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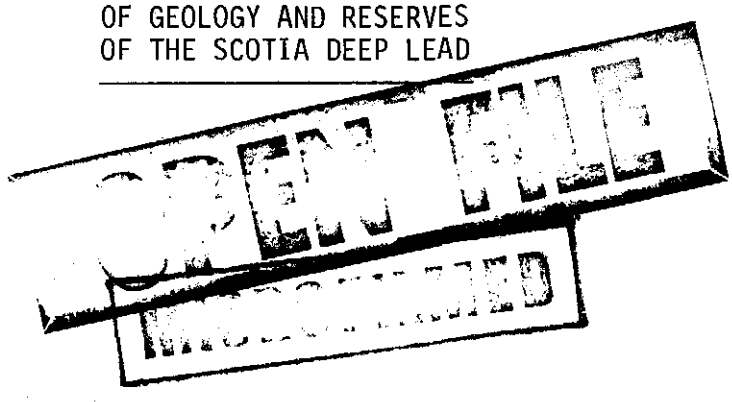
REPORT ON AN ASSESSMENT OF GEOLOGY AND RESERVES OF THE SCOTIA DEEP LEAD



by C.R. Gibson
December, 1976

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Appendix I - ASSESSMENT OF S.C.M.C. TESTING OF BLOCK 3

INTRODUCTION

The object of the study was to analyse the possibility of economically mining the tin from the Scotia deep lead. In order to do so it was necessary to :

1. re-calculate the total number of tons cassiterite contained in the deep lead,

2. to delineate the distribution of the cassiterite, and

3. to establish the ratio of overburden to ore.

A further important consideration was the Geology of the overburden and particularly its clay content. The results and reports on several drilling programmes conducted on the Scotia Lead were made available by the Mines Department. The most comprehensive drilling programmes have been conducted in the area by the Mines Department. Although some of the Mines Department results have been at variance with private company testing the comparisons have been consistent in suggesting that the Mines Department drilling is reliable.

ORE CALCULATIONS

The approach was to redraw dredge paths and sections across them and to calculate the tin in the basal wash.

A series of 72 sections covering the various runs of ore were drawn and the dredge paths outlined in the plan showing the drill hole locations.

A report on the drilling conducted by Storey Creeks Tin Mining Company (S.C.T.M.C.) during the first half of 1965 was made available to us and their results, particularly those pertaining to "Ore Block 3", were re-appraised, as their conclusions appeared to be negative. In summary they reported lower values than those obtained by the Government programme. Their "lower" results are treated in more detail in the text of this report.

ORE RESERVES (see plan of drill hole locations, orebody and dredge path outlines)

The ore reserves are based on the Mines Department drilling results. Blocks 1, 2, 3, 4 etc. in parenthesis refer to the ore areas used in the Mines Department reports.

SUMMARY OF RESERVES

Measured Ore Runs (drilling density fairly high)

Ore Run	Overburden (cu yds)	Ore Wash (cu yds)	Grade ozs/cu yd	Tons SnO_2	Ore to Overburden Ratio
I. Southern Run Sections A-V (Block I)	2,079,725.0	298,840	47.84	398.9	1:6.96
II. Link Area (Block 3 plus some overlap Block 4) Sections LA1-LA14	2,462,998.0	275,347	52.47	403.10	1:8.95
III. Northern Run (Block 4) Sections N1-N25 and I-XIII	3,630,122.0	713,664	23.49	467.83	1:5.09
	8,172,845.0	1,287,851	35.34	1,269.87	1:6.35

Possible Ore (very limited drilling in these areas)

Ore Run		Overburden (cu yds)	Ore (Wash) (cu yds)	Grade ozs/cu yd	Tons SnO_2	Ore to Overburden Ratio
IV.	Run connecting I & II above (Block 2)	1,701,678.0	135,850	31.74	120.31	1:12.53
V.	Run to North of III above (Blocks 5 & 6) 80 chains long	3,400,000.0	270,000	20.0	150.00	1:12.59
VI.	Eastern Tributary to old Lochaber workings	410,742.0	45,041	26.54	33.35	1:9.12
VII.	Dredge path connecting Main Run & Eastern Tributary	365,212.0	22,360	74.53	46.50	1:16.33
		5,877,632.0	473,251	26.52	350.16	1:12.42
(VI and VII combined		775,954.0	67,401	42.45	79.85	1:11.51
Total		14,050,447.0	1,761,102	32.96	1,620.03	1: 7.98

COMPARISON OF ORE RESERVES GIVEN IN THE MINES DEPARTMENT REPORTS WITH RESERVES CALCULATED BY B.M.I., STOREYS CREEK AND KIBUKA MINES

Overall Reserves

	This Report (Kibuka)	B.M.I. Report	Storeys Creek Report	Tas. Mines Department Report
Overburden (cu yds)	14,050,477	23,542,126	9,231,700)	4,383,203
Ore (cu yds)	1,761,102	1,448,424	1,571,738)	
Grade ozs/ cu yd	32.96	Valuation not attempted	32.8	7.78
SnO_2 (tons)	1,620.03		1,439.0	951.63
Ore to overburden ratio	1:7.98	1:16.25	1:5.87	NA
Batter slope used	45°	30°	60°	90°

COMPARISON OF RESERVES BY ORE BLOCK AREAS (as first used and designated by the Tasmanian Government in their calculation of reserves)

The comparison is not exact as slightly different areas along the deep lead were used.

	This Report (Kibuka) Combined Ore & Overburden Sn oz	B.M.I. Report Combined Ore & Overburden	Storeys Creek Report Combined Ore & Overburden SnO_2	Tas. Mines Department Report
Block 1	2,378,565 (399 tons)	3,223,429	497,417 (58)	315,000 (62)
" 2	1,837,528 (120.31 ")	4,329,429	1,761,078 (265)	580,000 (118)
" 3	2,738,345 (403 ")	4,348,446	2,415,187 (582)	1,380,000 (346.3)
" 4	4,343,786 (468 ")	5,150,079	619,630 (32)	260,000 (76)
" 5)	3,670,000 (150 ")	7,839,167	2,142,460 (298)	1,260,000 (235)
" 6)			1,920,540 (204)	585,000 (113)
Total	14,968,224 (1540 ")	24,990,554	9,353,312 (1439)	4,400,000* (952)
				*9,400,000 (952) batters vol added

There is near agreement between Storeys Creek and Kibuka calculations which indicate a similar tonnage of cassiterite in the main lead (1440 vs 1540). The difference in overall yardage (overburden and wash) is probably a function of batterslope - 60^{0} vs 45^{0} - and of interpretation. B.M.I. overall yardage is 30% greater than Kibukas and is probably due to use of an even flatter - 30^{0} - batter. In the reports made available for study by the writer, B.M.I. have not attempted a valuation of contained cassiterite.

GENERAL COMMENT ON RESERVES

1. The cassiterite values lie in approximately 15' of wash on the basement (slate or sandstone) in which the original channel (gutter) of the former river flowed NNW to the sea.

2. Subsequently the wash-filled gutter was covered by layers of mixed sand, clay and in some sections further gravel wash containing some cassiterite. This overburden averages 80' in depth. In places a hard-pan cement layer is encountered just below the present soil covered surface.

3. In some sections the deep lead or buried river course has widened and spread out. These flatter sections appear to be somewhat richer which is explained by the fall-out of tin in the more quiescent sections of the river.

4. The Southern Run of ore (I in Summary of Ore) is separated from the Link Area (II) to the north by a gap of 40 chains in which there are only a few drill holes. Several of these holes have plumbed the channel which is narrow for the most part, deeply buried, and contains fairly good (2lb) cassiterite values. For "continuity" of mining it would be necessary to dredge along this path to get to the larger and richer Northern Runs (II and III).

