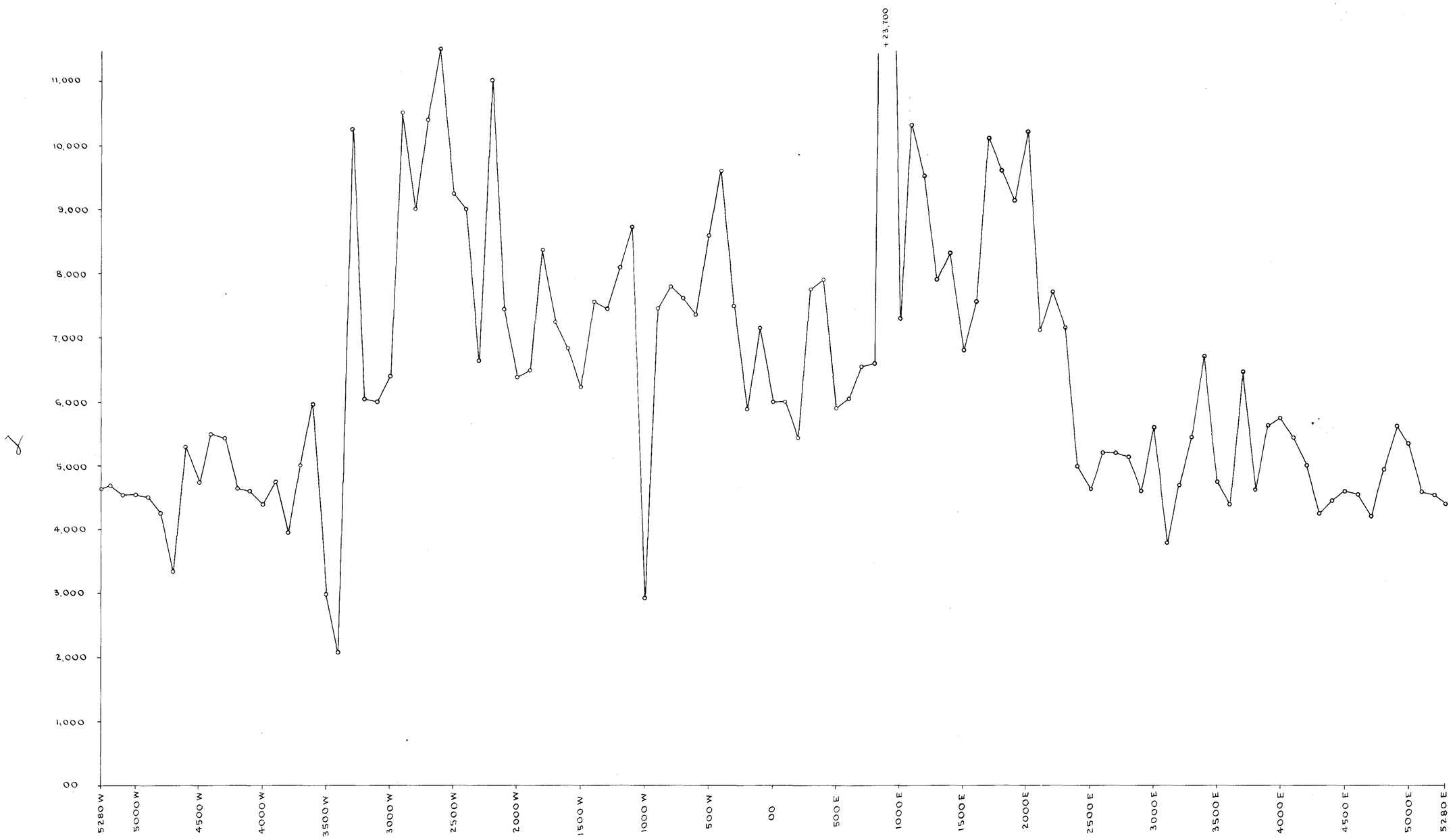
To accompany Report by J.F. Gilfillan & J.P. Marshall

FIG. 42

2363

995168

70-6444



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC PROFILE

VERTICAL COMPONENT

TRAVERSE 7000 N

Date: June 1969

Scales Vert: 1" = 1000 γ
Horiz: 1" = 500'

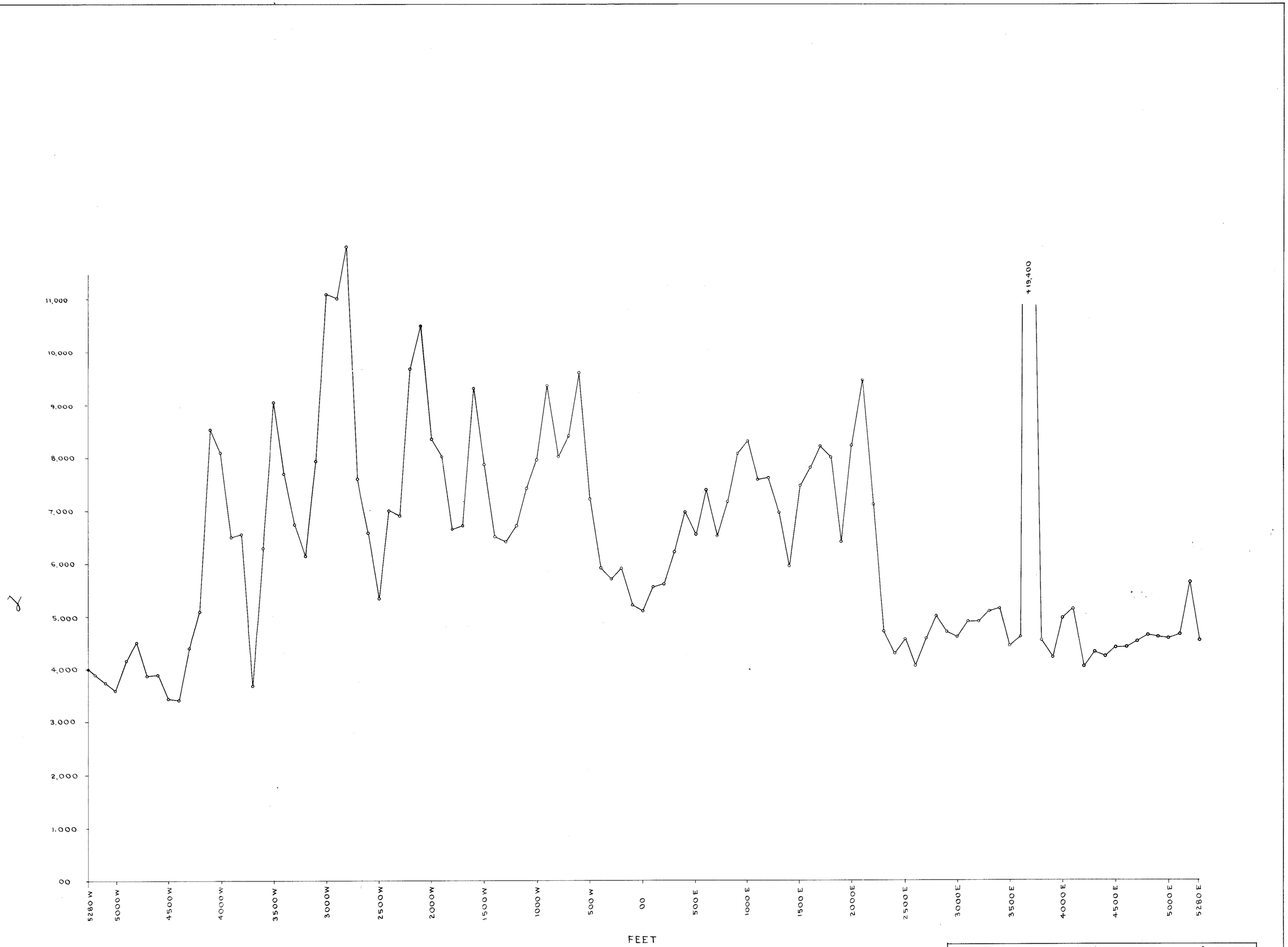
To accompany Report by J.F. Gilfillan & J.P.Marshall

