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ABERFOYLE TIN DEVELOPMENT PARTNERSHIP

CLEVELAND DEVELOPMENT PROJECT

R E P O R T

BULK SAMPLING OPERATION

EXPLORATORY UNDERGROUND DEVELOPMENT

RL.1300' LEVEL

N.A. GILBERTHORPE

JULY, 1965.

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CONTENTS

INTRODUCTION

One of the main objectives of the Cleveland exploratory development programme undertaken between January and December, 1964 was to break bulk samples across pre-determined sections of the orebody at the 1300 R.L. horizon. The development programme entailed main adit entry at the Qa section, piercing Hall's lode from east to west, contour driving north and south on the west wall of Hall's lode and at sections V, T, R, P, N, L and K crosscut back through Hall's lode. Other crosscutting on the R section and driving on Henry's lode was also undertaken. Bulk sampling was conducted in Hall's lode by cutting slots over the back of the crosscuts on the sections referred to above. Channel and grove samples were also taken on both walls of exposed lode in the crosscuts.

Sampling crosscuts were spaced at approximately 120 ft. intervals, strike length drive on Hall's lode approximated 1200 ft. and total development about 2600 ft.

The functions of the bulk samples were, and I quote, Ø

"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.

Ø Outline of Proposed Exploratory Development and Ore Testing Programme - A.A.C. Mason, November, 1963.

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

This report places on record the procedures followed in taking and processing the bulk samples, the data derived from the bulk samples and observations arising from an analysis of the data.

I have assumed that readers of this report are generally familiar with the geography, topography and geology of the Cleveland tin deposit or if not have access to this information.

CONCLUSIONS

1. For Cleveland conditions a groove or channel sample is as reliable, within reasonable limits, as a bulk sample.

2. Indications are that tin values in the Cleveland lodes are distributed erratically.

3. Expert assistance in the statistical analysis of results may contribute to the interpretation of assay results from spatial diamond drill holes in the Cleveland lodes.

4. Some further work on sampling is justified from which a correlation between diamond drill split core assays and other classes of sampling can be made.

RECOMMENDATIONS

1. That expert assistance be obtained from a recognised authority on statistical analysis of mine sampling results; such assistance to take the form of assessing results and translating the assessment to spatial diamond drill assay results on which grade of ore reserves are based.

2. That a series of horizontal drill holes on the 1300 R.L. horizon referable to bulk, channel and groove sample sections be commissioned, viz. at V, T, R, Qa, P, N, L and K and/or one or two crosscuts on intermediate sections for a similar correlation.

SUMMARY OF RESULTS

1.	Number of bulk samples taken	72
	Total tonnage in bulk samples	311.0
	Average batch tonnage	4.3

2.	Crushed and cut sample	28.3 ton
	% cut	9.1
	Split products:	
	Laboratory sample	6.8 ton
	% cut	2.2
	Ore Dressing Sample	21.5 ton
	% cut	6.9

3. Mean assays from laboratory samples:

Tin (chemical)	0.81%
Tin (vanned)	0.64%
Copper	0.30%
Sulphur	8.5%
Acid Insolubles	52.1%

Densities:

In situ cubic ft/ton	11.0
Broken dry cubic ft/ton	18.7
Expansion factor	1.7

5. Comparison of Assays from bulk, channel, groove and split core samples.

	Bulk	Channel	Groove	Split core
Tin %	0.81	0.83	0.80	0.94
Copper %	0.30	0.32	0.30	0.29

6. Results for each individual crosscut are tabulated in Schedules 1, 2 and 3 immediately following. It should be noted that all means are weighted- the bulks according to sample weights; the channel, groove and split core according to sample lengths.

CLEVELAND DEVELOPMENT PROJECT

CONSOLIDATED BULK SAMPLING DATA

SCHEDULE 1

WEIGHTS AND ASSAYS OF PRODUCTS

Crosscut	Bulk Sample Calculated Dry Weight lb.	CRUSHED AND CUT SAMPLE		SPLIT PRODUCTS				Reject to Stockpile lb.	ASSAYS OF LAB. SAMPLES %					
				Lab. Sample		Ore Dress. Sample								
		Wt. lb.	% Original	Wt. lb.	%	Wt. lb.	%		Sn Chem.	Sn Vanned	Recov.	Cu	S	Acid
V	140,062	12,560	8.9	2,981	2.1	9,579	6.8	127,502	0.40	0.29	72.4	0.18	8.7	52.4
T	110,969	10,227	9.3	2,391	2.2	7,836	7.1	100,742	0.73	0.59	81.0	0.22	8.4	54.6
R	119,360	10,832	9.1	2,593	2.2	8,239	6.9	108,528	0.81	0.64	79.0	0.28	7.7	54.8
Qa	49,123	4,325	8.8	1,053	2.1	3,272	6.7	44,798	0.90	0.81	90.0	0.56	9.8	51.6
P	68,583	6,214	9.0	1,514	2.2	4,700	6.8	62,369	1.28	1.02	79.2	0.54	9.1	54.0
N	86,321	7,676	8.9	1,831	2.1	5,845	6.8	78,645	1.17	0.93	79.4	0.31	9.4	52.3
L	23,884	2,185	9.1	479	2.0	1,706	7.1	21,699	0.76	0.54	71.0	0.29	9.2	49.0
K	100,491	9,273	9.3	2,369	2.4	6,904	6.9	91,218	0.82	0.59	71.9	0.27	7.7	51.6
ALL	698,793	63,292	9.1	15,211	2.2	48,081	6.9	635,501	0.81	0.64	79.1	0.30	8.5	52.1
	311.0 tons	28.3 tons	-	6.8 tons	-	21.5 tons	-	282.7 tons						

CLEVELAND DEVELOPMENT PROJECT

CONSOLIDATED BULK SAMPLING DATA

SCHEDULE 2

MOISTURE AND DENSITY

Crosscut	Number of Samples over width in ft.	Measured volume cubic ft.		Wet weight lb.	Moisture Content %	Calculated Dry weight lb.	Density cubic feet per ton			Expansn. Factor Dry	% Sn.	% Cu.
		In Situ	Broken				In situ	Broken Dry	Broken Wet			
V	13 - 59	665	1,168	142,455	1.7	140,062	10.5	18.6	18.4	1.7	0.40	0.18
T	12 - 50½	541	956	113,373	2.1	110,969	10.9	19.3	18.9	1.8	0.73	0.22
R	13 - 54½	680	1,029	121,242	1.6	119,360	10.9	19.3	19.0	1.8	0.81	0.28
Qa	6 - 26½	256	405	49,763	1.3	49,123	11.7	18.5	18.2	1.6	0.90	0.56
P	7 - 33	325	554	69,490	1.3	68,583	10.6	18.1	17.9	1.7	1.28	0.54
N	8 - 36½	365	711	87,655	1.5	86,321	9.5	18.5	18.2	1.9	1.17	0.31
L	3 - 12	125	209	24,333	1.9	23,884	11.7	19.6	19.3	1.7	0.76	0.29
K	10 - 42¾	463	804	102,416	1.9	100,491	10.3	18.0	17.6	1.8	0.82	0.27
	72	3,420	5,836	710,727	1.7	698,793	11.0	18.7	18.4	1.7	0.81	0.30

SCHEDULE 3

CLEVELAND DEVELOPMENT PROJECT

CONSOLIDATED BULK SAMPLING DATA

COMPARISON OF ASSAYS FROM BULK, CHANNEL, GROOVE AND SPLIT CORE SAMPLES

Section	SN %				CU %			
	Bulk	Channel	Groove	Split Core ∅	Bulk	Channel	Groove	Split Core ∅
V	0.40	0.30	0.22	-	0.18	0.16	0.14	-
U	-	-	-	1.31	-	-	-	0.16
T	0.73	0.71	0.79	-	0.22	0.23	0.24	-
S	-	-	-	0.81	-	-	-	0.21
R	0.81	0.88	0.78	-	0.28	0.26	0.24	-
Qb	-	-	-	1.05	-	-	-	0.43
Qa	0.90	0.95	1.00	-	0.56	0.60	0.50	-
Q	-	-	-	0.76	-	-	-	0.43
P	1.28	1.01	1.03	-	0.54	0.44	0.50	-
O	-	-	-	0.53	-	-	-	0.25
N	1.17	1.21	1.18	-	0.31	0.34	0.33	-
M	-	-	-	1.32	-	-	-	0.35
L	0.76	0.60	0.42	-	0.29	0.36	0.22	-
Ka	-	-	-	0.84	-	-	-	0.26
K	0.82	1.17	1.13	-	0.27	0.41	0.37	-
J	-	-	-	0.77	-	-	-	0.14
MEANS	0.81	0.83	0.80	0.94	0.30	0.32	0.30	0.29

∅ Taken at intermediate sections, includes groove sample from lode section exposed by drive.

METHOD

Brief Description of Exploratory Programme

Following the establishment of suitable access, service and employee facilities development commenced at the Qa adit. Adit size was 8 ft. x 7 ft. and equipment used included airleg mounted Gardner Denver automatic 3" rockdrills; Eimco 12B rocker shovels, 1½ ton Gemco trammer and 1 ton side tipping trucks, ventilation by 2 stage 19 inch Aerofoil electric fans and a track gauge of 24 inches with 20 lb/yd. rail.

The Qa adit advanced on a bearing of 312°, commonly referred to as west, and intersected Hall's lode at about 280 ft. After exposing full lode width driving north and south commenced simultaneously. The 7 x 6 section drives were maintained on the western wall contact. As drives progressed, and at planned sections R, T and V in the north and at P, N, L and K in the south, crosscuts east (actual bearing 132°) were driven to fully expose the lode section. Including the Qa section these were the selected sites for bulk sampling at approximate intervals of 120 ft. along the strike of the lode.

At "R" section the crosscut was driven west also to expose and explore Henry's lode. - No bulk sampling was undertaken in Henry's lode.

At intermediate sections U, S and Qb in the north, Q, O, M, Ka and J in the south, diamond drill holes were drilled to augment geological knowledge and for sampling.

Plan No. A/139 (L), included with this report, shows and records a completed survey plan of the exploratory development programme.

Channel and groove samples were taken from both walls of each crosscut 4 ft. above rail level. Grooves were 1" x ½" and channels 6" x 2" in section. This is fully reported by R. Cox in his Geological Report. ∅

∅ Geological Report on completion of the Exploratory Development Project - R. Cox, Resident Geologist, January, 1965.

