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FINAL REPORT

SPRAY MINE EVALUATION

E.L. 44/70, TASMANIA

R.E. Besley
Geologist
August, 1971

AMG REFERENCE POINTS ADDED

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LIST OF FIGURES

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Spray Mine looking west showing adit entrance
with facilities and upper workings on hillside.

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1. SUMMARY

The silver-lead lodes of the Spray Mine were among the richest and most productive lodes of the Zeehan field.

Operations commenced in early 1970 to evaluate the possibility of ore remaining in the lower levels and extending in depth. The mine was dewatered to the lowest level and the lode exposures sampled and mapped. Diamond drilling was completed from surface, adit level and No. 5 level.

The results proved that insufficient reserves of mineable grade remained in the lower workings and that it is unlikely that economic mineralization extends at depth.

In addition, it is now evident that the overall grade mined was considerably lower than previously estimated from the incomplete production figures.

The lodes as exposed are true fissure vein fillings with irregular patches and veins of galena-boulangerite (jamesonite) - tetrahedrite-sphalerite in a lode formation of pyrite-siderite-quartz.

2. INTRODUCTION

Work commenced on the old Spray Mine by Minops Pty. Limited in early 1970 as part of the exploration program on Exploration Licence 44/70. Preliminary investigations and a surface diamond drill hole were completed by September, 1970 and a dewatering program commenced.

Following an Agreement between the Minops Group of Companies and Tenneco Australia, Inc., Tenneco took over as Operators for the exploration program on E.L. 44/70 in November, 1970, and completed dewatering the mine workings and evaluating the mineable reserves and the potential for orebody extensions.

The Spray Mine was considered as one of the best examples of the numerous silver-lead fissure fill lodes that occur throughout the Zeehan field and the one most likely to contain reserves of economic mineralization.

The potential of the Spray lodes was partly based on reports by Dr. C. Loftus-Hills, who spent considerable time in the field and on research of relevant literature.

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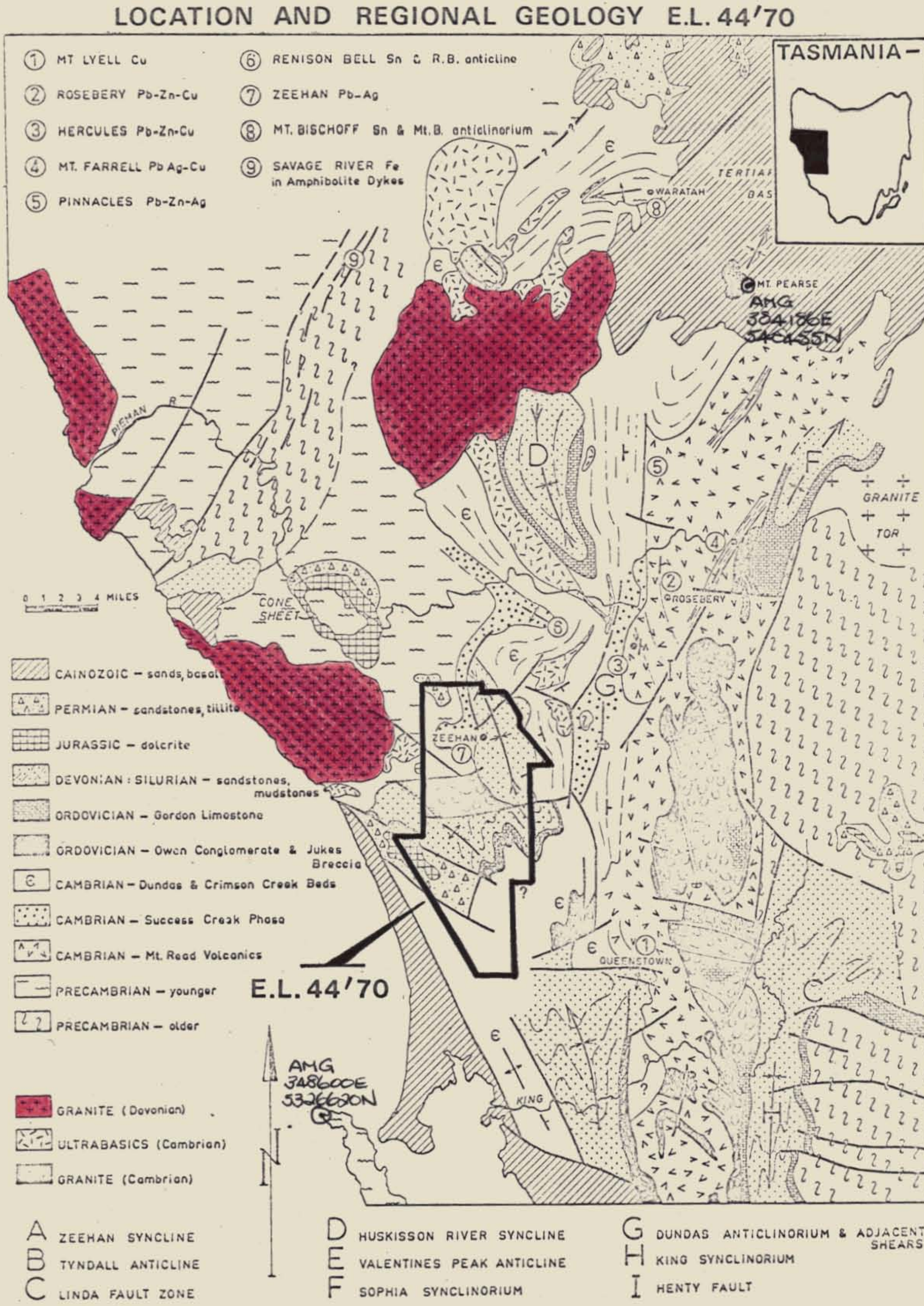
LOCATION AND REGIONAL GEOLOGY E.L. 44'70



—Geological map of central western Tasmania, compiled from Campana and King (1963) and other sources.

5 cm

FIGURE 1

AMG REFERENCE POINTS ADDED

His conclusions indicated that large tonnages of ore were left in the Mine workings as only the high grade was extracted and that below No. 4 level ore was left due to excessively high antimony values that rendered the ore untreatable at that time.

3. LOCATION

The Spray Mine is situated in the Zeehan Mineral field in the West Coast region of Tasmania (Lat. 41°53'S, Long. 145°20'E). It is about one mile southwest of the Zeehan township which is one of the three main settlements on the West Coast of Tasmania (population 1,000).

Vehicle access to the area is good and a railway connects Melba Flats, some 8 miles north, to the port of Burnie, 80 miles further north.

The mine is located in an area of hilly topography with relief up to 500 ft. The surface workings follow along the slope of a ridge with adits at various levels in the hillside.

The area has a rainfall of approximately 100 inches per year. This supports a dense growth of vegetation in most uncleared hill regions that is often very difficult to penetrate on foot.

4. HISTORY AND PRODUCTION

The earliest exploration of the region was in 1876 and the first mining commenced in 1879 on tin mineralization around the edges of the Heemskirk Granite.

Silver-lead mineralization was first found in 1882 but the field was slow to develop until 1887. Production for the field reached a peak in 1906 but rapidly declined after that and by 1913 most of the mines had closed. Mining activity since 1913 has been sporadic. The last significant producers in the field were the Montana Silver Lead Mine, which ceased operations in 1958 and the Oceana Mine, which closed in 1960. The Zeehan field has produced approximately 200,000 tons lead and 27,000,000 oz. of silver.

The first lease on the Spray area was taken up in 1887 and the first company to work the area was the Silver Spray Silver Mining Co. Ltd., floated in 1889. They had

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PRODUCTION CURVES SPRAY MINE

