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OUTLINE OF PROPOSED EXPLORATORY DEVELOPMENT AND ORE TESTING PROGRAMME

by

A.A.C. Mason, K.R. Glasson, T. Hopwood

Aberfoyle Tin Development Partnership
(Mount Cleveland Project)

November, 1963.

Contents

Outline of proposed exploratory development and ore testing programme by A.A.C. Mason.

Appendices:-

1. Extract from memorandum to the Partnership Committee by A.A.C. Mason (June, 1963).

2. Mount Cleveland, Tasmania. Aberfoyle Tin Partnership by K.R. Glasson (Feb. 1963).

3. Summary of diamond drilling results (d.d.L.s 1-43) by A.A.C. Mason (April, 1963).

4. Geological report Mount Cleveland mine, Waratah District, Tasmania, by K.R.G. Glasson and T. Hopwood (1962). (N.B. Report incomplete).

Plans and Sections:-

In accompanying envelope.

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ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND

Plans to accompany letter to Director of Mines, Tasmania, dated August 6, 1963.

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1. Composite Plan of Surface, Underground Workings and Diamond Drillholes.

2. Horizon Plan R.L. 1300, showing proposed Exploratory Development.

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4. Longitudinal Projections:-

   A Hall's Lode
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5. Geological Fact Plans (New Geophysical area)

   No.1 North Sheet
   No.1 " " - No.1 East Sheet.

6. Copies of Diamond Drill Core Logs of Holes 29 and 31-46 inclusive. Un available

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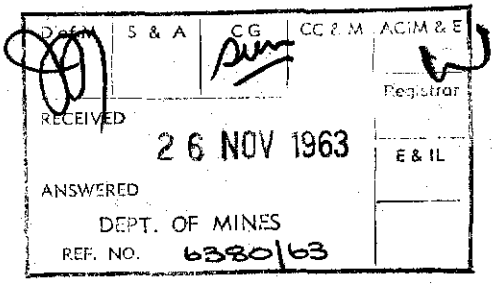
ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

CABLES AND TELEGRAMS:
JONBRANDON,
MELBOURNE

REGISTERED OFFICE:
100 COLLINS STREET, MELBOURNE, C.1
AUSTRALIA

TELEPHONE:
63-6321

November 22, 1963.



The Director of Mines,
Mines Department,
Davey Street,
HOBART, TASMANIA.

Dear Sir,

Attached hereto for the confidential information of yourself and Senior Officers of your Department is a copy of the Outline of Proposed Exploratory Development & Ore Testing Programme at Mount Cleveland.

Discussions have been conducted in the field with Mr. Manson and proposals arising therefrom are receiving his consideration which I hope will result in your Department being able to handle the comparatively large quantities of sample ore for experimental milling and determination of bulk grade.

The detailed planning and estimation of the cost of this proposed project has been commenced and I hope that I can soon inform you of firm plans for putting the proposals into effect.

It would be appreciated if you could promulgate this information to the Minister for Mines.

Yours faithfully,

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

(A. A. C. Mason)
Manager.

Att.:

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ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND PROJECT

OUTLINE OF PROPOSED EXPLORATORY DEVELOPMENT & ORE TESTING PROGRAMME.

INTRODUCTION:

Approximately 12,000 feet of diamond drilling has been completed at Mount Cleveland and has disclosed indicated and inferred ore of the order of 2 million tons averaging a little better than one per cent tin.(1)

This ore appears to be readily accessible and the geological environment allows apportunity for extension to the presently indicated and inferred reserves.(2)

Preliminary economic studies indicate that the prospect merits continuing efforts to establish a mine with a production of up to 200,000 tons of ore per annum.

During the progress of the drilling, a bulk sample of split diamond drill core weighing approximately 350 lbs. was forwarded to the Department of Mines Metallurgical Laboratories, Launceston, for ore dressing investigation. This sample represented 950 lineal feet of drilling from 19 holes as follows:-

Battery Lode,	6 holes,	186 ft.	of drilling
Hall's Lode,	8 "	432 ft.	" "
Henry's Lode,	5 "	332 ft.	" "

The lode material comprising the bulk sample was truly representative of the intersections made by diamond drilling then completed and the weighted average grade, determined from about 300 sample assays, was 1.04% tin which compared reasonably with the bulk assays of 0.99% tin. It is also a matter of some interest that the analysis of the bulk sample revealed 0.34% Copper. The results of the investigation are embodied in Ore Dressing Investigation Report No.421.(3)

...2

The concentration tests carried out on the above-mentioned bulk sample indicate recoveries of the order of 65% - 68% of the tin from an ore assaying 0.99% tin. As an adjunct to these tests a mineragraphic study was made on a suite of diamond drill core samples by the Tasmanian Department of Mines.(4)

With due recognition of a number of limiting factors and some difficulty in the case of Henry's lode, the interpretation of the drilling results has been advanced to a useful stage.

Further exploratory drilling is justified but before consideration of this, the driving of an exploratory underground level on Hall's and Henry's lodes should be undertaken for the purpose of bulk sampling, reconciliation of the results of bulk sampling with the results obtained from completed exploratory diamond drilling, pilot scale ore dressing investigation and detailed geological mapping. This proposed exploratory development will also allow data to be gathered for the purpose of planning a mining system that will ensure optimum economic success. These data must essentially include such aspects as shape, size, continuity and general irregularities in the orebodies, the nature and strength of the wall rocks and the rate of mining production that the orebodies could safely sustain. At this stage, however, it is believed that many sections of the orebodies will respond favourably to fairly large-output, low-cost stoping methods, providing adequate forward development is undertaken.

PROPOSED EXPLORATORY DEVELOPMENT:

Consideration of the problem shows that useful entry to Hall's and Henry's lodes for the purpose of the exercise in mind can be made from the Deep Creek valley by means of a relatively short adit cross-cut at R.L. 1300 ft.

Further reasons for choosing this horizon are:-

(a) It is a mean depth of about 130 feet below the lode outcrops and, therefore, could be expected to encounter purely primary ore.

(b) It is a useful vertical interval in light of ultimate stoping to the surface.

(c) It is 200 feet vertical interval above the lowest level (R.L. 1100') at which a main haulage adit could be considered in order to take advantage of natural mine drainage.

(d) It is at a useful horizon to allow mine levels at intervals of 100 feet or multiples thereof.

(e) Entry into Hall's and Henry's lodes can be made where advantage can be taken of a good deal of diamond drilling results.

(f) In the ultimate event of a main haulage adit from the Whyte River valley at about R.L. 1100 ft. (which is feasible at a crosscut length of 1800 feet) the proposed exploratory adit level will serve as an excellent upcast ventilation and service opening.

This proposal is set out on the accompanying plan and section; viz.,

(a) Horizon Plan 1300',
Showing Proposed Exploratory Development
- Scale 1" = 40'

(b) Cross Section "Qa"
- Scale 1" = 40'

The proposal calls for making entry underground from a point at approximate co-ordinates 1885N. 3243E. at R.L. (rails) 1298'. A crosscut will be driven through to and beyond the west wall of the Hall's Lode complex. Contour drives will then be driven North to "V" Section and South to "K" Section, following the contact between the west wall of Hall's Lode and the stratigraphic underwall rocks which will probably be cherts, shales and sandstones. The Hall's Lode complex will be exposed by crosscuts normal to the lode at each presently established cross section, an average interval of about 130 feet.

Although difficult to interpret from the results of drilling to date, Henry's lode is estimated to lie to the West of Hall's Lode with its centre of gravity at R.L. 1300' at about co-ordinates 2250N. 3030E. and will be explored by cross-cutting West from the west wall of Hall's Lode along Cross-Section "R" and then by contour drives North and South for a total distance of approximately 300 feet. The exploratory development outlined above is itemised as follows:-

ITEM	CROSS SECTION	FOOTAGE	SIZE OF MINE OPENING
Main Adit x-cut	"Qa"	280'	7' x 6'
Hall's Lode			
Main Contour Drive North	-	450'	7' x 6'
Main Contour Drive South	-	700'	7' x 6'
Crosscut	"R"	300'	7' x 6'
"	"T"	90'	7' x 6'
"	"V"	180'	7' x 6'
"	"P"	100'	7' x 6'
"	"N"	100'	7' x 6'
"	"L"	140'	7' x 6'
"	"K"	100'	7' x 6'
SUB-TOTAL		2440'	
Henry's Lode			
Main Drive		300'	7' x 6'
Main x-cut	"R"	200'	7' x 6'
Other x-cuts	(?)	60'	
TOTAL		3,000'	

The proposal also calls for approximately 10 horizontal underground diamond drill holes, interposed between exploratory crosscuts and totalling about 300 lineal feet, in order to completely delineate the lode outlines at the R.L. 1300' horizon.

To service this development a new lower level access road will require construction. This will involve approximately 65 chains of new formation on an easy grade. The excavation of a bench in the hillside about the portal of the proposed adit, will also be necessary.

On the indications from the diamond drilling results, the proposed exploratory work will substantially develop approximately 170,000 tons of ore.

SAMPLING & ORE TESTING PROGRAMME:

Simultaneously with the exploratory development programme, as suitable representative faces of ore are exposed in the underground crosscuts, it is proposed that bulk samples be broken by blasting down ore from the backs of the various crosscuts in carefully measured batches. These batches should be kept segregated in such a way that the eventual results derived from their treatment are accurately referable to the portion of lode from which they were broken.

These bulk samples are proposed primarily to obtain large quantities of representative ore for use in the following:-

1. Determination of bulk grade of the ore and the variation of grade from place to place.

2. Experimental milling and metallurgical tests.

3. Checking the reliability of other types of samples and the possible determination of a correction factor for use in estimates based on samples of other types.

4. To derive for future estimation and operational use, density factors for both broken and unbroken ore.

It is proposed to break batches of ore from the backs of the cross-cuts in lots of maximum dimensions of 5' long x 5' wide x 2' high, which, at a density factor of 11 cu. ft. per ton in situ, will amount to approximately 4½ tons per batch. Some batches will of necessity be of shorter length than 5 feet and consequently will be smaller than the maximum. From our present knowledge of the nature of the lode formations the approximate quantity of ore sample likely to be derived is as follows:-

LOCATION				QUANTITY (tons)
Sec.	Qa	Crosscut		34
"	R	"	Hall's Lode	27
"	P	"		26
"	T	"		27
"	N	"		32
"	L	"		18
"	K	"		40
"	V	"		40
"	R	"	— Henry's Lode	27
			TOTAL	261 tons

From preliminary studies it can be demonstrated that the ore from which the bulk samples may be derived will become exposed by crosscuts at irregular intervals from between 6 and 34 weeks after commencement of underground development. However, the breaking of the batch samples can be regulated to facilitate preparation, transport and treatment, along the following lines:-

LOCATION	FROM COMM. OF DEVELOPMENT (weeks)	RATE	QUANTITY (tons)
Qa x-cut	6 - 8	5 tons/day	34
Others	16 -34	2½ tons/day	227
		TOTAL	261

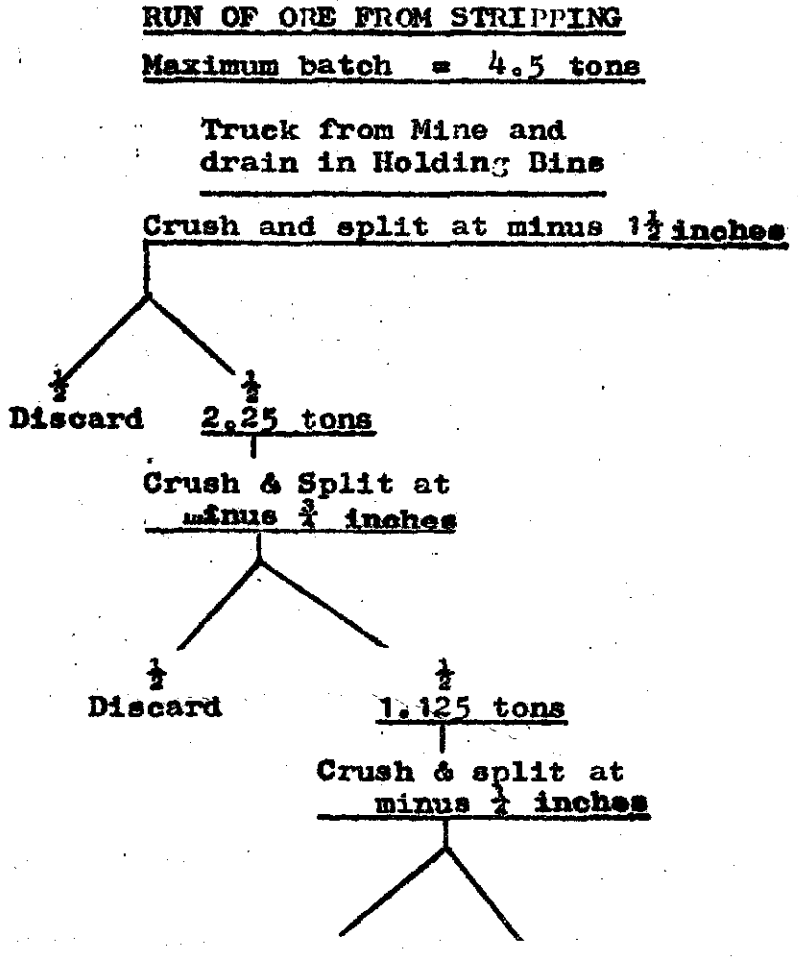
Tentative arrangements have been made with the Director of Mines, Tasmania, and the Chief Chemist and Metallurgist, Department of Mines Laboratories, Tasmania, to undertake experimental ore testing and further metallurgical studies at Launceston. It is proposed that this work will be carried out in the pilot plant recently constructed at the Tasmanian Department of Mines Laboratories at Launceston but may involve the erection of a bulk sampling plant at or in the vicinity of the mine according to the procedure that may be adopted.