5. Dredging of the Lochaber Tributary (VI) and the main channel northward beyond the Northern Run would depend on information from additional test drilling. The few holes drilled in these sections are very widely spaced.

6. Ground on both sides E and W of the old Scotia workings also needs further testing before the start of operations. Government geologist, Nye comments "In addition to the deep ground of the Scotia Lead, some of the shallow ground at the southern and western sides of the worked-out ground may contain sufficient values to enable it to be worked. Thus on the fall to Newhaven Creek, on the western side of the workings, a Mr. H. Roach put down 24 bore holes. The ground ranged in depth from 4 to 9.5 feet, and the values from a little tin to 1lb per c. yard".

Of the 24 bore holes :

2 holes had a value of 1lb/yard
6 " " " " " between 0.5 - 1lb yard
7 " " " " " 0.25 to .5 lb/yard
5 " " " " " 0.1 and 0.25lb/yard

RELIABILITY OF DRILLING RESULTS

1. The B.M.I. test work (1970 - 1973) aimed at :

a. checking the reliability of the Mines Department drilling, and
b. to trace the channel north of the area of intensive drilling and provide information on untested areas.

B.M.I. work confirmed the reliability of the Mines Department drilling. Auger drilling was used to delineate the channel while Percussion boring was used to test for values.

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The delineation of the main channel to the west of the old Scotia workings was achieved as a result of this work. It also found "no new results" in the northern part of the area where the lithology of the bore holes demonstrated an "intermingling of fluvial and marine sediments".

2. Storeys Creek Tin Mining Company's test work (1964 - 1966) also aimed at checking the results of the Government boring. They set out in particular to check selected blocks of the ore reserves, namely: Block 3, Block 4, Block 5 and 6.

Eight bore holes, S16 to S23 inclusive, were bored in Blocks 5 - 6 alongside Government bore holes. "In general the values were lower", however, "the relative distribution of values was similar".

Eight bore holes S1 - S3, S8 - S12 were bored between lines of Government bores in Block 3. They compared the weighted mean value of these bores to the average grade for the Block from the Government results. They admit that the comparison was "improper" but state that their work indicates more erratic values than suggested by the Government results. They conclude that :

a. the accuracy of their boring is in doubt,
b. the Government results should be used for final evaluation, and
c. that sufficient holes should be bored to establish the reliability of the Government results.

In our study the Storeys Creek Mining Company's results for holes bored in Block 3 were compared with results of adjoining Government bore holes. S.C.M.C. bored a total of 11 holes in Block 3 whereas the Government bored 52 holes in this area.

Whereas S.C.M.C.'s holes S1 - S3 and S8 - S12 were positioned to plumb the centre of the channel (lead) their additional holes S13, S14 and S15 were designed to test alongside a Government bore and on either side of it. As the channel is narrow (in this section) the two holes to the side at distances of 2 chains from the centre were not particularly useful.

Our comparison which disregards the overburden, shows that of the 11 holes bored by S.C.M.C.:

a. 6 reported lower values than the adjoining Government holes but of these four (S1, S2, S8, and S13) intersected mineable values. In the case of S.C.M.C. hole S2 the comparison was as follows :

	S2	17'00" @ 9.27	ozs/cu yd (95' -112')
Govts	59B	21' 6" @ 68.1	ozs/cu yd (95'4"-116'10")
"	60B	24'10" @ 5.54	ozs/cu yd (82'8"-107'6")

It is very likely that whereas Government hole 59B was in the centre of the gutter hole 60B was located on the edge of it.

(b) 5 S.C.M.C. bore holes reported higher values than the adjoining Government bore holes. Of the 5 holes S3 and S11 intersected mineable values :

S3 20'0" @ 36.6 ozs/cu yd (95'-115')

S11 17'0" @ 14.50ozs/cu yd (108'-125')

It is felt that S.C.M.C.'s assessment of their results was superficial and their conclusion "(3) values did not confirm the 9 ozs/cu yd as expected from Government boring" was not warranted. The best explanation of their low value holes is of course that the lead is narrow and their holes were on the edge of the gutter.

Metallic tin content of concentrate from the wash was estimated at a conservative 50% in most cases. Concentrates from three of the holes were assayed by the Government and these were :

S2	Govt.	assay	33.0%	Sn	Samplers	estimate	10%
S3	"	"	70.7%	"	"	"	60%
S8	"	"	60.7%	"	"	"	50%

Additional check drilling will be necessary in this area. The number of traverses may be reduced but hole spacing along a traverse should be closed up to 10 metres.

Appendix I "Assessment of S.C.M.C. Testing of Block 3" details the comparison of S.C.M.C.'s results and the Mines Department results.

GEOLOGY

A serious concern was felt initially because of the large thicknesses of material in the overburden which had been described as pug. The lithology of only a selected few bore holes (as reported in the boring logs) has been plotted on geological cross-sections of the lead. However all the bore logs were sighted covering the whole length of the lead from north to south.

This information suggests :

(i) there are some thick beds of pug in some sections in the Southern Run,

(ii) the pug beds decrease in thickness and occurrence to the north, and

(iii) it will be necessary to check the material which has been called "pug" because if it is indeed a dense clay it could be a problem.

A hard-pan layer of brown cement occurs frequently two to three feet below the surface. This layer of cement is up to 5' in thickness in some places. There is usually no problem in ripping this material which in any case occurs intermittently.

Other lithological descriptions of sections include puggy drift, sandstone and clay. The latter is a minor occurrence whereas puggy drift forms the major rock type in the area. It is further described as a "puggy clayey coarse to medium sand". It is most likely that this is essentially unconsolidated material which would be susceptible to being broken up and disintegrated by the action of a suction-cutter.

The Government Geologist, Mr. P.B. Nye (Report on the Scotia Mine dated 4.7.72) describes the lead material of the old workings in the south in detail: "The lead consists of alternating layers of clayey sand and granitic quartz sand.

Gravels are absent except in surface layers where rounded quartz pebbles are present on the western side. These gravels, however, have probably been formed subsequent to the lead. On the sides of the gutter the bottom "wash" consists of angular quartz pebbles, associated with brownish sandy clay. As far as can be seen from unworked portions of the lead, lignitic clayey sand fills the gutter while in places large boulders (up to 5 feet) of quartz with rounded edges rest directly on the bottom (slates and quartzites)."

No large boulders have been reported from drill holes to the north in the unworked ground. Their presence in the old workings indicate the juvenile nature of this part of the old river course (the lead). It is presumed that the wash will contain fewer large size boulders away from this source area.

CONCLUSION

The assessment confirms the estimates of the Mines Department Reports. The deep lead contains economic grades of tin to support a profitable mining operation but only if the overburden can be removed at low cost. Kibuka's engineers are investigating low cost overburden removal methods.

Further investigations should include check evaluation of the previous boring programmes not by further boring, although this will be necessary in the low density tested areas (possible ore), but by trenching across the deep lead at two or three selected traverses. Trenching could be done by bulldozer or drag line to give a lot of vital information on clay content, rippability of cement layers, tin concentrate values, water inflow rates, size of wash boulders, dredge pond wall stability etc. Obviously each trench would involve fairly large yardages as the trench floor would have a minimum width of at least 20 metres.