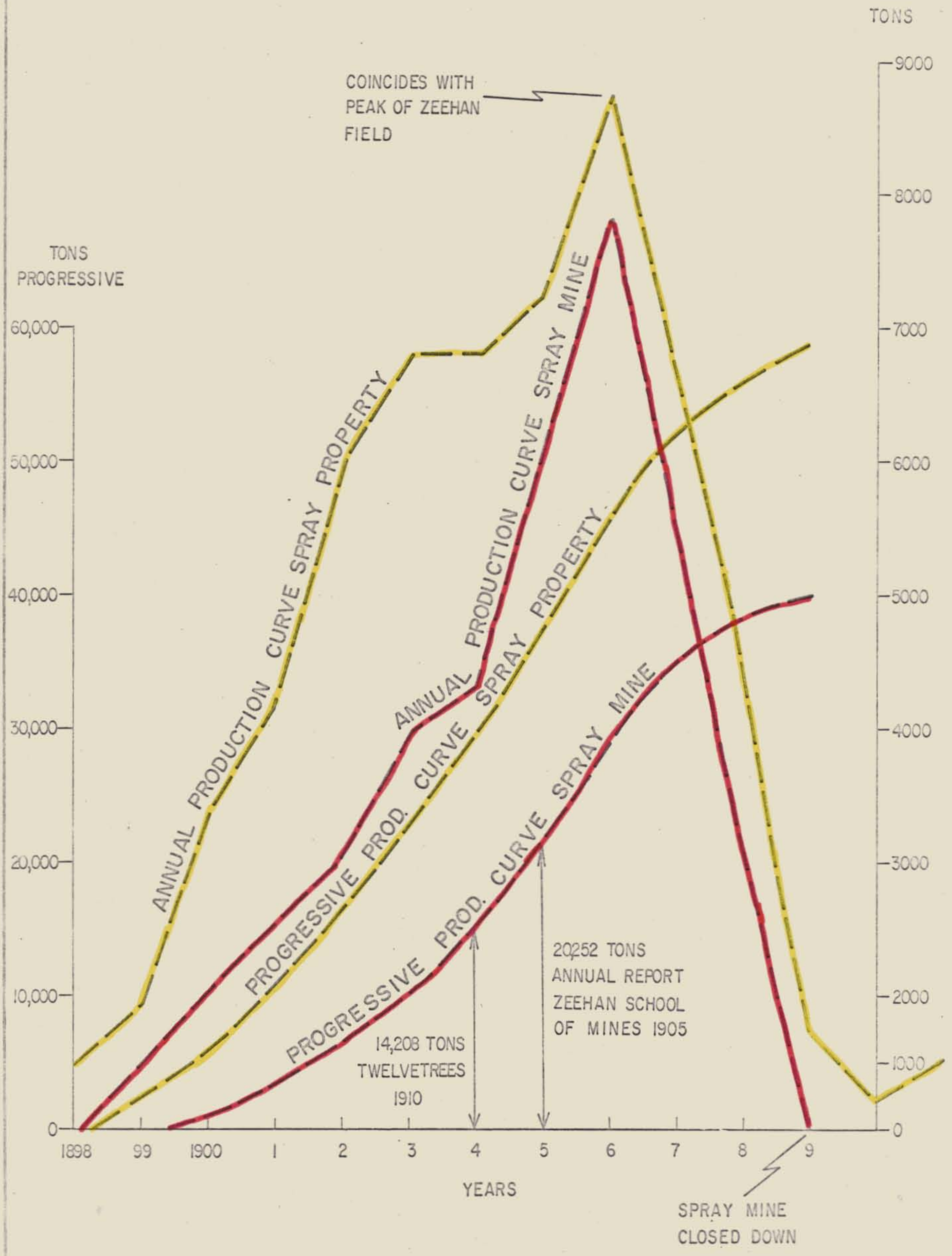

FIGURE 2

little success and the area was taken over in 1890 by The Mount Zeehan (Tasmanian) Silver-Lead Mines Limited. This company worked a number of lodes in the area, referred to generally as the Spray Zone, but attention was not focused on the Spray Mine proper until about 1900. At this time, development revealed the main lode and No. 3 lode and during the next few years this was the most important mine in the Zeehan Field.

The mine was closed down in 1910 owing to the unprofitable nature of the ore in the lower levels. The total tonnage of ore produced, including that by tributors, was around 40,000 tons. This is the tonnage of ore sold to the smelters and represents the final ore upgraded either by hand sorting or gravity concentration. The total production from the Spray Property which includes the Nike, Wave, Foam, etc. amounted to some 60,000 tons. The production statistics are shown on Fig. 2. The figures are derived from Twelvetrees (1910), Annual Report Zeehan School Mines (1905) and King and Blissett (1968).

The Mines Department completed a drill hole in 1932 to test the No. 1 lode 250' below No. 6 level. The lode horizon was intersected in the vicinity of the planned depth but it consisted only of siderite and pyrite with traces of jamesonite.

In 1949, Zeehan Explorations commenced dewatering the mine and after 11 months gained access to No. 5 level. A drill hole was commenced from No. 3 level crosscut to intersect the main lode below No. 6 level but it was abandoned before reaching target.

5. REGIONAL GEOLOGY

5.1. Stratigraphy

The regional geology of the Zeehan District and its relation to mineralisation has been discussed at length by Campana and King (1963) while the most detailed study of stratigraphy is by Blissett (1962). Further descriptions of the regional geology are given in Spry and Banks (1962), McAndrew (1965), Solomon (1965) and Both and Williams (1968).

The oldest rocks of the area are the Concert Schist and Whyte Schist that have been assigned to the Older Proterozoic.

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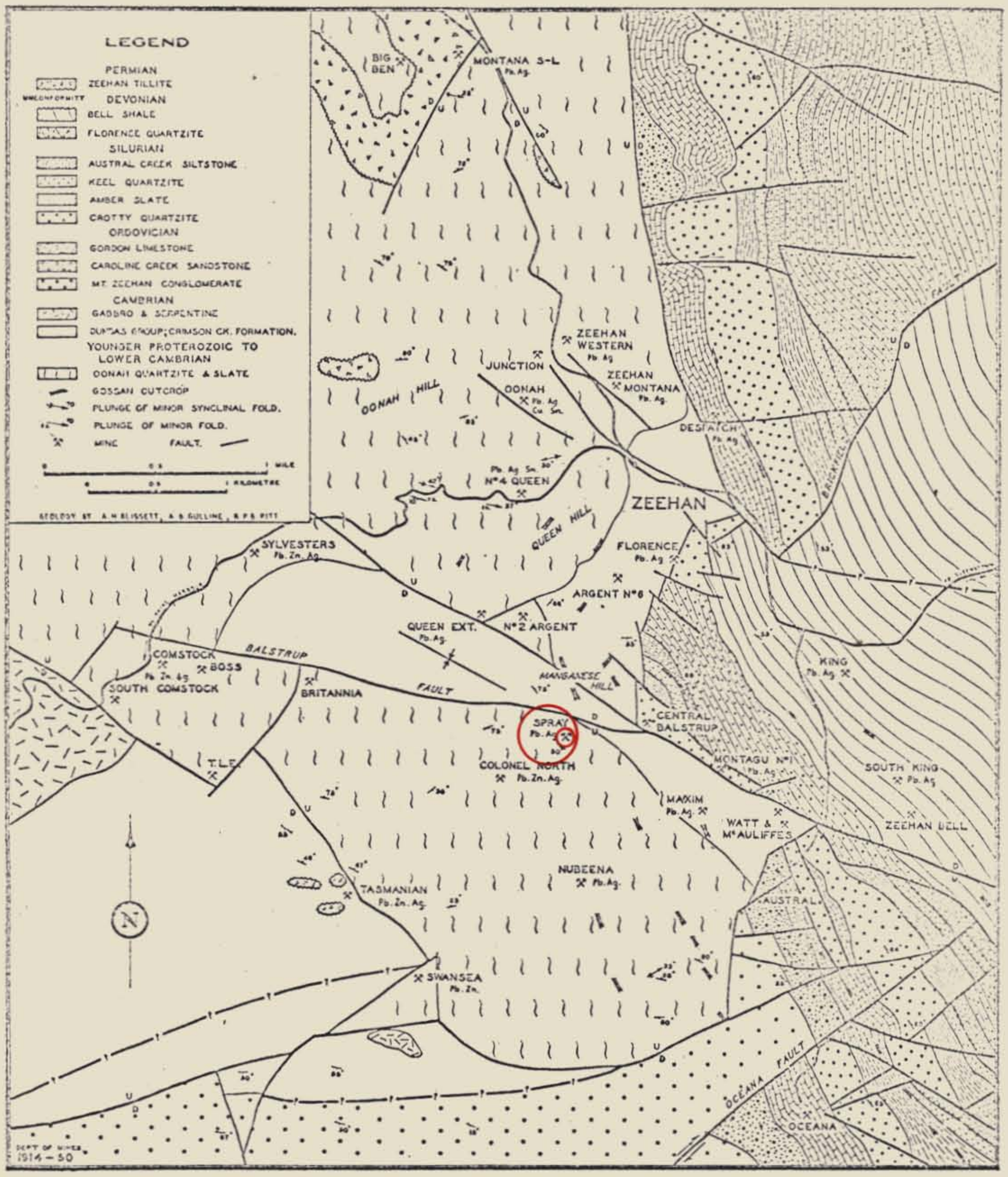

Geology of the Zeehan Mineral Field (Blissett and Pitt).

FIGURE 3

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Unconformably over-lying these rocks is the Oonah Quartzite and Slate consisting of alternating quartzites, siltstones and laminated slates. Dark grey limestones and dolomites occur locally and spilitic lava flows and pyroclastic bands are found in the upper part of the sequence. The Oonah Quartzite and Slate is of the order of 7,000 ft. thick and is exposed in the Zeehan area within a complex folded anticlinorium. The Spray Mine lodes are located in this formation.

Succeeding this sequence, apparently conformably, is 10,000 ft. of mudstone (slate) and greywacke of the Crimson Creek formation which passes up to the similar Dundas Group of sediments. These are of Cambrian age and represent Eugeosynclinal sedimentation, similar in orogenic character to the Flysch type.

Sedimentation ceased abruptly in the Upper Cambrian with the onset of the Tyennan Orogeny. Ordovician deposition commenced with thick sequences of conglomerates passing up into sandstones, shales and finally limestones (the Gordon Limestone). Later sedimentation in the Silurian and early Devonian represent the miogeosynclinal phase of quiet infilling.

Permian glacial sediments unconformably overlie older sediments.

5.2. Igneous Rocks

In late Cambrian widespread intrusion of basic and ultrabasic sills and dykes occurred. These are all partially or completely serpentinized.

The Heemskirk Granite complex, which outcrops over an area of 50 square miles to the west of Zeehan was intruded during the major orogenic phase in Mid Devonian.

This Granite has been studied in some detail by Brooks and Compton (1965), Green (1966) and Heier and Brooks (1966). It forms an elongated stock, emplaced in the axial zone of an anticlinorium. To the north and east, Oonah Quartzite and Slate sediments are invaded with very little contact metamorphic effects.