Sizing and weight of bulk samples

It was decided that bulk samples would be cut as a slot over the back of each crosscut and that for planning and design purposes each bulk sample batch would be about 10,000 lb. or 4½ tons.

Each batch was to be crushed to ½" and a cut of 800 lb. or 8% taken. This was split into two products one of 200 lb. for assay and other quantitative assessments and another of 600 lb. for pilot scale metallurgical tests.

To test the accuracy of this approach Pierre Gy's Formula for Sampling was applied. ∅

Basic formula -

$$\sigma^2 = \left(\frac{1}{k} - 1\right) \frac{1}{p} \; f \; g \; l \; m \; d^3 \; a^2$$

For the usual small fractions

kp = w where k = sample ratio

p = weight of pile

w = sample weight

The formula becomes

$$\sigma^2 = \frac{1}{w} \; f \; g \; l \; m \; d^3 \; a^2 \text{ in c. g. s. units}$$

where σ^2 = the variance of the percentage error calculated on the true assay of the lot, made when cutting a sample, expressed as a decimal.

∅ The sampling of Ores - The Error in Preparing a Sample from a Batch of Ore by P. Gy. Paper A2 of the Congress des Laveries des Mines Metalliques Francaises, 1953.

f = a shape factor

g = size distribution factor

l = liberation factor

m = mineralogical factor

d = aperture of the screen retaining 5 - 10% of the sample

a = the assay expressed as mineral and as a decimal.

For a given ore as in our case, the variance formula may be divided into two parts,

$$\sigma^2 = (f\ g\ m\ a^2)\ \frac{l d^3}{w},$$

that part in the brackets being constant for the ore, while the part outside the brackets depends on the sampling conditions.

f = usually taken as 0.5

g = 0.25 for natural crushed samples with fines

$$m = \delta v\ \frac{(1 - \bar{a})^2}{\bar{a}} + \delta g\ (1 - \bar{a})$$

$\bar{a}$ = mean assay

$= \frac{0.01}{0.786}$

= 0.013

δv = S.G. of valuable mineral

= 7.0

δg = S.G. of gangue

= 2.65

$$m = 7.0 \times \frac{0.987^2}{0.013} + 2.65 \times 0.987$$

= 526.9

$a = \frac{0.01}{0.786}$ for a 1% Sn. ore

Sn. = 0.786 x Sn. O_2

$= 0.013$

Hence $f\ g\ m\ a^2 = 0.5 \times 0.25 \times 526.9 \times 0.013^2$

$= 1.11 \times 10^{-2}$

Cut point = ¼ inch

= 0.63 cm.

Assumed $d = 0.60$

$d^3 = 0.216$

Assume liberation size say 60 mesh

= 0.250 m.m.

Ratio to liberation size $= \frac{6.3}{0.25} = 25$

Assume $l = 0.14$

(Gy's tables - At a size lying between 10 and 100 times the size of liberation - $0.05 < l < 0.2$)

$W = 800$ lb.

$= \frac{800 \times 10^3}{2.2}$ gm.

$= 3.64 \times 10^5$

$\frac{ld^3}{W} = \frac{0.14 \times 0.216}{3.64 \times 10^5}$

$= 0.83 \times 10^{-7}$

Hence $\sigma_1^2 = 0.83 \times 10^{-7} \times 1.11 \times 10^{-2}$

$= 0.92 \times 10^{-9}$

Allow for successive splits noting that there is no change in sizing.

For second stage

$w = 400$ lb.

$\therefore\ \sigma_2^2 = 0.46 \times 10^{-9}$

For third stage

$w = 200$ lb.

$\therefore\ \sigma_3^2 = 0.23 \times 10^{-9}$

$\sigma^2 = (0.92 + 0.46 + 0.23) \times 10^{-9}$

$= 1.61 \times 10^{-9}$

$$= 16.1 \times 10^{-10}$$

$$\sigma = 4.01 \times 10^{-5}$$

$$\text{Error} = \frac{2\sigma}{a}$$

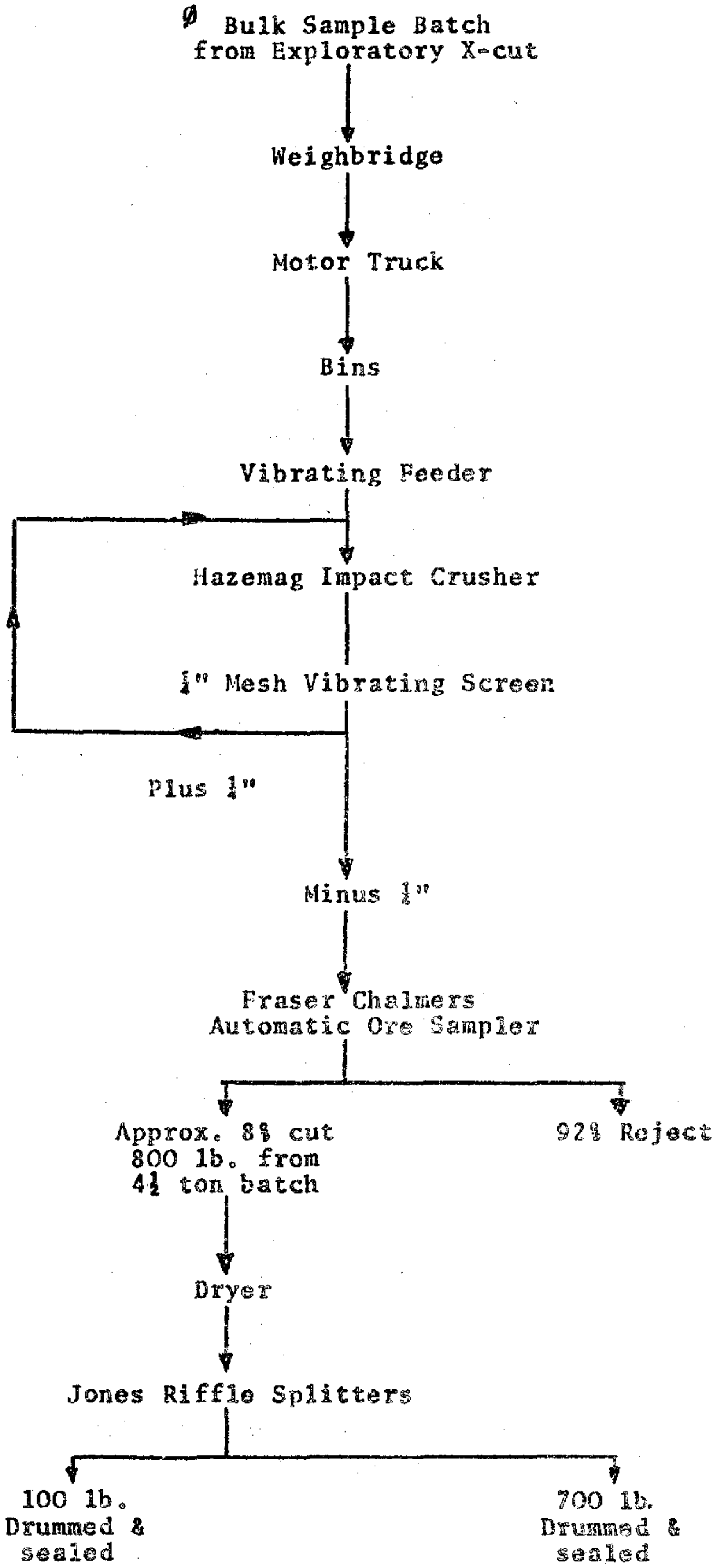
$$= \frac{8.02 \times 10^{-5}}{1.4 \times 10^{-2}} = 6.16 \times 10^{-3}$$

$$= 0.62\%$$

It is therefore reasonable to record that the accuracy of our sample for assay falls well within a 5% error.

Sample reduction plant flowsheet

With the assignment clearly defined and after various considerations the process for sample reduction took the basic form as shown in the following line diagram: Ø



From this basic layout the flowsheet developed to its final design as schematically illustrated in drawing No. MC.013.

CLEVELAND DEVELOPMENT PROJECT
ABERFOYLE TIN DEVELOPMENT PARTNERSHIP
– BULK SAMPLE REDUCTION PLANT –

FLOW SHEET

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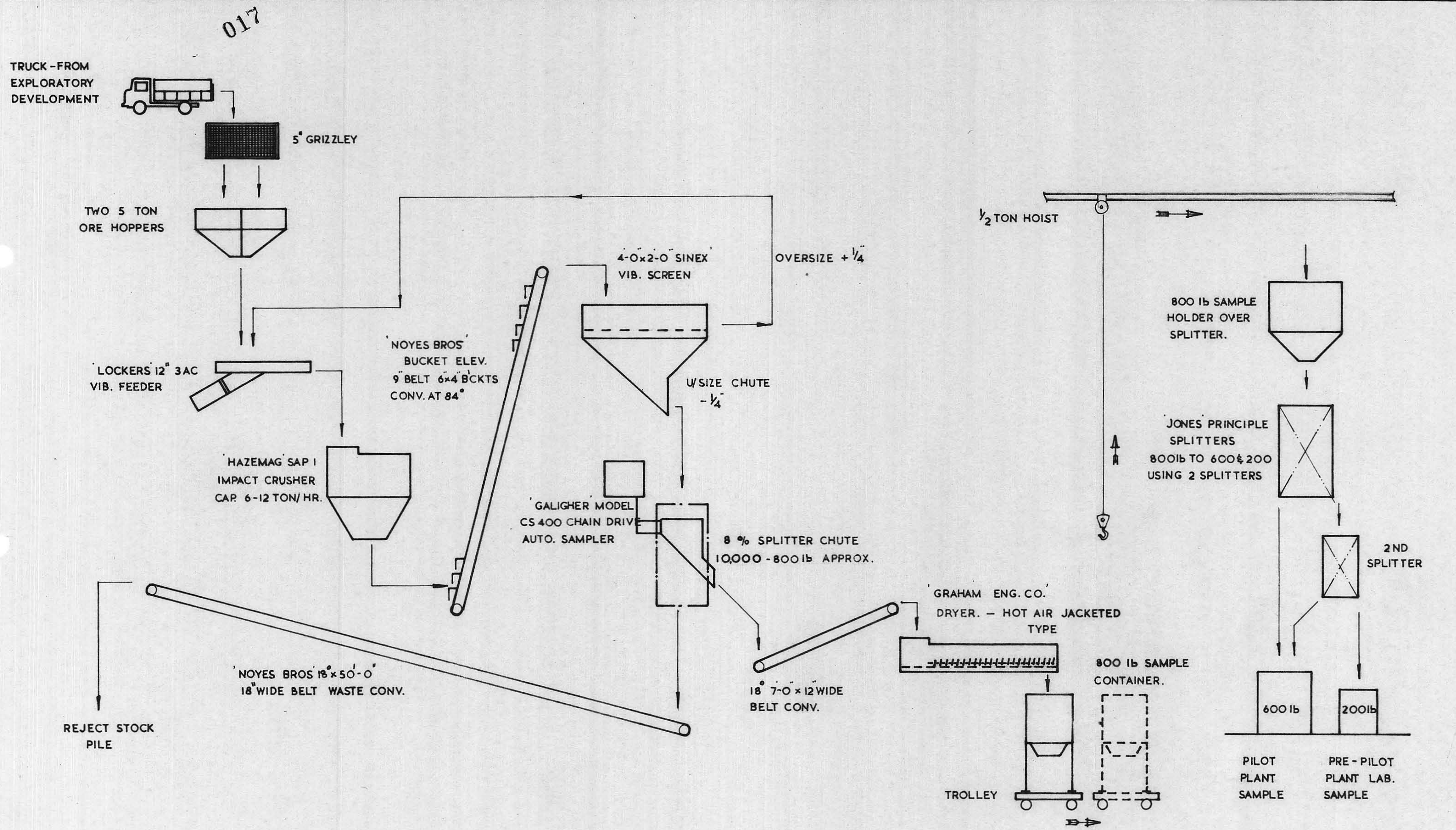