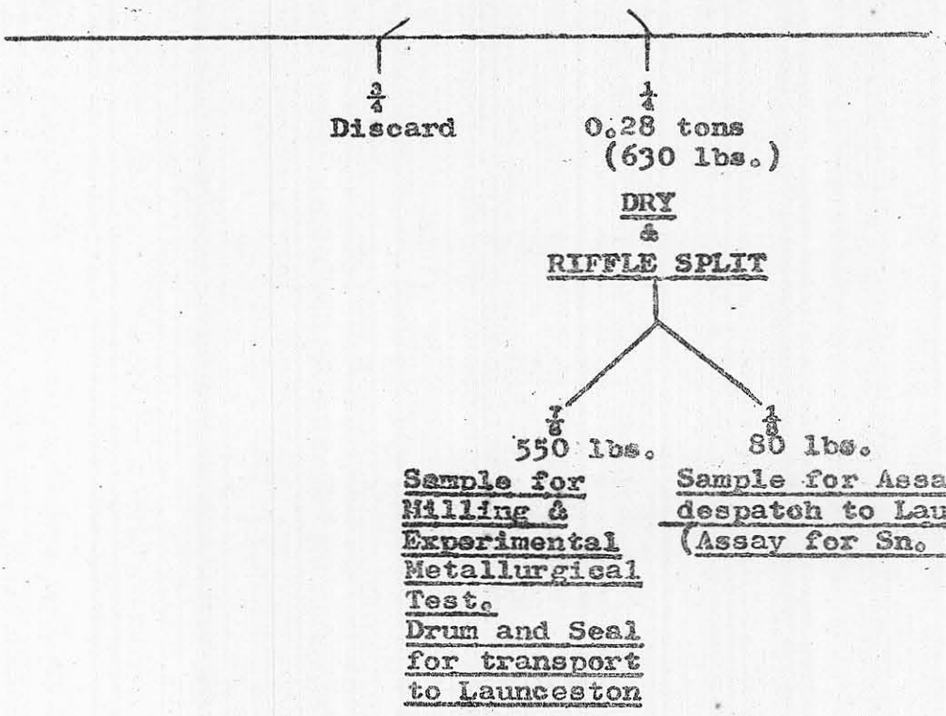
In this respect there are several cases to consider; viz.,

1. The transportation to Launceston of the full bulk of the ore as it comes in batches directly from the stripping of the crosscut backs for treatment in toto at the Mines Department Launceston pilot plant. This would require the mechanical cutting out at Launceston of a sample for assay for determination of the head grade of each batch. The remainder of each batch would then be dealt with by milling the entire quantity for the recovery of a low grade pyritic concentrate and middling, automatically sampling the batch tails and assaying samples of the products derived so that the head grade of the batch can be calculated. The low grade concentrate and middling may be further treated in batches or stockpiled for composition with other batches for further treatment.

2. Run of development ore as it comes in batches from the mine could be stage reduced to approximately minus ¼" size in a sampling mill near the adit portal and mechanically split to give a small sample that will accurately represent the entire batch.

   For example:-





Either:-

(i) Treat fully in batches.

or

(ii) Compose and fully treat composites of groups of batches.

or

(iii) Treat in batches to point of low grade concentrate, sample and assay products for calculation of head grade of individual batches and then stockpile concentrate for further treatment in composite batches.

3. Similar arrangements to Case 2, above, but cart ore from holding bins outside adit portal to sampling mill erected in Waratah. This would have the advantage of utilising established power installations and local operating labour without the necessity to service the latter if accommodated at Cleveland.

The foregoing propositions have been discussed in the field with Mr. W. St. C. Manson, Chief Chemist & Metallurgist, Department of Mines, Tasmania, and he is at present giving them consideration in light of his facilities and with the object of determining the best combination consistent with our basic requirements and the laboratory ore dressing studies that have been done to date.

A. A. C. MASON
NOVEMBER 21, 1963.

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ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND PROJECT

OUTLINE OF PROPOSED EXPLORATORY DEVELOPMENT & ORE TESTING PROGRAMME.

REFERENCES

1. Memorandum to the Committee of the Aberfoyle Tin Development Parthership - A.A.C. Mason, 5th June, 1963. Appendix (1)

2. Mount Cleveland Tin Deposits, Tasmania. - K. R. Glasson, 3rd October, 1963.

3. Ore Dressing Investigation No. R.421. - W. St. C. Manson and John Liddy, Department of Mines Metallurgical Laboratories, Launceston, Tasmania, March, 1963.

4. Report on Mineragraphic Investigations - G. Everard, Department of Mines, Tasmania, 14th February, 1963.

Melbourne.
11-21-63.

APPENDIX 1

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ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

EXTRACT FROM:-

MEMORANDUM TO: THE PARTNERSHIP COMMITTEE

FROM: A. A. C. MASON

MOUNT CLEVELAND

From the results available and the extent to which I believe they can be presently interpreted, I have made a careful attempt to estimate the Indicated and Inferred ore reserves down to R.L. 700' which is approximately 800' below the highest outcrop. These reserves are summarised in Table 2 attached, and reasonably approximate the tonnage and grade previously quoted but this exercise demonstates that about 40% of the total lies below the suggested haulage adit, assuming that it would make entry at approximately R.L. 1100'. These figures are at variance with our earlier preliminary approach but do not detract from the prospect in terms of proposals for production rated at 800 tons per day. It merely requires review in light of alternative methods of mining access but it is questionable just how far this should be taken at this moment. For example, a shaft collared at R.L. 1300' if sunk 600' would command the presently indicated and inferred ore and then would be established for deeper operations if further ore was proved in depth.

The present exercise also demonstrates that approximately 38% of the quantity of ore is in the inferred category (i.e., generally below the depth of our drilling to date) but its introduction is not baseless. Depending upon how one accepts the interpretation of the Mount Cleveland ore deposits will depend on how the inferred ore is accepted both in tonnage and grade. In my view it is fully acceptable as a base for further testing to establish the existence of such ore beyond reasonable doubt. It should go without saying, this course should be adopted in any event; indeed, we have made a decision to this effect.

With the exception of some difficulty in the case of Henry's Lode, the interpretation of the drilling results has been advanced to a useful and practical stage. The bases for the computation of the ore reserves summarised in Table 2 are discussed as follows:-

Hall's Lode:

The calculations based on Cross Sections "K" to "V" are embodied in Tables 1 & 1A. The interpretation placed on

these cross sections demonstrates that Hall's Lode System is a folded complex with reasonably sensible continuity. Nowhere, along the strike length of the system between these sections, has a drill hole been directed at Hall's Lode and failed to make an intersection. It should be noted that hole No. 21 which did not intersect lode was drilled for the express purpose of probing the West wall of Hall's Lode. Modifications to the interpretation will almost certainly be possible and it is now relatively easy, in retrospect, to see where additional drilling can be done; but these factors, in my opinion, do not in any way detract from the claim for continuity. Whatever the interpretation, the linearity upon which the indicated and inferred ore reserves are based is established beyond reasonable doubt.

Tables 1 & 1A claim indicated and inferred ore down to R.L.850' which is 650' vertical depth below the highest outcrop.

Henry's Lode.

In spite of efforts, because of the complexity of the folding, Henry's Lode is difficult to interpret from the drillhole results and it is probable that not much more can be done with the interpretation until underground exposures are made. However, assuming a reasonable possible linearity and dropping off lower-grade tin mineralisation, for the purpose of the exercise on indicated ore reserves calculations, the lode system can be resolved into a near-vertical tabular body with an average strike length of 250 ft. It has an approximate average true width of 12 feet and appears to plunge very steeply south. It is difficult to establish a weighted average grade without full interpretation but the arithmetic average of twelve intersections after sensibly dropping off lower grade mineralisation, is 1.60% Sn.

Thus it can be calculated:-

Indicated Ore to R.L. 1100'

$$\frac{250' \times 12' \times 500}{11} = 136{,}000 \text{ tons (approx)}$$

Inferred Ore between R.L.'s 1100' and 900'

$$\frac{250' \times 8' \times 150}{11} = 27{,}000 \text{ tons (approx)}$$

The following holes directed at Henry's Lode failed to make intersections for the reasons stated alongside.

Hole No.	Length	Proved Reason for Failure to Intersect
19	100'	Well above Henry's on plunge. Confirmed strike limitations southerly at this horizon.
29	407'	Traversed "underwall" sandstone all to the west of Henry's lode and thus established steep dip for Henry's.
36	350'	Traverse of hole passes over Henry's on its steep south plunge which was postulated quite early in the drilling programme. This hole was drilled expressly to delimit Henry's on strike at the R.L. 1300' horizon. It accomplished this and confirmed steep south plunge.

All of these holes achieved their purpose and the information gained has been used for delineating the boundaries which were used in the above-mentioned assessment of ore reserves. Nowhere did a negative hole penetrate the tabular body upon which the estimates are based. It should be noted that Henry's Lode has not been delimited to the north by drilling.

Lucks - Khaki System:

The fact that the lode mineralisation at Mount Cleveland is associated with an horizon of shaley rocks has been established.

In the vicinity of the old Lucks - Khaki workings there is a pronounced embayment of cherty shale analogous with a similar embayment in the vicinity of Henry's workings. The limited mapping done to date in this area demonstrates that this is the host for the Lucks and Khaki Lodes which are presently thought to be the same ore bed as Hall's which is folded or perhaps sheared into this position.

Although the geophysical survey by the B.M.R. produced no appreciable magnetic anomalies in this area, it did demonstrate a pronounced self-potential anomaly of intensity equally as great as that indicated for Hall's Lode although over a much smaller area.

No serious attempt has been made to drill the Lucks - Khaki lode system. The three holes (Nos. 6, 7 & 8) were no more than short probes employing Luck's lower adit as a convenient station for the underground drill, which was the only drilling equipment on the field at that time.

Some shallow extractive mining was undertaken on the Lucks - Khaki lodes in the early days and it is concluded that the grade was not inferior to that of Henry's, Hall's and the Battery lodes which were all worked to shallow extent about the same time.

In light of the foregoing it is felt that there is justification for expecting from exploration at least half of the tonnage presently indicated for Henry's Lode; i.e., 80,000 tons; 50,000 tons of which might be above R.L. 1100'. The average grade could be at least equivalent to the average for the reserves inferred for Hall's lode.

Battery Lode System:

All knowledge points to the Battery Lode as being of substantial significance. Our drilling has been limited to five shallow holes drilled from underground stations as preliminary probes. Further drilling was deferred in favour of concentration of attention on Hall's Lode.

From the limited exposures the Battery system appears to be folded in a generally similar fashion to Hall's Lode and I would like it to go down on record that I believe it is in fact the same lode bed as Halls, folded or sheared into this position. In the vicinity of the Battery workings the system appears to have two recognisable components which are simply described as the Main Limb and No. 1E. The basis for the establishement of ore reserves is as follows:-

Indicated Ore

Main Limb

Strike Length		S.P. Anomaly	500'
"	"	Mag. "	300'
"	"	Surface Mapping	500'

Therefore, adopt 500' length as minimum.

After dropping off low grade assays on selvedges of intersections we have:-

Hole No.1	6'	x 1.07%	= 6.42
No.2	10'	x 0.80%	= 8.00
No.3	22'	x 0.96%	= 21.12
No.4	16'	x 0.78%	= 12.50
No.5	20'	x 1.00%	= 20.00
	74'	0.93	68.04

∴ Weighted Av. grade = 0.92% Sn.

Average true width from Cross Sections A, B & C = 10 feet.

From outcrop to R.L. 1100' averages 100' height.

∴ Above R.L. 1100'

$$\frac{500' \times 10' \times 100'}{11} = 50{,}000 \text{ tons approx.}$$

No.1 E. Limb

Indicated Ore

Strike length minimum 300'

Average true width from limited exposures = 8'

From outcrop to R.L. 1100' averages 80' height.

∴ Above R.L. 1100'

$\frac{300' \times 8' \times 80}{11}$ = 18,000 tons approx.

Equivalent to 750 tons per vertical ft. (i.e.,total)

∴ Total indicated ore above R.L. 1100' = 68,000 tons to which is assigned a grade of 0.92% Sn.

Based on the established geological concept and the deepest intersection of Hall's lode (R.L. 700' in hole 41) there is reason to believe that the Battery Lode will continue in depth to at least R.L. 700'.

Inferred Ore

Below R.L. 1100'

400' x 750 tons/vert. ft. = 300,000 tons.

Concluding Remarks:

The Partnership undertook exploratory work at Mount Cleveland on the basis that reserves of 200,000 tons might be proven, sufficient to support mine production at the rate of 20,000 tons per annum. It was roughly assessed that this would cost £20,000.

To date we have expended approximately £50,000 and in return we have indications of a fairly safe 1,200,000 tons of indicated ore of a grade a little better than 1% Sn. with every likelihood of ultimately proving a minimum of 2,000,000 tons of generally similar grade which could feasibly support production at 200,000 tons per annum. However, this is still a prospect and the presently indicated and inferred reserves cannot be elevated respectively to the proved, measured and indicated categories without further testing work which must essentially include underground exploratory development and further diamond drilling. Any economic studies done to date have been done on the premise that they serve only as a guide to establish that the prospect merits continuing efforts to establish a mine.

A. A. C. MASON

JUNE 5. 1963.

TABLE 1.

SHEET 1.

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND

INDICATED ORE RESERVES CALCULATIONS - HALL'S LODE SYSTEM

(Indicated from diamond drilling results limited underground exposures, surface workings and mapped outcrops.)

Depth Interval R.L.	Section	Lode	Dip Height	True Width Av.	Cross Sectional Area squ. ft.	Length Applicable to Section	Volume Cu. ft.	Grade Applicable % Sn.	Tons (Basis 11cu. ft./ton)	Product Tns x Grd.	Av.Grd. % Sn.	Remarks
1400'-1200'	"V"	Halls-Main Limb	205'	18'	3690	160'	590,400	0.55	53,700	29,500		
1200'-1100'	"	" " "	100'	21'	1200	160'	336,000	1.55	30,500	47,300		
1300'-1100'	"	" - 1E	230'	13'	2990	160'	478,400	1.20	43,500	53,200		
1500'-1320'	"T"	Halls Main Limb	160'	10'	1600	110'	176,000	0.82	16,000	13,100		
1460'-1305'	"	" No. 1E	160'	14'	2240	110'	246,400	0.80	24,700	18,000		
1460'-1305'	"	" No. 2E	160'	6'	960	110'	105,600	0.61	9,600	5,900		
1305'-1170'	"	" No. 2E	130'	12'	1560	110'	171,600	1.84	15,600	28,700		
1170'-1100'	"	" No. 2E	80'	9'	720	110'	79,200	1.23	7,200	8,900		
1300'-1180'	"	" Nos. 3&4E	120'	6'	720	70'	50,400	0.82	4,600	3,800		
1180'-1100'	"	" " "	80'	6'	480	70'	33,600	0.89	3,100	2,700		
1480'-1170'	"S"	Hall's Main Limb	310'	12'	3720	55'	204,600	0.96	18,600	17,900		Omit from computation pro tem.
1480'-1170'	"	" No. 1E	310'	6'	1860	55'	102,300	1.18	9,300	11,000		
1480'-1170'	"	" No. 2E	310'	6'	1860	55'	-	-	-	-		
1470'-1335'	"R"	Hall's Main Limb	135'	15'	2025	90'	182,250	0.96	16,600	15,900		
1335'-1150'	"	" " "	185'	12'	2220	90'	199,800	1.76	18,200	31,900		
1470'-1335'	"	" No. 1E	135'	6'	810	90'	72,900	1.18	6,600	7,800		
1335'-1150'	"	" No. 1E	185'	9'	1665	90'	149,850	1.22	13,600	16,600		
1450'-1310'	"	" No. 2E	140'	5'	700	90'	63,000	-	-	-		= As above
1480'-1335'	"Qa"	Halls Main Limb	145'	11'	1595	90'	143,500	0.86	13,000	11,200		
1335'-1150'	"	" " "	185'	15'	2775	90'	249,750	1.32	22,700	30,000		
1350'-1100'	"	" No.1&2E	250'	10'	2500	90'	225,000	1.46	20,500	30,000		
1150'-1100'	"	" Estn Limb	50'	6'	300	90'	27,000	4.94	2,400	12,000		
1170'-1100'	"	" " "	70'	5'	350	90'	31,500	1.41	2,800	3,700		
1170'-1100'	"	" " "	70'	5'	350	90'	31,500	1.87	2,800	5,200		
1390'-1350'	"	" " "	40'	5'	200	90'	18,000	1.80	1,600	2,900		
1390'-1350'	"	" " "	40'	5'	200	90'	18,000	1.00	1,600	1,600		
1290'-1230'	"	" " "	60'	5'	300	90'	27,000	1.60	2,400	3,900		

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TABLE 1.