5.3. Structure

The most important orogenic phase in Tasmania was the Tabberabberan Orogeny in Devonian times. There are no major angular unconformities from late Precambrian to Devonian. This orogeny produced the major structural features present with minor tectonic activity in post Permian.

The sediments of the Zeehan district occupy the core and western flank of a synclinorium structure Solomon (1965)

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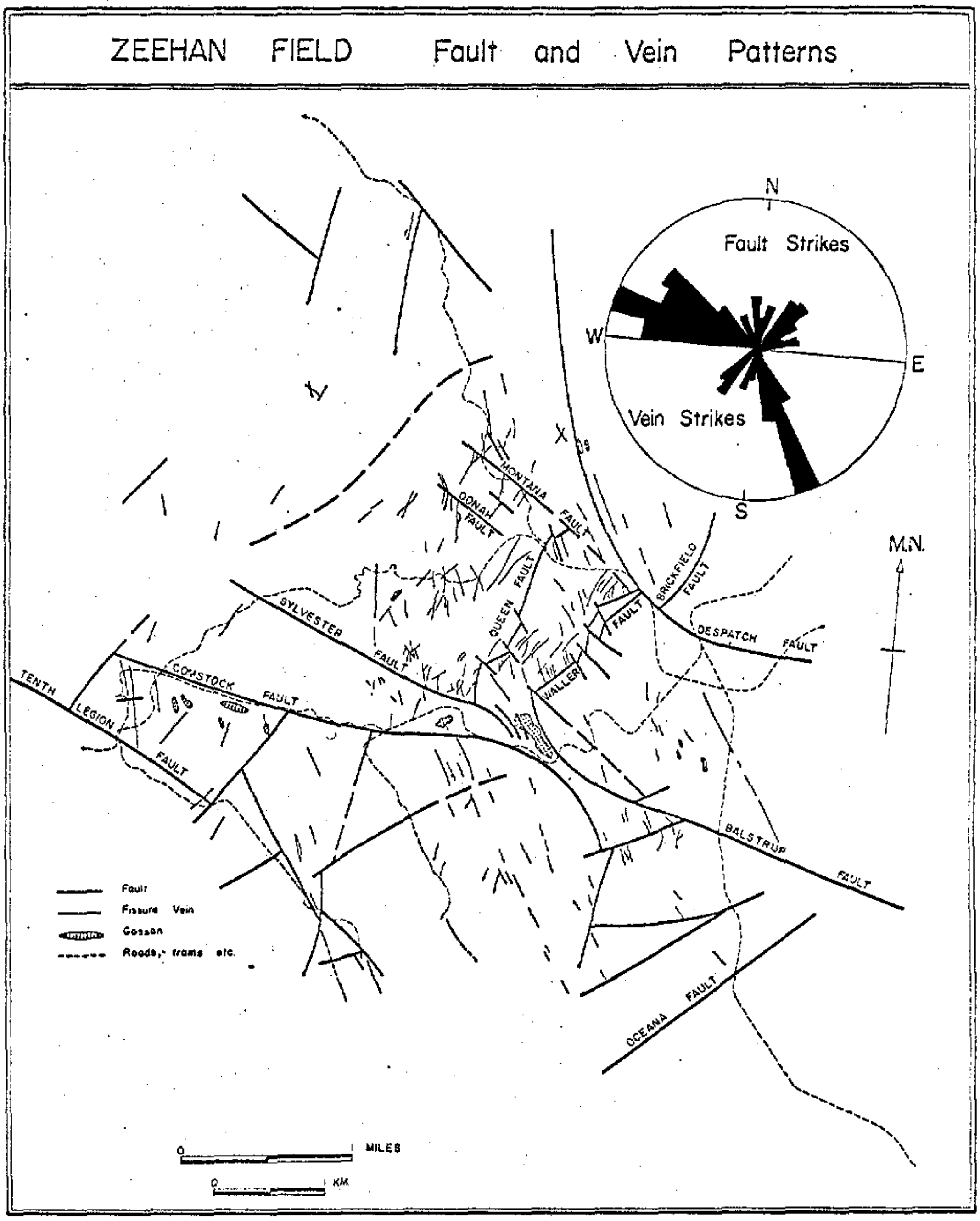

Fault and vein distribution in the Zeehan field.

FIGURE 4

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with the Heemskirk Granite emplaced in a parallel anticlinal zone to the west.

In general, the fold axis trend N.N.W. with variable plunge.

Faulting is complex and intense with the major faults having a predominant W.N.W. strike (refer Figure 3.) The greater proportion of these structures were developed during the Tabberabberan Orogeny but considerable movement took place in Jurassic and Tertiary times.

5.4. Mineralization

The tin, lead and silver deposits of the Zeehan district are related to the intrusion of the Heemskirk Granite. The mineralization is zoned around the intrusion and this was first described by Waller (1904) and recently in detail by Both and Williams (1968).

Tin deposits occur in and immediately adjacent to the granite mainly as small fissure veins of quartz-tourmaline-cassiterite and as fissure veins and replacements of cassiterite-pyrrhotite-pyrite.

The main production of the field came from fissure lodes of lead-silver mineralization. The mineralized fissure veins vary in composition with distance from the granite. Both and Williams (op.cit.) defined four progressive zones:

(i) Cassiterite Zone
(ii) Pyritic Zone
(iii) Sidero-pyritic Zone
(iv) Sideritic Zone

The high sulphosalt ores are generally confined to the sidero-pyritic zone. There is also a marked zoning in the Fe and Mn contents of sphalerite corresponding to temperature gradients of the granite stock.

The lodes are developed in fractures rather than faults or shears and have a predominant N.N.W. strike as opposed to the predominant W.N.W. strike of the faults (refer Figure 4.). This parallels the axial direction of the Zeehan Basin.

The majority of fractures that are mineralized are adjacent to major faults and thus have the character of feather fractures of tensional origin.

The Heemskirk Granite is post orogenic and therefore, the mineralization post-dated the development of the principle structures. However, later faulting has displaced and drag folded many of the lodes.

The greater number of lodes are developed in the Oonah Quartzite and Slate as lenticular irregular bodies of lode sometimes containing very high grade veins but often barren of sulfides. Most of the ore shoots are less than one foot wide and less than 200 feet in length.

6. GEOLOGY OF THE SPRAY MINE

6.1. Rock Types

The lodes of the Spray Mine are all within the Oonah Quartzites and Slates except for a weak continuation to the north for a short distance across the Balstrup Fault into Crimson Creek Formation. In the Mine area, quartzite and siltstone predominate over shale and slate.

The quartzites are pale grey often containing carbonaceous material and occasional kaolinised feldspar. The slates are usually highly graphitic. Layering thickness varies from several feet to less than 1 inch. Cut and fill structure and sedimentary brecciation are often displayed on a small scale.

There are no marker beds in the mine area that could be used to trace structure and the monotonous alternating sequence of quartzites and slates could not be subdivided. In addition, it is likely that most of the beds are lenticular.

Interbedded spilites are recorded from the northern end of the workings but none were observed in the present investigation in the workings that were available.

6.2. Structure

The Spray Mine lies between the Balstrup and Nubeena Tear Faults (refer Figure 5.)

The quartzites and slates are strongly folded and fractured throughout the area. The scale of folding observed in underground exposures is of the order of feet with numerous fractures and faults on a similar scale. The main fractures containing the ore shoots are of a much larger scale and appear to be developed in a separate phase of deformation. The No. 1 lode fracture has been traced over 1,400 ft. strike length and 600 ft. of depth.

Barren Lode formation near Station 8, No. 4 Level, south drive. The Lode consists of broken and brecciated country rock with siderite infilling. The hanging wall fracture face is in the upper left and relatively undisturbed footwall sediments on the right-hand side.

Mineralized Lode in sublevel 12 ft. below No. 5 level north drive. Stringers of galena and quartz with minor boulangerite and tetrahedrite with infillings of siderite and quartz that contains dissemination of pyrite.

There are two main lode structures developed, the No. 1 lode and the No. 3 lode (Gurnie's Lode) some 550 ft. apart. Between these are two smaller lode structures that did not develop significant mineralization. The general strike of the lodes is 330° with very little variation and the dip is near vertical with upper levels inclined to the east and lower levels to the west.

There does not appear to be a marked change in the extent or character of the country rock structures in the vicinity of the fractures. The fractures themselves form a zone that varies in width from less than 1 inch up to 20 ft. The zone is usually bounded by two well defined fracture walls although the eastern wall is less commonly developed than the western. The walls form a clear cut break between the interbedded quartzites and slates and the lode formation and often show weakly developed slicken sides and flutes with a predominant shallow northerly plunge.

Within the fracture zone the lode material varies from brecciated country rock and clay pug to massive sulphide lenses and stringers in quartz-siderite gangue. Sulphide lenses within the fracture zone have been folded and much of the lode material rebrecciated. This indicates that the fracture zone has had movement on it subsequently to mineralization.

The lack of secondary minerals along the fracture face, the weak development of lineations and the extremely sharp distinction between country rock and fracture zone indicates that relative movement was not extensive and that the structure is most likely a tensional release fracture with movement only of the order of a few feet. Subsequent adjustments caused rebrecciation and minor distortion.

Displacement of the lode zone by folding or faulting was not observed in the Spray workings although it is often displayed in other lodes of the district.

6.3. <u>Mineralization</u>

The primary sulphides identified in hand specimen and confirmed by mineragraphic investigation, are pyrite, galena, boulangerite (jamesonite), sphalerite, tetrahedrite-bournonite, chalcopyrite and arsenopyrite. Argentite is suspected from chemical analysis of samples from the lowest level. The gangue minerals are quartz and siderite.