FROM DRG MC 013

Bulk sampling procedure

Development drives were maintained on the western contact with the objective of keeping about 2 ft. of wall rock in the drive face and thus exposing 4 ft. of lode. Due to rapid changes in attitude there were some mishaps in drive control but this did not affect the bulk sampling technique.

Development was planned, where possible, so that multiple working faces were available to the operators. This was desirable from the viewpoint of operator satisfaction, work organisation and performance; hence crosscuts were in progress simultaneously with the drives. Planning indicated that some of the earlier bulk samples would have to be cut while development was in progress. In such cases the drive was swung off the lode until the crosscut site was exposed and then swung back onto the lode. This practice avoided disruption of development and breaking of services. This is explained below in more detail.

It was decided that ore derived from that section of each crosscut embracing the lode would not be gathered as the bulk sampling material; it was considered desirable to geologically map each crosscut before any type of sampling was conducted. It was also decided that bulk samples would be taken as slices cut along the back of the crosscut, the slices sub-divided into batches according to a plan. Plan No. A/139 (L), included with this report shows the location of bulk sample batches.

A full description of the practice is best illustrated by a reproductionof the procedure laid down to the field staff. This follows:

"CLEVELAND DEVELOPMENT PROJECT

BULK SAMPLING TECHNIQUE PROCEDURE

1. When drive is 35 ft. from centre of planned crosscut,

turn west on survey control so that east wall of drive is a minimum of 2 ft. from west wall of lode. Refer Figs. 1 and 2.

Where lode wall is irregular, this may produce problems, but in the worst case it could only mean additional stripping to arrive at the desired result.

2. Crosscut at minimum size consistent with mechanical equipment. The length of each crosscut will be known to fairly close limits resulting from projection of geological data. The suspension of crosscutting is by direction of the Resident Geologist.

3. As crosscutting progresses, the drive is swung back on to normal course as shown in Fig. 1. A jump up is risen on east wall of lode to provide free face, as in Fig. 1.

4. (a) Crosscut will be accurately surveyed, plotted and geologically mapped immediately upon completion and forthwith groove sampled on each wall according to geological features of lode (i.e., interspersion of lode and chert bands) as determined by the Resident Geologist.

   (b) Conformable channel and bulk sample design should be determined jointly by the Project Supervisor and the Resident Geologist and referred to the Project Director for approval.

5. Upon approval or alternative direction by the Project Director, cut channel samples from back of crosscut according to approved design and identified in such a way that they will be referable to subsequent bulk samples. In general, approval will follow receipt of assay results of groove sampling.

6. Drilling of slot can now be commenced. In the case

of the first batch, drill for this batch only so that spacing of tear holes, burden, loading, etc., can be accurately and finally specified for future batches. Refer Figs. 3 and 4.

In subsequent batches, it should be possible for the whole slot to be pre-drilled to sampling design.

7. Before firing, provision must be made for adequate flooring of the drive to facilitate hand muching and minimise losses. Laying of sollar boards to achieve this to be progressive to ensure no loss of sample on uncovered section of drive and to make hand mucking as simple as possible. A blasting curtain may be necessary to prevent scatter.

8. (a) Trucks are to be filled no higher than 4" below the overflow level.

   (b) Each truck load, before weighing, will be grab sampled from the top in 6 places with a container of struck capacity of about 1 lb., i.e., approximately 6 lb. of sample from every truck.

9. Trucks to be hauled, weighed, tipped, recorded and despatched under expert and responsible supervision.

N.A. GILBERTHORPE
6/7/1964."

"CLEVELAND DEVELOPMENT PROJECT

BULK SAMPLING TECHNIQUE

Some Relevant Notes to be read in conjunction with procedure

1. Drive Control:

The drive is to be directed by survey control so that at the area of crosscutting the eastern wall of the drive is about 2 ft. from the western wall of the lode.

.../17

It is realised that if this requirement corresponds with a serious irregularity in attitude of the lode, difficulties may arise in achieving the desired position of the drive. If such is the case, and as a last resort, the west wall of the drive will have to be stripped to permit designed installation of track, ventilation tube and other services.

However, it is important that in preparing to swing the drive off and back onto the lode, the control is governed by geological data and round by round survey direction. Stripping is costly, non-productive and leaves the impression of an unworkman-like operation.

2. Crosscutting:

Ensure that crosscut direction is controlled from the first round and kept straight with a regular width of 6 feet.

3. Jump Up:

Is required to create a free face for the first firing of bulk sample.

Care must be taken in exposing the east wall of the lode. The first firing in the jump up will be such that a skin of, say, 4"-6" of wall rock is left on the east wall of the lode, then trimmed with care to avoid overbreak into lode.

4. Drilling Practice:

A stoper will be acquired which will ensure accurate hole control and more efficient drilling.

At a hole angle of 68^{o} and a slot depth of 2'6":-

Hole depth = 2'8"
and 2' for butt = 2'10"

At a slope angle - 68°

slope height of drive back = 90"

Therefore desirable that stoper be less than 90"-34" = 56" when closed.

Silver 3 Double Telescopic Feed Stoper satisfies at 51" and gives a 40" run.

A special steel with detachable bits will be purchased so that drilling can be done in one run.

All holes to be controlled to give correct slope, direction and depth.

5. **Firing Pattern:**

The firing pattern as designed in Figs. 3 and 4 is not intended to be inflexible. The cross-sectional dimensions of the slot will not vary, viz., 4 ft. wide x 2½ ft. deep and where possible length of slot will be 5 ft. A 5 ft. slot will break about 4½ tons.

Length will vary according to toal width of lode exposed- for instance, if this is 12 ft., then 3 batches each of 4 ft. would be cut. In other cases, length may be determined by relationship of lode and unmineralised chert bands.

Spacing of tear holes and blast holes may have to be varied. One or two blasts will provide sufficient experience on which to base final specifications.

6. **Blasting Practice:**

Again, final practice will depend on experience gained over one or two blasts, but it is suggested that two plugs AN60 per hole be tried initially.

To ensure a neater muck pile and cleaner break, it will be advantageous to use short delay electric detonators (blue-red wires) with the firing order shown in Fig. 3.

After firing, be meticulous in scaling down.

7. Results:

The desired result is a clearly fired ore pile free of scatter and leaving a slat 4 ft. x 2'6", by multiples of 5 ft. if possible, that can be conveniently measured for volume with a reasonable degree of accuracy.

N.A. GILBERTHORPE
6/7/1964."

Figures 1, 2, 3 and 4 referred to above are included with this report.

In accord with the reference in clause 4 of the Procedure, included with this report are individual bulk sample location plans for V, T, R, Qa, P, N, L and K showing the relationship of bulk sample batches to the geology.

Each bulk sample was processed under the supervision of Mr. J. Cox, Mining Engineer, or Mr. H.S. Fraser, Project Supervisor. For each batch pertinent data were recorded on a bulk sampling certificate (Form CD6) a copy of which is included with this report. The original of each certificate is retained in the official Company files.

Combining these data with assay data from the Tasmania Department of Mines the results for each crosscut were assembled and processed.

TABULATIONS OF RESULTS

Schedules 4 to 11 inclusive follow. Each schedule represents the results from individual batches compounded into one result for the reference crosscut.