FIG. 43

2364

995169

70-6444



AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT TASMANIA

MAGNETIC PROFILE

VERTICAL COMPONENT

TRAVERSE 7500 N

Date: June 1969

Scales: Vert: 1" = 1000 γ
Horiz: 1" = 500'

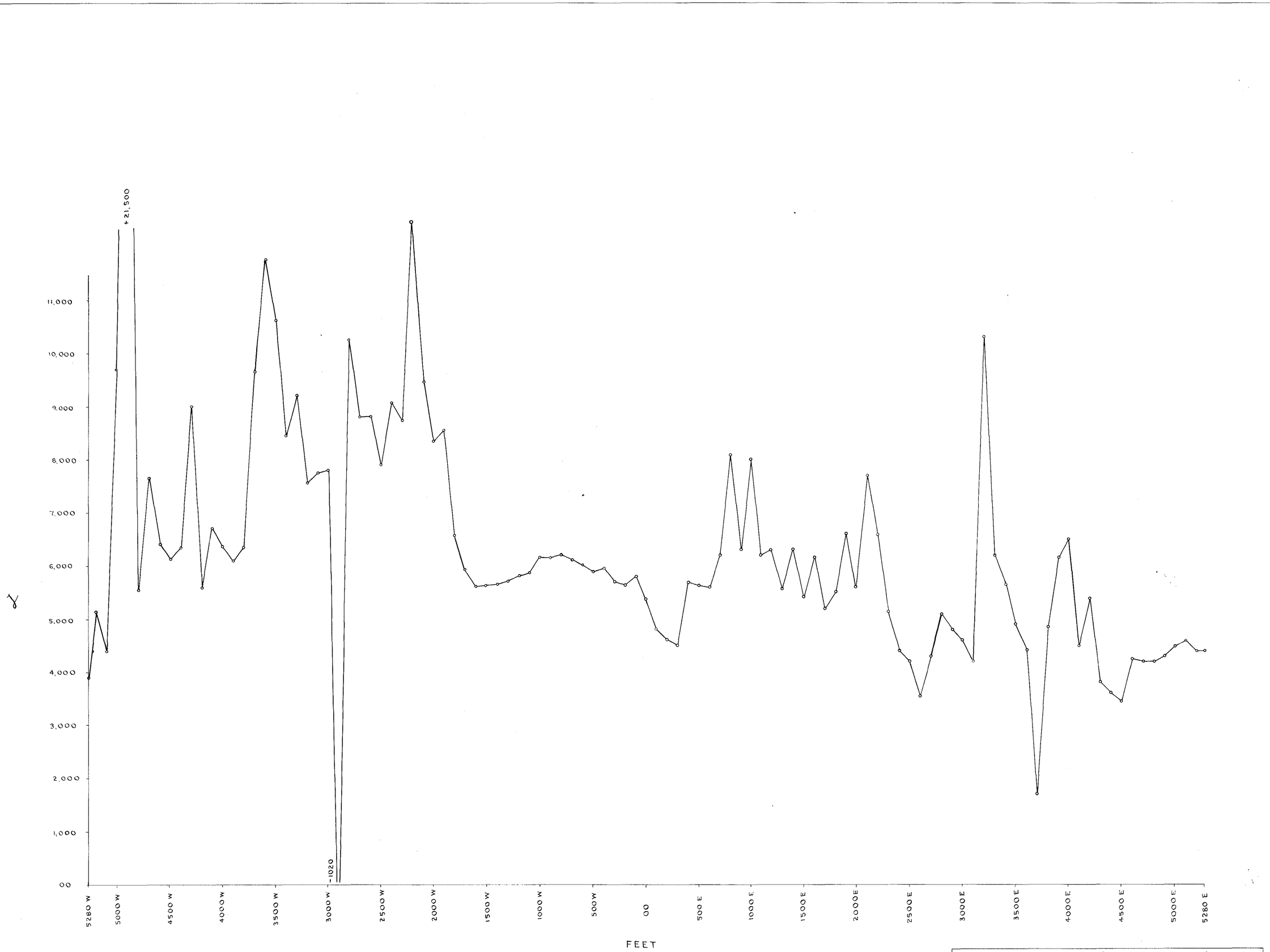
To accompany Report by J.F Gilfillan & J.P Marshall

FIG. 44

2365

995170

70-644



AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT TASMANIA

MAGNETIC PROFILE

VERTICAL COMPONENT

TRAVERSE 8000 N

Date: June 1969

Scales: Vert: 1" = 1000 γ
Horiz: 1" = 500'

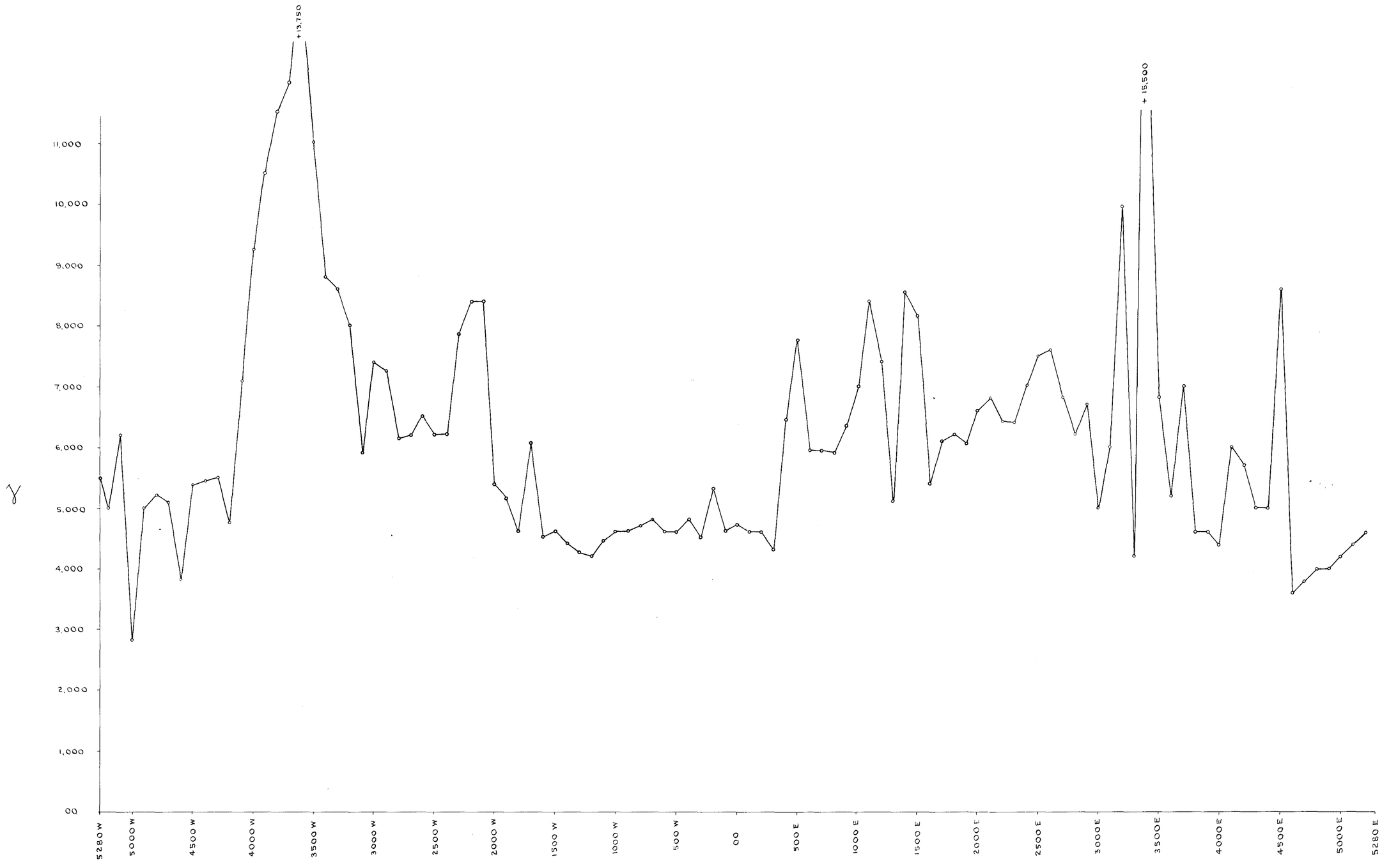
To accompany Report by J.F. Gilfillan & J.P. Marshall