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A suite of representative samples from exposures throughout the workings were collected by the Department of Mines for detailed identification and description. The location of sample points is shown on Figure 7. The following is a summary of the preliminary examination by Geoff Green of the Department.

> The assemblage noted is the same as that observed by Williams and Both although in most sections galena is more abundant than boulangerite.
>
> There appears to be insufficient tetrahedrite present for this mineral to be the major concentration of Ag; galena probably fills this role. No Ag minerals have been seen in polished section.
>
> Williams idea of a paragenetic sequence with quartz pyrite and arsenopyrite earliest, sphalerite, siderite and probably chalcopyrite next with galena and boulangerite last is in agreement with this study although the evidence suggests overlapping phases of deposition as also put forward by Williams. Tetrahedrite and bournonite probably form, in the main, by replacement of sphalerite and chalcopyrite by galena and boulangerite.
>
> Textural evidence indicates that the later minerals were emplaced partly by replacing the earlier ones and partly by filling cavities formed by renewed or continued opening of the lode fissure as shown by lode wall breccias, bent cleavages in galena, etc.
>
> Due to variation between polished sections, there is insufficient evidence for any mineralogical zoning, although the relative abundance of the copper bearing minerals, chalcopyrite, bournonite and tetrahedrite in the lower levels of the mine may be significant.

Vertical zoning of the mineralization is not strongly evident although there is an increase in pyrite and chalcopyrite content with depth. Two samples from the lowest level (No. 6) assayed 0.12% Tin whereas no tin was detected in the few samples assayed for it from the upper levels.

C. Loftus-Hills (1947) suggested there was a drastic change in ore type at No. 4 level where the upper galena rich ore changed to jamesonite ore with little or no galena.

Although only limited exposures of mineralization were seen in the upper levels, the quantity of jamesonite (boulangerite) appears to decrease with depth. This is supported by observations of Waller (1904) -

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> "There is a good deal of antimony in the ore, especially in the upper levels".

The development of massive galena lenses decreases with depth but its place is not taken by jamesonite.

The silver content is predominantly in tetrahedrite and does not usually show a direct relationship to the antimony or lead values.

The lode formation and ore mineralization is extremely lenticular, particularly in the upper levels. The development of ore mineralization is not directly related to the extent of lode formation. In places 8 to 10 ft. of quartz-siderite, rock-fragment lode contains only occasional disseminations and stringers of sulphide while in others 2 to 3 ft. of massive sulphide constitutes the entire lode. It appears that quartz-siderite was first deposited in the fracture zone and that this was again fractured prior to the introduction of the ore minerals.

6.4. <u>Ore Shoots</u>

The outline of the ore shoots in No. 1 lode is shown by the stoped areas on the longitudinal section. The main production was the south or main shoot, the north shoot being very narrow and low grade. Significant production was also obtained from the No. 3 lode shoot (Gurnie's Lode) above the No. 3 level. At No. 3 level mineralization in the backs is scattered and low grade along the entire length of the lode horizon.

The main shoot has its longest development (550 ft.) at No. 4 level although it was not continuously mineable over this length. From this level down to No. 6 level, the length decreases to 150 ft. of ore reserves.

The lode formation continues between the main shoot and the northern shoot but contains virtually no sulphides except for occasional stringers of pyrite. The southern limit of the workings was inspected on No. 4 and No. 6 levels and both headings are barren of ore.

The old plans show a centre shoot developing in the northern drive of No. 6 level and C. Loftus-Hills quotes sample results for the last 60 ft. of the drive. In the area of this shoot the drive was completely back-filled with mullock for some 40 ft. The drive continued for a further 50 ft. beyond the limit shown in the old plans. Two raises and some limited stoping are present in the reported position of the centre shoot but no significant mineralization was observed.

7. OREBODY EVALUATION

7.1. Mining Records

Records of production prior to closing the mine indicate that 40,000 tons of high grade ore was shipped to the smelters. The greatest proportion of this was derived from hand sorting and gravity concentration rather than direct shipping. On the basis of the volume of stoping, it appears that a total of around 200,000 tons of ore was mined. Ore shipped to the smelters averaged 40% Pb and 60 oz. Ag/ton and this gives an average grade for the mine of 8% Pb and 12 oz. Ag/ton. This corresponds closely to the figures given in the 1910 Select Committee Report on the Zeehan Smelters for the economic limit of mining for milling ore.

The Mine Manager, in his report to the Committee, stated that the lower levels were uneconomic.

7.2. Previous Investigations

The Tasmanian Department of Mines drill hole in 1932 penetrated the main No. 1 lode 200 - 500 ft. below No. 6 level and intersected 5 ft. of siderite, quartz and pyrite with a trace of jamesonite.

Dr. C. Loftus-Hills in 1947 compiled an optimistic report on the Spray Mine stating that only the high grade ore was mined and shipped and implied that large tonnages of medium grade ore remained throughout the unstoped portions of the lode horizon and was used as stope fill. In addition, he stressed that below No. 4 level the lode contained no galena and had changed to tetrahedrite - jamesonite ore which was untreatable and therefore not mined. This further implied that large reserves of antimony rich ore remained in the lower levels.

In 1949, Zeehan Explorations Pty. Ltd. spent almost one year dewatering and investigating the mine. There are no records available on any of their work or results except for a brief log of the diamond drill hole from No. 3 level cross-cut that did not reach its target.

The hole did intersect a number of veinlets of jamesonite-galena but none were of sufficient dimension to assay and no core is available. Recent communication was received from North Broken Hill Limited (operators of Zeehan Explorations) stating that the dewatering was abandoned as the results of samples taken between Nos. 5 and 6 levels were disappointing.

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7.3. Diamond Drilling

The No. 1 hole was drilled from the surface on the east side of the No. 1 lode (refer Figure ~~6~~5.) and designed to test the mineralization between the main (north) and south shoots on No. 1 lode. The hole penetrated the lode horizon about 250 ft. north of No. 2 shaft and midway between Nos. 5 and 6 levels (refer Figure 7.) and the intersection consisted of 1 inch of galena.

The No. 2 hole was drilled from the "A" adit level on the west side of No. 1 lode (refer Figure 6.) and designed to test the depth extension of the No. 1 lode at 130 ft. below the No. 2 shaft. Both the hole and lode steepened with depth to give a low angle intersection at 280 ft. below No. 6 level. At this depth only pyrite bearing core was recovered and the hole was lost in attempting to cement and redrill the zone. The only significant intersection was 8 inches of jamesonite (boulangerite)-tetrahedrite at a hole length of 402 ft. which assayed 267 oz. Ag/ton, 17% Pb, 9% Sb, 1.4% Cu.

A 1 ft. intersection of jamesonite quartz was recorded in Zeehan Explorations drill hole that corresponded closely to the above intersection in No. 2 hole (refer Figure 6.). The possibility of a continuous, but small, high grade silver lode to the west of No. 1 lode was tested by 4 drill holes from No. 5 level (refer Figure 9.4.). There were no significant intersections of vein mineralization in any of these drill holes.

7.4. Lode Sampling and Ore Reserves

The only significant ore mineralization remaining in the workings is between Nos. 5 and 6 levels. Exposures of the lode between these levels was channel sampled and the results plotted on the level plans. North of the shaft, the block of mineralization is very low grade. To the south of the shaft the lode averages between 3 and 4 ft. of galena-tetrahedrite-boulangerite mineralization for a distance of 150 ft. This block contains a maximum of 4000 tons of ore from which a 50 lb. bulk sample assayed 14 oz. Ag/ton, 19% Pb, 1% Sb.

Although several high grade silver samples were obtained from this block, the overall average of the channel sampling, ignoring the very high grades, would approximate 25 oz. Ag/ton, 12% Pb, 1% Sb.

7.5. <u>Stope Fill Sampling</u>

Several large grab samples of stope fill material were taken throughout the workings. In most cases these were taken from collapsed stope material on the various levels. These samples are by no means representative of the overall grade of stope fill in the mine but they do give an approximate indication.

A total of 6 separate sample localities averaged 4.5 oz. Ag/ton and 4% Pb.

7.6. <u>Conclusions</u>

The remaining ore within the mine workings is too low grade for direct shipping and insufficient tonnage for a milling operation.

Drilling failed to reveal any high grade blind shoots parallel (en echelon) to the main shoot that could be mined and direct shipped.

The average antimony content of the ore in the lower levels is not greater than 1% and the tonnage of ore in these levels was low. There is no economic grade mineralisation remaining as low grade between the main shoot and the north shoot or to the south of the main shoot.

The results of drilling and geologic investigations indicate it is unlikely that sufficient tonnage of mineable ore could exist within a reasonable distance below the present workings.