CLEVELAND DEVELOPMENT PROJECT

(ABERFOYLE TIN DEVELOPMENT PARTNERSHIP)

SCHEDULE 4

BULK SAMPLING DATA

"V" X/C

Lot No.	Location X-cut "V"	Description	Measured Volume (cu.ft.)		Wet Weight lb.	Moist. Cont. %	Calc. Dry Wt. lb.	Density (cu.ft./ton)		Expansion Factor
			In situ	Broken				In situ	Broken	
52	VB1 57'0" - 52'6"	L. & Ch.	51	76	9,296	1.5	9,156	12.3	18.3	1.5
53	VB2 52'6" - 47'6"	L. & Ch.	60	112	13,949	2.0	13,670	9.2	17.2	1.9
54	VB3 47'6" - 42'6"	L. & Ch.	56	90	11,944	2.2	11,680	10.5	16.9	1.6
55	VB4 42'6" - 37'6"	L. & Ch.	56	96	12,467	1.8	12,242	10.0	17.2	1.7
56	VB5 37'6" - 32'6"	L. & Ch.	54	112	14,800	1.6	14,563	8.2	17.0	2.1
57	VB6 32'6" - 28'6"	L. & Ch.	43	86	10,159	1.4	10,019	9.5	19.0	2.0
58	VB7 28'6" - 24'0"	L. & Ch.	48	69	8,123	1.7	7,985	11.8	19.0	1.6
59	VB8 24'0" - 19'6"	L. & Ch.	50	95	11,490	2.1	11,248	9.8	18.5	1.9
60	VB9 19'6" - 15'0"	L. & Ch.	48	89	9,967	1.4	9,827	10.8	20.0	1.9
61	VB10 15'0" - 11'0"	L. & Ch.	48	94	10,062	1.9	9,872	10.8	21.0	2.0
62	VB11 11'0" - 6'9"	L. & Ch.	43	69	8,165	1.5	8,043	11.8	19.0	1.7
63	VB12 6'9" - 2'0"	L. & Ch.	48	76	9,220	1.2	9,110	11.4	18.0	1.6
64	VB13 2'0" - 2'0" West	L. & Ch.	60	104	12,813	1.3	12,647	10.5	18.2	1.7
ALL			665	1,168	142,455	1.7	140,062	10.5	18.6	1.8

Lot No.	CRUSHED & SPLIT PRODUCTS NET DRY WEIGHT (lb.)						Reject to Stockpile Weight (by Difference) lb.	ASSAYS OF LAB. SAMPLES					
	Lab. Sample			Bulk Sample				% Tin			%		
	Weight	Mark	% of Original Dry Wt.	Weight	Mark	% of Original Dry Wt.		Total	Vanned	Recov.	Cu.	S.	Acid
52	198	VBL1	2.2	642	VB01	7.1	8,316	0.36	0.28	77.8	0.26	11.4	50.3
53	296	VBL2	2.2	969	VB02	7.1	12,405	0.71	0.41	57.7	0.20	10.3	52.9
54	244	VBL3	2.1	750	VB03	6.5	10,686	0.46	0.34	73.9	0.26	13.2	46.2
55	263	VBL4	2.2	793	VB04	6.5	11,186	0.47	0.33	70.2	0.27	12.6	46.0
56	322	VBL5	2.2	989	VB05	6.8	13,252	0.57	0.46	80.7	0.21	9.9	49.4
57	214	VBL6	2.1	693	VB06	6.9	9,112	0.21	0.19	90.5	0.17	6.3	62.0
58	173	VBL7	2.2	566	VBL7	7.1	7,246	0.23	0.21	91.3	0.15	7.8	56.6
59	249	VBL8	2.2	762	VB08	6.8	10,237	0.24	0.20	83.3	0.20	10.0	46.2
60	222	VBL9	2.2	678	VB09	6.9	8,927	0.11	0.07	63.6	Tr.	3.6	64.5
61	195	VBL10	1.9	679	VB010	6.9	8,998	0.06	0.05	83.3	Tr.	1.9	71.8
62	158	VBL11	2.0	568	VB011	7.0	7,317	0.22	0.15	68.2	0.12	5.4	53.9
63	186	VBL12	2.0	670	VB012	7.3	8,254	0.62	0.48	77.4	0.21	10.1	42.1
64	261	VBL13	2.1	820	VB013	6.5	11,566	0.59	0.42	71.2	0.18	8.1	48.0
ALL	2,981	VBL	2.1	9,579	VBO	6.8	127,502	0.40	0.29	72.4	0.18	8.7	52.4

CLEVELAND DEVELOPMENT PROJECT

(ABERFOYLE TIN DEVELOPMENT PARTNERSHIP)

SCHEDULE 5 "T" X/C

BULK SAMPLING DATA

Lot No.	Location X-cut "T"	Description	Measured Volume (cu.ft.) In situ	Measured Volume (cu.ft.) Broken	Wet Weight lb.	Moist. Cont. %	Calc. Dry Wt. lb.	Density (cu.ft./ton) In situ	Density (cu.ft./ton) Broken	Expansion Factor
42	TB3 41'6" - 37'6"	L. & Ch.	40	92	10,831	1.0	10,723	8.3	19.0	2.3
43	TB4 37'6" - 33'0"	L. & Ch.	52	109	12,869	1.9	12,626	9.1	18.8	2.0
44	TB5 33'0" - 29'0"	L. & Ch.	51	57	6,122	1.9	6,006	18.7	20.8	1.1
45	TB6 29'0" - 25'6"	L. & Ch.	42	89	10,149	1.7	9,967	9.3	19.6	2.1
46	TB7 21'3" - 25'6"	L. & Ch.	48	93	11,471	2.0	11,242	9.4	17.9	1.9
47	TB8 17'6" - 21'3"	Chert	38	58	7,299	1.1	7,220	11.7	17.9	1.6
48	TB9 17'6" - 12'9"	Lode & Ch.	54	86	9,884	1.6	9,727	12.2	19.5	1.6
49	TB10 8'9" - 12'9"	L. & Ch.	48	76	9,222	2.4	9,002	11.7	19.0	1.6
50	TB2 50'6" - 55'0"	L. & Ch.	45	77	9,286	1.4	9,157	11.0	19.0	1.7
51	TB1 55'0" - 59'6"	L. & Ch.	54	104	12,595	2.1	12,331	9.7	18.6	1.9
71	TB11 8'9" - 4'3"	L. & Ch.	32	57	6,543	0.9	5,958	11.0	19.5	1.8
72	TB12 4'3" - Zero	L. & Ch.	37	58	7,102	1.3	7,010	11.6	18.3	1.6
ALL			541	956	113,373	2.1	110,969	10.9	19.3	1.8

Lot No.	CRUSHED & SPLIT PRODUCTS NET DRY WEIGHT (lb.) Lab. Sample Weight	Lab. Sample Mark	Lab. Sample % of Original Dry Wt.	Bulk Sample Weight	Bulk Sample Mark	Bulk Sample % of Original Dry Wt.	Reject to Stockpile Weight (by Difference) lb.	ASSAYS OF LAB. SAMPLES % Tin Total	% Tin Vanned	% Tin Recov.	% Cu.	% S.	% Acid
42	220	TBL3	2.1	792	TB03	7.3	9,711	0.48	0.33	68.8	0.28	10.0	50.6
43	282	TBL4	2.2	888	TB04	7.0	11,456	0.33	0.25	75.8	0.20	6.8	59.7
44	143	TBL5	2.3	430	TB05	7.2	5,433	0.11	0.08	72.7	0.09	3.0	72.9
45	206	TBL6	2.1	733	TB06	7.4	9,028	0.24	0.20	83.3	0.12	4.4	65.8
46	250	TBL7	2.2	804	TB07	7.2	10,188	0.78	0.61	78.2	0.25	9.7	50.8
47	143	TBL8	1.9	496	TB08	6.9	6,581	1.09	0.85	78.0	0.27	11.0	46.2
48	210	TBL9	2.2	705	TB09	7.3	8,812	0.24	0.18	75.0	Tr.	2.2	64.3
49	175	TBL10	1.9	630	TB010	7.0	8,197	1.43	1.24	86.7	0.24	9.9	46.6
50	191	TBL2	2.1	654	TB02	7.1	8,312	0.77	0.61	79.2	0.30	9.3	50.4
51	251	TBL1	2.0	910	TB01	7.4	11,170	0.87	0.74	85.1	0.23	8.4	54.5
71	150	TBL11	2.5	325	TB011	5.5	5,483	1.40	1.17	83.5	0.32	11.9	43.2
72	170	TBL12	2.4	469	TB012	6.7	6,371	1.56	1.34	85.9	0.30	10.5	46.2
ALL	2,391	TBL	2.2	7,836	TBO	7.1	100,742	0.73	0.59	81.0	0.22	8.4	54.6

CLEVELAND DEVELOPMENT PROJECT

(ABERFOYLE TIN DEVELOPMENT PARTNERSHIP)

SCHEDULE 6 | "R" X/C

BULK SAMPLING DATA

Lot No.	Location X-cut "R"	Description	Measured Volume (cu.ft.)		Wet Weight lb.	Moist. Cont. %	Calc. Dry Wt. lb.	Density (cu.ft./ton)		Expansion Factor
			In situ	Broken				In situ	Broken	
1	RB3 64'0" - 69'0"	L. & Ch.	55	108	12,797	0.9	12,682	9.7	19.1	2.0
2	RB2 74'0" - 77'6"	L. & Ch.	45	83	9,431	1.7	9,270	10.7	20.1	1.9
3	RB1 77'6" - 81'0"	L. & Ch.	45	73	9,002	1.2	8,894	11.0	18.4	1.7
4	RB4 59'0" - 64'0"	L. & Ch.	50	90	11,442	1.2	11,305	9.8	17.8	1.8
5	RB5 55'0" - 59'0"	L. & Ch.	50	76	8,470	1.0	8,385	13.0	20.3	1.6
6	RB6 50'0" - 55'0"	L. & Ch.	50	95	11,429	0.8	11,336	10.0	18.6	1.9
7	RB7 45'0" - 50'0"	L. & Ch.	50	95	11,367	1.8	11,162	10.0	18.8	1.9
8	RB8 40'6" - 45'0"	L. & Ch.	45	70	8,281	3.4	8,000	12.2	19.0	1.6
9	RB9 36'6" - 40'6"	L. & Ch.	40	76	9,275	1.3	9,154	9.6	18.2	1.9
10	RB10 32'6" - 36'6"	Pr. Lode	40	74	7,078	1.9	6,943	10.3	19.0	1.8
11	RB11 28'6" - 32'6"	" "	40	76	9,090	1.9	8,917	10.0	18.7	1.9
12	RB12 25'0" - 28'6"	L. & Ch.	35	61	7,312	2.2	7,151	10.7	18.7	1.8
13	RB13 21'6" - 25'0"	Lode	35	52	6,268	1.7	6,161	12.6	18.6	1.5
ALL			680	1,029	121,242	1.6	119,360	10.9	19.3	1.8