SHEET 2.

ADELFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND

INDICATED ORE RESERVES CALCULATIONS - HALL'S LODE SYSTEM

(Indicated from diamond drilling results, limited underground exposures, surface workings and mapped outcrops.)

Depth Interval R.L.	Section	Lode	Dip Height	True Width	Cross Sectional Area squ. ft.	Length Applicable to Section	Volume Cu. ft.	Grade Applicable % Sn.	Tons (@11cu.ft./ton)	Product Ton x Grd.	Weighted Av. Grade % Sn.	Remarks
1460'-1330'	"Q"	Hall's Main Limb	130'	15'	1950	65'	126,750	0.76	11.500	8,700		
1330'-1130'	"	" " "	200'	15'	3000	65'	195,000	0.96	17,700	17,000		
1320'-1180'	"	" No. 1E	40'	8'	320	65'	20,800	1.00	1.900	1,900		
1300'-1100'	"	" No. 2E	200'	8'	1600	65'	104,000	1.00	9,400	9,400		
1460'-1140'	"P"	Hall's Main Limb	320'	10'	3200	70'	224,000	1.06	20,300	21,600		Grd. 1.06
1480'-1160'	"	" No. 1East	320'	5'	1600+	70'	112,000	0.95	10,200	9,700		Mean of 1.176
1480'-1160'	"	" No. 2 "	320'	5'	1600	70'	112,000	0.95	10,200	9,700		+ 0.96%
1450'-1100'	"O"	Hall's Main Limb	350'	14'	4900	65'	318,500	1.14	29,000	33,000		
1475'-1250'	"	" No.1East	225'	5'	1125	65'	73,100	1.76	6,600	11,700		
1250'-1100'	"	" " "	150'	5'	750	65'	48,700	1.00	4,400	4,400		
1475'-1250'	"	" No. 2"	225'	5'	1125	65'	73,100	2.02	6,600	13,300		
1250'-1100'	"	" " "	150'	5'	750	65'	48,700	1.00	4,400	4,400		
1460'-1200'	"N"	Hall's Main Limb	270'	23'	6210	65'	403,650	1.35	36,600	49,500		
1200'-1100'	"	" " "	100'	12'	1200	65'	78,000	3.00	7,100	21,200		
1460'-1140'	"	" No.1 East	320'	5'	1600	65'	104,000	1.00	9,500	9,500		
1460'-1200'	"	" No.2 "	260'	5'	1300	65'	84,500	1.00	7,700	7,700		
1200'-1100'	"	" " "	100'	5'	500	65'	32,500	1.27	2,900	3,700		
1465'-1350'	"M"	Hall's Main Limb	115'	22'	2530	70'	177,100	1.35	16,100	21,700		
1350'-1100'	"	" " "	260'	18'	4680	70'	327,600	1.13	29,800	33,800		
1330'-1100'	"	" No.1 East	230'	5'	1150	70'	80,500	0.95	7,300	6,900		Assumed Grade
1330'-1100'	"	" No.2 "	230'	5'	1150	70'	80,500	0.95	7,300	6,900		" "
1540'-1100'	"L"	Hall's Main Limb	440'	18'	7920	110'	871,200	1.00	79,000	79,000		Assumed Grade
1250'-1100'	"	" No.1 East	150'	5'	750	110'	82,500	1.50	7,500	11,300		No.2E neglected
1500'-1310'	"K"	Hall's Main Limb	190'	12'	2280	180	410,400	1.03	37,200	38,500		
1500'-1310'	"	" " "	190'	6'	1140	180'	205,200	1.22	18,600	22,700		
1310'-1100'	"	" " "	210'	12'	2520	180'	453,600	1.03	41,300	42,500		
									901,300	911,400	1.01	Sub-total
		Lode indicated at "W" Section entitles adding 100ft. of strike length to North end at average grade for deposit south of Section "W".						1.01	30,000	30,300		
1100'-1000'	"V"	Hall's various	100'		1200	160'		1.41	49,300	69,800		
1000'- 950'	"	" "	50'	12'	600'	160'		1.01	8,700	8,800		
						PRESENT TOTAL INDICATED ORE			989,000	1,020,000		

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TABLE 1A

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND

INFERRED ORE RESERVES - HALL'S LODE SYSTEM

Depth Interval R.L.	Section	Lode	Dip Height	True Width Av.	Cross Sectional Area squ. ft.	Length Applicable to Section	Volume Cu.ft.	Grade Applicable % Sn.	Tons (@11cu.ft./ton)	REMARKS
1100'- 850'	"K-T"	Hall's various	250'	12'	3000	1160'	3,498,000	1.01	318,000	Indications from drilling entitle assumption that 250' of further depth over 1160' of strike length, at average width of 12' down to R.L.850' i.e. 1270 tons per vertical foot. N.B. Some of this inferred ore could qualify as indicated, - E.g. Section "L" - Down to RL 950' " "Qa"- " " " "

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TABLE 2

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND

SUMMARY OF INDICATED AND INFERRED ORE AS AT APRIL 30, 1963.

Category	Lode System	TONNAGE: Above RL1100'	TONNAGE: Below RL1100'	TONNAGE: Aggregate	Grade %Sn.	Product Tons x Grade	Weighted Av. Grade % Sn.	REMARKS
Indicated	Hall's	901,000	88,000	989,000	1.03	1,020,300		From Table of Indicated Reserves Hall's Lode.
	Henry's	136,000	-	136,000	1.60	218,000		Arithmetic grade of 12 intersections.
	Battery	68,000	-	68,000	0.92	62,600		Grade from 5 closely arranged drillholes
	Total Indicated	1,105,000	88,000	1,193,000		1,494,800	1.08	
Inferred	Hall's	-	318,000	318,000				Of possible similar grade to presently indicated ore.
	Henry's	-	27,000	27,000				
	Luck's Khaki	50,000	30,000	80,000				
	Battery	-	300,000	300,000				
	Total Inferred	50,000	675,000	725,000				
TOTAL COMBINED INDICATED & INFERRED		1,155,000	763,000	1,918,000				

DEFINITIONS (U.S. BUREAU OF MINES TERMINOLOGY.)

INDICATED ORE: Ore for which tonnage and grade are computed partly from specific measurements, samples or production data and partly from projection for a reasonable distance on geologic evidence. The sites available for inspection, measurement and sampling are too widely or otherwise inappropriately spaced to outline the ore completely or to establish the grade throughout.

INFERRED ORE: Ore for which quantitative estimates are based largely on broad knowledge of the geologic character of the deposit and for which there are few, if any, samples or measurements. The estimates are based on an assumed continuity or repetition for which there is geologic evidence; this evidence may include comparisons with deposits of similar type. Bodies that are completely concealed may be included if there is specific geologic evidence of their presence. Estimates of inferred ore should include a statement of the spatial limits within which the inferred ore may lie.

A. A. C. MASON
JUNE, 1963.

APPENDIX 2

MOUNT CLEVELAND TASMANIA

ABERFOYLE TIN PARTNERSHIP

INTRODUCTION: The Geological investigation of the Mount Cleveland prospect commenced in January 1962 and after an initial period of intense mapping a limited drilling programme was drawn up and carried out.

The early drilling results proved favourable and suggested that the revised geological concept was correct and the prospect offered considerable potential and a target of 500,000 tons of approximately 1.0% Tin (metallic) could be inferred. Steps were then taken to extend and confirm reserves by a further programme of drilling together with close geological checking of the details in the Hall's, Henry's and Battery workings.

At this stage, when the extended drilling programme nears completion, it is necessary to review briefly the established reserves and make proposals for future exploration and development.

GENERAL DISCUSSION: In the report furnished by Glasson, February 1962, certain conclusions were made in terms of geological control of mineralisation and these have been verified by subsequent mapping and drilling.

The assertion that there is a strong stratigraphic control of mineralisation at Mount Cleveland has been confirmed and extended in detail. This does not preclude mineralisation extending in shear thrust positions where the lode horizon is thin. This is shown between the northern section of Hall's (i.e. Roadwell Section) and the northern anomaly (intersected in D/D Holes 34 and 40) where mineralisation corresponds to the shear position.

However, the main mineralisation lies within the lode horizon and this has facilitated the interpretation, location and depth of drilling.

The stratigraphic sequence as postulated in the earlier report has been confirmed and the structural interpretation has proved valid.

This confirmation of both structure and stratigraphy now allows a much more positive statement to be made in terms of future potential and reserves.

Initially, it was thought that, there may be gaps in the line of mineralisation in the Hall's prospect but drilling to date has extended the overall strike length to something in the order of 1,200 feet with a distinct possibility of continuous ore values.

In the earlier report it was stressed that the priority of drilling should be in the Hall's section and the results indicate that the major reserves will occur in that section. Drilling results in both the Battery and Henry's workings have indicated that these ore ~~leases~~ lenses will give substantial additional tonnages in positions that can be readily developed in the mining operation.

In regard to the interpretation of the earlier geophysical anomalies carried out by the Bureau of Mineral Resources (Report No. 7) it was stated by Glasson that he believed there was close agreement between the geophysical anomalies and the mineralisation. This has been proved by drilling of the anomaly at 2,300N, 3,400E and gives further weight to the earlier recommendation that additional geophysical work might be undertaken north of co-ordinates 4,000N and 6,000E.

The present report is not designed to enter into a long discussion on the technical aspects of the prospect but rather to give basic conclusions which are valid in terms of geological knowledge gained by the additional field work of A. B. Clarke and the drilling programme completed on 7/2/63. It should be clearly recognised that the organisation, careful planning and supervision of the project carried out by Mr. Mason has been largely responsible for the remarkable success of the operation in such a relatively short time.

EXPLORATORY DRILLING: Thirty-six diamond drill holes have been completed for a total of 7,500 feet of drilling. Of this completed drilling approximately 15% of the core length has been in significant lode and the weighted average of all these intersections is 1.12% metallic tin.

At the present time two holes are in progress (Nos. 36 & 37), which have intersected Hall's lode and which are designed to cut Henry's lode at depth. Two additional holes (Nos. 38 & 39) for deeper intersections on Hall's lode are programmed. These holes when completed will complete the programme of drilling as drawn up by Mason and Glasson.

The point now arises as to future drilling required in the area. It would seem that two additional holes could be profitably programmed to extend and confirm the values obtained in the drilling of 33 & 40 on the geophysical anomaly. These holes however could be deferred should a decision be made to drive a level for the full length (1,200 feet) of Hall's Lode.

The second possibility would be directed ~~forwards~~ towards obtaining a deep (1,000 feet) intersection on the Hall's lode. This hole would have a twofold advantage.

(i) It would check mineralisation to a much greater depth and thus give more weight to the inferred reserves.

(ii) It would establish the position of the lode horizon at depth, allowing a better geological interpretation to be made. It is the belief of Glasson that the lode horizon may flatten at depth and this would tend to increase the tons per vertical foot of development.

CONCLUSIONS:

1. The premises on which the geological interpretation were made have been strengthened by subsequent drilling and mapping. Both the stratigraphic and structural control has been established to such an extent that indicated reserves can be given with a fair degree of certainty.

2. The drilling programme has confirmed the postulation of the grade of ore to be in excess of 1.0% metallic tin. The sampling of the ore paddock of the Hall's Lower Adit gave a grade of 1.25% metallic tin which is in agreement with the drilling results.

3. Subject to favourable intersections being obtained in proposed drill holes Nos. 38 & 39 the indicated ore reserves for Hall's workings down to the 500 foot level will be approximately 900,000 tons. This assumes that the strike length of Hall's will be in the order of 1,200 feet and allows for 10% to be left in possible low grade sections. An average width of 18 feet for the lode is adopted and a tonnage conversion figure of 11 cubic feet per ton.

4. The indicated reserves for Henry's lode are in the order of 300,000 tons and the indicated reserves for the Battery lode 400,000 tons.

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5. The agreement between the geophysical results and subsequent testing by drilling indicates that further extension of the geophysical work is warranted.

6. The stage has now been reached where the further testing of Hall's lode should be undertaken by an adit and drive at R.L. 1,300' approx. This drive should be designed to include the lode intersected by holes Nos. 33 & 40. A deep drill hole at section line (N) should be drilled to test the Hall's orebody at a depth of 1,000 feet below the surface.

7. Geological mapping should be undertaken and continued to trace the lode horizon both to the north and south of the Cleveland Mine area. It is believed by Glasson that there could be further lenses of economic ore occupying the same stratigraphic position as the Cleveland ore.

8. Efforts should be made to induce the B.M.R. geophysical team to carry out further self-potential and magnetometer work north of 4,000N.

9. Further investigation of the Battery workings could be postponed until the development of Hall's exploratory drive is completed.

10. Thus twelve months after the initial work in the area commenced indicated and inferred reserves for the Cleveland prospect can be estimated to be in the order of 2 million tons with a grade in excess of 1.0% metallic tin.

K. R. GLASSON
Consulting Geologist.

MELBOURNE
8th Feb. 1963.