8. APPENDIX

DRILL HOLE SUMMARY LOGS

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Contractor A.S. James Rig Mindrill 1000 DRILL LOG

Dates: Start 5/1/71 Finish 23/2/71 Type of Drilling Diamond Drill (B.Q. Wireline)

From	To	Core Recovd.	Summary Log	From	To	Assays Pb	Zn	Ag	Cu	Sb		
0'	77'		Mainly quartzite with a few intercalations of thinly banded grey slates.									
77'	208'		Mainly banded slates with intercalations of quartzites and muddy quartzites.	87'11" (S.M.P.	88' 0030)	11.6%	0.04%	37.1 oz/ton	0.08%	4.25%	(SEE DETAILED Lo	
208'	266'		Massive quartzites.									
266'	335'		Alternating bands of grey slate and quartzite.									
335'	363'		Massive quartzite.									
363'	401'4"		Banded slates and muddy quartzites.									
401'4"	402'		8" vein of massive and acicular jamesonite with a little pyrite. Gangue mineral is siderite.	401'4" (S.M.P.	402' 0031)	16.8%	0.08%	267 oz/t.	1.42%	8.82%		
402'	441'		Massive quartzite with occasional bands of graphitic slate.									
441'	478'		Alternating bands of slate and quartzite.									
478'	523'6"		Massive quartzite.									
523'6"	530'		Homogenous graphitic slate.									
530'	554'6"		Massive quartzite, heavily brecciated in places.									

14.

Property	E.L. 44/70	Location	Spray	Hole No.	2
Coords	R L	Bearing	N. 38° E. - N. 4[illegible]° E.	Inclination	78° - 81°10'	Page No.	1

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834024

Contractor A.S. James Rig Mindrill 1000

DRILL LOG

Dates: Start 5/1/71 Finish 23/2/71 Type of Drilling Diamond Drill (B.Q. Wireline)

From	To	Core Recovd.	Summary Log	From	To	Assays Pb	Zn	Ag	Cu	Sb		
554'6"	629'		Banded slates and quartzites with graphitic slate partings in the quartzites.									
629'	633'4"		Massive quartzite.									
633'4"	633'6"		$1\frac{1}{2}$" (true width) vein of siderite with a $\frac{1}{4}$" band of galena in centre. Open fracture filling.	633'4" (S.M.P.	633'6" 0032)	21·9%	<0.01%	13·1 oz	0.02	0.11		
633'6"	711'		Mainly quartzites with intercalations of slate throughout the length.									
15. 711'	721'		Quartzite, brecciated and replaced by vein quartz and siderite.									
721'	726'		Quartzite with graphitic slate partings. Siderite veinlets contain traces of pyrite.									
726'	728'		Massive quartzite and slate with dense replacement by fine-grained pyrite. Pyrite shows banding, stringers and bleb-like concentrations.	726'3" (S.M.P.	727'5" 0033)	0·10	<0·01	0·50	<0·01	0·08		
728'	735'		Banded quartzite and slate. Broken in places.									
735'	742'		Fractured and fragmented quartzite and slate, in places reduced to a gouge. Heavily sheared.									

Property	E.L. 44/70	Location	Spray	Hole No.	2
Record 024	R L	Bearing	N. 38° E. - N. 44°E.	Inclination	78° - 81° 10'	Page No.	2

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DRILL LOG

Contractor A.S. James Rig Mindrill 1000

Dates: Start 5/1/71 Finish 23/2/71 Type of Drilling Diamond Drill (B.Q. Wireline)

From	To	Core Recov'd	Summary Log		To	Assays						
742'	752'		Massive pale grey quartzite with some recrystallization and veins of siderite and quartz containing fine-grained pyrite.									

16.

Property	E.L. 44/70	Location	Spray	Hole No.	2
Records	R L	Bearing	N. 38° E. - N. 44° E.	Inclination	78° - 81° 10'	Page No.	3

023

TENNECO AUST. INC. DRILL RECORD 834026

025

SCALE 1" reps. 20 ft.		DIRECTION	HOLE No. 5/4
Sulfides	Pyrite py	INCLINATION 2°	PROPERTY EL 44/70
Oxides	Pyrrhotite po	STARTED June 12, 1971	LOCATION Spray Mine Level
Bedding	Violarite vi	COMPLETED June 15, 1971	CO-ORD. N E
Jointing	Chalcopyrite cp	DEPTH 159'	COLLAR ELEV.
Shearing	Magnetite mag.	NOTES BY Besley/Wright	SHEET 1 OF 1
Foliation, schistosity, cleavage		TYPE OF CORE EX	DRILLER Longyear

CORE REC'D.	ASSAYS Inter.	% Ni	% Cu	oz/ton Ag	% Pb	% Sb	% Zn	SECTION	Structure	Veining	Mineral'n	% sulfides	MINERALISATION	SYMBOL	GEOLOGY

MINERALISATION

1" vein containing pyrite and galena at 7'1" - 7'2". Bordered by quartz veins. Vein 70° to core axis.

1" vein containing galena, pyrite and siderite. Vein 40° to core axis

¼" vein containing sphalerite and minor jamesonite. Vein 45° to core axis

¾" siderite rich vein containing galena and jamesonite (minor). Vein bored down dip.

GEOLOGY

Alternating quartzites and slates of the Oonah quartzites and slates

Quartzite

Slate

The division of the section into alternating horizons of quartzite and slate is diagrammatic - but the width of the horizons is representative of the relative proportions of quartzite and slate in a given part of the section.

:Pug zones

:Mineralization

S S S :Brecciation within the core

:Lineation of non-sulphide veins.

5 cm

TENNECO AUST. INC. ______ DRILL RECORD 18. 834027

026

SCALE 1" reps.20 ft.	DIRECTION	HOLE No. 5/3
Sulfides	INCLINATION 30°	PROPERTY EL 44/70
Oxides	STARTED June 3, 1971	LOCATION Spray Mine Level 5
Bedding	COMPLETED June 8, 1971	CO-ORD. N E
Jointing	DEPTH 179'	COLLAR ELEV.
Shearing	NOTES BY Besley/Wright	SHEET 1 OF 1
Foliation, schistosity, cleavage	TYPE OF CORE EX	DRILLER Longyear

Pyrite — py; Pyrrhotite — po; Violarite — vi; Chalcopyrite — cp; Magnetite — mag.

CORE REC'D.	Inter.	% Ni	% Cu	oz/ton Ag	% Pb	% Sb	SECTION	Structure	Veining	Mineral'n	% sulfides	MINERALISATION	SYMBOL	GEOLOGY
												Fine crystals of jamesonite in vein at 4'6". Vein: ¼" wide		
												Small crystals of jamesonite in stringers in brecciated zone. Total width of mineralized zone = ¾".		
												Well disseminated pyrite at 70'6" - in country rock		
			0.02	11	48	23						1" vein at 109' of massive sulphide mineralization. Small bladed crystals of jamesonite. Vein 60° to core axis		
												1/8" - ¼" wide vein with cavities. Elongate crystals of jamesonite on walls of cavities. Vein 45° to core axis - at 140'7"		
												Minor pyrite associated with quartz vein in slate at 171'4"		

Alternating quartzites and slates of the Oonah Quartzites and Slates

Quartzite

Slate

The division of the section into alternating horizons of quartzite and slate is diagrammatic - but the width of the horizons is representative of the relative proportions of quartzite and slate in a given part of the section.

: Pug zones

: Mineralization

S S S : Brecciation within the core

5 cm

TENNECO AUST. INC. ______ DRILL RECORD 19. 834028

SCALE 1" reps. 20 ft.

Sulfides	Pyrite — py	DIRECTION	HOLE No. 5/1
Oxides	Pyrrhotite — po	INCLINATION 18°	PROPERTY EL 44/70
Bedding	Violarite — vi	STARTED June 9, 1971	LOCATION Spray Mine Level 5
Jointing	Chalcopyrite — cp	COMPLETED June 12, 1971	CO-ORD. N ___ E ___
Shearing	Magnetite — mag.	DEPTH 100 ft.	COLLAR ELEV.
Foliation, schistosity, cleavage		NOTES BY Besley/Wright	SHEET 1 OF 1
		TYPE OF CORE EX	DRILLER Longyear

CORE REC'D.	ASSAYS Inter.	% Ni	% Cu	ton Ag	% Pb	% Sb	% Zn	SECTION	Structure	Veining	Mineraln	% sulfides	MINERALISATION	SYMBOL	GEOLOGY
													Minor bleb pyrite associated with quartz vein at 12'		Alternating quartzites and slates of the Oonah quartzites and slates.
													Minor bleb pyrite in quartzite at 71'4"		Quartzite Slate The division of the section into alternating horizons of quartzite and slate is diagrammatic - but the width of the horizons is representative of the relative proportions of quartzite and slate in a given part of the section

S S — :Pug zones

S S S :Brecciation within the core

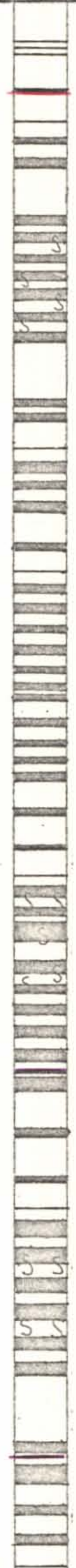
:Mineralization

5 cm

TENNECO AUST. INC. DRILL RECORD 20 834029

027

SCALE 1" reps. 20 ft.	DIRECTION	HOLE No. 5/2	
Sulfides	Pyrite py	INCLINATION 17°	PROPERTY EL 44/70
Oxides $x^x x$	Pyrrhotite po	STARTED May 25, 1971	LOCATION Spray Mine Level 5
Bedding	Violarite vi	COMPLETED June 2, 1971	CO-ORD. N E
Jointing	Chalcopyrite cp	DEPTH 177'	COLLAR ELEV.
Shearing	Magnetite mag.	NOTES BY Besley/Wright	SHEET 1 OF 1
Foliation, schistosity, cleavage		TYPE OF CORE EX	DRILLER Longyear/Tenneco

CORE REC'D.	ASSAYS Inter.	% Ni	% Cu				SECTION	Structure	Veining	Mineraln	% sulfides	MINERALISATION	SYMBOL	GEOLOGY
												¼" shear at 10 ft. of siderite, pyrite and minor galena shear 30° to core axis.		Alternating quartzites and slates of the Oonah quartzites and slates

Quartzite

Slate

The division of the section into alternating horizons of quartzite and slate is diagrammatic - but the width of the horizons is representative of the relative proportions of quartzite and slate in a given part of the section.