FIG. 45

2366

995171

70-6444



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC PROFILE

VERTICAL COMPONENT

TRAVERSE 8500 N

Date: June 1969

Scales: Vert: 1" = 1000 γ
Horiz: 1" = 500'

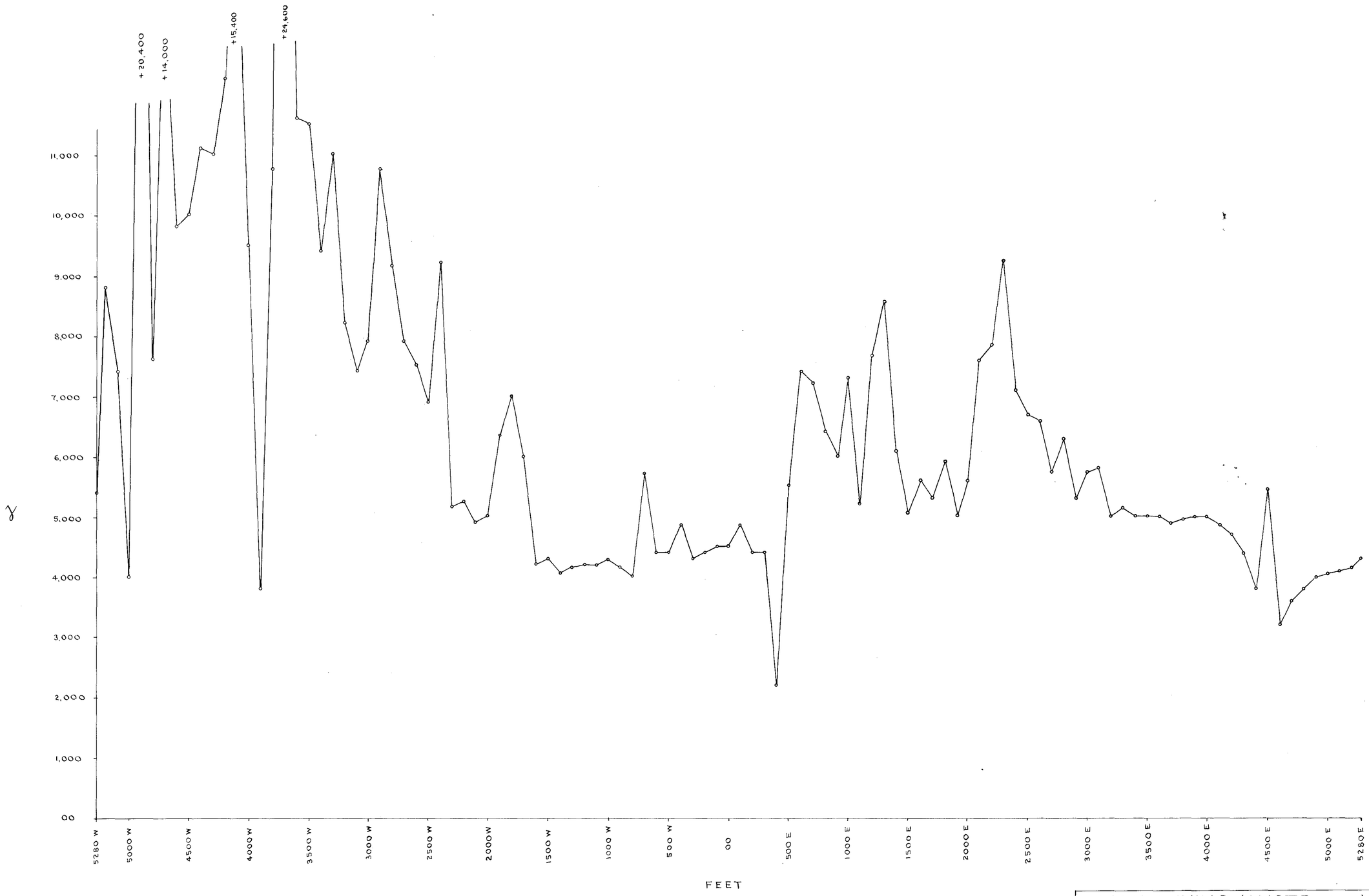
To accompany Report by J. F. Gilfillan & J. P. Marshall

FIG. 46

2367

995172

70-644



AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT TASMANIA

MAGNETIC PROFILE

VERTICAL COMPONENT

TRAVERSE 9000 N

Date: June 1969

Scales: Vert: 1" = 1000 γ
Horiz: 1" = 500'

To accompany Report by J. F. Gilfillan & J. P. Marshall

FIG. 47

2368

995173

70-644

γ

11,000
10,000
9000
8000
7000
6000
5000
4000
3000
2000
1000
00

+12000

-500

5280W 5000W 4500W 4000W 3500W 3000W 2500W 2000W 1500W 1000W 500W 00 500E 1000E 1500E 2000E 2500E 3000E 3500E 4000E 4500E 5000E 5280E

FEET

5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC PROFILE

VERTICAL COMPONENT

TRAVERSE 9500 N

Date: June 1969

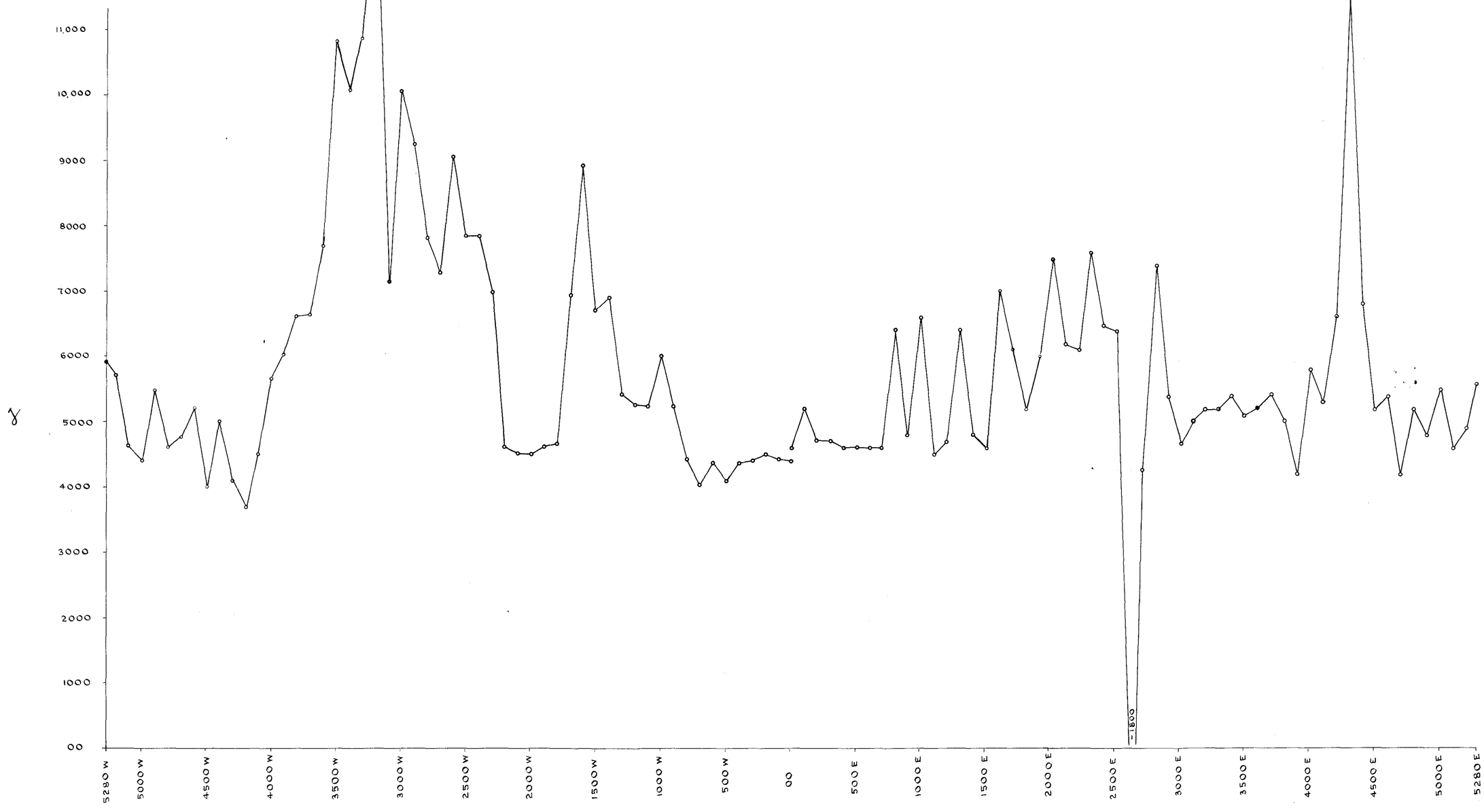
Scales: Vert: 1" = 1000γ, Horiz: 1" = 500'