APPENDIX 3

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND

SUMMARY OF DIAMOND DRILLING RESULTS

Hole No.	Footage From	Footage To	Description	Core Length	Grade % Sn.
1.	0'	6'	F.g. Sulphide Lode	6'	0.85
	96'	102'	Massive Sulphide Lode (Battery Lode)	6'	1.07
2.	43'9"	46'9"	Massive Sulphide Lode	3'	0.16
	46'9"	49'6"	" " "	3'	0.40
	49'6"	58'6"	" " "	9'	0.85
	58'6"	61'6"	" " "	3'	0.55
	61'6"	69'6"	" " " (Battery Lode) Est. true width 43'9" -69'3" = 23 feet Averaging 0.53% Sn.	6'6"	0.36
3.	85'9"	88'9"	Massive Sulphide Lode	3'	0.15
	88'9"	124'9"	" " "	36'	0.96
	124'9"	126'0"	" " " (Battery Lode) Est. true width 85'9" - 126'0" = 22 ft. Averaging 0.87% Sn.	1'3"	Tr.
4.	58'6"	61'6"	Massive Sulphide Lode	3'	0.30
	61'6"	87'6"	" " "	26'	0.71
	87'6"	89'6"	" " " (Battery Lode) Core length of Intersection = 31' Av. 0.65% Sn.	2'	0.42
5.	60'6"	78'6"	Massive Sulphide	18'	1.04
	78'6"	96'6"	" " Lode	18'	0.58
	96'6"	123'6"	" " "	27'	1.28
	123'6"	138'6"	" " " (Battery Lode) Core length of Intersection = 78' Av. 0.94% Sn.	15'	0.79
6.	103'0"	104'6"	F.g. Lode (Luck's Lode)	1'6"	3.11
7.	16'	17'	F.g. Lode	Not sampled	
	20'	24'	F.g. Disseminated		
	41'	43'	Lode (Luck's)		
8.	13'	15'	Mineralised Tuffaceous sandstone	2'	0.11
	66'6"	68'6"	Lode material	2'	Trace
9.	69'3"	77'3"	Lode with some chert bands (Halls?)	8'	0.92
10.	53'0"	58'9"	Lode	5'9"	2.00
	70'0"	74'6"	"	4'6"	1.76
	77'0"	106'0"	" (Halls?) 77' - 106' true width = 29'	29'0"	1.22

Hole No.	Footage From	Footage To	Description	Core Length	Grade % Sn.
11.	0'0"	95'0"	Lode (Halls Lode) Drilled down pitch obliquely crossing lode at angle of approx. 5° to strike. True width 20'+	95'0"	1.35
12.	0'0"	44'0"	Lode, lode bands & lode and chert.	44'	1.16
	46'6"	72'0"	Lode & chert	25'6"	1.01
	80'0"	86'0"	Lode & tuff	6'0"	0.20
	111'0"	114'0"	Lode (Halls) Av. 1.06% Sn. over 72' of core length.	3'0"	2.75
13.	58'0"	61'0"	Lode with chert	3'0"	1.81
	65'0"	84'0"	" " " bands	19'0"	0.82
	89'6"	113'6"	" " " "	24'0"	0.80
	126'0"	141'0"	" " " " (Hall's Lode System)	15'0"	0.36
14.	97'	219'	Recommenced & extended		
	105'	123'	Sulphide Lode	18'	0.81
	130'	178'	" "	48'	0.92
	187'	193'	" " & Chert	6'	0.45
	198'	207'	Chert bands & Lode (Henry's Lode Zone) Core lengths are an approx. expression of true width.	9'	0.44
15.	0'0"	15'0"	Lode	15'0"	3.09
	17'6"	20'0"	Chert (Henry's Lode System	2'6"	0.74
16.	0'	48'	Sulphide Lode	48'	0.76
	48'	54'	Chert	6'	0.06
	54'	63'	Chert & Lode	9'	1.00
	63'	120'	Lode	57'	1.78
	120'	126'	Chert	6'	0.48
	126'	132'	-	6'	Nil
	132'	147'	Lode	15'	0.92
			Av. 0' - 147'	147'	1.11
17.	60'	106'	Lode	46'	1.02
	106'	115'	"	9'	0.14
			Av. 60' - 115'	55'	0.84
18.	187'	211'	Sulphide Lode	24'	0.91
	214'	226'	" "	12'	1.98
	226'	238'	" " & Chert	12'	0.90
			Overall Average 187' - 238' Henry's Lode (down pitch drilling)	51'	1.13
19.	0'	100'	No lode intersected	-	-

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Hole No.	Footage From	Footage To	Description	Core Length	Grade % Sn.
20	0'	27'	Lode and Chert	27'	1.02
	39'	42'	Mineralised Chert	3'	1.14
	78'	90'	Lode	12'	0.56
	100'	121'	Lode with chert bands	21'	0.26
	130'	166'	" " " "	36'	1.08
	169'	178'	" " " "	9'	0.54
			Overall Average 78' - 178' Components of Henry's Lode System. Cross-cutting intersection true width possibly 30'-40'	100'	0.594
21.	0'	61'	No lode intersected		
22.	0'	9'	Massive Sulphide lode	9'	0.53
23.	71'	74'	Massive lode	3'	0.34
	74'	92'	" "	18'	0.95
	92'	128'	" "	34'	0.54
			Av. 71' - 128'	55'	0.66
24.	89'	101'	Lode	12'	1.29
	115'	142'	"	27'	0.37
	179'	194'	Lode with chert banding	15'	0.45
	217'	246'	Fractured chert & lode (Est. true width 15'+)	29'	0.90
25.	33'	37'	Lode band	3'	0.95
	132'	177'	Massive lode (Est. true width 10'+)	45'	0.96
26.	71'	73'	Lode band	2'	0.69
	78'	87'	Lode and chert	9'	1.10
	97'	100'	Lode	3'	1.09
27.	271'	301'	Lode Included in which were the two following lighter grade inter-sections.	30'	0.69
	274'	280'	Lode	6'	1.17
	289'	295'	"	6'	1.47
	377'	392'	Lode	15'	1.27
	392'	407'	Lode & interformational chert	15'	0.06
	407'	425½'	Lode	18½'	0.32
	453'	468'	Lode Included in which was a higher-grade inter-section 459'-465'	15' 6'	0.74 1.34
	468'	483'	Lode	15'	0.12
			All of the above inter-sections in Hole No.27 represent various components of Hall's Lode		

Hole No.	Footage From	Footage To	Description	Core Length	Grade % Sn.
28.	90'	99'	Lode and chert	9'	0.21
	99'	114'	" " "	15'	1.19
	114'	120'	" " "	6'	0.32
			Av. 90' - 120'	30'	0.72
	231'	241'	Lode and Chert	10'	0.60
29.			No lode intersected		
30.	111'	150'	Lode Included in which were the two following higher grade intersections.	39'	0.80
	111'	120'	Lode	9'	1.22
	132'	150'	Lode	18'	1.03
			The above intersection 111'-150' in Hole No.30 represents the main limb of Hall's Lode - est. true width 30'		
31.	413'	430'	Lode	17'	0.73
			Including 425'-430' component of Hall's	5'	2.35
	506'	527'	Lode	21'	1.25
			Including 506'-521' Hall's main limb	15'	1.69
32.	0'	18'	Lode (Henry's)	18'	1.12
33.	131'	146'	"Anomaly" west component ? Hall's northern extension	15'	0.80
34.	47'	65'	Lode & chert	18'	0.82
			Including 50'-59' "Anomaly east component	9'	1.24
35.	315'	321'	Lode E. Comp. of Hall's	6'	1.27
	328'	346'	Lode W. Comp. of Hall's	18'	2.58
			(400' vert. below outcrop)	true width =10	
36.	16'	37'	Lode	18'	0.66
			of which 22'-34' Hall's Roadwell Section	12'	0.86
37.	180'	232'	Lode & chert Hall's	52' Est.true width 37'	1.23
	334'	352'	Lode Henry's? 400' vertically below outcrop	18'	1.87
38.	180½'	184'	Lode	3½'	0.87
	188'	218'	Lode	30'	1.24
			of which 206'-218' Hall's Est. true width = 25	12'	1.76
	297'	309'	Lode (Henry's-400' depth)	12' Est. true width 9'	1.40

Hole No.	Footage From	Footage To	Description	Length	Grade %Sn.
39	100'	113½'	Lode	13½'	1.60
	187'	191'	"	4'	0.31
	207'	212'	"	5'	2.07
	218'	221½'	"	3½'	4.55
	228'	237'	"	9'	1.87
	244'	259'	"	15'	1.41
	262'	280'	"	18'	4.14
	387'	399'	(Hall's(folded limb)	12'	1.65
40	196'	202'	Lode	6'	0.36
	212'	266'	" (true width 24')	54'	1.55
			including (true width 10') 245' - 266'	21'	2.51
			Western component of Hall's northern extensions 350' vert. depth).		
41	381'	396'	Lode & Chert	15'	Not yet assayed
	398'	400½'	" " "	2½'	"
	401½'	404½'	" " "	3'	"
	411¼'	415'	" " "	3½'	"
	417½'	427'	" " "	9½'	"
	429½'	437'	" " "	7½'	"
			Flexured eastern component of Hall's Lode?		
	602'	609¾'	Lode	7½' truewidth	"
			Possibly Hall's Main Limb (800' below surface outcrop)	7'	"
42	199'	211'	Lode & Chert	12'	Not yet assayed
	239'	250'	" " "	11'	"
43	177'	191'	Lode & Chert	14'	Not yet assayed
	196'	204'	" " "	8'	"
	206'	209'	" " "	3'	"
			Various Components of Hall's Lode		
	305'	312'	Lode	7'	"
			Henry's Lode (depth 400')		

A. A. C. MASON

April. 23. 1963.

APPENDIX 4

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Preliminary Geological Report Mount Cleveland Mine
Waratah District, Tasmania.

Part I K.R. Glasson
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4. Regional Geology
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   - B. Structure
5. Mine Detail
   - A. Grade and Mineralisation
   - B. Battery Lode
   - C. Luck's and Khaki Workings
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Part II T. Hopwood
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X Plans and Figures

Jan 1962

Geological Report on Mount Cleveland Mine

Waratah District, Tasmania.

Part I

1. Introduction. The present investigation of the Mount Cleveland Mine has been undertaken on behalf of Aberfoyle Tin N.L. at the request of Mr. A.A.C. Mason, Manager of the Tin Development Partnership of the above company. A party consisting of Messrs. A.B. Clarke, T. Hopwood, G. Paton and K.R. Glasson carried out the ground investigations from 5th January to 2nd February, 1961. The investigation was confined to detailed underground and surface mapping. This work has been supplemented by detailed structural analysis of the field, together with a petrological study of the rock types, at the Department of Geology at the University of Sydney.

As a result of this work it is believed a new structural interpretation of the field is possible and general features with regard to ore localisation for similar types of deposits can be postulated for other known tin occurrences such as Rennison Bell on the West Coast of Tasmania.

The investigation was made possible and considerably facilitated by the work of Mr. Mason, who collected all available literature and arranged for a visit to Mount Cleveland Mine by Mr. T.D. Hughes, Chief Geologist, Mines Department of Tasmania. In addition he arranged for an access road to be prepared, and all old workings drained.

I would stress the importance of preparing suitable access and making old works accessible by draining adits, etc. Too often this aspect is neglected in exploration, and geologists engaged to re-appraise old mines are initially unfavourably impressed, and spend most of their time trying to gain suitable access and often find it necessary to leave the old workings unmapped.

2. Previous Literature. The records available are drawn upon freely where required. Special acknowledgment is made of Mr. T.D. Hughes' work (1953) and his kindness in making himself available to show us around the area mapped by him, and in discussing his interpretation. Also acknowledged is the geophysical report No. 7, 1954, B.M.R., and the reports of Q.J. Henderson and Prof. S.W. Carey, 1945 (officers of the Tasmanian Mines Department).

3. Method of Attack. After discussion with Mr. Mason and Mr. Hughes, a programme of investigation was drawn up which we felt would be the most profitable to the company.

1. Hughes had carried out a detailed stadia survey of the Mount Cleveland Mine and laid down traverse lines which were subsequently used by the Bureau of Mineral Resources in their geophysical survey. It was decided to adopt Mr. Hughes' pegs and use them as the basis for the survey. However it was discovered that there was a differnce of approximately 5 degrees between magnetic north as established by a large number of compass readings and the magnetic north adopted by Hughes. Hence his azimuth was swung on to a magnetic bearing in keeping with our local readings. The contours established by Hughes were adopted, since they were drawn from a large number of stadia traverses.

2. Initially the investigation was directed into two parties.

(a) Hopwood and Paton carried out traverses by compass, tape and abney along three topographic features. (1) The access road and old tram track; this traverse was in the order of 2½ miles. (11) The old water race east of Deep Creek. (111) Along the bed of Deep Creek. The main object of these traverses was to establish a basis for structural interpretation and position of rock types. The traverses were joined on to Hughes' pegs where possible, but there remained errors which are consistent with this type of traversing. However, along the tram track and within the mine lease these traverses were controlled by later stadia survey. Any error in the traverses would not effect the geological interpretation.

At a later stage Hopwood and Paton assisted in carrying out detail contact traverses between rock types in the mine lease areas.

(b) Clarke and Glasson remapped all the underground workings on a scale of 20 feet = 1 inch (Vide sheets 1, 2 & 3). This mapping was carried our from control points fixed by stadia and using compass and tape in the workings.

A stadia survey was carried out by Glasson and Clarke, and then additional contact compass and tape survey of contacts were carried out in conjunction with the other two party members. At the completion of this work a number of drill sites were laid out. These are discussed under the heading of Future Investigation.

Aerial photographs of the area were available, but because of the scale of these photographs they were not suitable to the investigation but served merely to locate topographic features.

4. Regional Geology

(A) Stratigraphy

The rocks at the Mount Cleveland Mine belong to the Dundas Series of Cambrian Age. We were not able to confirm or deny the age of these rocks but simply use this name for correlation purposes. These rocks occur over a wide area on the West Coast of Tasmania and it is the overall correlation that is important.

The rocks have a wide range in composition, through shales, slates, cherts, tuffs, greywackes, sandstones and lavas. In certain areas they are extensively intruded by later granites, porphyries and gabbros, but within the area mapped no later intrusions were encountered.

Within the Mount Cleveland Mine area we finally adopted three formations.

Basic Volcanics Formation (youngest)
Lode Formation
Micaceous Sandstone Formation (oldest)

The petrological description of these rocks is dealt with in Section II, Part 2 of this report.

The subdivision corresponds broadly with that of Hughes in which his tuffs of the North adit correspond to the Micaceous Sandstone and his lavas correspond to the Basic Volcanics. However, with a clearer understanding of the structure, a better definition of the formation and formation boundaries is possible.

(a) The Micaceous Sandstone horizon contains blue chert bands, and these are seen near the northern workings. In general there is an absence of either fine grained tuffs or shales within this formation.

(b) The Lode Formation. The detailed statigraphy leading to the overall statigraphic sequence was established in the mine workings (Hall's working area). Naturally this involved a search for sedimentary structures which would establish a "way-up" for the sequence, but these structures are few and difficult to establish. However a combination of structure and stratigraphy has led us to believe that the sequence is as follows:

(i) Footwall beds

Fine tuffs with cherty bands, 100' thick)
Micaceous Sandstone, greywacke, 20'thick) general
White cherts/tuffs greywacke, 10'thick) Fine tuff/ greywacke
Small lenses of dolomite material largely intruded.

(ii) Lode beds - Shales. These vary in colour from yellow to chocolate and locally may resemble jaspers. Thickness varies from 5' to 50'.