:Pug zones

:Mineralization

S S S :Brecciation within the core

5 cm

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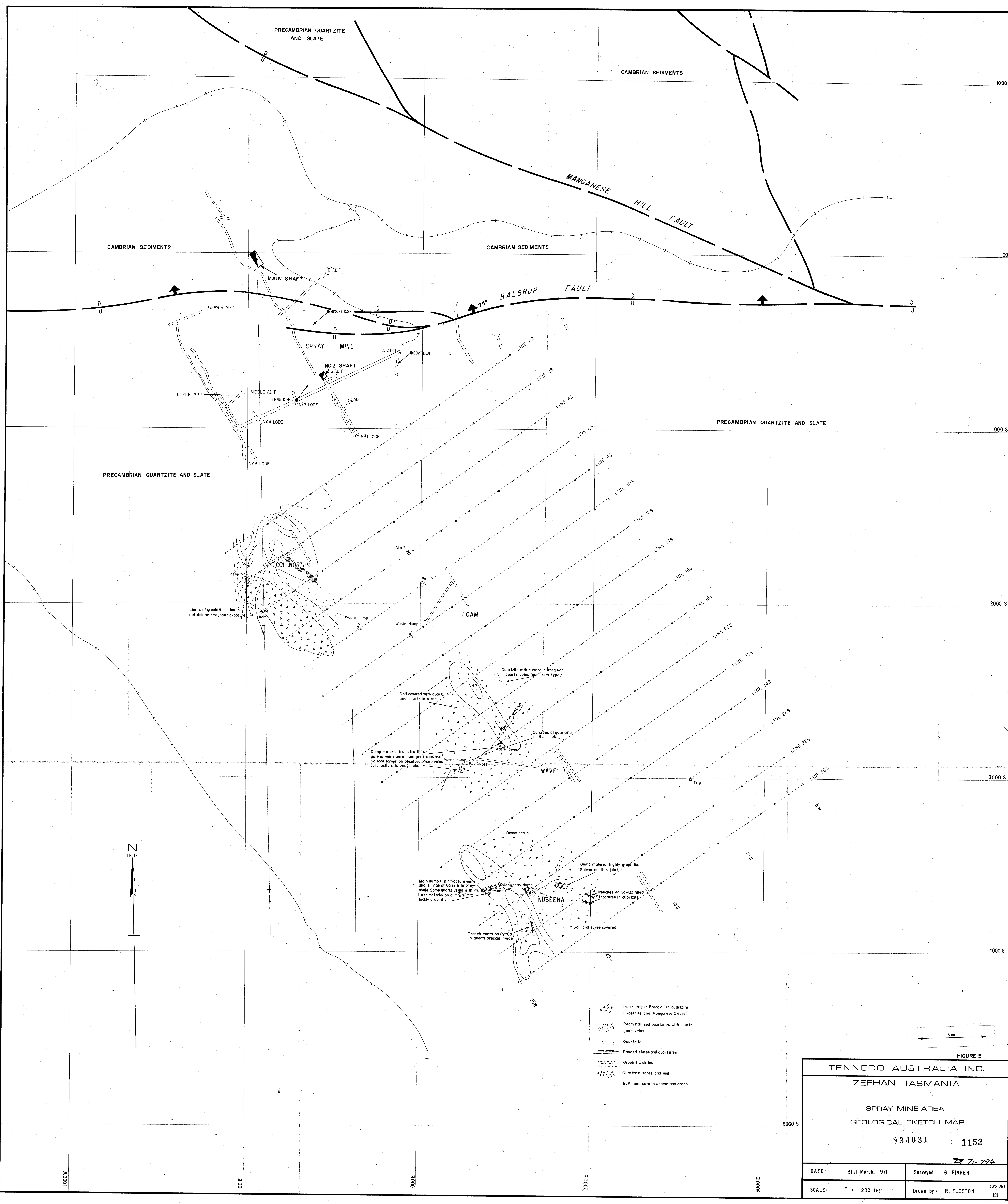


FIGURE 5

TENNECO AUSTRALIA INC.

ZEEHAN TASMANIA

SPRAY MINE AREA

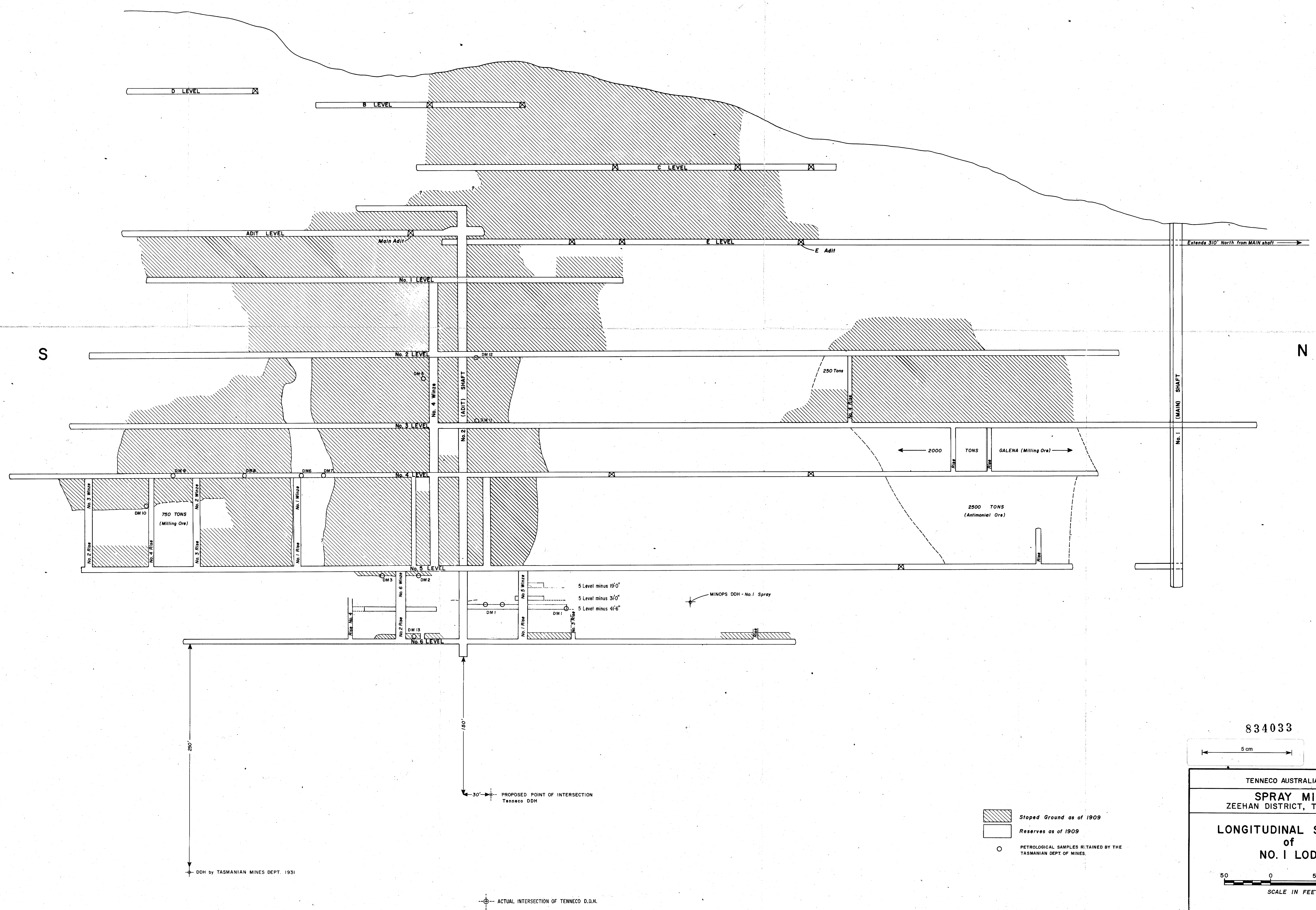
GEOLOGICAL SKETCH MAP

834031 1152

~~FB~~ 71-794

DATE : 31st March, 1971	Surveyed : G. FISHER
SCALE : 1" = 200 feet	Drawn by : R. FLEETON DWG. NO 121

No.1 SHAFT
No.5 Level
E Level
No.5 Level
Lower Adit
No.4 Level
No.5 Level
No.3 Level
No.2 Level
D.D.H. 5/1 18°
No.6 Level
No.1 Level
PROJECTION OF INTERSECTION AT
NO.5 LEVEL
D.D.H. 5/2 17°
12" Intersection of
Jamesonite
No assay or core available.
North Broken Hill
D.D.H. (1949)
D.D.H. 5/3 30°
No.2 SHAFT
B Level
A Level
Tenneco D.D.H.
Spray No.2
8" Intersection
16% Pb
267oz Ag/ton
8·8% Sb
1·4% Cu
No.2 Lode
D Level
D.D.H. 5/4 2°
No.6 Level
No.2 Level
Top Adit
No.3 Level
No.4 Lode
Middle Adit
Lower Level
No.3 Level
No.3 Lode
No.5 Level
No.3 Level
No.4 Level
No.1 Lode
LEGEND
D LEVEL
B LEVEL
C LEVEL
Not shown - location unknown.
An adit level between levels A & B.
A LEVEL (Main adit.)
E LEVEL
No.1 LEVEL
No.2 LEVEL (Incomplete data)
No.3 LEVEL
No.4 LEVEL
No.5 LEVEL
No.6 LEVEL
MAIN LODE ADITS
TOP ADIT
MIDDLE ADIT
LOWER ADIT
N
MAG. NORTH
NOV., 1970
834032
1153
5 cm
FIGURE 6
TENNECO AUSTRALIA INC.
SPRAY MINE
ZEEHAN DISTRICT, TASMANIA 71-794
COMPOSITE PLAN
OF WORKINGS
DWG.No.199
SCALE IN FEET
50 0 50 100 150
J.R.B.
1970



834033 1154

FIGURE 7

TENNECO AUSTRALIA INC.