ASSAYS OF LAB. SAMPLES

Lot No.	CRUSHED & SPLIT PRODUCTS NET DRY WEIGHT (lb.)						Reject to Stockpile Weight (by Difference) lb.	% Tin			%			
	Lab. Sample			Bulk Sample										
	Weight	Mark	% of Original Dry Wt.	Weight	Mark	% of Original Dry Wt.		Total	Vanned	Recov.	Cu.	S.	Acid	
1	316	RBL3	2.5	894	RBO3	7.1	11,472	0.67	0.54	80.6	0.27	6.8	58.9	R482/1
2	204	RBL2	2.2	618	RBO2	6.6	8,448	0.96	0.75	78.1	0.25	7.5	58.2	2
3	153	RBL1	1.7	603	RBO1	6.8	8,138	1.22	1.00	82.0	0.29	8.2	59.1	3
4	254	RBL4	2.3	728	RBO4	6.5	10,323	0.87	0.62	71.3	0.38	11.3	46.2	4
5	190	RBL5	2.3	558	RBO5	6.7	7,637	0.67	0.49	73.1	0.27	8.3	52.2	5
6	251	RBL6	2.2	758	RBO6	6.7	10,327	0.74	0.58	78.4	0.31	9.1	50.1	6
7	250	RBL7	2.2	790	RBO7	7.1	10,122	0.46	0.39	84.4	0.21	4.2	61.2	7
8	178	RBL8	2.2	548	RBO8	6.8	7,274	0.32	0.28	87.5	0.12	2.6	70.7	8
9	195	RBL9	2.1	629	RBO9	6.8	8,330	1.14	0.98	86.0	0.50	10.4	45.9	9
10	164	RBL10	2.4	583	RBO10	8.4	6,196	0.67	0.53	79.1	0.22	6.0	56.7	10
11	170	RBL11	1.9	608	RBO11	6.8	8,139	1.27	0.95	74.8	0.25	10.6	45.7	11
12	154	RBL12	2.1	502	RBO12	7.0	6,495	0.81	0.63	77.8	0.16	5.8	55.7	12
13	114	RBL13	1.9	420	RBO13	6.8	5,627	1.19	0.94	79.0	0.35	9.3	51.2	13
ALL	2,593	RBL	2.2	8,239	RBO	6.9	108,528	0.81	0.64	79.0	0.28	7.7	54.8	

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CLEVELAND DEVELOPMENT PROJECT

(ABERFOYLE TIN DEVELOPMENT PARTNERSHIP)

SCHEDULE 7 "QA" X/C

BULK SAMPLING DATA

Lot No.	Location X-cut "QA"	Description	Measured Volume (cu.ft.)		Wet Weight lb.	Moist. Cont. %	Calc. Dry Wt. lb.	Density (cu.ft./ton)		Expansion Factor
			In situ	Broken				In situ	Broken	
65	QB1 21'3" - 16'9"	L. & Ch.	48	67	8,424	1.9	8,264	12.8	18.0	1.4
66	QB2 16'9" - 12'3"	L. & Ch.	35	50	5,840	1.5	5,753	13.5	19.2	1.4
67	QB3 12'3" - 8'9"	L. & Ch.	43	70	8,648	1.0	8,562	11.1	18.2	1.6
68	QB4 8'9" - 4'3"	L. & Ch.	38	66	8,151	1.0	8,070	10.4	18.0	1.7
70	QB5 4'3" - 0'3"	W of A5 L. & Ch.	45	76	9,423	1.4	9,290	10.7	18.1	1.7
69	QB6 0'3" - 5'3"	W of A5 L. & Ch.	47	76	9,277	1.0	9,184	11.3	18.3	1.6
ALL			256	405	49,763	1.3	49,123	11.7	18.5	1.6

Lot No.	CRUSHED & SPLIT PRODUCTS NET DRY WEIGHT (lb.)						Reject to Stockpile Weight (by Difference) lb.	ASSAYS OF LAB. SAMPLES					
	Lab. Sample			Bulk Sample				% Tin			%		
	Weight	Mark	% of Original Dry Wt.	Weight	Mark	% of Original Dry Wt.		Total	Vanned	Recov.	Cu.	S.	Acid
65	166	QBL1	2.1	573	QBO1	7.0	7,525	0.56	0.49	87.5	0.58	7.3	56.5
66	131	QBL2	2.3	396	QBO2	6.9	5,226	0.43	0.37	86.1	0.29	4.7	61.4
67	183	QBL3	2.1	558	QBO3	6.5	7,821	1.01	0.95	94.1	0.52	8.9	50.0
68	142	QBL4	1.7	527	QBO4	6.5	7,401	1.19	1.04	87.4	0.64	12.0	46.9
70	215	QBL5	2.3	604	QBO5	6.5	8,471	0.84	0.76	90.5	0.70	11.9	49.2
69	216	QBL6	2.4	614	QBO6	6.7	8,354	1.23	1.10	89.4	0.54	12.1	48.6
ALL	1,053	QBL	2.1	3,272	QBO	6.7	44,798	0.90	0.81	90.0	0.56	9.8	51.6

CLEVELAND DEVELOPMENT PROJECT

(ABERFOYLE TIN DEVELOPMENT PARTNERSHIP)

SCHEDULE 8 "P" X/C

BULK SAMPLING DATA

	Lot No.	Location X-cut "P"	Description	Measured Volume (cu.ft.) In situ	Measured Volume (cu.ft.) Broken	Wet Weight lb.	Moist. Cont. %	Calc. Dry Wt. lb.	Density (cu.ft./ton) In situ	Density (cu.ft./ton) Broken	Expansion Factor
	30	PB1 31'0" - 35'0"	L. & Ch.	44	86	10,209	2.0	10,005	9.8	19.1	2.0
	32	PB2 27'0" - 31'0"	Lode	45	94	11,587	1.2	11,449	8.7	18.2	2.1
ø	71	PB3 22'0" - 27'0"	Lode	35	57	7,349	0.4	7,319	10.7	17.5	1.6
ø	72	PB4 17'0" - 22'0"	L. & Ch.	35	57	7,246	0.4	7,217	10.7	17.7	1.7
	37	PB5 12'0" - 17'0"	L. & Ch.	56	83	10,937	1.2	10,697	11.5	17.0	1.5
	39	PB6 7'0" - 12'0"	L. & Ch.	59	86	11,209	1.3	11,063	11.8	17.2	1.5
	40	PB7 2'6" - 7'0"	L. & Ch.	51	91	10,953	1.1	10,833	10.5	18.7	1.8
	ALL			325	554	69,490	1.3	68,583	10.6	18.1	1.7

ø Repeats of 33 and 36

	Lot No.	Crushed & Split Products Net Dry Weight (lb.) — Lab. Sample Weight	Lab. Sample Mark	Lab. Sample % of Original Dry Wt.	Bulk Sample Weight	Bulk Sample Mark	Bulk Sample % of Original Dry Wt.	Reject to Stockpile Weight (by Difference) lb.	Assays of Lab. Samples — % Tin Total	% Tin Vanned	% Tin Recov.	% Cu.	% S.	% Acid	
	30	206	PBL1	2.5	725	PBO1	7.2	9,074	1.81	1.51	83.4	0.75	14.3	44.8	R482/33
	32	277	PBL2	2.4	754	PBO2	6.6	10,418	0.91	0.72	79.1	0.68	8.7	56.6	34
ø	71	165	PBL3	2.3	546	PBO3	7.5	6,608	1.74	1.28	73.7	0.53	11.6	53.5	35
ø	72	187	PBL4	2.6	462	PBO4	6.4	6,568	1.47	1.14	77.6	0.58	11.9	50.5	36
	37	220	PBL5	2.0	768	PBO5	7.0	9,709	0.59	0.41	69.5	0.40	5.2	64.8	37
	39	233	PBL6	2.1	706	PBO6	6.4	10,124	1.61	1.36	84.5	0.52	13.0	47.5	
	40	226	PBL7	2.1	739	PBO7	6.9	9,868	1.04	0.85	81.7	0.33	0.4	56.7	
	ALL	1,514	PBL	2.2	4,700	PBO	6.8	62,369	1.28	1.02	79.2	0.54	9.1	54.0	

CLEVELAND DEVELOPMENT PROJECT

(ADERFOYLE TIN DEVELOPMENT PARTNERSHIP)

SCHEDULE 9 — BULK SAMPLING DATA — "N" X/C

Lot No.	Location X-cut "N"	Description	Measured Volume (cu.ft.) In situ	Measured Volume (cu.ft.) Broken	Wet Weight lb.	Moist. Cont. %	Calc. Dry Wt. lb.	Density (cu.ft./ton) In situ	Density (cu.ft./ton) Broken	Expansion Factor
27	NB1 45'6" - 50'6"	L. & Ch.	50	94	11,496	2.4	11,220	9.8	18.3	1.7
28	NB2 40'6" - 45'6"	L. & Ch.	50	90	11,352	0.8	11,262	10.0	17.8	1.8
29	NB3 36'6" - 40'6"	L. & Ch.	40	86	10,358	2.0	10,151	9.0	18.7	2.1
31	NB4 32'6" - 36'6"	Lode	40	87	10,557	1.2	10,431	8.5	18.5	2.2
34	NB5 28'0" - 32'6"	L. & Ch.	45	90	10,034	1.6	9,974	10.0	20.0	2.0
35	NB6 23'6" - 28'0"	L. & Ch.	45	81	11,209	1.6	11,030	9.0	18.1	2.0
38	NB7 19'0" - 23'6"	L. & Ch.	45	88	11,450	0.9	11,346	9.0	17.2	1.9
41	NB8 14'0" - 19'0"	L. & Ch.	50	95	11,199	1.8	10,907	10.1	19.2	1.9
ALL			365	711	87,655	1.5	86,321	9.5	18.5	1.9

Lot No.	CRUSHED & SPLIT PRODUCTS NET DRY WEIGHT (lb.) — Lab. Sample Weight	Lab. Sample Mark	Lab. Sample % of Original Dry Wt.	Bulk Sample Weight	Bulk Sample Mark	Bulk Sample % of Original Dry Wt.	Reject to Stockpile Weight (by Difference) lb.	ASSAYS OF LAB. SAMPLES — % Tin Total	% Tin Vanned	% Tin Recov.	% Cu.	% S.	% Acid	
27	231	NBL1	2.1	802	NBO1	7.1	10,187	1.60	1.27	79.4	0.24	8.1	53.0	R482/27
28	248	NBL2	2.2	802	NBO2	7.1	10,212	1.24	1.00	80.7	0.40	11.4	51.5	28
29	227	NBL3	2.2	737	NBO3	7.1	9,187	0.68	0.61	89.7	0.24	6.8	57.9	29
31	261	NBL4	2.5	691	NBO4	6.6	9,479	1.34	1.03	76.9	0.25	9.0	45.0	30
34	181	NBL5	1.8	692	NBO5	7.0	9,101	1.29	0.95	73.6	0.27	9.3	46.4	31
35	202	NBL6	1.8	752	NBO6	6.8	10,076	1.37	1.05	76.6	0.43	11.8	49.4	32
38	241	NBL7	2.1	643	NBO7	5.7	10,462	1.33	1.09	82.0	0.49	13.6	50.4	
41	240	NBL8	2.2	726	NBO8	6.6	9.941	0.53	0.43	81.1	0.19	5.4	64.2	
ALL	1,831	NBL	2.1	5,845	NBO	6.8	78,645	1.17	0.93	79.4	0.31	9.4	52.3	