(iii) Hanging Wall beds. Fine tuffs/white cherts very similar to the footwall rocks but usually without any micaceous sandstone. These beds apparently thin rapidly to the north, and are absent north of the northern workings.

(c) Basic Tuffs/Lavas. The thickness of this formation has not been established. It consists of basic flows and tuffs with a few shale/fine tuff partings. It is best developed in the Deep Creek area.

To the west of the mine and trending more or less parallel to the overall strike of the above sequence is a serpentine/ultrabasic intrusion which was not examined in any detail but probably occupies a major anticlinal position.

The main feature of the stratigraphy is the apparent close association of mineralisation with one particular bed. These lode shales appear to belong to the same "Red Rock" group which are the best for mineralisation at the Mennison Bell Mine. The recognition of a definite stratigraphic sequence, equivalent to the "Red Rock" group is the key to the search for ore in the field. This was not recognised by previous workers in the field, and hence the regional significance was not suspected.

Unfortunately I did not visit the old "Mount Magnet Mine" but I have closely examined the sequence and section described by V.M. Cottle on this deposit, published in

the A.I.M.N. 1953 "Ore Deposits". I believe the sequence there is identical with the lode occurring in the cherts immediately below the basic flows. Regardless of any theory we have on ore genesis, we must adopt a marker bed favourable for mineralisation, if such a bed can be established. This does not preclude the ore occurring at a slightly different stratigraphic position, but it is likely that the bulk of the ore will probably occur in the one horizon. Also it does not preclude in any way ore occurring in sheers and/or favourable structures, but it does limit the mineralisation to the position of intersection of favourable bed and favourable structure for the main "makes".

The question arises as to why the stratigraphic control was not recognised by previous workers. Hughes of course does recognise it, but failed to trace the beds out. I think the main reasons for failure to recognise the favourable beds were as follows:

1. Insufficient mapping was done to obtain a stratigraphic sequence. This is important because many prospects are written off by later investigations without establishing the overall geological control.
2. Generally a classic genetic recurrence is assumed for tin, i.e., it is thought to be localised only in fractures and not controlled by stratigraphy. Thus at the Mount Cleveland Mine all the early prospecting was devoted to following the flat-lying veins in which the tin is closely associated with quartz and pyrite. These veins traverse almost horizontally the field and seldom attain a width of more than a few inches. However since these veins pay no regard to rock type they tend to mask the strong stratigraphic control in the cassiterite pyrrhotite bodies which are the only worthwhile reserves.

The net result of this failure to recognise the favourable horizon precluded an understanding of the importance of the field. Once a stratigraphic control is established the field takes on a completely different aspect. When the lode bed is clearly overlain by basic volcanics, then a non-outcropping ore body is a distinct possibility.

The lack of large gossans must be considered here. Examining the favourable bed to the north, I was inclined to believe the absence of gossan may preclude this section as a possible ore making position. However after examining the Rennison Bell Mine I am convinced the absence of gossan does not detract from the area. At Rennison Bell I saw the "Red Rock" beds outcropping with no sign of gossan, and yet

at depths of 20 feet considerable thickness of lode was intersected in the drilling.

(B) Structures

Mr. Hopwood is preparing a separate section of the report on the structural analysis in the area. However it is necessary to indicate briefly here the major regional structures in order to interpret the lode potential.

We believe the major structure is a syncline with flat plunges, locally steepening and reversing from north-east to south-west. The folding is essentially complicated and obscured by major thrust faults and movement on the cleavage. This structure is entirely different from that of Hughes. We make the major synclinal position along Deep Creek which was the anticlinal position of Hughes.

Thus west of Deep Creek the structure is a west limb syncline plunging towards the south-west. The overall strike follows a north-east direction, approximately the trend of the old tram track. Dips vary from very steep and over-turned towards the west to flatter dips towards the east. The axial cleavage plane is only partially developed in many places but has a strike corresponding to the trend of the major fault in the Hall's workings with an overturning so that the dip is in the order of 75° towards the north-west. In the area east of Deep Creek the plunge reversals are clearly seen in the relationship between the chocolate shales and basic tuff contacts.

Faulting is developed in two main directions, these are the axial plane direction (i.e. north-east)and due north.

The movement on the first type is essentially overthrusting from the west with the eastern side moving down and towards the south-east as shown by slicks on facings.

The movement on the north-south trending fault is probably largely vertical with movement only in the order of 100 feet at the most. Other minor faulting occurs in an east-west direction but this is essentially movement on joints. A flat set of joints/fissures occur throughout the field. These may be either tight with some clay, or open and infilled with late quartz, pyrite and cassiterite mineralisation.

The structures shown on Figures 4 and 5 are factual in relation to dip, strike etc., but these have been interpreted and boundaries are in many cases inferred.

However these figures do indicate the overall structural pattern of the field. It will be noted that the structures, which are mainly largely drag folds have essentially provided the loci for faulting. As mentioned

in the stratigraphy, the ultrabasics to the west of the area are interpreted as being intruded into the major anticlinal position and were related to the thrusting and overturning of the main fold axis. There was probably at the time of emplacement of the plutonic ultrabasics considerable pressure from the west and south-west with the thrusting forming channels for mineralising solution. The flat joints represent a final phase of open sets of tension fissures for late stage mineralisation.

5. Mine Detail

(A) Grade and Mineralisation

The mineralisation has been recognised as belonging to two different types namely (i) the flat dipping joints in which quartz cassiterite and pyrite from the major constituents and (ii) the pyrrhotite cassiterite replacement ore shoots, which follow bedding of a favourable rock type or shears and thrusts parallel to the overturned axial plane.

If one examines critically all the old adits, it is clear that the prospectors followed the type (i) mineral veins, in which the cassiterite was easier to recover and constituted a marker vein. Thus we find the mineralisation extending across bedding, pinching and bifurcating, but always remaining within the adit. The so called northern workings constitute adits following this type of mineralisation. Again it is found on the water race etc. From a company point of view type (i) does not present a target of any consequence but locally veins of this type of ore will transect the main pyrrhotite bodies with the resultant increase in grade. It is quite likely that individually these veins may yield assays in the order of 4% tin, but they have to be discarded in the overall assessment.

The pyrrhotite type mineralisation (ii) has been the main producer in the field and the most comprehensive figures in regard to grade are taken from Q.J. Henderson's statement "The distribution of tin ore in the massive lodes is very irregular and conditions governing the distribution could not be determined". Henderson had the advantage of carrying out his survey concurrent with the exploration programme of the Mount Bischoff Company at Mount Cleveland. This meant that he was in a position to examine critically the values as sampled.

On my visit to Rennison Bell I examined some of the results of their drilling and the values there appear irregular

and sporadic but overall these values will possibly approximate a grade corresponding to that which will be mined. At Mount Cleveland I expect that within the pyrrhotite ore bodies the values will range from between 0.20% tin to 1.5% tin with an average grade approximating 1% tin.

Henderson stated in regard to values: "As much depends upon correct interpretation of assay results it has been thought advisable with permission of the mine manager W.H. Porte, to include a few comparative assays which he had made and the deductions drawn therefrom.

	W.H. Porte		Mines Office Lab. Launceston
	Vanning	Wet Process	Wet Process
1.	0.8	1.25	1.34
6.	0.9	1.30	1.39
8.	1.5	2.4	2.62
9.	0.6	1.2	1.04
Average	0.95	1.55	1.60

"This shows approximately 50% increase in chemical assay over a vanning ore. It is estimated that a good mill will recover 60% of a chemical assay, therefore, an estimated recovery of 90% of a careful vanning assay can be anticipated.

"The assay results given in the text are from vanning assays". I do not propose to list Henderson's figures in detail but the relevant material is extracted for various lodes. The figures shown by Henderson show a range which I have suggested above. Henderson himself in his conclusions noted "the average value of the ore cannot be ascertained without further development and careful sampling -".

I have already discussed with Mr. Mason the possibility of bulk sampling of material stacked from the Hall's, Battery and Luck's lower adits driven by the Mount Bischoff Company. This material is essentially suitable to bulk sampling since it was stacked by the company near the adit portals during the exploration programme. In addition to this sampling the initial diamond drilling campaign will also aim at establishing grade as well as checking detail of structure and stratigraphy.

Thus at this stage it is suggested that the grade of ore may approximate that postulated by Carey, Henderson etc., being in the order of 1% tin in the pyrrhotite bodies.

Samples have been collected for mineragraphic determination and the results of this investigation will form a separate supplementary report at a later date, together with examination of drill core.

(B) Battery Lode.

The Battery Lode has been described by Henderson and other workers in terms of No^{s} 2, 3 and 4 workings. In each case it has been assumed that the "Smithy" and Battery Lodes are separate fissures and hence the lodes are not related to any particular bed. In our interpretation the lodes are considered to be the faulted extension of the Hall's Lode band. We postulated that it is a south-west synclinal drag with the "Smithy" and "Battery" Lodes representing the same bed plunging to the south-west at an angle of 35 degrees. We admit however, that this is only an interpretation, and drilling will be necessary to confirm or refute this interpretation. If the lodes are controlled by fissures and not a favourable horizon, then they should continue as parallel lines of mineralisation which are offset by cross faulting. They will however, plunge in the same direction but lack the potential of flat "makes" near the centre of the drag. Unfortunately we were not able to examine the No.2 workings at depth since the old stopes were full of water. However the No. 3 and No. 4 workings were remapped.

The so called "Smithy" Lode has a strike length of approximately 300 feet and where exposed in the cross cut has widths of up to 12 feet. In the "Battery" Lode the widths are reported to be up to 15 feet. Sample results contained in Henderson's report show that in the drive from No. 3 workings values ranged from 0.93% tin to 0.26% tin over a length of 70 feet. Henderson notes that the Battery Lode was not intersected in the cross cut to the south. On our theory it would not be expected, but on Henderson's interpretation it would have passed beneath on plunge. In order to check this D/D hole No.4 has been designed from the end of the cross cut drilling at a depressed angle of 60° towards the E.S.E. On the longitudinal section it will be seen that the potential of the Battery Lode depends essentially on the plunge to the south-east being maintained. We did not follow this on the surface and future work here will be undertaken during the drilling.

Carey indicated probable reserves in the order of 10,000 tons for the combined "Smithy" and "Battery" Lode. Hughes in his report thought the ore would continue in depth and was most impressed with the lodes. We place a possible 300 tons per vertical foot to the ore body, but rate the deposit much

lower than the potential of Hall's workings. Hughes also indicated that the samples taken by Reid showing values above 1.5% tin for the Battery Lode might be significant.

Thus to sum up we postulate that the "Smithy" and "Battery" Lodes are replacement of the ore bed in a synclinal drag plunging to the south-west. We accept a probable value of 1.0% tin having a potential of 300 tons per vertical foot.

(C) Luck's and Khaki Workings.

These two workings are grouped together because we feel that Luck's is the faulted continuation of the Khaki workings. We mapped the main Khaki workings but were unable to examine the drive which connected the workings since it had collapsed. We agree with Carey that the lode is essentially in a synclinal position but disagree with the interpretation of two lode horizons. We believe the Khaki lode is merely the faulted portion of the shale to the west of the main fault on the western edge of the Luck's main slope. The beds have been extensively faulted and dragged. The real potential here would lie in the possibility of a large make of ore associated with extensive crushing near the fault with mineralisation transgressing bedding and filling fractures. Two drill holes, Nos 5 and 6, have been designed to check this possibility but they have a lower priority than those at Hall's workings. Carey indicated a probable reserve of 80,000 tons for Luck's workings but this figure seems high and without further drilling we do not propose to give reserves for these workings. Henderson noted that in the lower adit driven by Mount Bischoff the value of the ore was only 0.36% tin over a distance of 35 feet. He indicated the width of the ore was in the order of 24 feet but no strike length was established. A figure of 200 tons per vertical foot would seem reasonable but the depth extension is problematical.

(D) Hall's Workings.

The Hall's Cut represents the lode bed in a flat plunging position caught up in a tight, slightly overturned, anticline and syncline associated with a major thrust. Where the lode occupies this position, due to thickening by folding, it has widths (including gangue etc.) of up to 50 feet. However in the non folded position this bed is probably in the order of 8 feet to 10 feet wide.

The Mount Bischoff Company drove an adit below the open cut and followed the lode for approximately 75 feet towards the south. Henderson gave a figure of 0.65% tin for this drive with a width of 17 feet. Since neither Henderson nor Mount Bischoff personnel recognised the folded nature of the ore it is problematical whether the true hanging wall was reached.

Our mapping merely indicated that chert was present on both sides of the lode but this could mean further mineralisation extends to the west.

Henderson indicated that the length of the lode was approximately 400 feet but we believe the potential length of the lode extends from 1500N to 2100N along a north-east strike distance of 700 feet. Carey indicated that he believed Hall's workings to be separate from all other workings, but we disagree with this interpretation. We postulate that Hall's Lode is the continuation of Henry's Lode but in a flatter plunging position and that the attenuated continuation to the south-west is Battery Lode. One of us, Hopwood, is of the opinion that the wide section of Hall's Lode probably has a vertical extent of only 200-300 feet but this does not preclude remakes of the wide section along plunge and at depth. It is indeed very likely that a series of folded wide section will continue at or remake at depth.

Carey indicates that the probable reserves of Hall's workings are in the order of 100,000 tons. We believe that the figure is low, and would place probable reserves in the order of 300,000 tons for this section. Hall's workings are overlain by the basic volcanics and hence continuation at depth is clearly indicated on a stratigraphic basis. The drilling initially proposed in holes 7, 8 and 9 are merely to test the values and approximate widths below the old open cut.

The programme here is entirely preliminary and a second phase of drilling will be recommended regardless of the results of the first phase of drilling.

(E) Henry's Workings.

As shown on Sheet 3, Henry's workings consist of a large open cut together with three adits of which two at least were entirely exploratory. In the open cut the close folding of the ore horizon can be seen in which at least three anticlines and three corresponding synclines are shown on the plan. The exposed strike length is in the order of 150 feet and the individual width of the lode beds may be narrow and the apparent width is due to tight folding. In the top adit the lode swings to a strike of 130° with steep dips. In the lower adit driven by the Mount Bischoff Company the lode is narrow and for a good distance is probably following a lode of strike almost parallel but outside the adit. It would seem from Hopwood's structural study that the overall plunge for this section may be towards the north-west at an angle of 70°. This means that the favourable bed as it leaves the shear north of Hall's workings becomes engaged in a tight cross-fold so that the overall structure is an attenuated syncline. The northern

adit passed beneath the lode on plunge, lying within the footwall rocks. Hopwood is of the opinion that the structure at Henry's workings belonging to the steep plunge type may continue for a depth of 400 feet. I have formed the opinion that the lode here might prove very difficult to follow and will thicken and thin rapidly. Carey was of the opinion that the lode was confined to a tough-like syncline with no real depths. He indicated reserves of only 7,000 tons but this precludes any concept of the ore making at depth.