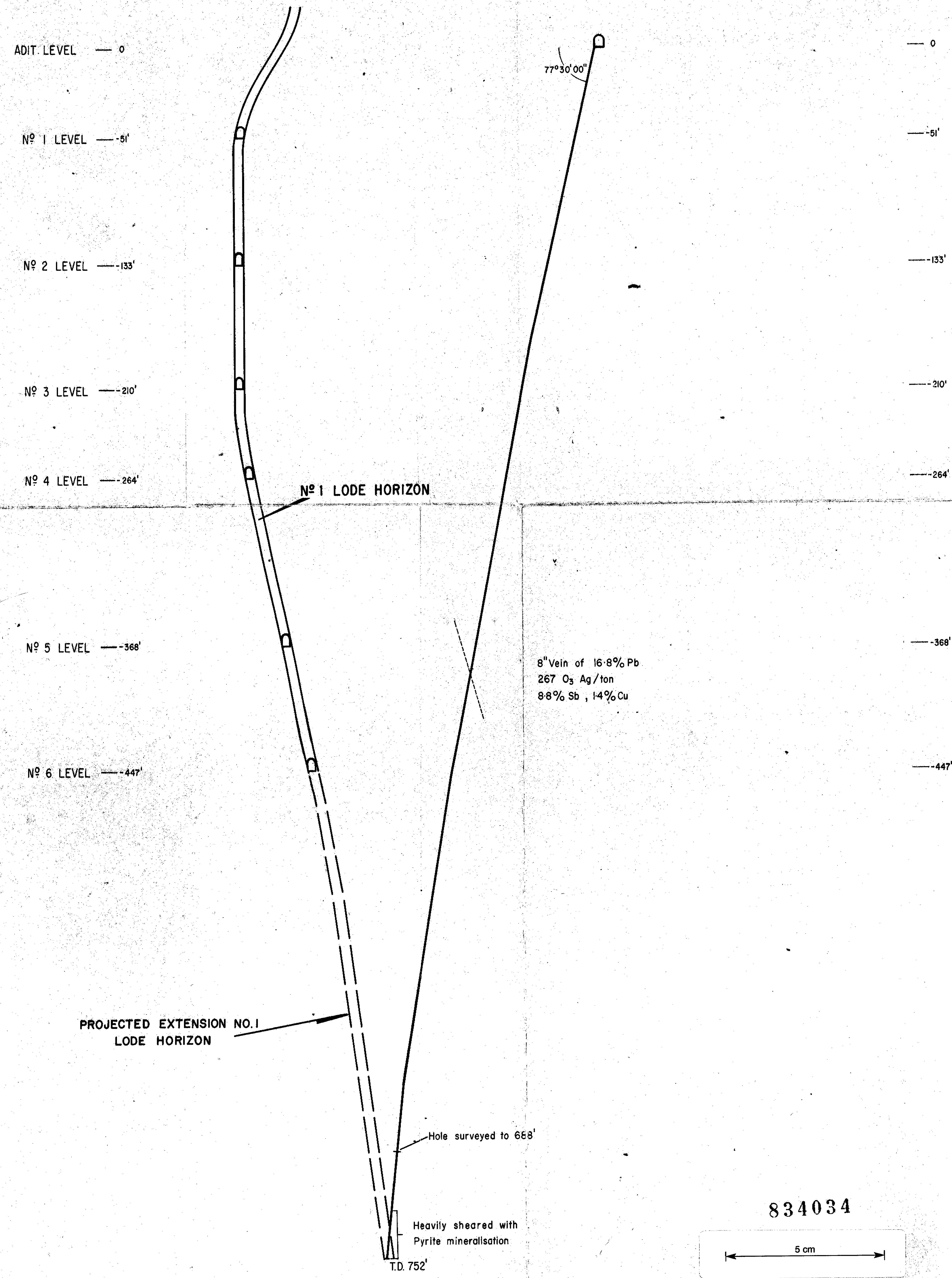
SPRAY MINE

ZEEHAN DISTRICT, TASMANIA 71-794

LONGITUDINAL SECTION
of
NO. 1 LODE

NOV. 1970

DWG. NO. 224



834034

5 cm

TENNECO AUSTRALIA INC.

CROSS-SECTION

SPRAY D.D.H. Nº 2

SECTION LOOKING SOUTH

50 0 50 100

FEET

Date: May 1971 Dwg. no. 239

1155

FIGURE 8 71-794

FIGURE 9.1

TENNECO AUSTRALIA INC. 71-794

SPRAY MINE
ZEEHAN DISTRICT, TASMANIA

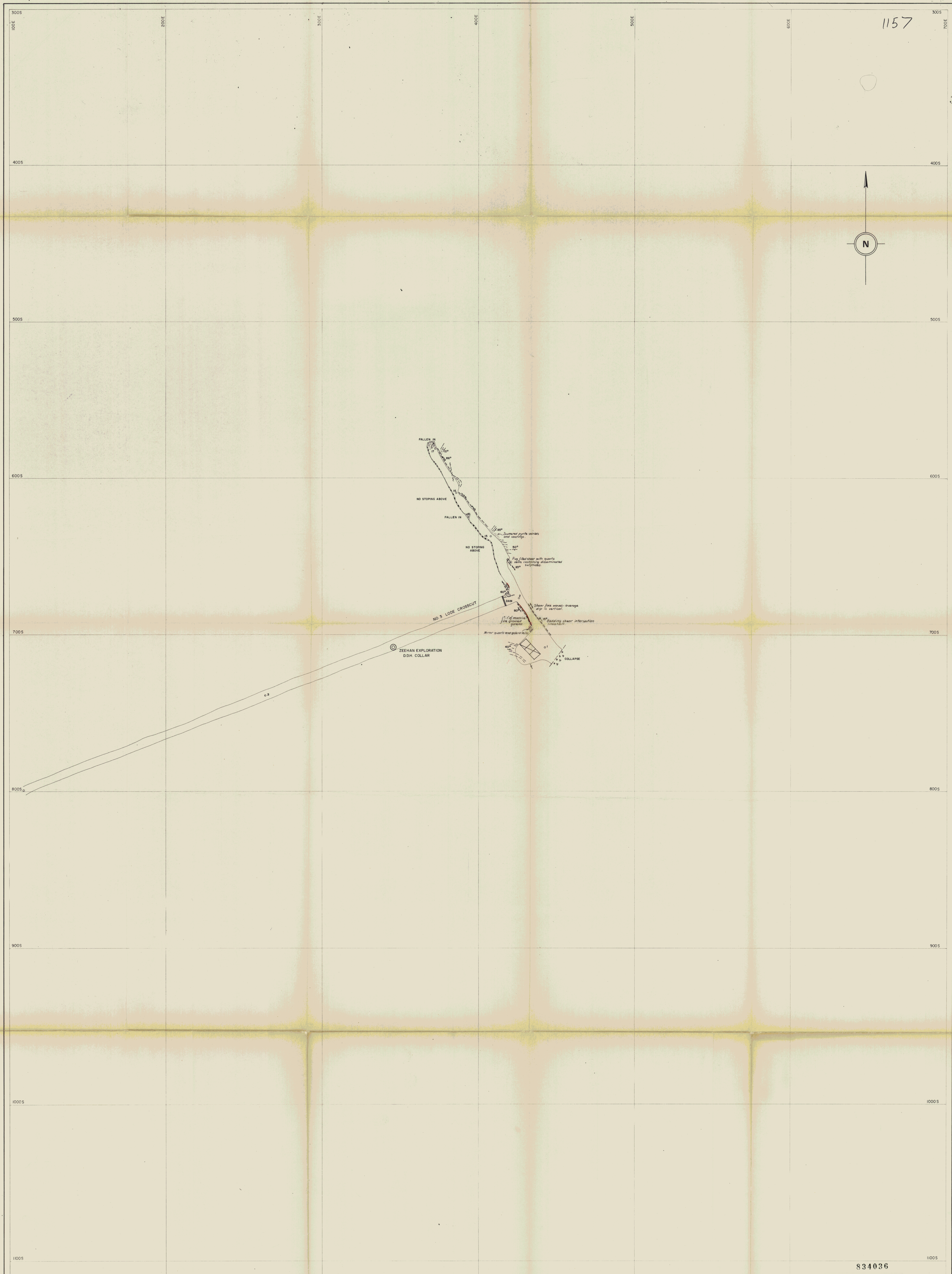
E.L. 44/70

ADIT LEVEL PLAN 1156

SCALE IN FEET
20 0 20 40 60

DATE: JULY 1971 DWG. NO. 335

1157



834036

5 cm

FOR LEGEND SEE ADIT LEVEL PLAN DWG. NO. 335

FIGURE 9.2

TENNECO AUSTRALIA INC.