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CLEVELAND DEVELOPMENT PROJECT

(ABERFOYLE TIN DEVELOPMENT PARTNERSHIP)

SCHEDULE 10 "L" X/C

BULK SAMPLING DATA

Lot No.	Location X-cut "L"	Description	Measured Volume (cu.ft.)		Wet Weight lb.	Moist. Cont. %	Calc. Dry Wt. lb.	Density (cu.ft./ton)		Expansion Factor
			In situ	Broken				In situ	Broken	
14	LB1 8'0" - 12'0"	L. & Ch.	40	58	7,130	1.4	7,030	12.6	18.2	1.5
15	LB2 4'0" - 8'0"	L. & Ch.	45	76	9,676	1.9	9,492	10.4	17.5	1.7
16	LB3 0'0" - 4'0"	L. & Ch.	40	75	7,527	2.2	7,362	11.9	22.4	1.8
ALL			125	209	24,333	1.9	23,884	11.7	19.6	1.7

Lot No.	CRUSHED & SPLIT PRODUCTS NET DRY WEIGHT (lb.)						Reject to Stockpile Weight (by Difference) lb.	ASSAYS OF LAB. SAMPLES						
	Lab. Sample			Bulk Sample				% Tin			%			
	Weight	Mark	% of Original Dry Wt.	Weight	Mark	% of Original Dry Wt.		Total	Vanned	Recov.	Cu.	S.	Acid	
14	143	LBL1	2.0	516	LBO1	7.3	6,371	0.77	0.56	72.7	0.30	10.0	52.3	482/1
15	184	LBL2	1.9	693	LBO2	7.3	8,615	0.93	0.68	73.1	0.30	9.7	45.7	1
16	152	LBL3	2.1	497	LBO3	6.8	6,713	0.55	0.34	61.8	0.28	7.7	49.6	1
ALL	479	LBL	2.0	1,706	LBO	7.1	21,699	0.76	0.54	71.0	0.29	9.2	49.0	

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SCHEDULE 11

CLEVELAND DEVELOPMENT PROJECT

(ABERFOYLE TIN DEVELOPMENT PARTNERSHIP)

"K" X/C

B U L K   S A M P L I N G   D A T A

Lot No.	Location X-cut "K"	Description	Measured Volume (cu.ft.)		Wet Weight lb.	Moist. Cont. %	Calc. Dry. Wt. lb.	Density (cu.ft./ton)		Expansion Factor
			In situ	Broken				In situ	Broken	
17	KB2 56'9" - 52'0"	Lode	40	73	9,131	1.6	8,984	10.0	18.0	1.8
18	KB1 61'3" - 56'9"	L. & Ch.	58	85	12,605	1.4	12,429	8.6	14.7	1.7
19	KB3 34'6" - 29'6"	L. & Ch.	50	76	10,157	1.2	10,034	11.1	17.0	1.5
20	KB4 29'6" - 24'6"	L. & Ch.	60	114	14,031	2.0	13,750	9.6	18.2	1.9
21	KB5 29'6" - 19'6"	L. & Ch.	50	76	9,571	2.6	9,321	11.7	18.0	1.6
22	KB6 19'6" - 14'6"	L. & Ch.	50	80	9,437	1.2	9,323	11.9	19.0	1.7
23	KB7 14'6" - 10'0"	L. & Ch.	45	103	12,525	2.4	12,225	12.3	18.4	1.5
24	KB8 10'0" - 5'6"	L. & Ch.	45	76	9,248	1.8	9,082	10.9	18.5	1.7
25	KB9 5'6" - 2'6"	L. & Ch.	30	46	6,345	2.4	6,192	10.9	17.0	1.6
26	KB10 2'6" - 1'0"	L. & Ch.	35	75	9,366	2.3	9,151	8.4	18.0	2.2
ALL			463	804	102,416	1.9	100,491	10.3	18.0	1.8

ASSAYS OF LAB. SAMPLES

Lot No.	CRUSHED & SPLIT PRODUCTS NET DRY WEIGHT (lb.)						Reject to Stockpile Weight (by Difference) lb.	% Tin			%			
	Lab. Sample			Bulk Sample										
	Weight	Mark	% of Original Dry Wt.	Weight	Mark	% of Original Dry Wt.		Total	Vanned	Recov.	Cu.	S.	Acid	
17	198	KBL2	2.2	637	KB02	7.1	8,149	0.96	0.74	77.1	0.15	7.0	46.5	R482/18
18	286	KBL1	2.3	891	KB01	7.2	11,252	0.77	0.54	70.1	0.19	7.6	44.8	17
19	206	KBL3	2.0	724	KB03	7.2	9,104	0.91	0.53	58.2	0.31	11.4	45.8	19
20	296	KBL4	2.1	917	KB04	6.7	12,537	0.86	0.61	70.9	0.18	6.2	56.0	20
21	206	KBL5	2.2	646	KB05	7.0	8,469	0.75	0.50	66.7	0.15	6.4	56.5	21
22	227	KBL6	2.4	653	KB06	7.0	8,443	0.53	0.32	60.4	0.12	4.7	61.9	22
23	304	KBL7	2.5	802	KB07	6.6	11,119	0.50	0.35	70.0	0.21	7.0	55.4	23
24	233	KBL8	2.5	603	KB08	6.6	8,246	0.43	0.36	83.7	0.26	6.9	56.6	24
25	173	KBL9	2.8	377	KB09	6.1	5,642	1.19	0.89	74.8	0.47	9.5	44.9	25
26	240	KBL10	2.6	654	KB010	7.2	8,257	1.45	1.17	80.7	0.76	11.8	45.8	26
ALL	2,369	KBL	2.4	6,904	KBO	6.9	91,218	0.82	0.59	71.9	0.27	7.7	51.6	

DISCUSSION OF RESULTS

Recapitulating from the Summary of Results and examining Schedule 3 the following comparison was recorded:

	Bulk	Channel	Groove	Split Core
Tin %	0.81	0.83	0.80	0.94
Copper %	0.30	0.32	0.30	0.29

It is recalled that bulk, channel and groove samples were taken from each crosscut. The bulks came from slices over the back whereas channels and grooves were cut from the walls of the crosscuts. Split core samples were taken from drill holes located at sections intermediate to crosscuts and at reasonably regular frequency. All samples were across the "grain" of the lodes.

Accepting the bulk sample assay for Sn. as datum the close agreement between channel and bulk, and between groove and bulk, (on weighted average within 2½% and 1¼% respectively), merits consideration. Individual results are graphed and shown in Figure 5. From this it is not difficult to imagine that bulk, channel and groove samples are representative of the same whole within the practical limits imposed by orebodies. Expressed otherwise each class of sample appears to exert the same degree or dimension of influence. No attempt is made here to quantify this degree.

Consequently it is reasonable to deduce that a groove sample from a given location gives a result of reliability equivalent to that obtained from a much larger sample (e.g. a bulk sample).

It is also reasonable to deduce that for a given location a split core sample has equal reliability with a groove sample- there is no apparent reason to expect bias either way. To form some idea of their relationship with bulk, channel and groove samples split core assays are graphed and superimposed on Figure 5. From this there