At this stage we have laid out two drill holes, Nos 10 and 11. The first will be to test the position of the Henry's workings to the south of the No. 2 Cross Cut. The second hole is designed to test the area to the east of Henry's workings and below the tram track. This position of the lode is discussed more fully in the next section.

6. Additional Prospects

Prospects not included in Section (5) fall into three distinct groups as follows:

(a) The "Northern Workings"
These workings occur below the tram track and comprise two adits and a number of smaller pits. These are the workings referred to by Hughes and which induced him to carry the geophysical survey further to the north-east. Unfortunately these workings lie entirely in the micaceous sandstone formation and as such have no potential. Mineralisation is restricted to the flat dipping veins of quartz, pyrite and cassiterite without potential.

(b) North-east of Henry's workings and below the tram track is an extensive development of the lode horizon which has a strike length in the order of 500 feet. It is faulted at the northern end and clearly overlain by basic tuffs. It was indicated in the self potential survey by the Bureau of Mineral Resources on traverse lines O, P, Q, R, S, and again on the magnetic profiles. At this stage diamond drill hole No. 11 has been sited to test the southern extension of this lode, but this is merely a preliminary hole. However, it should be realised that the possibility of extensive lode development in this area is anticipated.

(c) On Figure 5 from co-ordinates 4,000N + 5,800E the position of the lode horizon has been interpreted. Here the investigation was mainly for structural

features and it was not until near the completion of the investigation that the significance of this section became apparent. It is necessary that additional mapping be carried out here before any recommendations concerning drilling are made. However, the development of jasper etc. and the structural position does seem to warrant further investigations. It is apparent after visiting the Rennison Bell area that exploration must be continued with the object of more closely defining potential lode.

7. Geophysical Investigation.

No geophysical work was carried out during our mapping programme but previous work carried out by the Bureau of Mineral Resources should be reviewed at this stage.

During the visit to Rennison Bell, the resident geologist, Mr. Gilfillan, indicated that the geophysical work carried out there was of little importance. He believed that although the orebodies contain a large pyrrhotite content and hence are magnetic, due to their flat lying nature, the anomalies were not significant. At that stage I agree with him in general principle but considering the Mount Cleveland Mine area more closely, I find there is a close relationship between geophysical anomalies and the geophysical interpretation. This is probably due to the fact that the orebodies at Mount Cleveland have a much steeper dip.

In the self potential map (Plate 3, B.M.R. Report) the results are even more conclusive. Between traverse lines T and BN no anomalies are recorded and this fits very closely into our interpretation of footwall micaceous sandstone formation. It is a pity that traverses had not been extended a few hundred feet further north where the lode horizon reappears. It would seem that a series of short traverses across the tram line north-east of co-ordinates 4000N + 6000E might be useful in defining the sulphide mineralisation.

8. Conclusions.

1. The stratigraphic control of mineralisation at Mount Cleveland Mine seems to be conclusive.
2. A definite stratigraphic sequence has been postulated consisting of three formations of which one, the lode formation, has distinctive rocks which closely resembles the Rennison Bell lode formation.
3. Areas of mineralisation extend significant distances beyond the known workings and these require further detailed mapping.

4. Of the existing workings, the Hall's workings are the most promising.
5. There is reasonable agreement with earlier geophysical results and the present geophysical interpretation.
6. The structural interpretation indicates that the overall structure is synclinal, but there are numerous plunge reversals.
7. Faulting in two main directions has been established.
8. The grade of ore and the pyrrhotite bodies has not been fully established and additional work is required before a grade can be adopted. It is postulated that a grade in the order of 1% tin is likely. At this stage reserves remain unproved, but it is anticipated that reserves could be in the order of 500,000 tons down to the Deep Creek elevation.
9. It is concluded that further investigations are warranted and these should take the form of diamond drilling from existing adits, plus further surface mining. If it is possible some self potential geophysical work should be undertaken to the North of co-ordinates 4000N and 6000E after the proposed mapping programme is completed.
10. Careful consideration should be given to following the lode horizon towards the old Mount Magnet Mine.

9. <u>Recommendations</u>.

1. The programme of diamond drilling from the adits should be carried out. The priority of drilling would place holes from Hall's adit first, but this will depend on availability of water, etc.
2. Concurrent with the drilling, Mr. Clarke should be carrying out additional surface mapping to define the lode position to the North. As well as that Mr. Clarke should be present to examine the drill cores and control the target depths of the holes in the early stages.
3. Sampling of the dumps at adits driven by Mount Bischoff exploration should be undertaken.
4. The present drilling programme should be regarded as preliminary. A further programme to be submitted after this drilling should be foreseen.
5. If possible some self-potential survey should be undertaken after the proposed mapping programme is completed.

Proposed Drilling Schedule Mount Cleveland Mine

Working	Hole No.	Collar Position	Azimuth	Elevation	Target Depth
Battery	1.	110' from peg at Lower adit	120°	60° dep.	130'
"	2.	30' from peg at Lower adit	270°	20° dep.	80'
"	3.	30' from peg at Lower adit	330°	20° dep.	90'
"	4.	30' from peg at Lower adit	280°	45° dep.	100'
Luck's	5.	70' from peg at Lower adit	parallel to drive	45° dep.	120'
"	6.	70' from peg at Lower adit	45° west of centre line	30° dep.	150'
Hall's	7.	23' from peg at Lower adit	parallel to centre line	45° dep.	100'
"	8.	23' from peg at Lower adit	45° west of centre line	45° dep.	120'
"	9.	23' from peg at Lower adit	45° east of centre line	45° dep.	120'
Henry's	10.	40' from peg at Lower adit	30° west of centre line towards open cut	45° dep.	150'
"	11.	33' from peg at Lower adit	30° east of centre line towards tram track	45° dep.	150'
Total					1,300' approx.

Part II

1. Structural Review

The structure of the area, both major and minor has been controlled by two overlapping phases of deformation - the first, a regional folding about horizontal north-east - south-west axes (F_1), the second, a rather more complex folding, producing second phase fold axes (F_2) of variable orientation on the crests and limbs of F_1 folds.

The first phase of folding has produced the major structure, essentially an assymetrical syncline with its axis in Deep Creek; its south-eastern limb has been greatly shortened by the occurrence of a small anticline immediately south-east of the water race. The whole mine area lies within the north-western limb of this major structure which dips moderately to the south-east.

The second phase of folding is of a style described in the literature as "polyclinal". This term means that the axial planes of the fold system are not parallel. These axial planes may fan about or statistically intersect in a common axis, or they may not, as is the case at Mount Cleveland. As can be seen in Fig. 2, D2 (stereo) the axial planes tend to fan about two axes B_2 and B_2^1 for the 100' = 1" map area. From the data measured, it is possible to predict statistically where most axes should lie. Fig. 2, D2, shows that $\overline{11}S$ (poles to bedding) lie in a great arc, the normal which is the regional fold axis (F_1). Most bedding lies between the two great arcs defining the shaded area of the synoptic diagram Fig. 2, D4. Axial planes of the polyclinal fold system fan about axes B_2 and B_2^1 and F_2 fold axes should lie in the shaded area of Fig.2, D_4. Maximal F_2 should lie at the intersection of the commonest axial plane with the bedding area, as has been shown in the synoptic diagram. As can be seen, the predicted distribution for F_2 folds is close to the measured distribution.

Assuming that the stratigraphy is correct, and that cylindroidal fields (subareas with statistically straight axes) are reliable, the block diagram was prepared as shown in Fig.3. This diagram is an interpretation of the most probable structure of the area, and is meant only to convey an overall picture of the style of folding and the variation of fold axes within the area. The second block diagram

Fig. 4 is essentially to show the detail of the variation of the polyclinal fold axes, and faulting within the area is believed to be associated with this phase of folding. The mineralisation also is circumstantially associated with this folding. From the stereo Fig.2, D2. it can be said that more than 25% of the polyclinal fold axes plunge approximately 30% to the south-west. Statistically straight axes areas (cylindrical fields) are only small though; e.g. shallow axis areas are only within the order of 200' - 300' measured linearly. Vertical axis areas are larger in size, up to approximately 300' - 400'. Moving East from the mine area these sub-areas are much larger and are cylindroidal for up to 1,200' linearly. Thus there is a general simplification of the structure to the north-west, although both phases of folding are still present.

In summary, the regional structure is a syncline with a variable axial plunge. Superposed on t is is a polyclinal fold system which produces folds of all orientations, but restricted to the limbs and crest of the first phase structure - 25% of these folds plunge 30% approximately to the south-west. Faulting and mineralisation appear to have been associated with this second phase of folding. The metamorphosis of this area is slight and the deformation is indicative of only shallow burial.

Note on Stratigraphic Surface Diagrams.

These diagrams are constructed from the following data:

(1) Outcrop Pattern
(2) Distribution of cylindroidal subareas
(3) A knowledge of the style and characteristics of the folds in question.

The smaller block diagram is the more accurate and it only tries to portray the nature of interference of the polyclinal folding, within the limb of the major syncline. Plunges are accurate. Characteristics to be noted are (1) the dying out of horizontal axes and their regeneration (2) the persistence in modified form, of the vertical axis areas, and its faulting, and (3) the cross folded inhomogeneous areas. The larger diagram is based on a greater amount of inference and is quite correct in a general fashion, and the position of the smaller diagram on the north-west limb of the syncline with the vertical F_2 fold can be readily seen. Closed outcrop patterns and fold nose reversals are indicated by the bending of F_2 phase axes, which is the only legitimate way in which they may be interpreted. The arrows on the faults represent directions of movement as shown by slickensides.

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND, TAS.

COMPOSITE PLAN OF SURFACE & UNDERGROUND WORKINGS

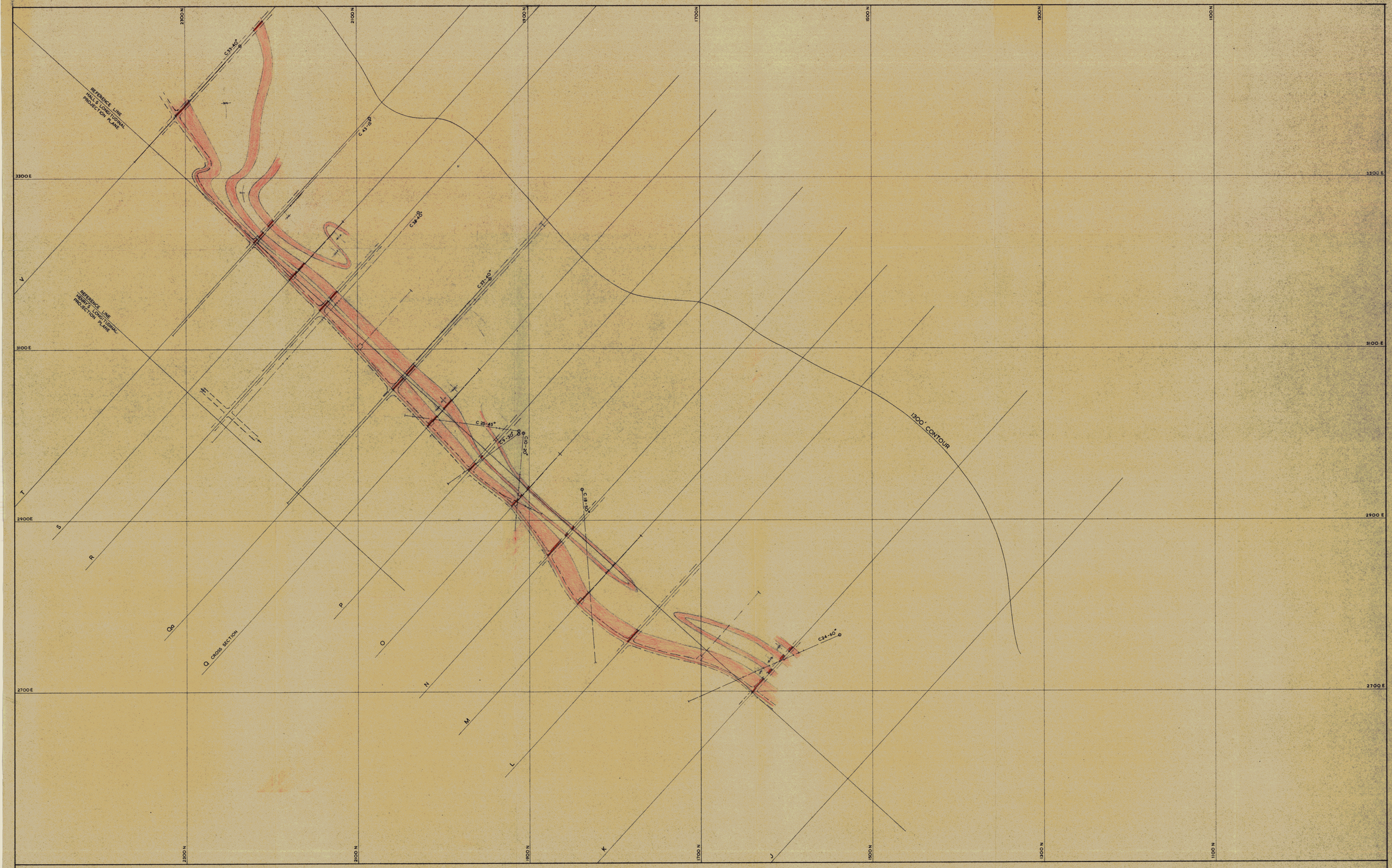
Scale of feet: 40 20 0 40 80

Date: 7·12·62

5 cm

277619

N°1 4700



40 0 40 80
SCALE OF FEET

5 cm

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND, TAS

HORIZON PLAN 1300'

SHOWING PROPOSED EXPLORATORY DEVELOPMENT

277050

Nº 2 5-7-63 4701

RL.1600

RL.1400

RL.1200

RL.1000

RL.800

HALL'S LODE

REFERENCE LINE

HALL'S LONG PROJECTION PLANE

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND TAS.

CROSS SECTION .K.

LOOKING CONVENTIONAL NORTH

40 0 40 80

SCALE OF FEET

5 cm

277051

4702

N°3K

600

RL 1600

00

RL 1400

RL 1200

RL 1200

RL 1000

RL 1000

RL 800

RL 800

REFERENCE LINE
HALL'S LONG. PROJECTION PLANE

40 0 40 80
SCALE OF FEET

5 cm

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND TAS.

CROSS SECTION L.

LOOKING CONVENTIONAL NORTH

277652

4703

63-362 No 3 L

RL.1600

RL.1400

RL.1200

RL.1000

RL. 800

HALL'S LODE

C.H.

C.I.B.