SPRAY MINE-TASMANIA

71-794

E.L. 44/70

1157

Nº 3 LEVEL PLAN

Nº 1 LODE AND CROSSCUT TO Nº 3 LODE

SCALE : 1" = 20'	DATE : JULY 1971	DWG. NO.
DRAWN : J. M. CURNOW		336

1158

834037

FOR LEGEND SEE ADIT LEVEL PLAN DWG. NO. 335

FIGURE 9.3

TENNECO AUSTRALIA INC.

SPRAY MINE - TASMANIA

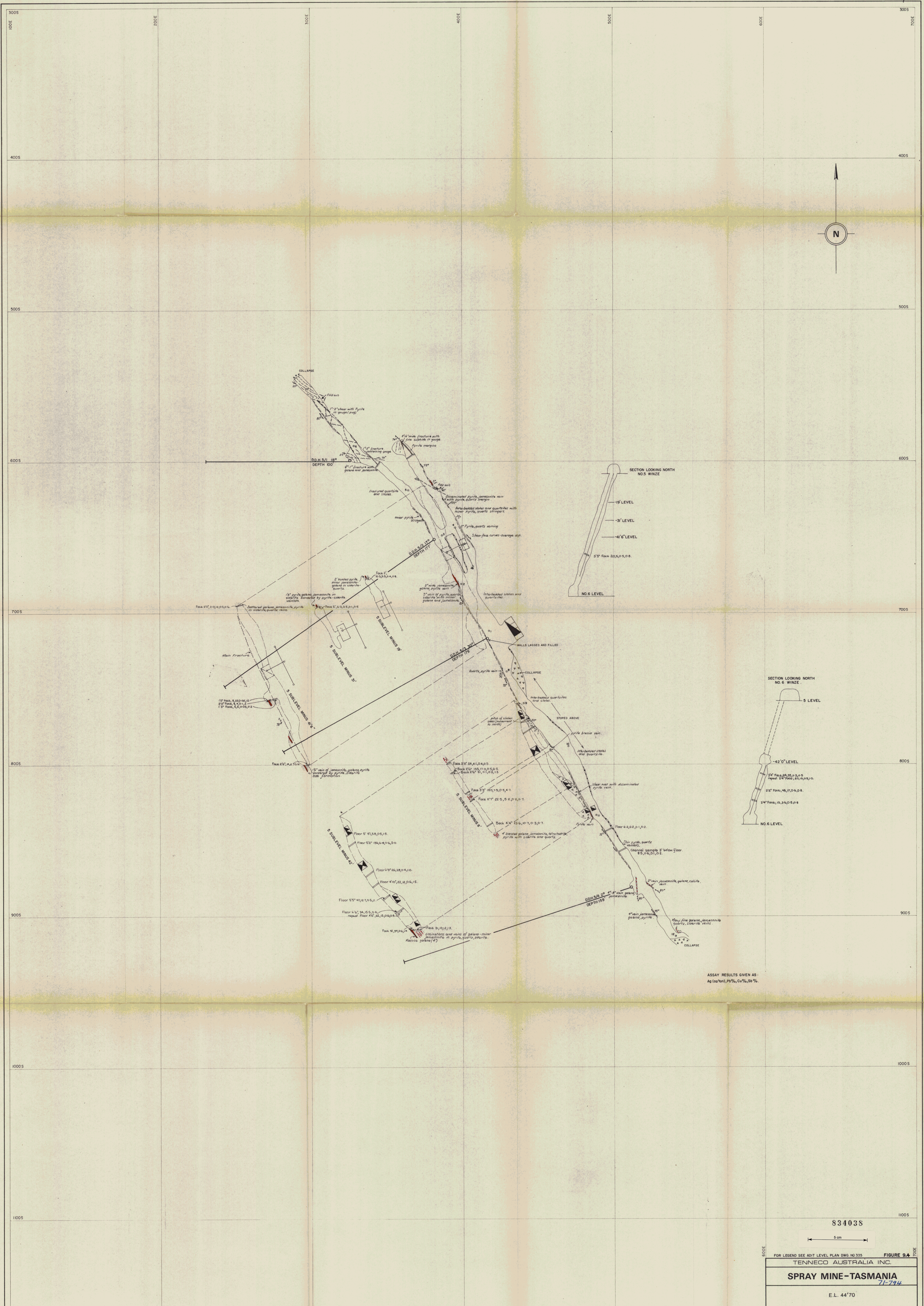
71-794

E.L. 44/70

Nº 4 LEVEL PLAN

1158

SCALE : 1" = 20'	DATE : JULY 1971	DWG. NO. 337
DRAWN : J.M. CURNOW.		



834038

5 cm

FOR LEGEND SEE ADIT LEVEL PLAN DWG. NO.335

FIGURE 9.4

TENNECO AUSTRALIA INC.

SPRAY MINE-TASMANIA

71-794

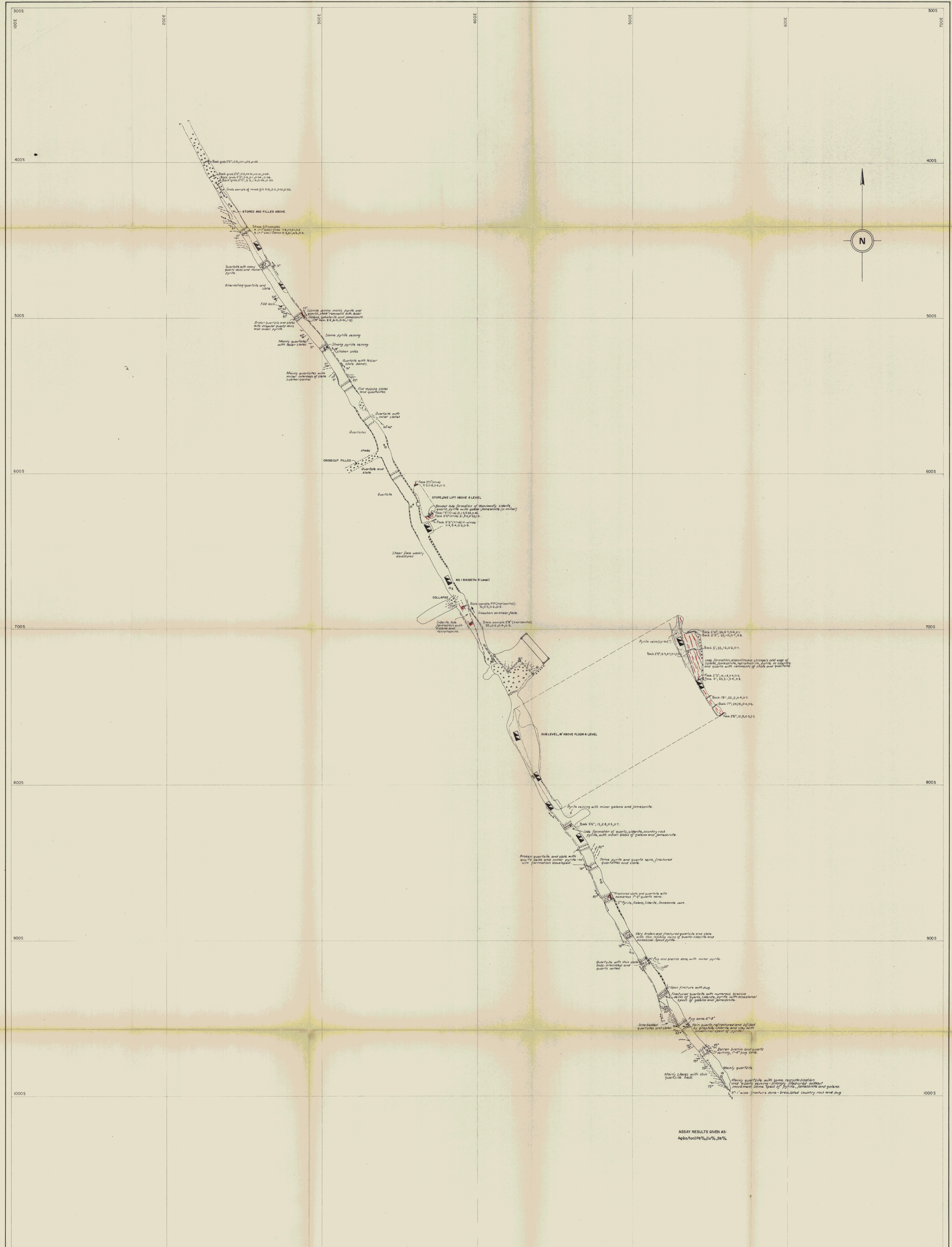
E.L. 44'70

Nº 5 LEVEL PLAN

1159

SCALE : 1" = 20'	DATE : JULY 1971	DWG. NO.
DRAWN : J. M. CURNOW		338

1160



834039

5 cm

FOR LEGEND SEE ADIT LEVEL PLAN DWG. NO. 335

FIGURE 9.5

TENNECO AUSTRALIA INC.

SPRAY MINE-TASMANIA

71-794.

E.L. 44/70

Nº 6 LEVEL PLAN

1160

SCALE : 1" = 20'	DATE : JULY 1971	DWG. NO.
DRAWN : J.M. CURNOW		339