Appendix I

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ASSESSMENT OF S.C.M.C. TESTING OF BLOCK 3

TEST HOLE LOCATIONS

S.C.M.C. Hole	Contiguous Govt. Holes			Section Line
S2	(60B)	(59B)		LA 1
S1	(80B)	(92B)	(91B)	LA 3
S3 (77B)	(75B)	(50B)	(79B)	LA 4
S8 (90B)	(20B)	(21B)	(88B)	LA 9
S9	(17B)	(20B)		LA 10
S10	(17B)	17B		LA 11
S11	10B	109B		LA 12
S12	97B	13B		
S13	88B			LA 8 & 9
S14 (East)	(1W)	(48B)		LA Bet 8-9
S15 (West)	(90B)	(24B)		

TEST HOLE VALUE COMPARISONS (disregarding overburden)

		Remarks
Sect. LA1		
59B	21' 6 " @ 68.1 ozs (95'4 " - 116'10")	Low cp Govt hole in centre of gutter
60B	24' 10" @ 5.5 ozs (82'8 " - 107' 6")	
S2	17' 00" @ 9.27 ozs/cuyd (95' - 112')	(Govt assay higher than Govt hole on 33% Sn) edge of gutter
Sect. LA3		
S1	34' 9" @ 41.0 ozs/cu yd (90' - 124'9")	
91B	23' 1" @ 104.46 ozs/cu yd (93' - 116'1")	Half of Govt's good values
92B	29' 0" @ 123.83 ozs/cu yd (93' - 122')	
Sect. LA4		
S3	20' 0" @ 36.6 ozs/cu yd (95' - 115')	Govt Assay 70.7% Sn
77B	Too low to be recorded TRACE	Much better than Govt holes around it are probably on side of gutter
50B	" " " " " "	
75B	31' 8" @ 1.86 ozs (72'4" - 194' 0")	
79B	5' 0" @ 29.4 ozs/ cu yd (93'0" - 98'0")	

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		Remarks
Sec. LA9		
S8	14' 3" @ 23.10 ozs/cu yds (100' - 114'3")	Govt Assay 60.7% Sn
90B	Trace to 101.0'	
20B	18' 8" @ 44.44 ozs (103'6" - 122'2")	Govt holes average for all ground is 9.0 ozs SnO_2/cu yd
21B	34' 6" @ 3.0 ozs (approx)	S8 has fairly good value at bottom i.e. half Govt value
88B	23' 2" @ 55.96 ozs/cu yd (95'4" - 118'6")	
Sec. Line Between LA8 and LA9		
or	40' @ 8.35 ozs (79' - 119')	
S13	17' @ 14.32 ozs/cu yd (50/70) (102' - 119')	Lower than Govts 88B
S14	12' @ 6.45 ozs/cu yd (60/70) (103' - 115')	cp (48B) to 86' only last 12' approx. 8 ozs/cu yd
S15	51' @ 3.7 ozs/cu yd (60' - 111')	Higher than Govts and over 51' Govts are trace
24B	Trace to 36' only (side of gutter)	
Sec. Line LA 10		
S9	11'10" @ 0.9 ozs/cu yd (110' - 121'10")	No assay - estd. 10% Lower than Govt's bore value
17B	27' 6" @ 101.53 ozs/yd^3 (103'6" - 130')	
20B	18' 8" @ 44.44 ozs/yd^3 (103'6" - 122'2")	
Sec. Line LA 11		
17B	27' 6" @ 101.53/yd^3 (103'6" - 130')	
S10	14' 0" @ 4.94 ozs/cu yd (115' - 129')	Weak cp. Govt bores on either side
12B	34' 6" @ 125.6 ozs/ cu yd (99'6" - 133'10")	
Sec. Line between LA 11 and LA 12		
S11	17' 0" @ 14.506 ozs/cu yd (108' - 125')	Twice as high as Govt bore result
10B	Stopped at 91'6" ? Low values	
109B	15' 7" @ 8.64 ozs/cu yd (102'8" - 118'3")	
Sec. Line between LA 11 and LA 12		
S12	25' 0" @ 2.20 ozs/cu yd (95' - 120')	)
97B	Trace values	)Comparatively low
13B	32' 6" @ 1.63 ozs/ cu yd (85'10" - 118'4"))	

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SUMMARY

6 S.C.M.C. drill holes weaker (of 6 S1, S2, S8 & S13 have mineable or interesting values)

5 S.C.M.C. drill holes better (of 5 S3, S11 have mineable values)

Low values due to :

(1) Narrow lead is probably best explanation. Values appear to be consistently low except in middle of gutter. Metallic tin content estimated in most cases. Only 3 Govt. assays for metal content.

(2) Although the lead is continuous values could be irregular, intermittent-in pockets - as would be expected.

(3) Government results higher because of run-ins caused by poor boring methods/ technique.

(4) Holes S13, S14, S15, test over 4 ch width. Whereas the actual "gutter" could be a mere one chain wide.

COMPARISON OF ORE RESERVES FOR BLOCK 3

	Kibuka Estimates	Mines Department (Govt) Estimates
Volume Cubic Yards	2,738,345	1,380,000
Grade	5.2 ozs/cu yd	9.0 ozs/ cu yd
Tons SnO_2	403	346

N.B. Kibuka calculations use a 45% batter for the dredge pit while the Mines Department calculation is based on vertical sides. Tin concentrate tonnage is fairly close for both estimates.

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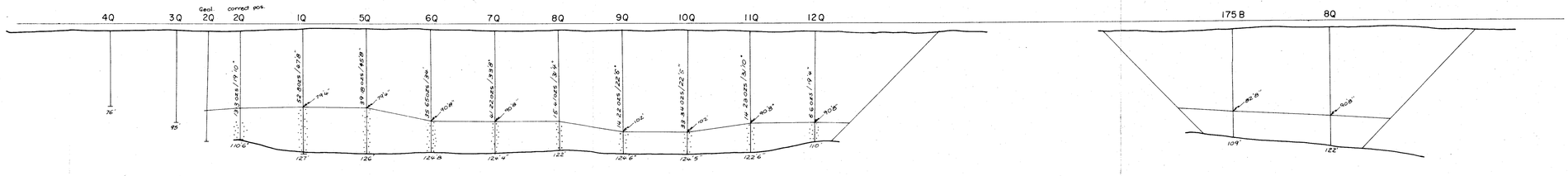
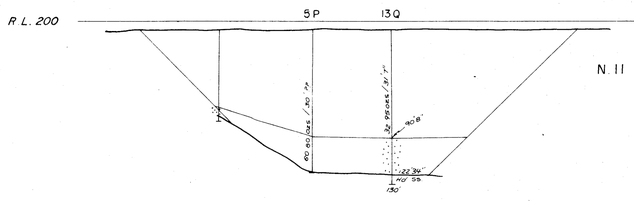
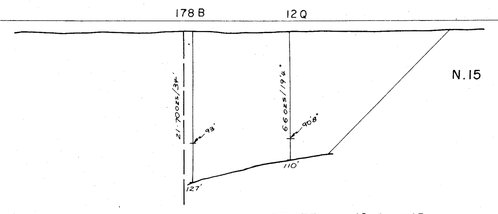


LONG SECTION of X SECTIONS BETWEEN N 12 & N 15 INCLUSIVE

BETWEEN N12 & N15





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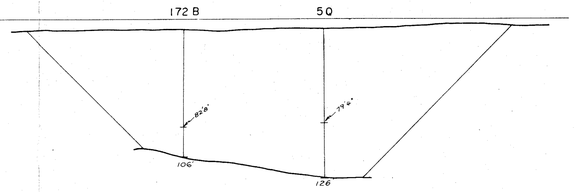

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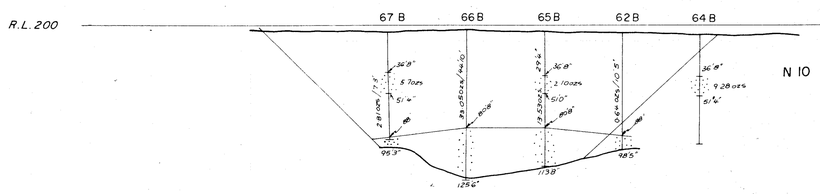