REFERENCE LINE
HALL'S LONG PROJECTION PLANE

40 0 40 80
SCALE OF FEET

5 cm

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

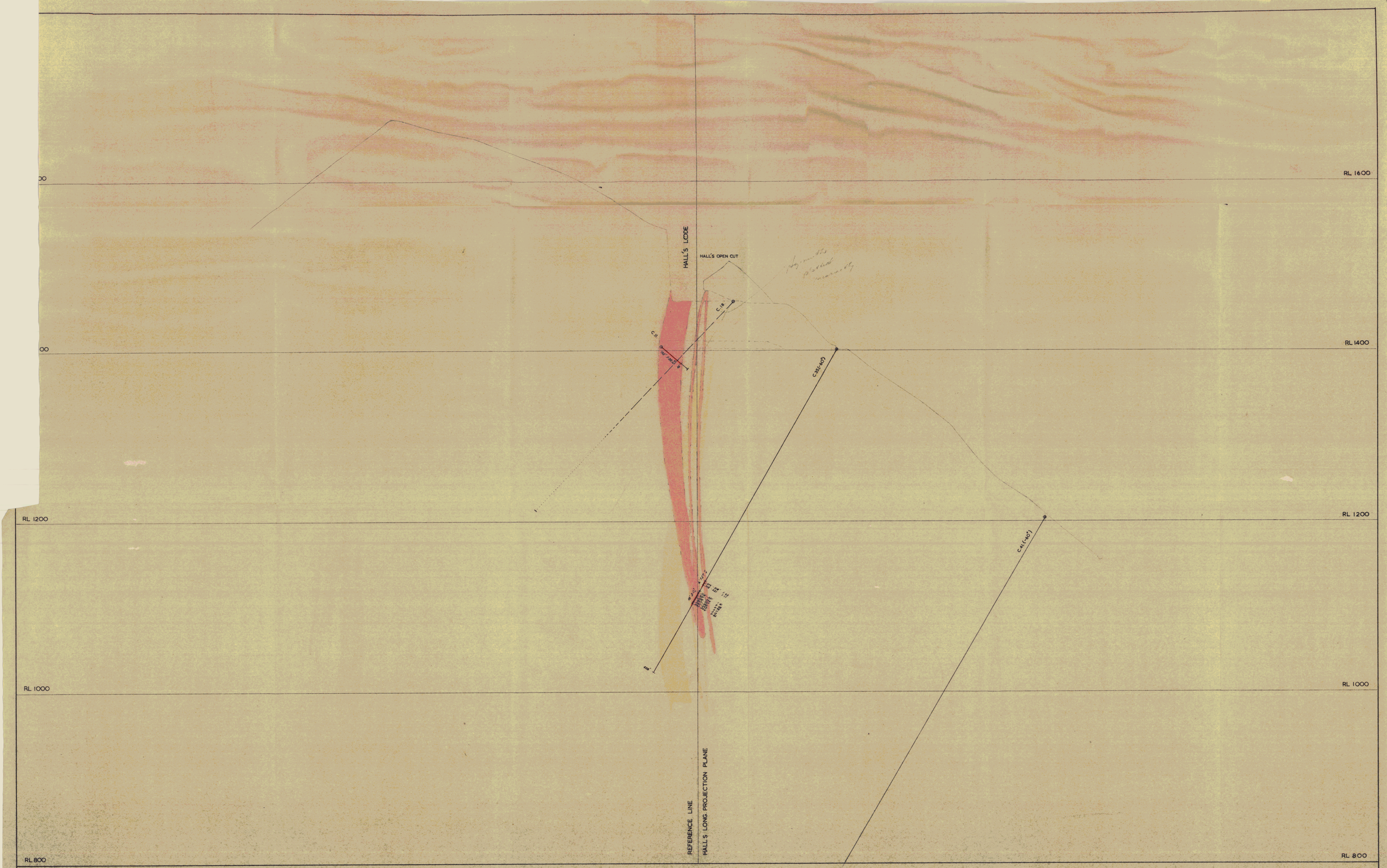
MOUNT CLEVELAND TAS.

CROSS SECTION .M.

LOOKING CONVENTIONAL NORTH

272053

N° 3 M 4704



ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

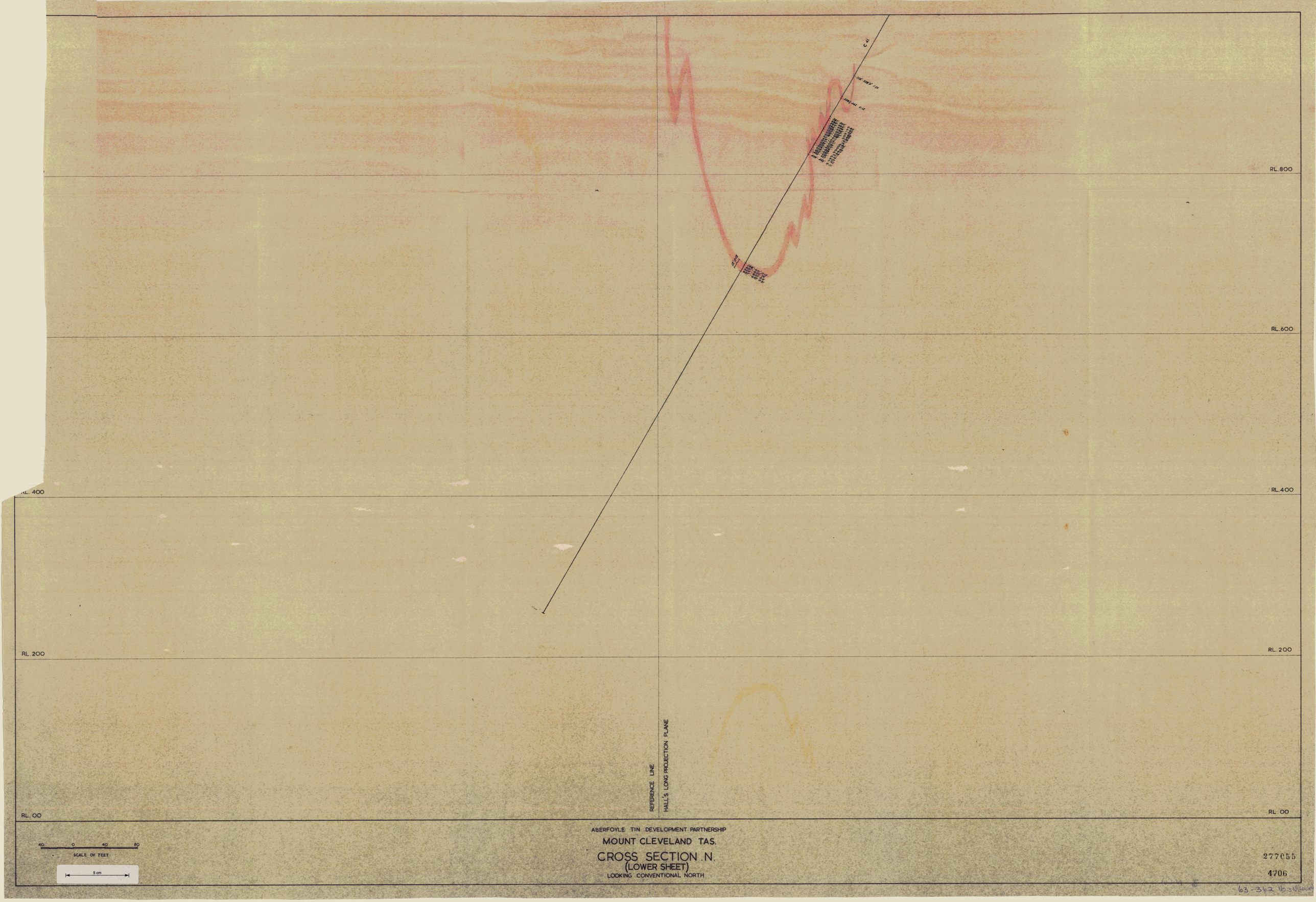
MOUNT CLEVELAND TAS.

CROSS SECTION .N.

LOOKING CONVENTIONAL NORTH

277054

N°3N 4705



ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

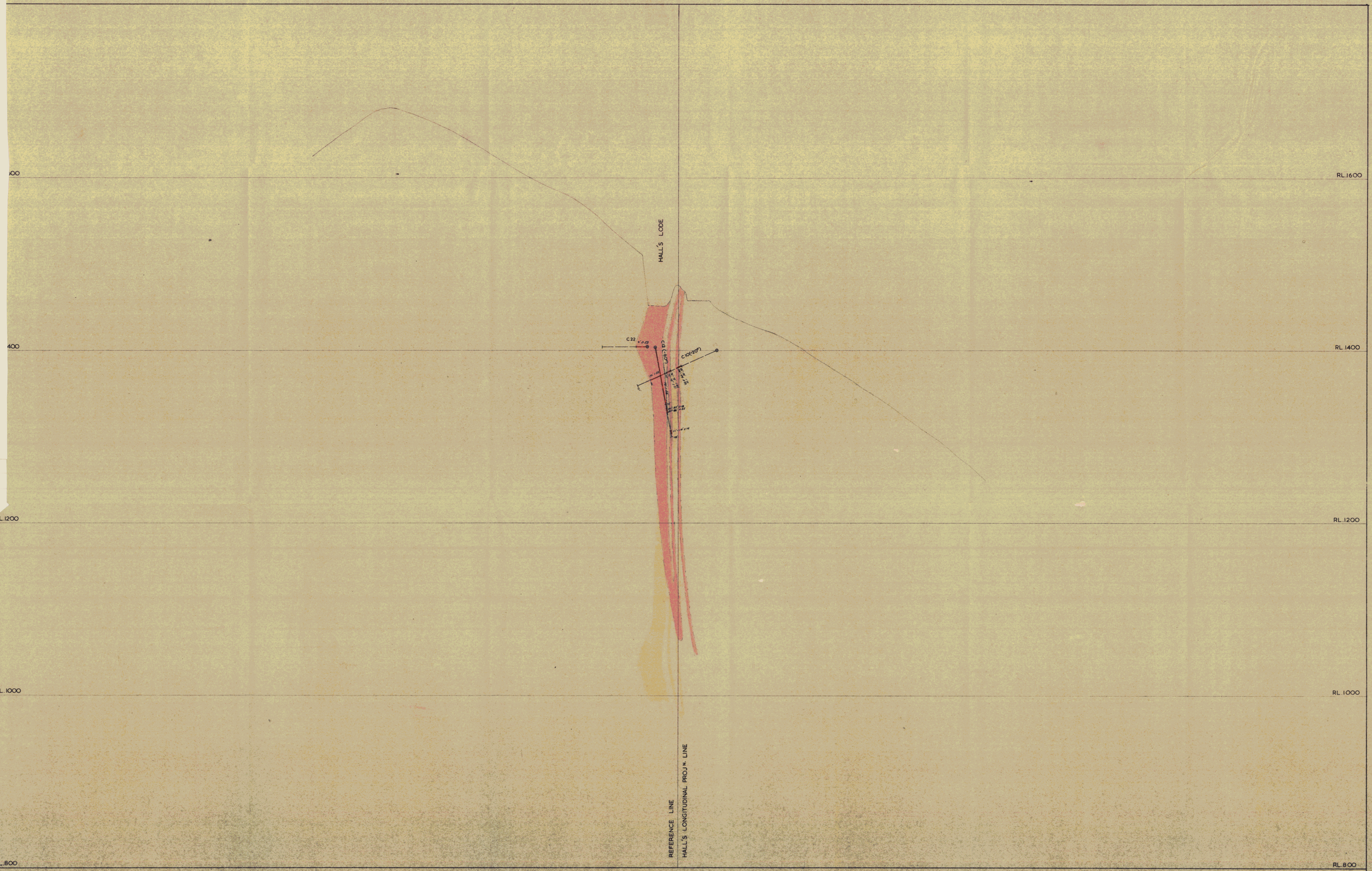
MOUNT CLEVELAND TAS.

CROSS SECTION .N.
(LOWER SHEET)
LOOKING CONVENTIONAL NORTH

277055

4706

63-362 No 3 N(Lower)



40 0 40 80
SCALE OF FEET

5 cm

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND TAS.

CROSS SECTION O.

LOOKING CONVENTIONAL NORTH

277056

N° 30 4707

1600

RL 1600

HALL'S LODE

HALL'S OPEN CUT

C.19

HALL'S UPPER ADIT

C.21

400

HALL'S LOWER ADIT

RL 1400

C.23

C.25

RL 1200

RL 1200

RL 1000

RL 1000

REFERENCE LINE

HALL'S LONG PROJECTION PLANE

RL 800

RL 800

40 0 40 80

SCALE OF FEET

5 cm

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND TAS.

CROSS SECTION . P.

LOOKING CONVENTIONAL NORTH

277657

4708

RL 1600

HALL'S LODE
HALL'S OPEN CUT

ACCESS ROAD (OLD TRAM)
HALL'S OPEN CUT

RL 1400

RL 1200

RL 1000

REFERENCE LINE
HALL'S LONG PROJECTION LINE

Scale of feet
40 20 0 40 80

Date: 3-12-62

5 cm

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND

CROSS SECTION 'Q'

(LOOKING CONVENTIONAL NORTH)

277058

N° 3Q 4709

600

RL. 1600

400

RL. 1400

1200

RL. 1200

RL. 1000

RL. 1000

RL. 800

RL. 800

HALL'S LODE

C-36 (-45°)

C-37 (-45°)

C-39 (-45°)

I wonder what the basin of these folding would be?

REFERENCE LINE

HALL'S LONG. PROJECTION PLANE

40 0 40 80

SCALE OF FEET

5 cm

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND TAS.

CROSS SECTION .Qa.

LOOKING CONVENTIONAL NORTH

277659

4710

N° 3 Qa

HENRY'S LODE

HALL'S LODE

RL.1600

RL.1400

RL.1200

RL.1000

RL.800

C16 -65°

C20 -65°

C14 -30°

C17 -45°

C28 -30°

C38 -40°

HENRY'S LONG PROJECTION PLANE

REFERENCE LINE

HALL'S LONG PROJECTION PLANE

40 0 40 80

SCALE OF FEET

5 cm

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND TAS.