To accompany Report by J.F.Gilfillan & J.P.Marshall

FIG. 48

2369

995174



5 cm

AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC PROFILE

VERTICAL COMPONENT

TRAVERSE 10000N

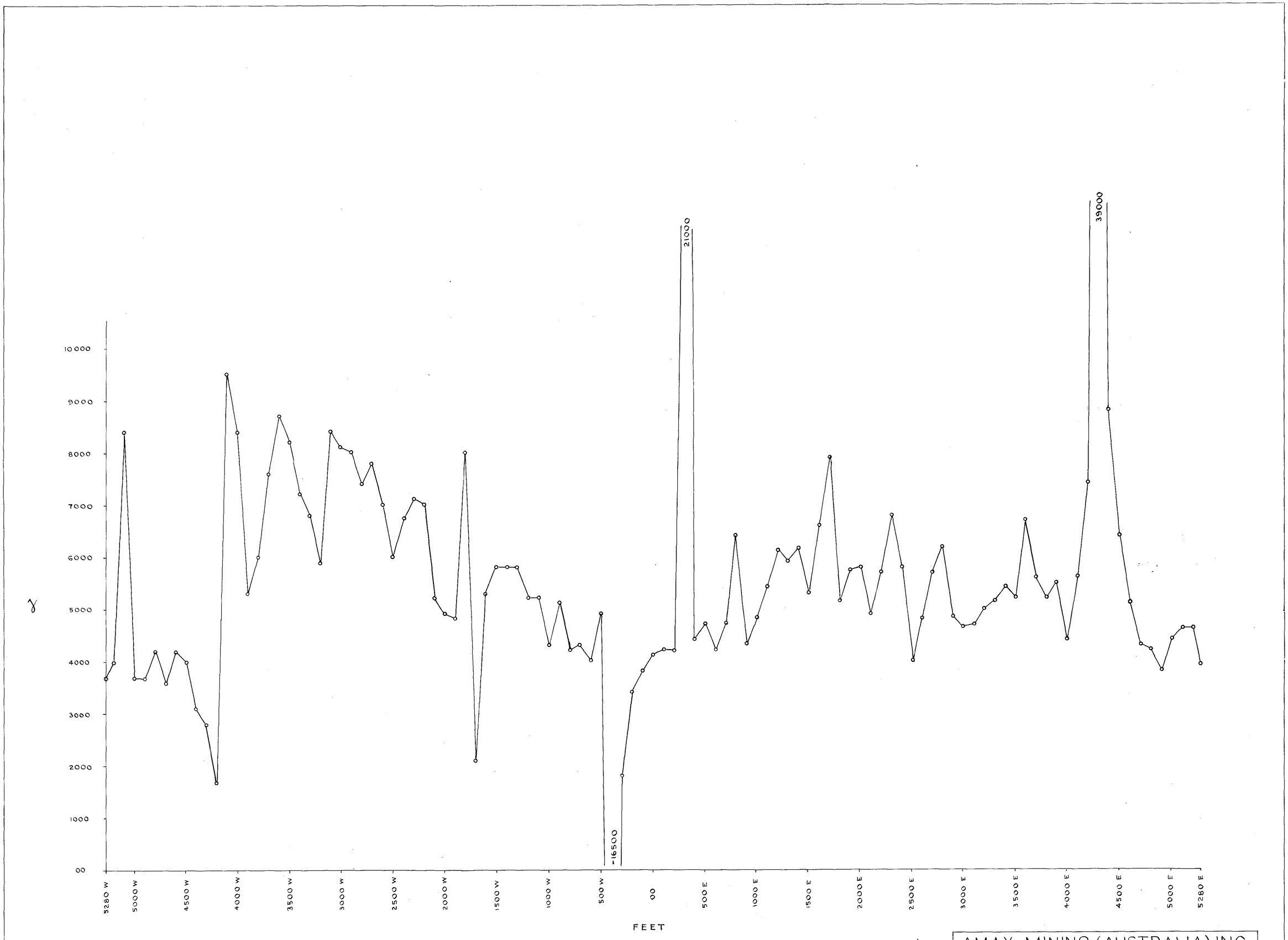
Date June 1969	Scales: Vert: 1" = 1000γ Horiz: 1" = 500'

To accompany Report by J. F. Gilfillan + J. P. Marshall

FIG. 49

2370

70-6444



AMAX MINING (AUSTRALIA) INC.

HEAZLEWOOD NICKEL PROJECT - TASMANIA

MAGNETIC PROFILE

VERTICAL COMPONENT

TRAVERSE 10500N

Date: June 1969 | Scales: Vert: 1" = 1000 γ, Horiz: 1" = 500'

To accompany Report by J.F. Gilfillan & J.P. Marshall

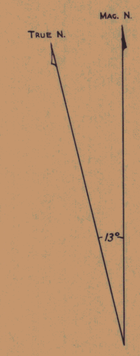
FIG. 50

2371

995176

70-644

2372



51

LEGEND

Tracks, roads (approx. location)
Tracks, roads (surveyed)
Creeks, rivers (approx)
Creeks, rivers (surveyed)
Bridges
H/T Power Line
Traverses Pegged
Adit & Dump
Shaft & Pit
Trench

15,840'N
15,500'
15,000'
14,500'
14,000'
13,500'
13,000'
12,500'
12,000'
11,500'
11,000'
10,560'
10,500'
10,000'
9,500'
9,000'
8,500'
8,000'
7,500'
7,000'
6,500'
6,000'
5,500'
5,000'
4,500
4,000'
3,500
3,000
2,500
2,000'
1500'
1000'
500'N

3 Miles
2 Miles
1 Mile

300'

S.P.L.N°37
DATUM 5280' 1 Mile 5000'W 4500' 4000' 3500' 3000' 2500' 2000' 1500' 1000' 500'W 0 500'E 1000' 1500' 2000' 2500' 3000' 3500' 4,000' 4,500' 5000'E 5280' 1 Mile