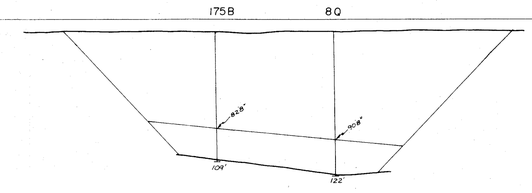

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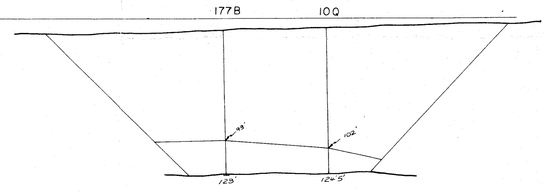

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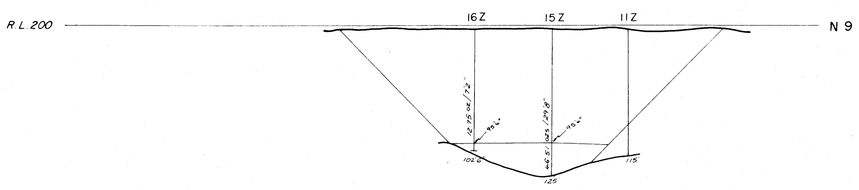
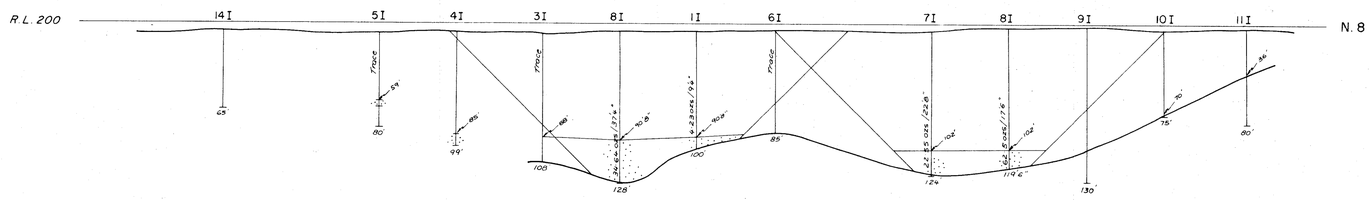
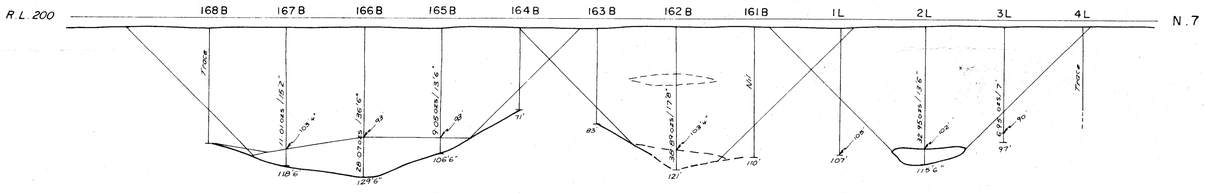
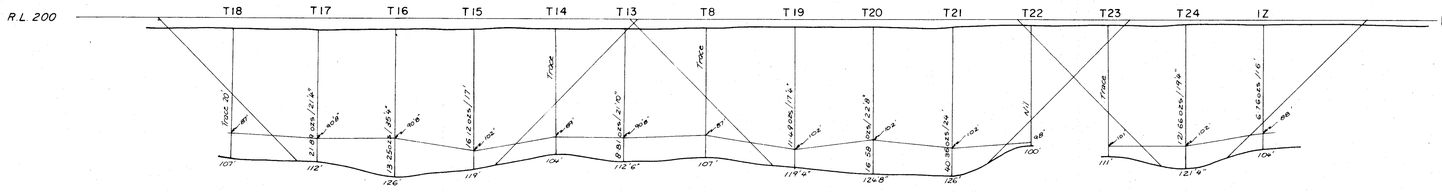
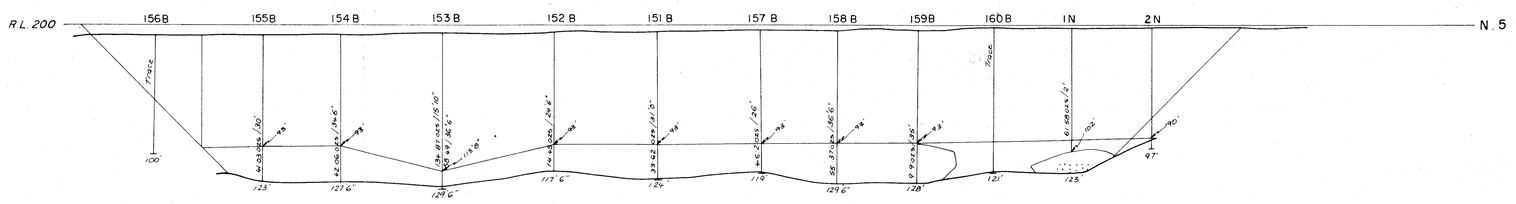
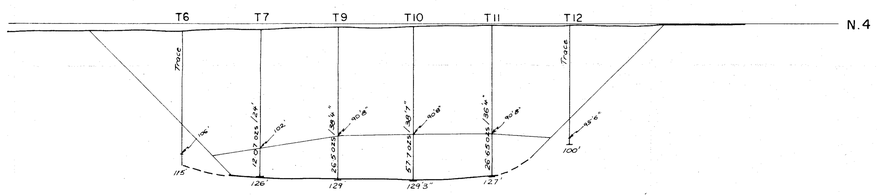


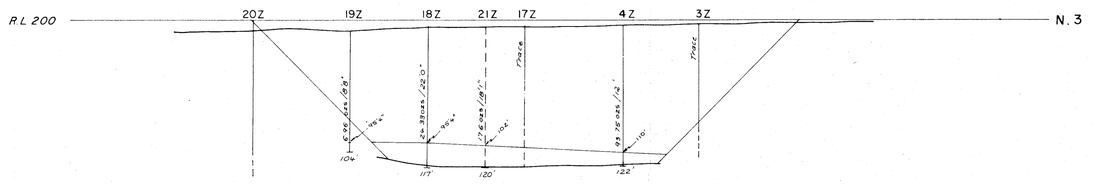


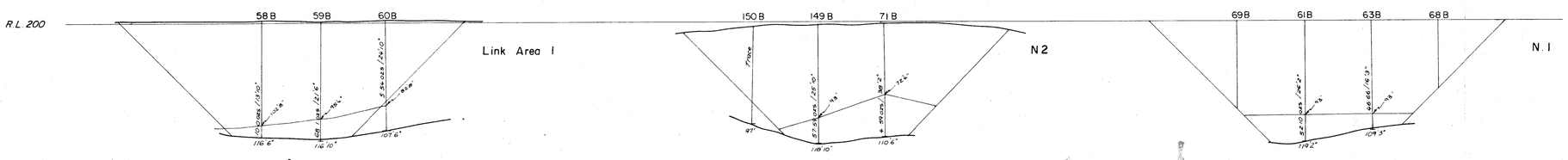












AMDEX MINING LIMITED

SCOTIA LEAD

ORE RESERVE SECTIONS

Scale : 1"=1 chain Vertical Horizontal

Date: December, 1976

Data by : Amdex - C. Gibson

Traced by : K. Stewart

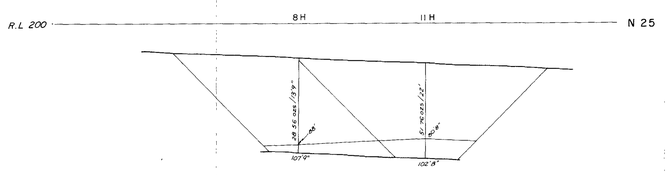
5 cm

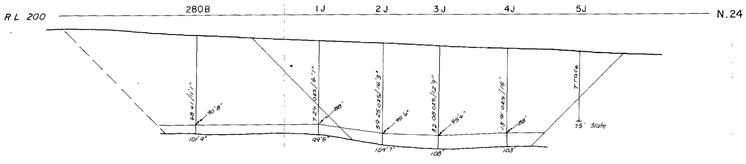
FIG. 1.