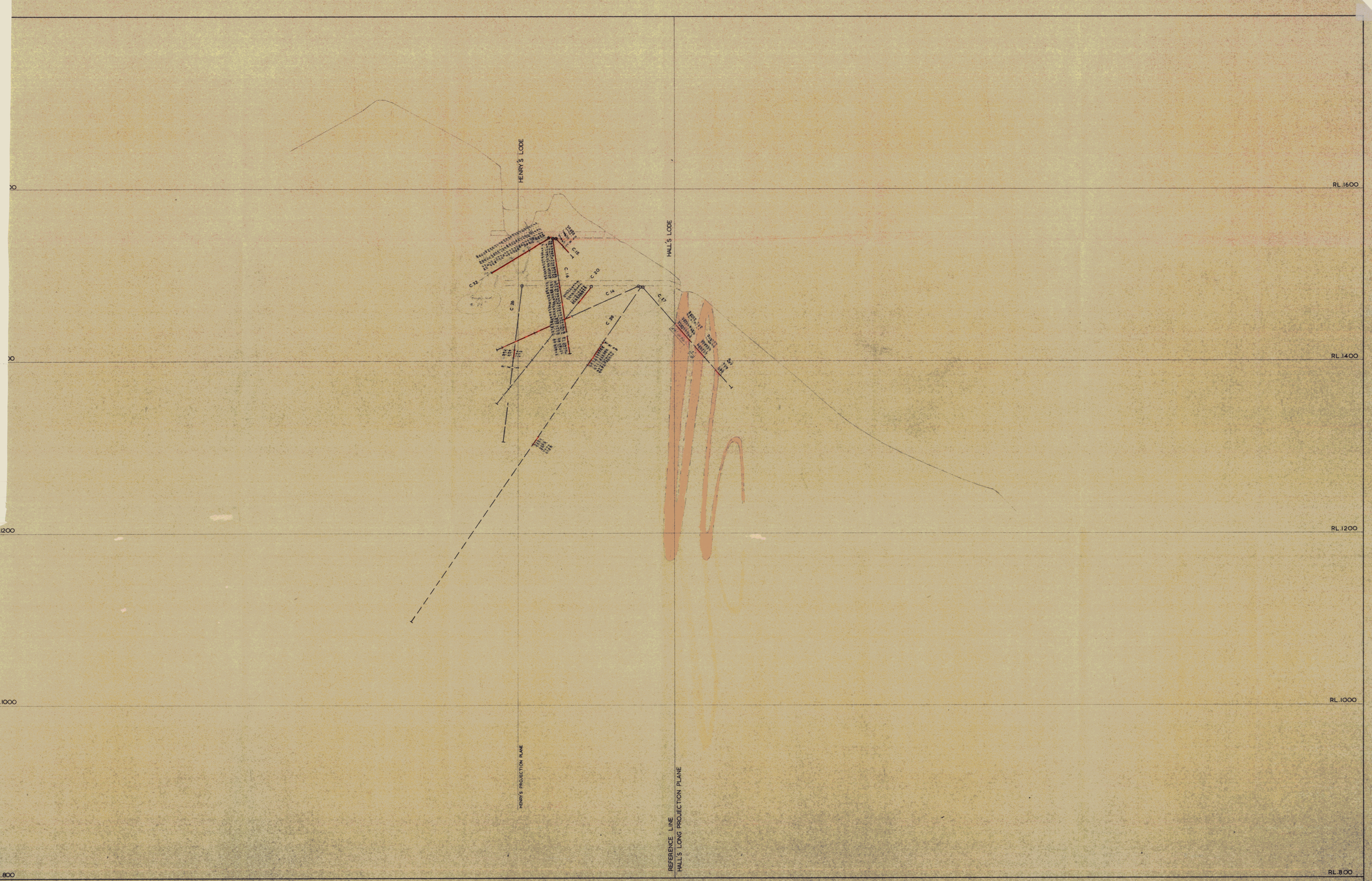
CROSS SECTION R.

LOOKING CONVENTIONAL NORTH

277660

4711

N° 3R



40 0 40 80
SCALE OF FEET

5 cm

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND TAS.

CROSS SECTION .S.

LOOKING CONVENTIONAL NORTH

277061

4712

63 362 No25

HENRY'S OPENCUT

HALL'S LODE

HENRY'S LOWER ADIT

C 13-45°

C 43-15°

C 42-45°

RL 1600

RL 1400

RL 1200

RL 1000

RL 800

REFERENCE LINE

HALL'S LONG PROJECTION PLANE

40 0 40 80
SCALE OF FEET

5 cm

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND TAS.

CROSS SECTION . T.

LOOKING CONVENTIONAL NORTH

277662

N° 3 T. 4713

RL 1600'

RL 1400'

RL 1200'

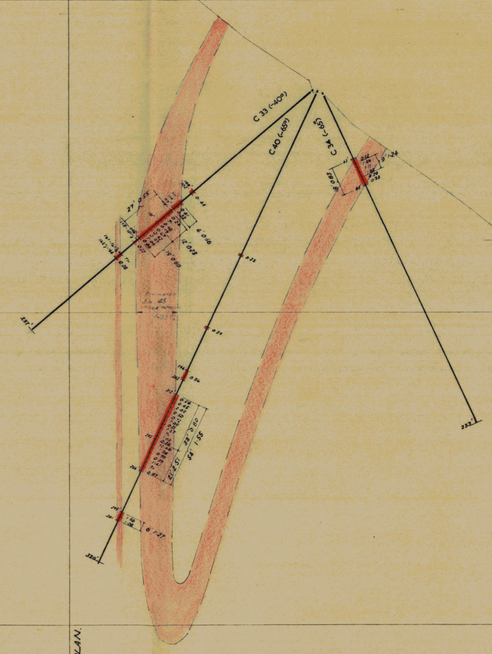
RL 1000'

R.L. 800'

BENCH MARK ON ROAD RL 1487.5'

CREEK LEVEL (APPROX)

REFERENCE LINE
HALL'S LONGITUDINAL PROJECTION PLAN.



40 0 40 80
SCALE OF FEET

5 cm

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND TAS.

CROSS SECTION .V.

LOOKING CONVENTIONAL NORTH

277063

4714

JKC 22.2.61

N° 3.V.

CONVENTIONAL SOUTH

CONVENTIONAL NORTH

RL 1600

RL 1400

RL 1200

RL 1000

RL 800

HALL'S OPEN CUT

C19 HALL'S UPPER ADIT

HALL'S LOWER ADIT

HENRY'S LOWER ADIT

ROAD

ROAD

ROAD WELL

CROSS SECTION K.

L.

M.

N.

O.

P.

Q.

Qa.

R.

S.

T.

U.

CROSS SECTION V

40 0 40 80
SCALE OF FEET

5 cm

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

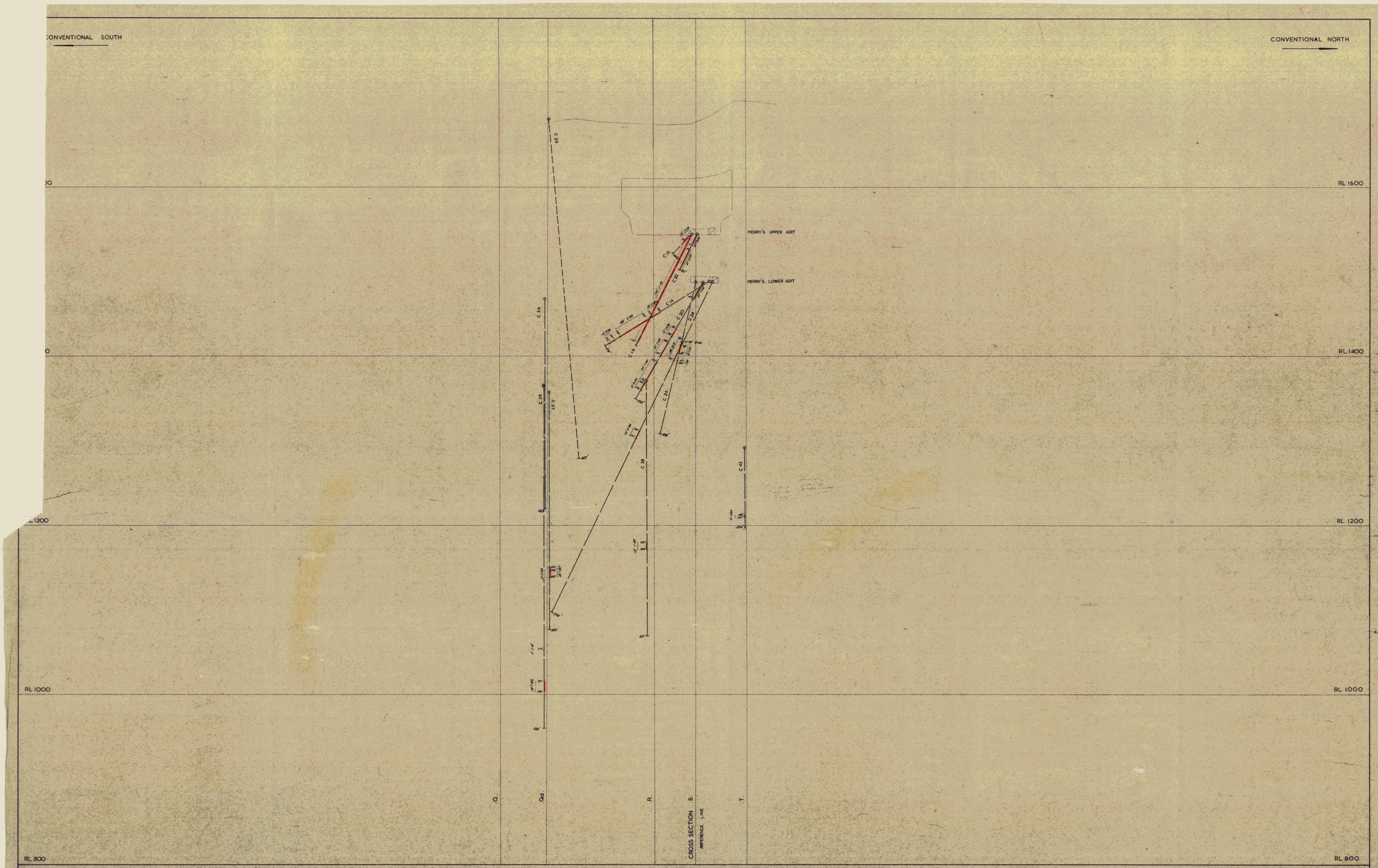
MOUNT CLEVELAND TAS.

LONGITUDINAL PROJECTION
HALL'S LODE

LOOKING CONVENTIONAL WEST

277064

N° 9a 4715



ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND TAS.

LONGITUDINAL PROJECTION
HENRY'S LODE

LOOKING CONVENTIONAL WEST

277065

Nº 4b 4716

AREA COVERED BY GEOPHYSICAL SURVEY BUREAU OF MINERAL RESOURCES 1963/3

CREEK

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

MOUNT CLEVELAND TAS.

GEOLOGICAL FACT PLAN.

N° 1 NORTH SHEET.

100 0 100 200
SCALE OF FEET.

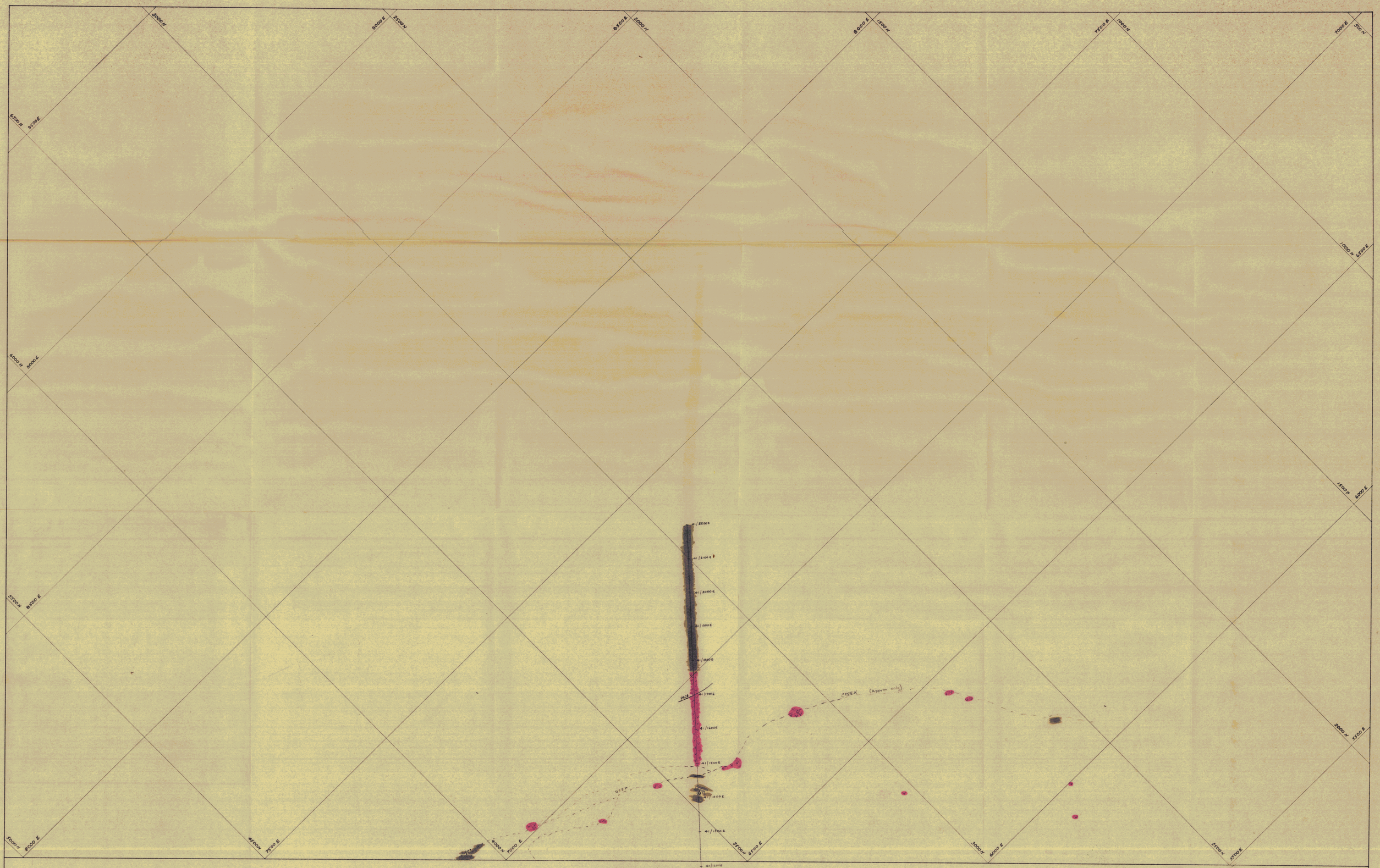
5 cm

N° 1 N°-N° 1 E	N° 1 E.
N° 1 N°	CENTRAL

SHALE	Chocolate, Grey
SANDSTONE	Feldpathic, Micaceous
VOLCANICS	
CHERT	

277066

N° 5a 4717



100 0 100 200
SCALE OF FEET

5 cm

ABERFOYLE TIN DEVELOPMENT PARTNERSHIP.

MOUNT CLEVELAND TAS.

GEOLOGICAL FACT PLAN.

Nº 1 NORTH - Nº 1 EAST SHEET.

Nº 1 Nº - Nº 1 E	Nº 1 E
Nº 1 Nº	CENTRAL

SHALE — 'Chocolate', Grey.

SANDSTONE — Felspathic, Micaceous.

VOLCANICS.

CHERT.

277067

4718

Nº 5b