..../22

034

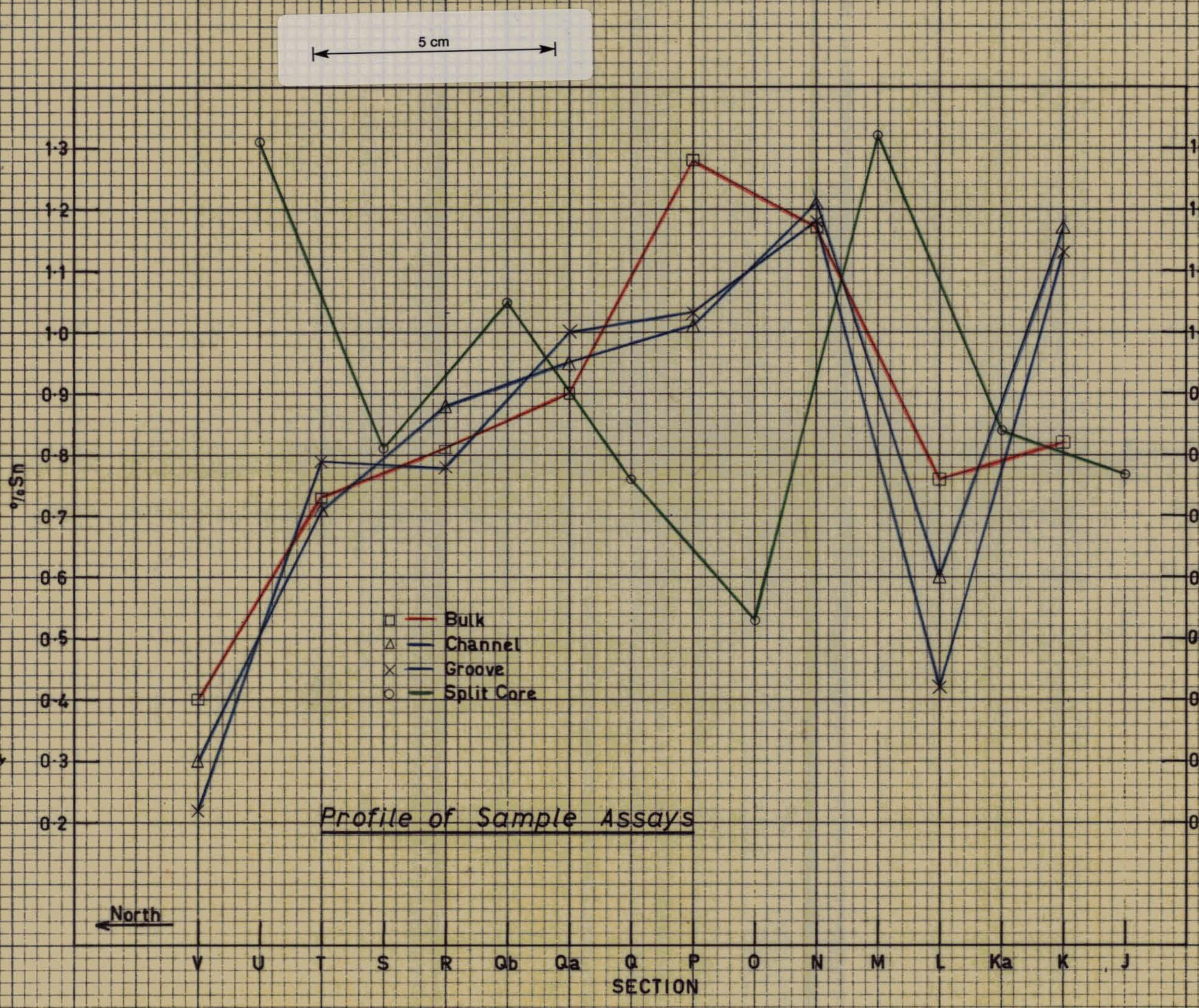


FIG.5

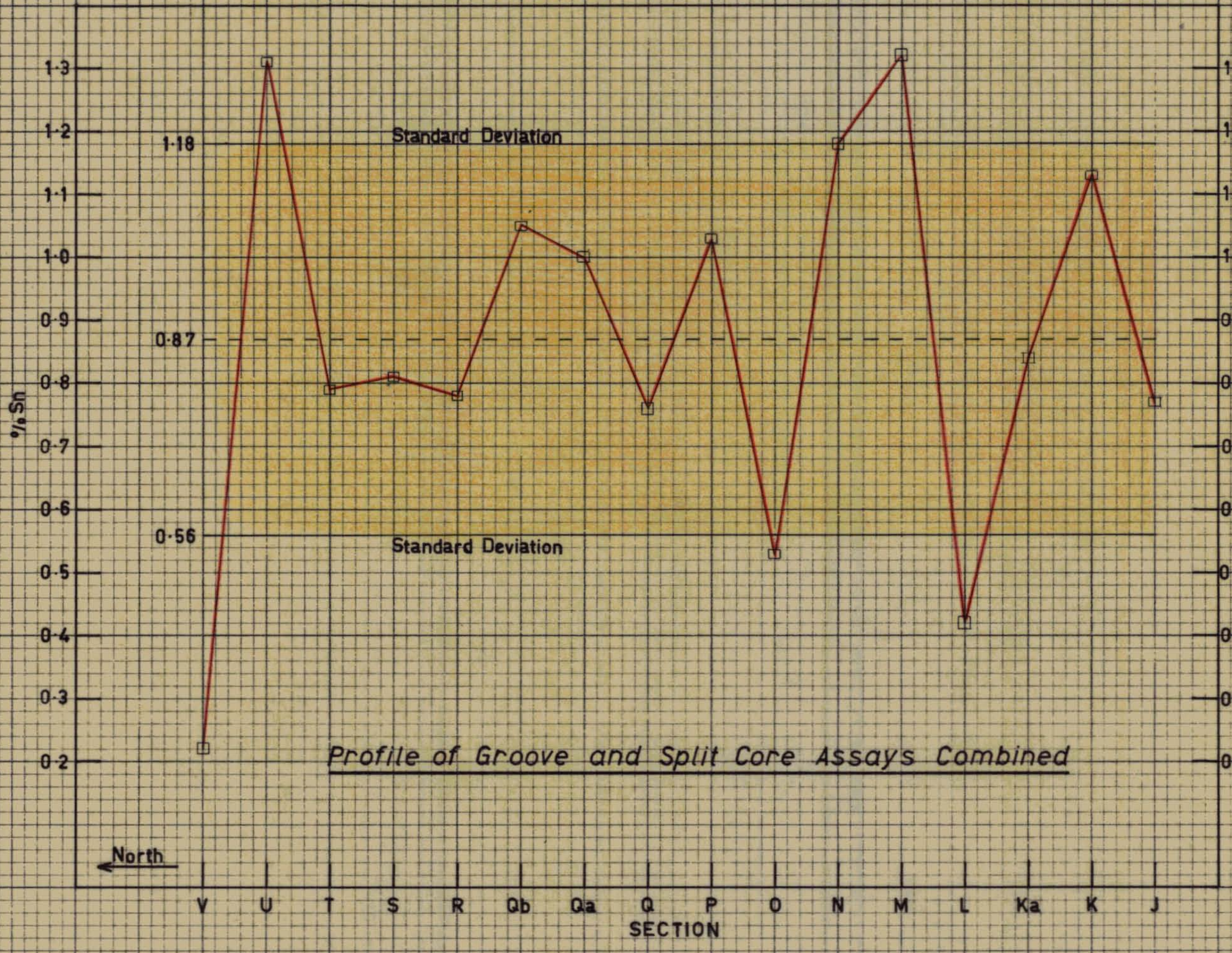


FIG.6

appears no justification in attempting to mate or correlate individual split core samples with say groove samples at adjacent sections, for instacne U with V, or O with P or N. In fact the relationship suggests it would be fallacious to do so.

If split core samples are combined with groove samples the effect is to have 16 samples across the lode at reasonably regular intervals on the 1300 R.L. horizon. The profile of the assay results from these samples is plotted on Figure 6 and the results tabulated on Schedule 12.

From Schedule 12 it will be noted that the arithmetic mean assay for Sn. is 0.87% with a standard deviation of ± 0.31% Sn. For convenience this is plotted also on Figure 6. These representations suggest very strongly -

(a) that the distribution of tin values is erratic,

(b) That the significance of assay results from diamond drill holes in other spatial points of the ore body must be influenced by the order of accuracy indicated above.

Unfortunately it emerges that no correction factor can be applied to assay results from diamond drill core. From the viewpoint of ore reserve estimation this could be important; hence the recommendation to augment our knowledge with additional results from horizontal diamond drill holes referable to split core assays at intermediate sections.

As an academic extension to the exercise the assay results from each class of sample were measured and standard deviations determined. The results are quoted:

Bulk Samples	0.86% Sn.	± 0.27% Sn.
Channel Samples	0.85% Sn.	± 0.30% Sn.

Groove Samples	0.82% Sn. ± 0.34% Sn.
Split Core Samples	0.92% Sn. ± 0.28% Sn.
All Combined	0.86% Sn. ± 0.29% Sn.

Schedules 13, 14, 15, and 16 tabulates this information.

The magnitude of the deviations from the mean suggests the desirability of enlisting a more expert statistical examination of results which may help in the interpretation of assays from diamond drill holes on which reserves are based.

SCHEDULE 12

CLEVELAND DEVELOPMENT PROJECT

DERIVATION OF STANDARD DEVIATIONS

Sample Section	Assay Value Sn. Groove & S/C	Deviation	Deviation Squared As Decimal
V	0.22	0.65	4225 x 10^{-8}
U	1.31	0.44	1936
T	0.79	0.08	64
S	0.81	0.06	36
R	0.78	0.09	81
Qb	1.05	0.18	324
Qa	1.00	0.13	161
Q	0.76	0.11	121
P	1.03	0.16	256
O	0.53	0.34	1156
N	1.18	0.31	965
M	1.32	0.45	2025
L	0.42	0.45	2025
Ka	0.84	0.03	9
K	1.13	0.26	676
J	0.77	0.10	100
SUMS	13.94		14160 x 10^{-8}
MEAN	0.87		

$$\sigma^2 = \frac{14160 \times 10^{-8}}{n - 1}$$

$$= 944 \times 10^{-8}$$

$$\sigma = \pm 31 \times 10^{-4}$$

$$= \pm 0.31\% \text{ Sn.}$$

CLEVELAND DEVELOPMENT PROJECT

BULK SAMPLES

SCHEDULE 13

Section	Assay "a"	Bulk Samples Deviation "d"	d^2
V	0.40	0.46	2120
T	0.73	0.13	169
R	0.81	0.05	25
Qa	0.90	0.04	16
P	1.28	0.42	1770
N	1.17	0.31	961
L	0.76	0.10	100
K	0.82	0.04	16
SUM	6.87		5177

$\bar{a}$ = 0.86% Sn.

σ^2 = 739

Standard Deviation σ = ± 0.27% Sn.

CLEVELAND DEVELOPMENT PROJECT

CHANNEL SAMPLES

SCHEDULE 14

Section	Assay "a"	Deviation "d"	d^2
V	0.30	0.55	3025
T	0.71	0.14	196
R	0.88	0.03	9
Qa	0.95	0.10	100
P	1.01	0.16	256
N	1.21	0.36	1296
L	0.60	0.25	625
K	1.17	0.32	1024
	6.83		6531

$\bar{a}$ = 0.85 % Sn.

σ^2 = 933

Standard Deviation σ = ± 0.30% Sn.

039

239039

CLEVELAND DEVELOPMENT PROJECT

GROOVE SAMPLES

SCHEDULE 15

Section	Assay "a"	Deviation "d"	d^2
V	0.22	0.60	3600
T	0.79	0.03	9
R	0.78	0.04	16
Qa	1.00	0.18	324
P	1.03	0.21	441
N	1.18	0.36	1296
L	0.42	0.40	1600
K	1.13	0.31	961
	6.55		8247

$\bar{a}$ = 0.82% Sn.

σ^2 = 1178

Standard Deviation σ = $\pm$ 0.34% Sn.

CLEVELAND DEVELOPMENT PROJECT

SPLIT CORE SAMPLES

SCHEDULE 16

Section	Assay "a"	Deviation "d"	d^2
U	1.31	0.39	1520
S	0.81	0.11	121
Qb	1.05	0.13	169
Q	0.76	0.16	256
O	0.53	0.39	1520
M	1.32	0.40	1600
K_a	0.84	0.08	64
J	0.77	0.15	225
	7.39		5475

$\bar{a}$ = 0.92% Sn.

σ^2 = 782

Standard Deviation σ = $\pm$ 0.28% Sn.

ACKNOWLEDGMENTS

To Mr. Ken Blaskett, Principal Research Officer, Ore Dressing Investigations, C.S.I.R.O., for his guidance in the application of P. Gy's work.

To Mr. Roy Cox and Mr. A.A.C. Mason of Aberfoyle Tin Development Partnership for their help in discussion of this subject.