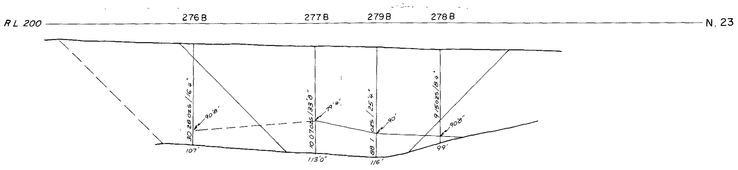
76-1188 R

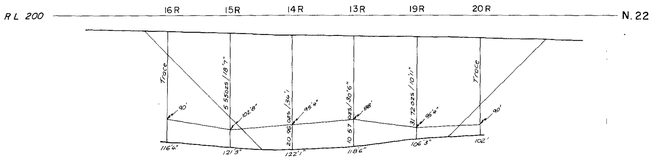
6682

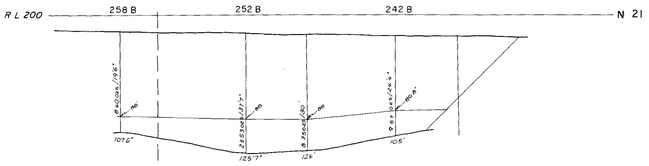
336018

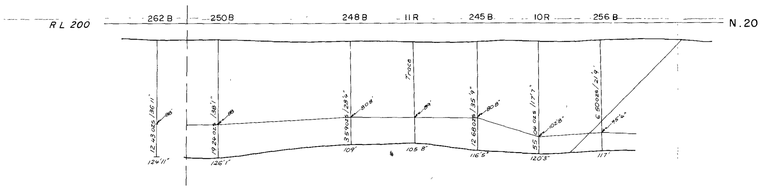


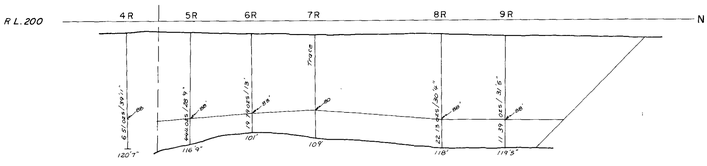


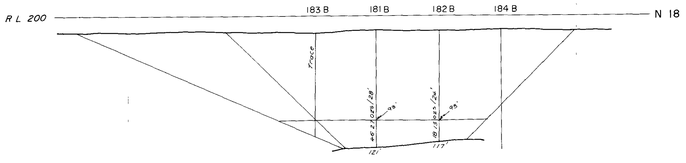


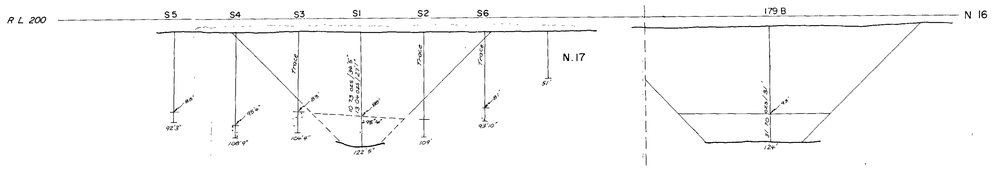


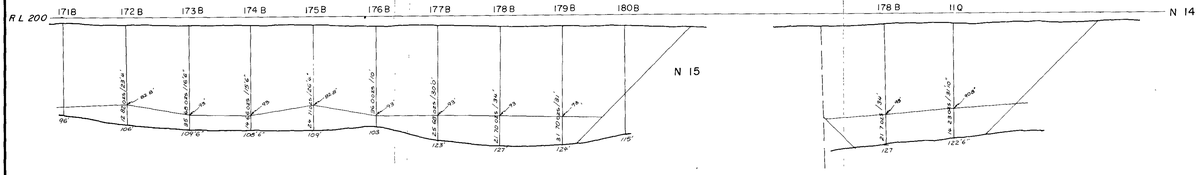












AMDEX MINING LIMITED

SCOTIA LEAD

ORE RESERVE SECTIONS

Scale 1"= 1 chain Vertical Horizontal Data by Amdex - C Gibson

Date December, 1976 Traced by K Stewart

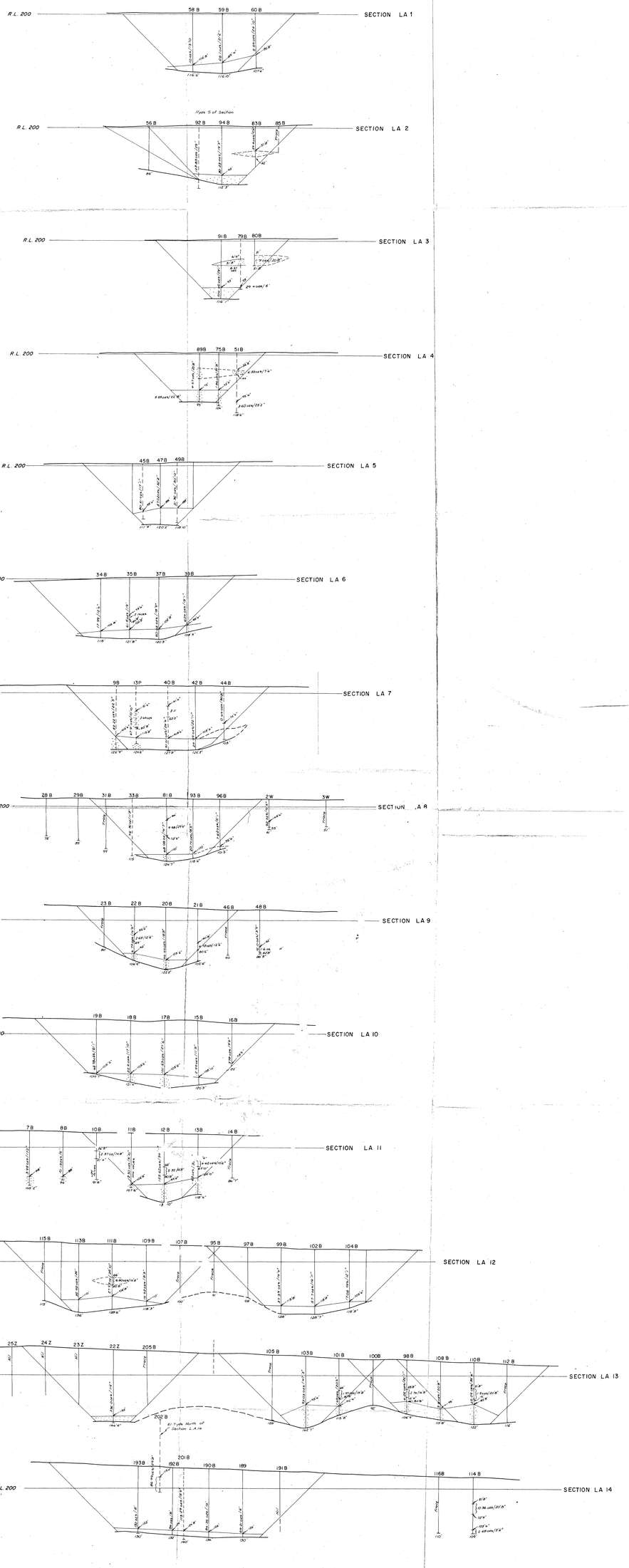
336019

FIG. 2, 76-1188 2

5 cm

6883

6684



336020

AMDEX MINING LIMITED

SCOTIA LEAD

ORE RESERVE SECTIONS

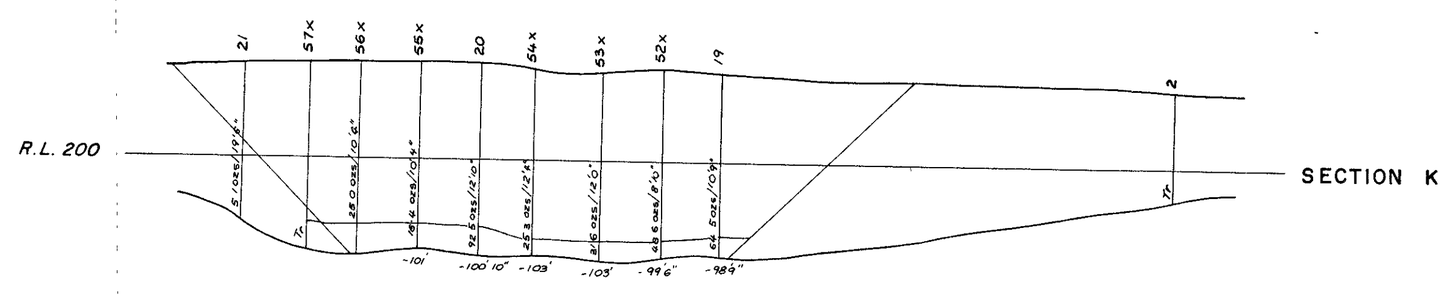
Scale : 1" = 1 chain vertical / horizontal Data by : Amdex - C. Gibson

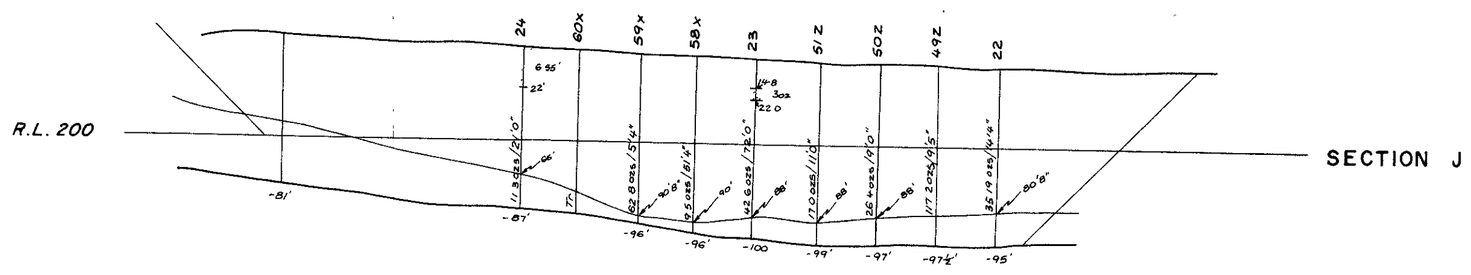
Date : December, 1976 Traced by : K. Stewart