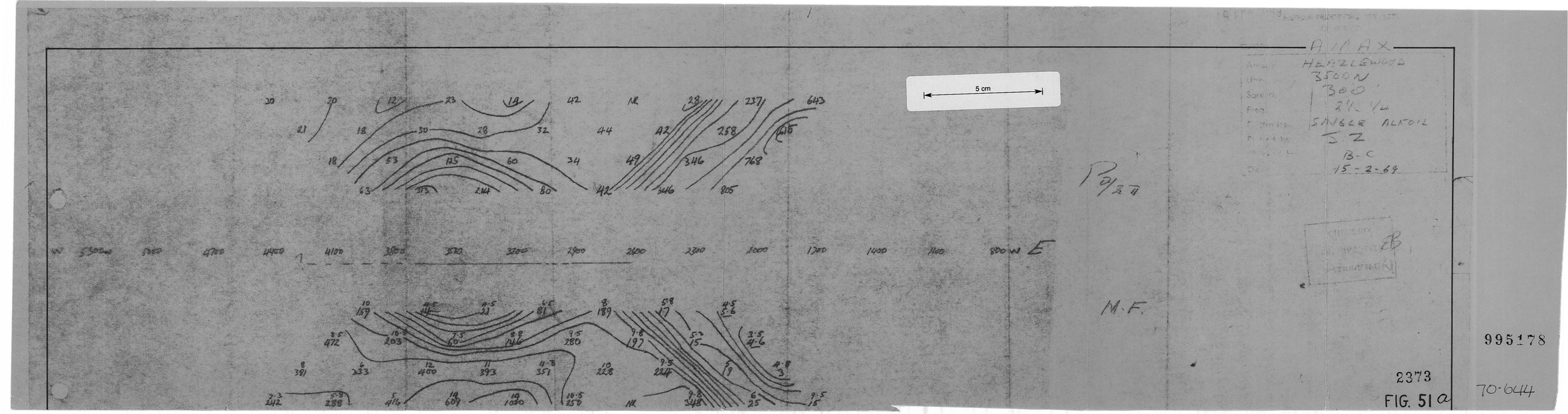
5 cm

995177

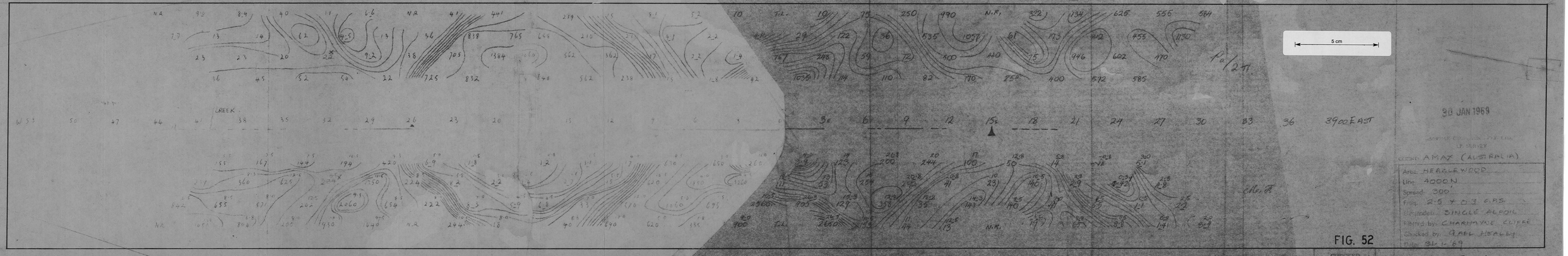
AMAX MINING (AUSTRALIA) INC.
HEAZLEWOOD NICKEL PROJECT - TASMANIA
I.P. PROGRESS.
Date: | Scale: 1" = 500'
To accompany Report by

FIG. 51

2372


AJAX
Area HEAZLEWOOD
Line 3500N
Sample 300'
Feet 24 1/4
Remarks SINGLE ALTOIL
Plotted by SZ
B-C
Date 15-2-69
5 cm
W 5300W 5000 4700 4400 4100 3800 3500 3200 2900 2600 2300 2000 1700 1400 1100 800W E
M.F.
995178
2373
FIG. 51a
70-644

105179



30 JAN 1969

IP SURVEY

CLIENT: AMAX (AUSTRALIA)

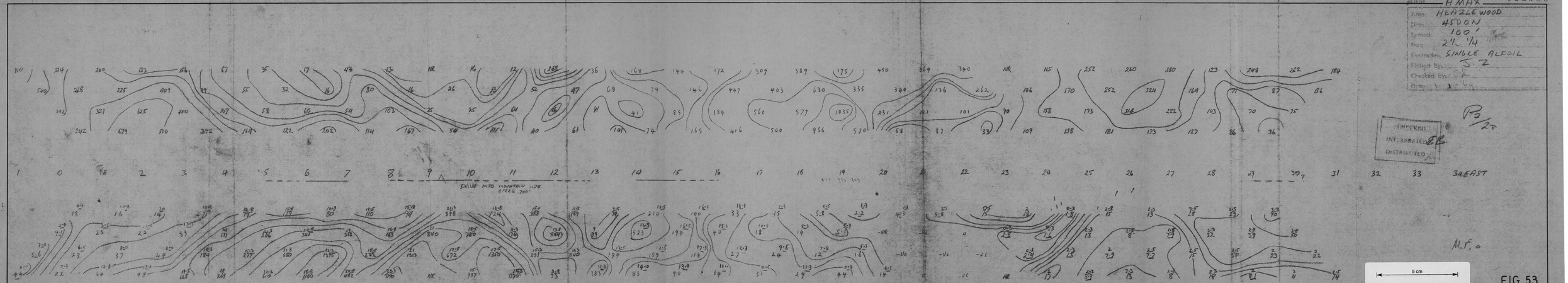
Area: HEARLEWOOD
Line: 4000 N
Spread: 300
Freq: 2·5 Y 0·3 C.P.S.
Electrodes: SINGLE-ALPOL
Plotted by: CHARMAINE CLIFFE
Checked by: CARL HEALEY
Date: 31-1-69