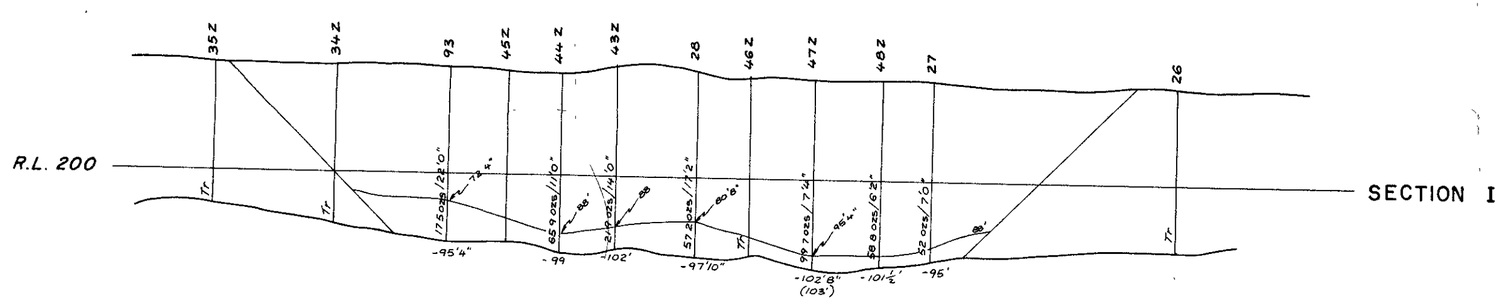
FIG 3. 76-1188

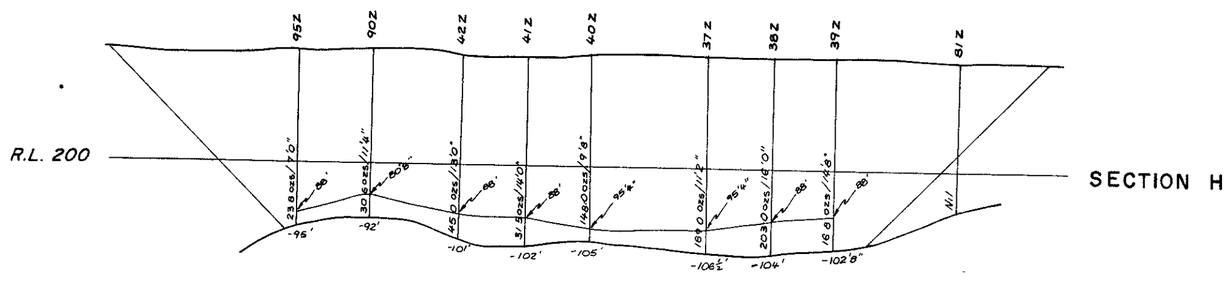
6684

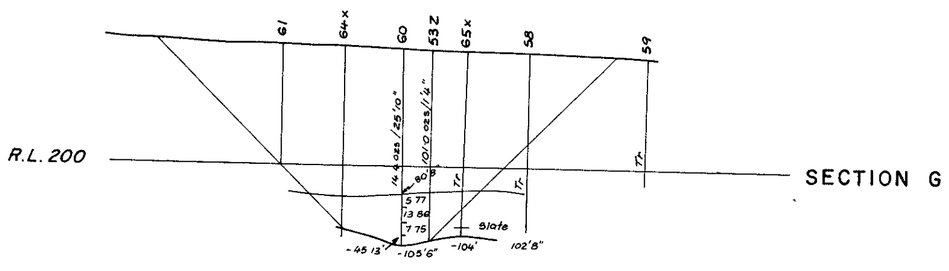
5599

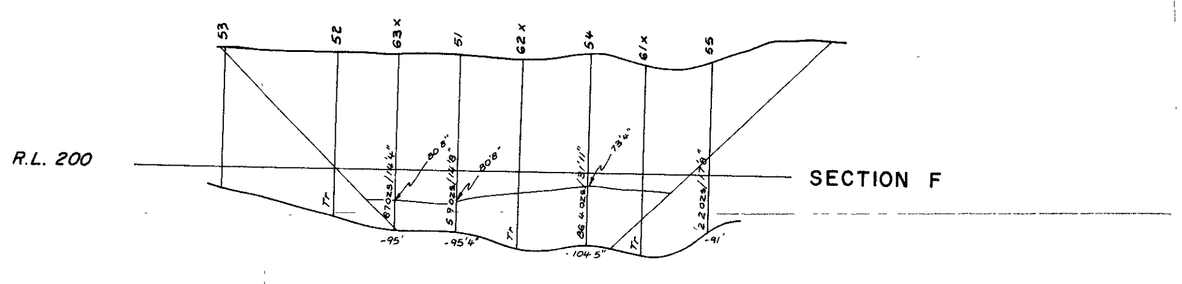


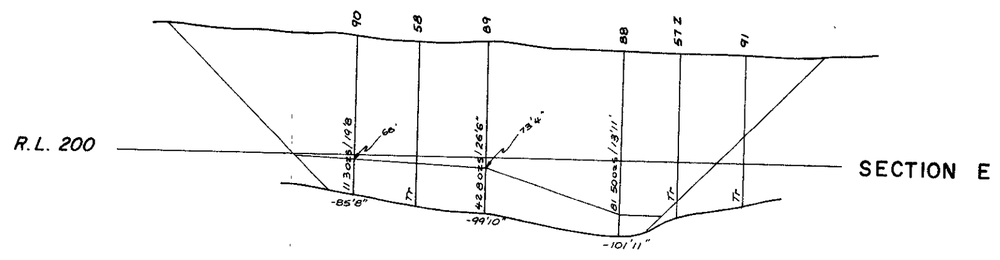


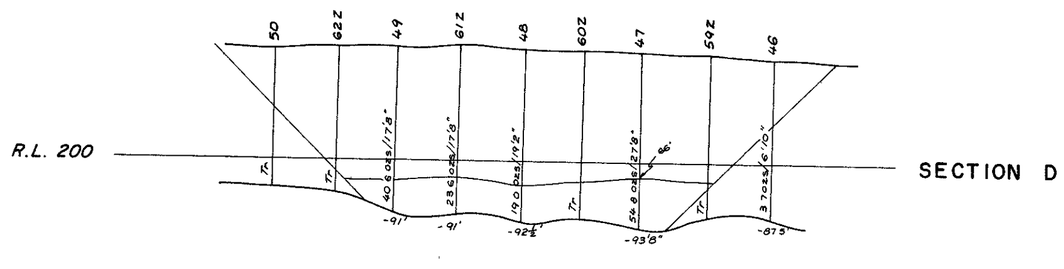


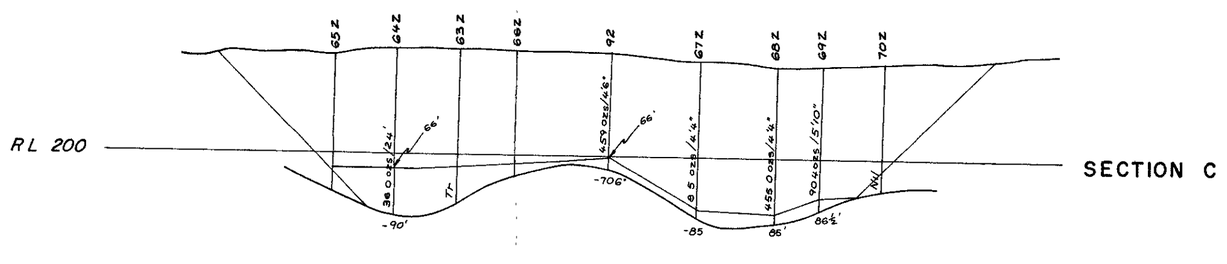


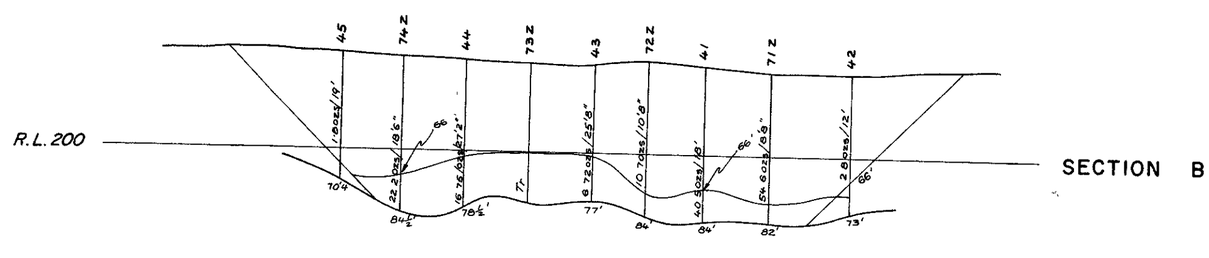


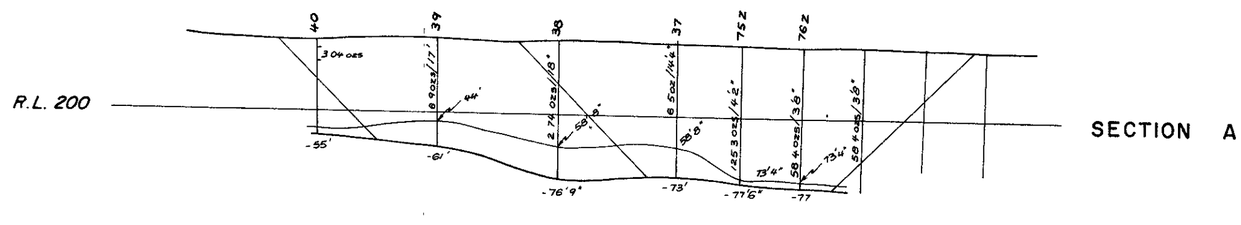












AMDEX MINING LIMITED

SCOTIA LEAD

ORE RESERVE SECTIONS

Scale 1"= 1 chain Vertical Horizontal
Date: December, 1976

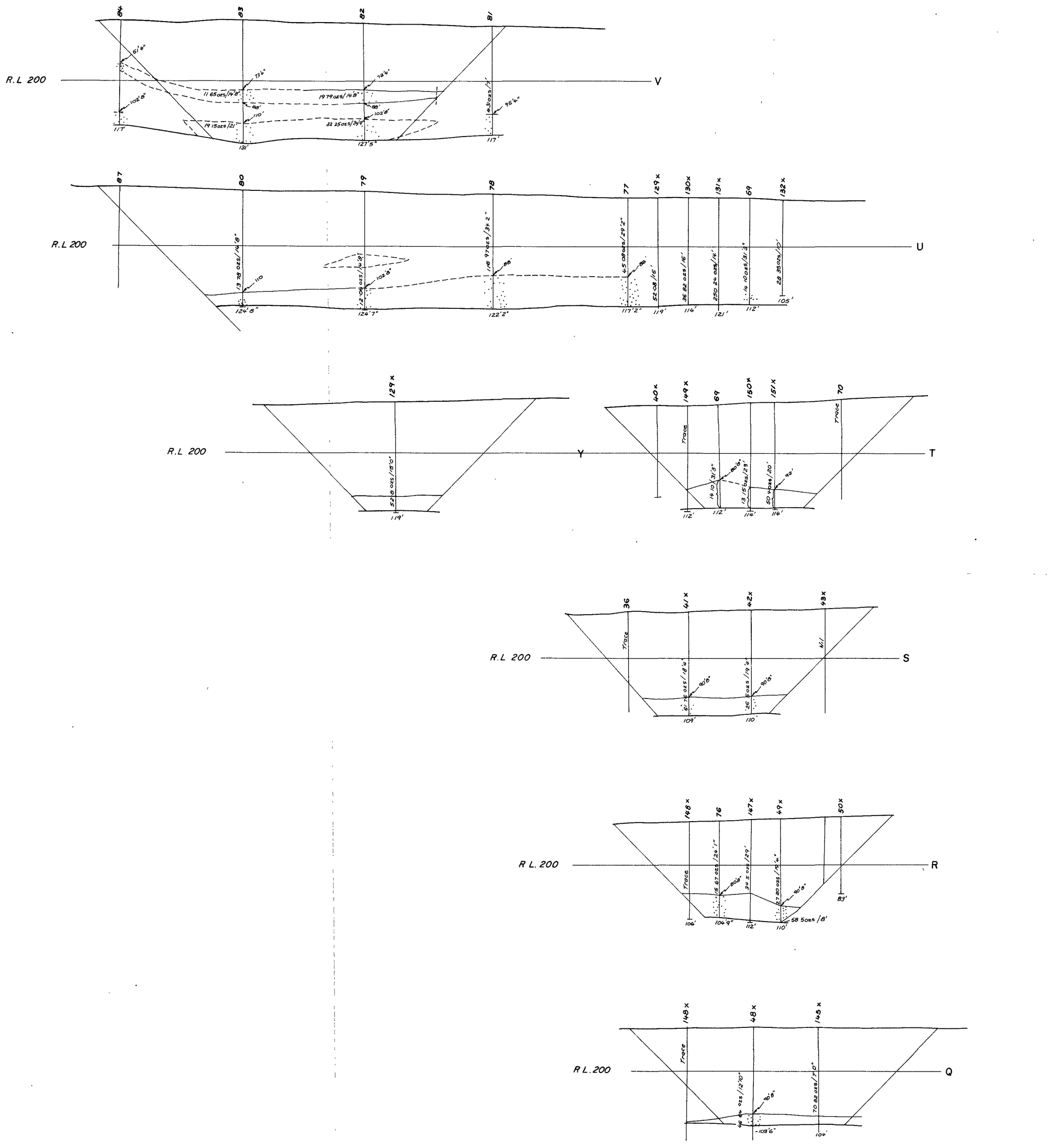
Data by : Amdex - C Gibson
Traced by : K Stewart

336021

76-1182

FIG 4

5 cm



AMDEX MINING LIMITED

SCOTIA LEAD

ORE RESERVE SECTIONS