FIG. 52

CHECKED
INTERPRETED EB
DISTRIBUTED

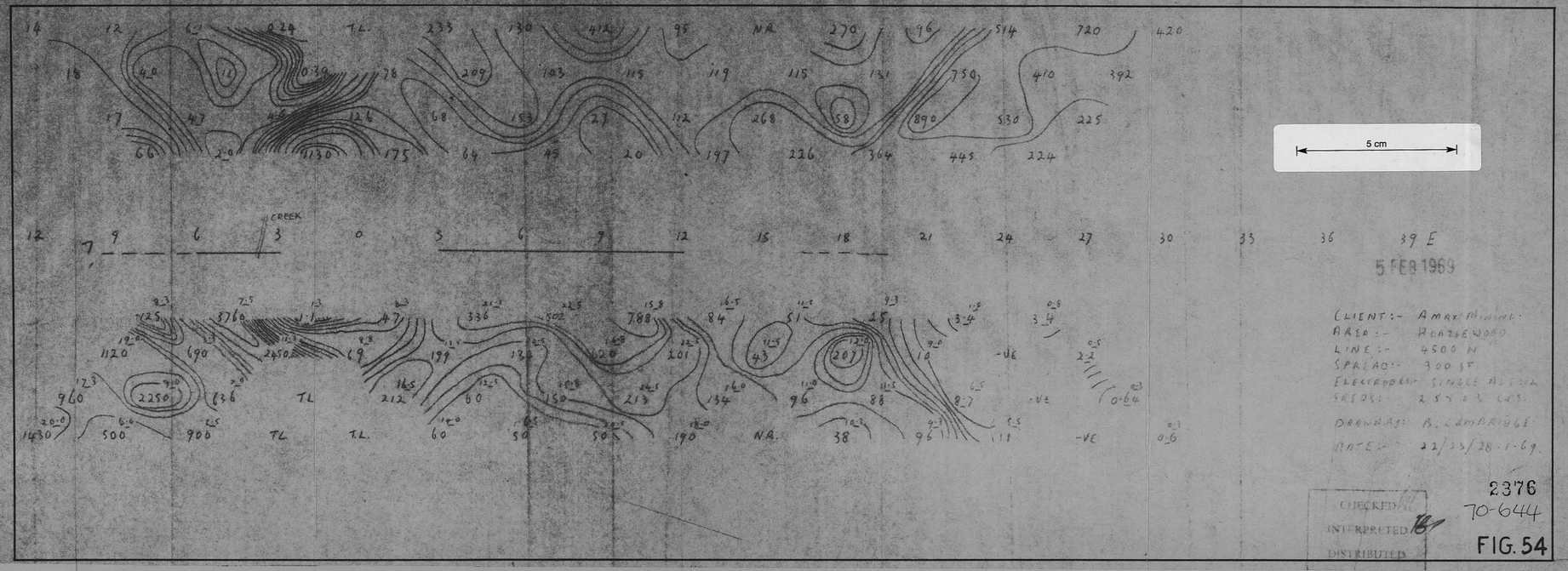
70-644

2374


AMAX
995180
Area: HEAZLEWOOD
Line: 4500N
Spread: 100'
Prog: 2½ 'N
Electrodes: SINGLE ALFOIL
Plotted by: SZ
Checked by:
Date: 31-1-69
CHECKED
INTERPRETED
DISTRIBUTED
P3
2½
DEUE INTO MOUNTAIN SIDE
AREA 700'
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 EAST
M.F. 0
5 cm
FIG. 53

70-644
2275

995181



5 FEB 1969

CLIENT :- AMAX MINERAL
AREA :- BLAZEWOOD
LINE :- 4500 N
SPREAD :- 300 ft
ELECTRODE :- SINGLE ALUM
SKIDS :- 2 SKIDS
DRAWN BY :- B. CAMBRIDGE
DATE :- 22/25/28-1-69.

CHECKED
INTERPRETED
DISTRIBUTED

2376
70-644

FIG. 54

995182

AMAX
HEAZLEWOOD
ASCOT
3200'
21 1/4 CPS
SAMPLE ALTOIL
Z.
3 C
18
65
5
20
31
90
23
42
14
50
166
225
20
20
41
347
417
209
103
64
248
395
360
490
RAGING TORRENT
W 4700
4400
4100
3800
3500
3200
2900
2600
2300
2000
1700
1400 m
EAST
9.5
92
15
234
11
44
8.5
11
6
12
11
550
16.5
825
16.5
403
10
12.5
23
9.5
43
12.5
543
12.3
3685
12
858
17.5
350
10.5
63
11.8
52
11.5
411
14
2156
12
2200
9.3
463
13.5
435
13
145
5 cm
FIG. 55
70-644
2377

995183

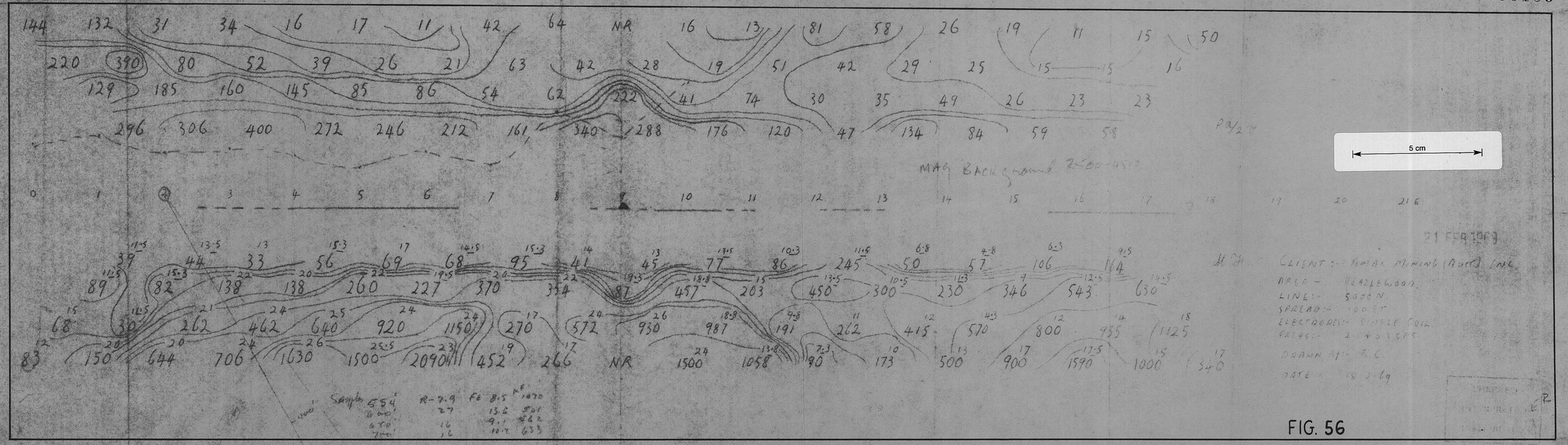


FIG. 56

70-644 2378

30 JAN
MINERAL DEPT.

995184

CLIENT: AMAX
Area: HEAZLEWOOD
Line: 50 000 N
Scale: 1" = 300'
Freq: 2½ 14 c/s
Electrodes: SINGLE PLATE
Plotted by: J Z
Checked by: 27-1-69
Date: GX

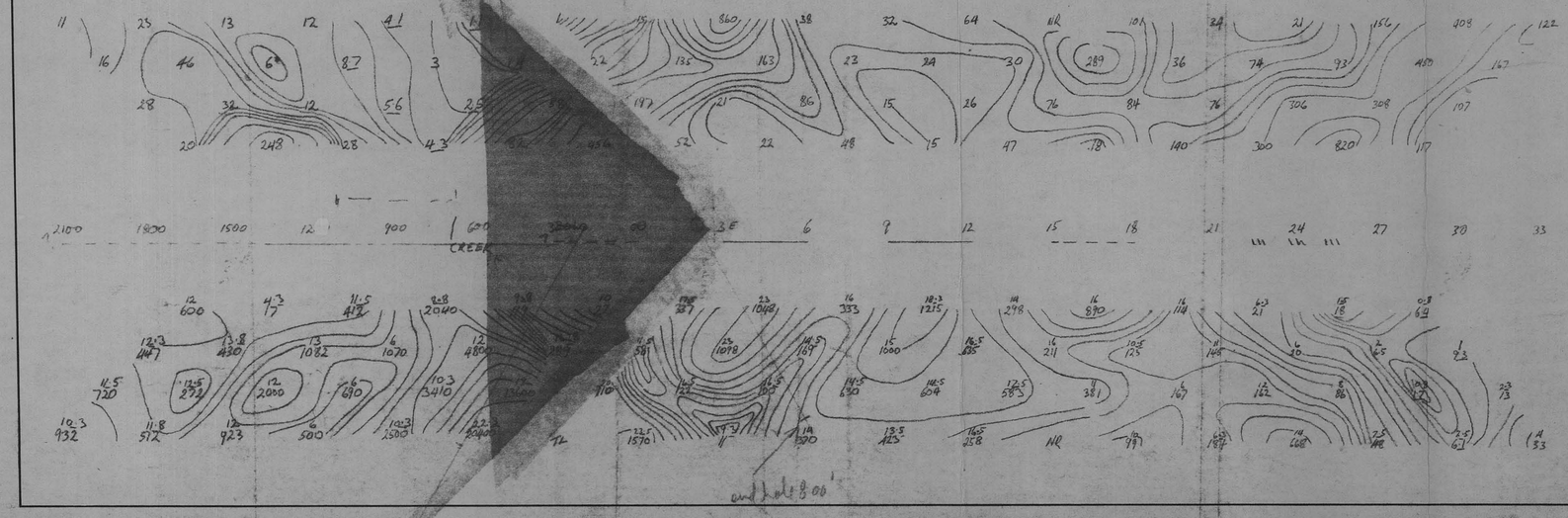


FIG. 57

70-644 2379

995185

CLIENT: AMAX MINING (AUST) ENG.

Area: HEAD + 4600

Line: 5500N

Spread: 300 FT.

Freq: 2.5 + 4.3 KC/S

Electrodes: SINTER / ALSOP

Plotted by: B. CAMARGOS

Checked by: S.Z

Date: 1/2/69

5 cm

FIG. 58

70-644

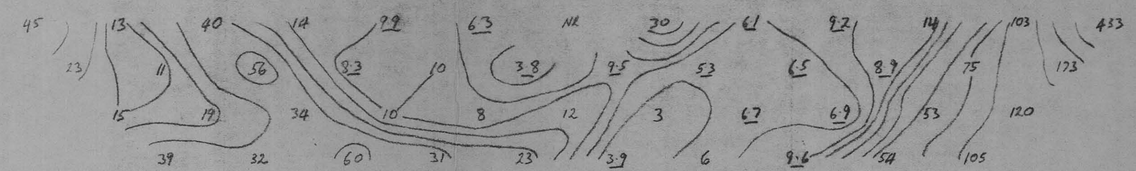
2380

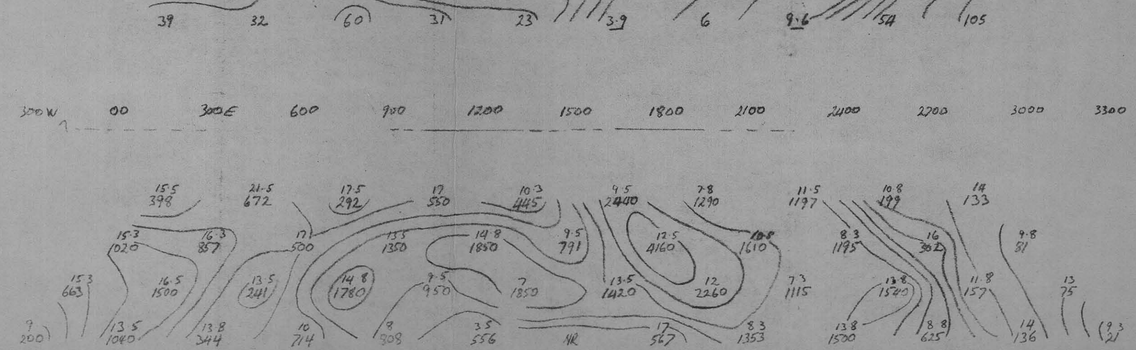
995186

24 FEB 1969
MURPHY GEOPHYSICS PTY. LTD.
GP SURVEY

CLIENT AMAX

Area	HEAZLEWOOD
Line	6010N
Spread	300'
Freq	24~ 1/4
Electrodes	SINGLE ALFOIL
Plotted by	S Z
Checked by	B C
Date	20-2-69





P3/27

M F.

5 cm

FIG. 59

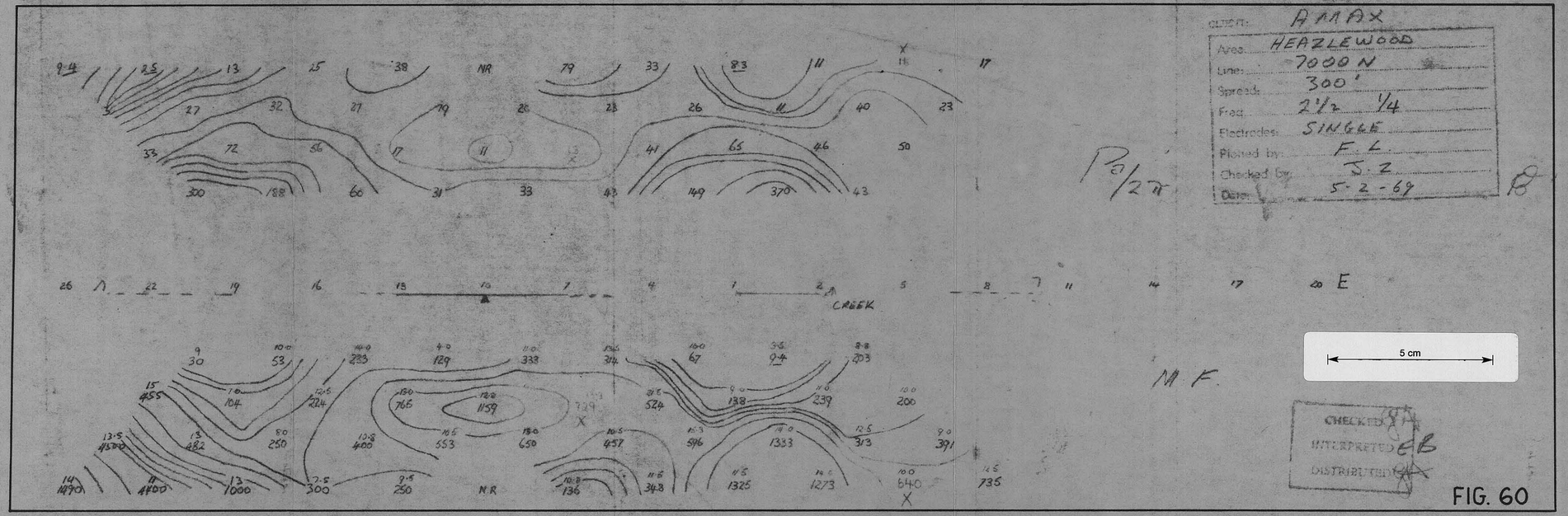
2381 70-644

11 FEB 1969

McPHAR GEOPHYSICS PTY. LTD.
IP & SURVEY

CLIENT: AMAX
Area: HEAZLEWOOD
Line: 7000 N
Spread: 300'
Frac: 2½ 1/4
Electrodes: SINGLE
Plotted by: F.L.
Checked by: J.Z.
Date: 5-2-69