Scale : 1" = 1 chain Vertical Horizontal
Date : December, 1976

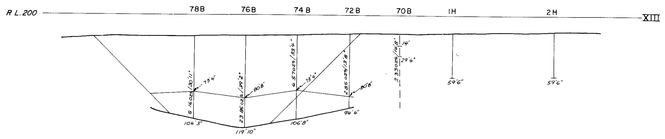
Data by : Amdex - C Gibson
Traced by K Stewart

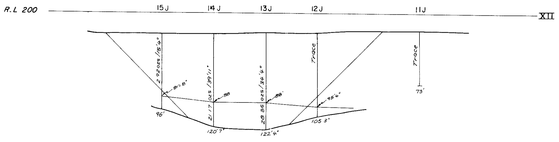
FIGS. 76-1188 R

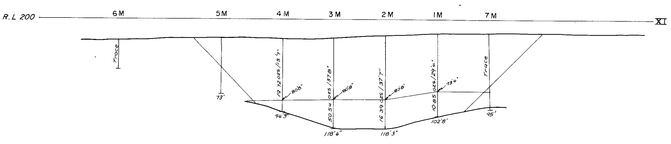
336022

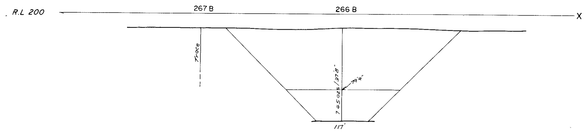
9899

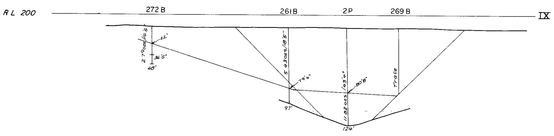
6687

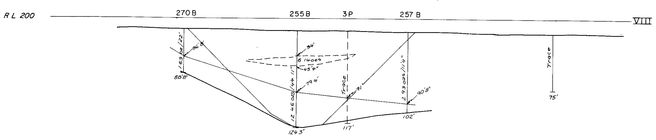


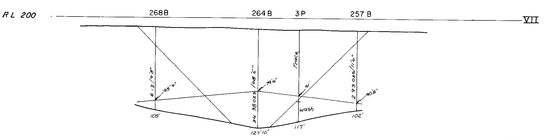


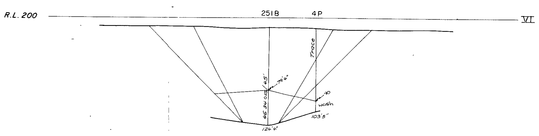


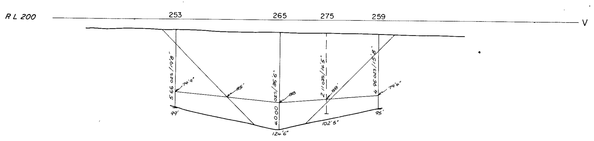


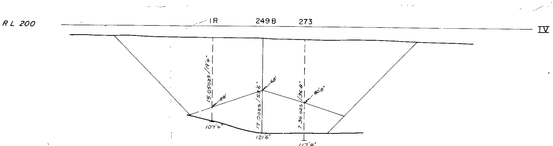


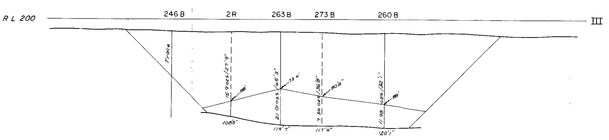


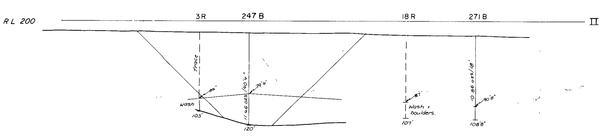


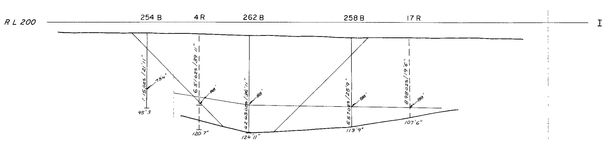












AMDEX MINING LIMITED

SCOTIA LEAD

ORE RESERVE SECTIONS

Scale 1" = 1 chain Vertical
Horizontal
Date December, 1976

Data by Amdex - C Gibson
Traced by K Stewart

336023

76-188 2 FIG 6.

6687

5 cm

BLOCK 5

KIBUKA V

KIBUKA III
Northern Run

BLOCK 4

BLOCK 3

KIBUKA II
Area

KIBUKA VII

KIBUKA II

BLOCK 2

Lochaber Workings

KIBUKA IV

KIBUKA I
Southern Run

BLOCK 1

NEWHAVEN WORKINGS

Insert

Workings

Big Taylor

Pit GRANITE BOTTOM

MacGregor Lagoon

GREAT NORTHERN PLAN

Mt CAMERON

WATER RACE

Block Dock Workings

Lochaber Workings

Vulcan

Scotia Workings

RINGAROOMA

AMDEX MINING LIMITED

SCOTIA LEAD

ORE RESERVE PLAN

FIG 7.

Scale 1" = 1 chain

Date December, 1976

Data by Amdex - C Gibson

Traced by K Stewart

336021

5cm

76-1882.