P1/2 π



M F

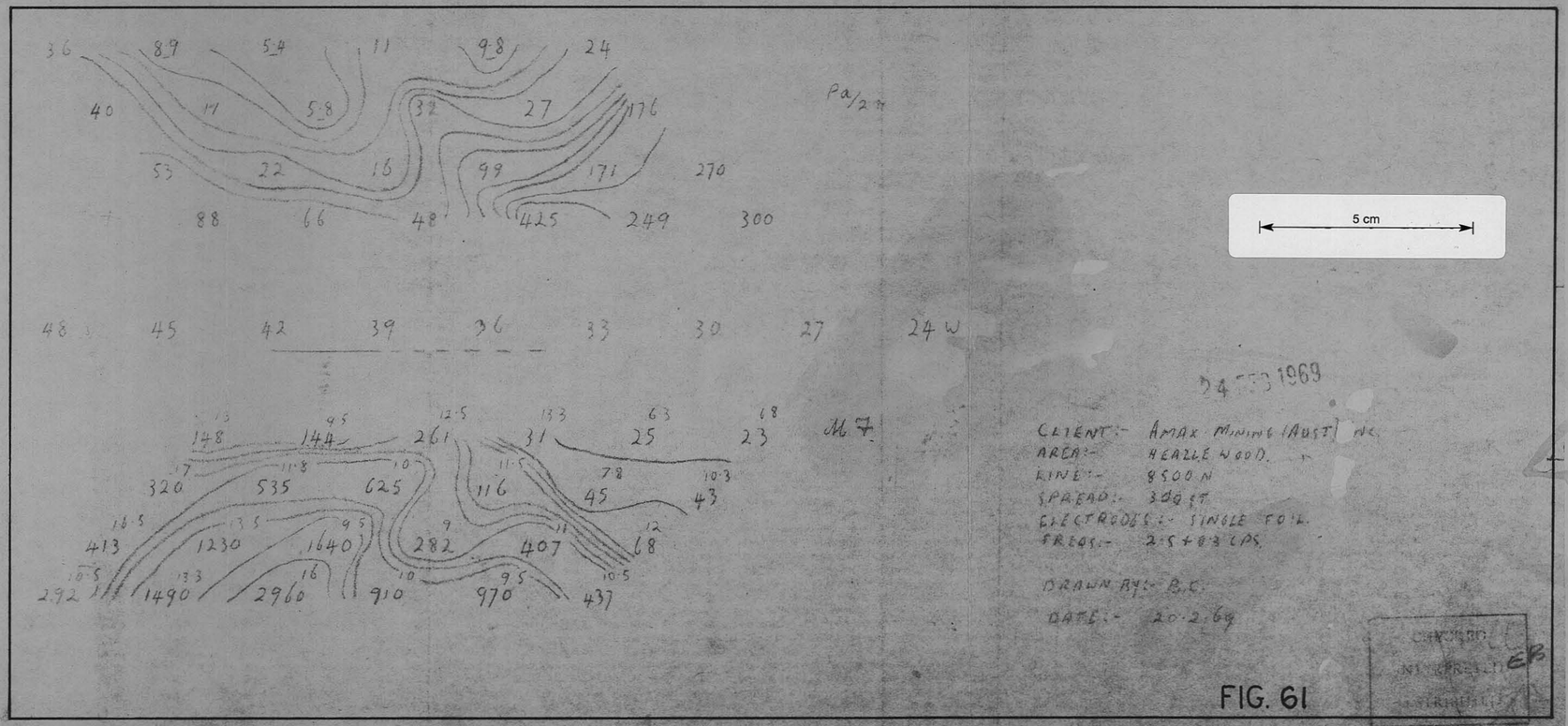
CHECKED JA
INTERPRETED EB
DISTRIBUTED

FIG. 60

995187

2382

995188



24 SEP 1969

CLIENT:- AMAX MINING (AUST.) INC.
AREA:- HEALLE WOOD.
LINE:- 8500 N
SPREAD:- 300 FT.
ELECTRODES:- SINGLE FOIL.
FREQS:- 2.5 + 8.3 CPS.

DRAWN BY:- B.C.
DATE:- 20.2.69

FIG. 61

2383 70-644

995189

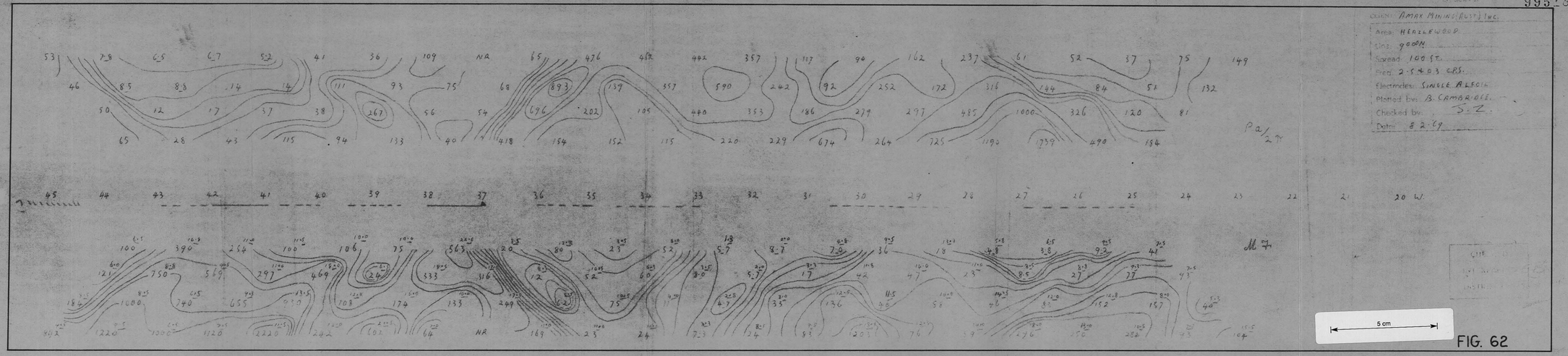
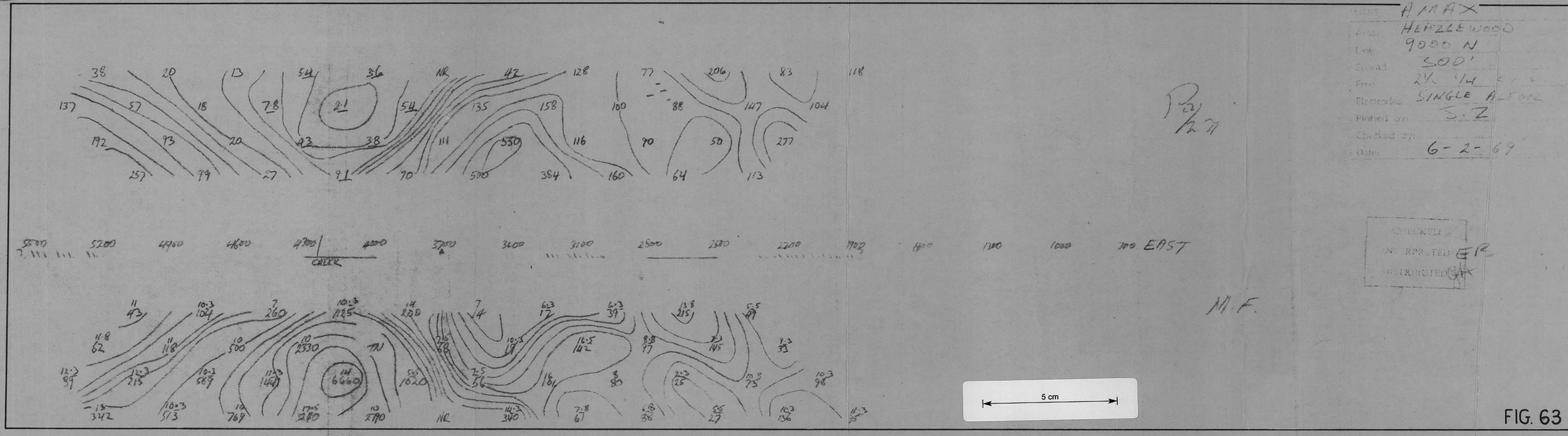


FIG. 62

70-644

2384

995190



AMAX
HERZLEWOOD
Line 9000 N
Spread 500'
Freq 2K 1/4 E/S
Electrode SINGLE ALPHA
Plotted by S.Z
Checked by
Date 6-2-69

CHECKED
INTERPRETED EIR
DISTRIBUTED

FIG. 63

70-644 2385

995191

AMAX

HEATHERWOOD

9500N

300'

2½ 1/4 c.p.s.

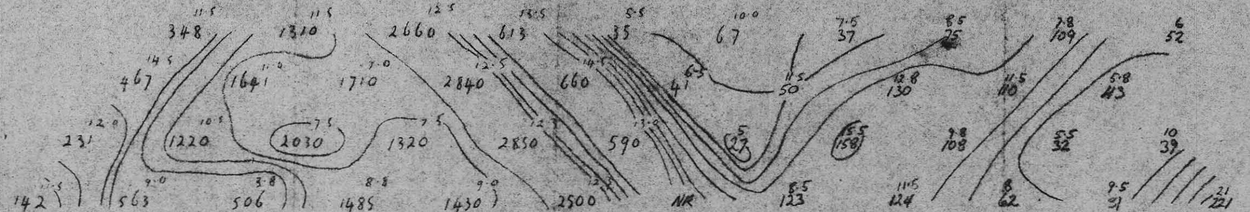
SINGLE ALFOIL

S 2

B C

10 2-69

5500 5200 4900 4600 4300 4000 3700 3400 3100 2800 2500 2200 1900 1600 1300N 1000 EAST



Pg 27

M.F

5 cm

FIG. 64

2386 70-644