SCALE OF FEET

40 0 40 80 120 160

5 cm

CLEVELAND MINE, TASMANIA

PLAN R.L. 1300' LEVEL

showing: BULK SAMPLE LOCATIONS

	Lode / CH. Contact thus ----------
A5 ⊙	Survey Station
1313·32	R.L. of Survey Station.
1307·00	R.L. of top of rails

041

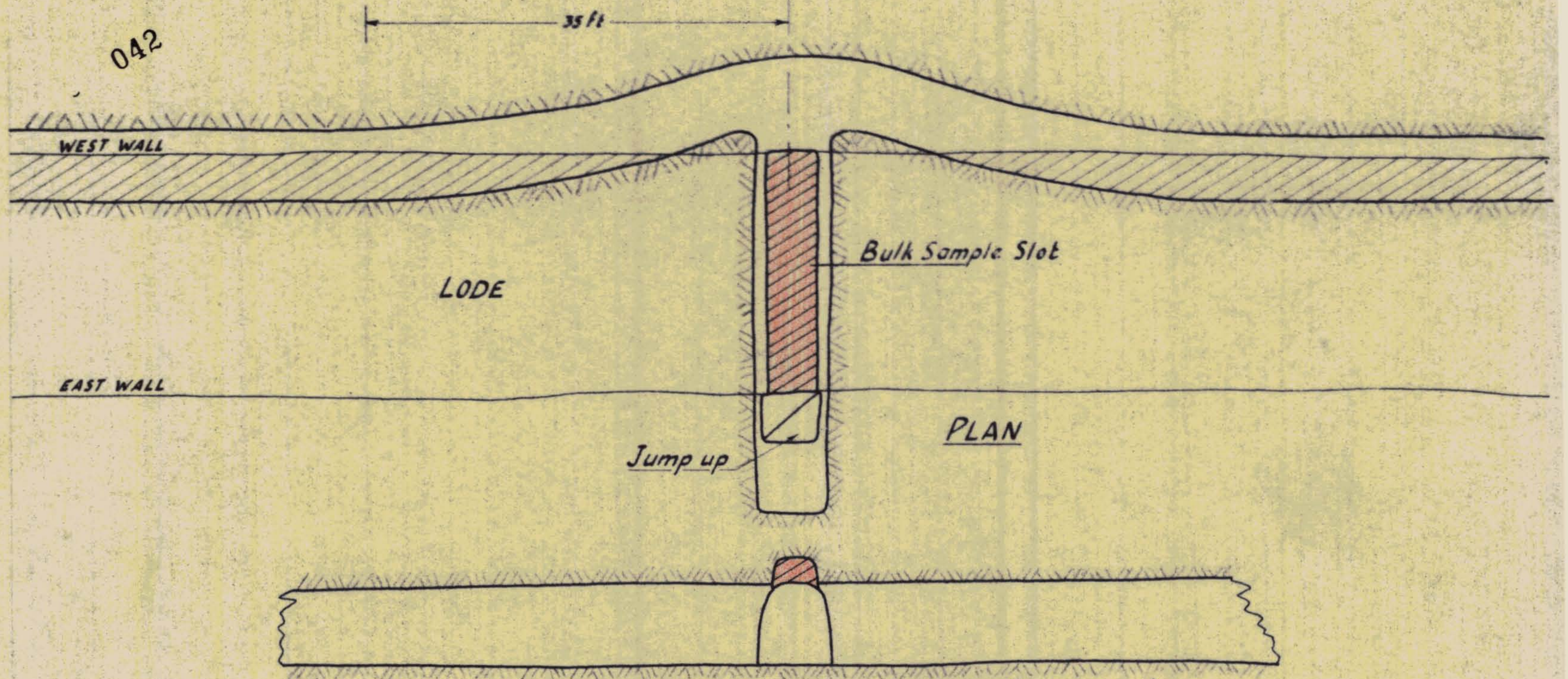
Surveyed by: H.S. FRASER

Date : June 1965

Drawing No. A/139 (L)

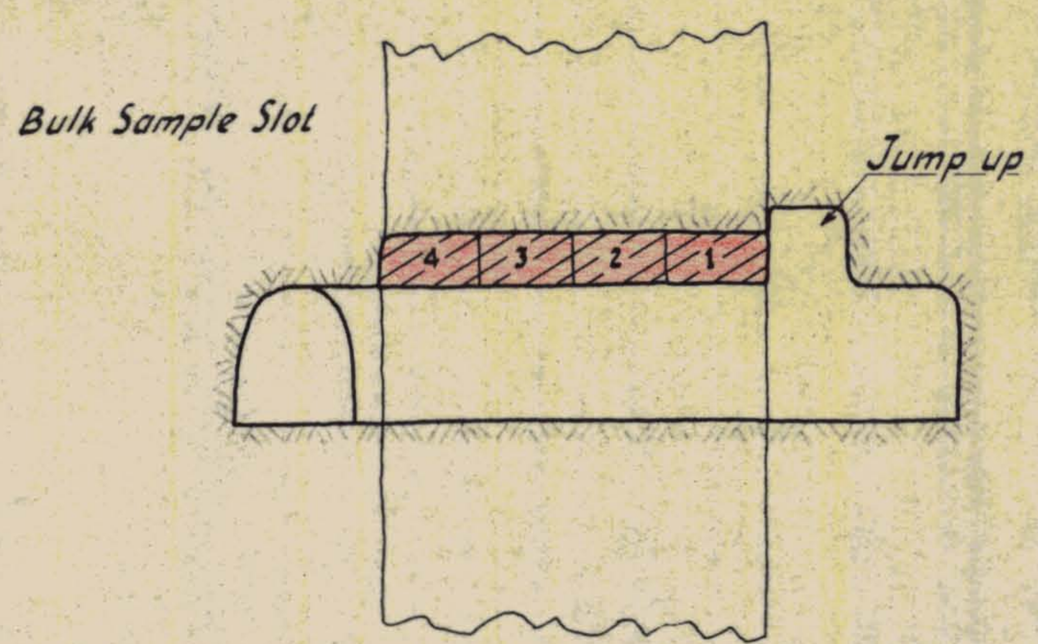
239041

042



SECTION (Looking East)

Fig.1



SECTION Looking North through ℄ Crosscut

Note:
Actual Batches Determined by:
(a) Width of Lode Structure.
(b) Banding of individual Lode Horizons and thus.
(c) Sampling Design.

BULK SAMPLING TECHNIQUE

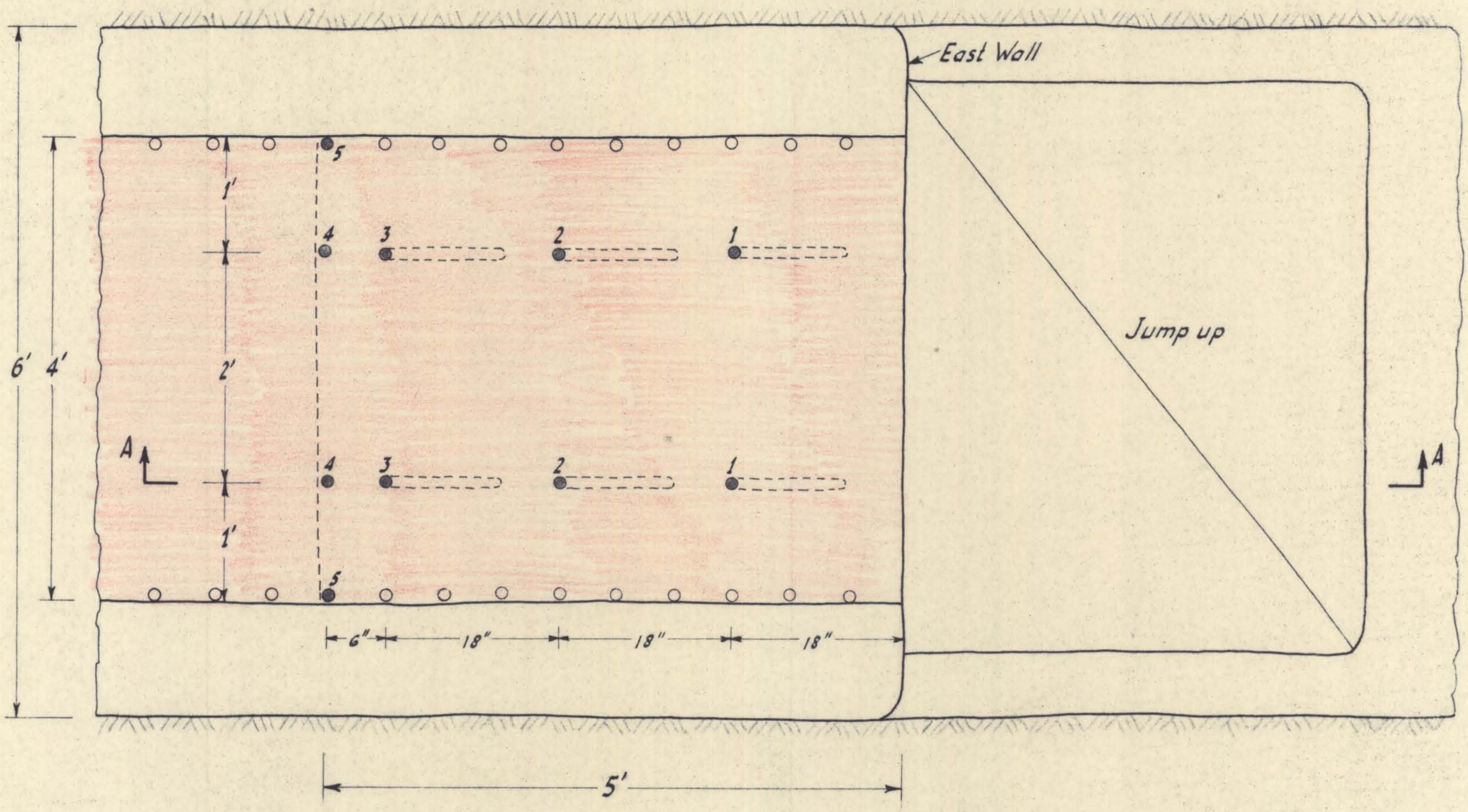
DRIVE - CROSSCUT DESIGN

239042

SCALE: 1" = 10'
DATE: 30-6-'64

Fig.2

043



○ Tear Holes

● Blast Holes

Representing an Ideal Batch Design,
yielding approximately 4½ tons

239043

5 cm

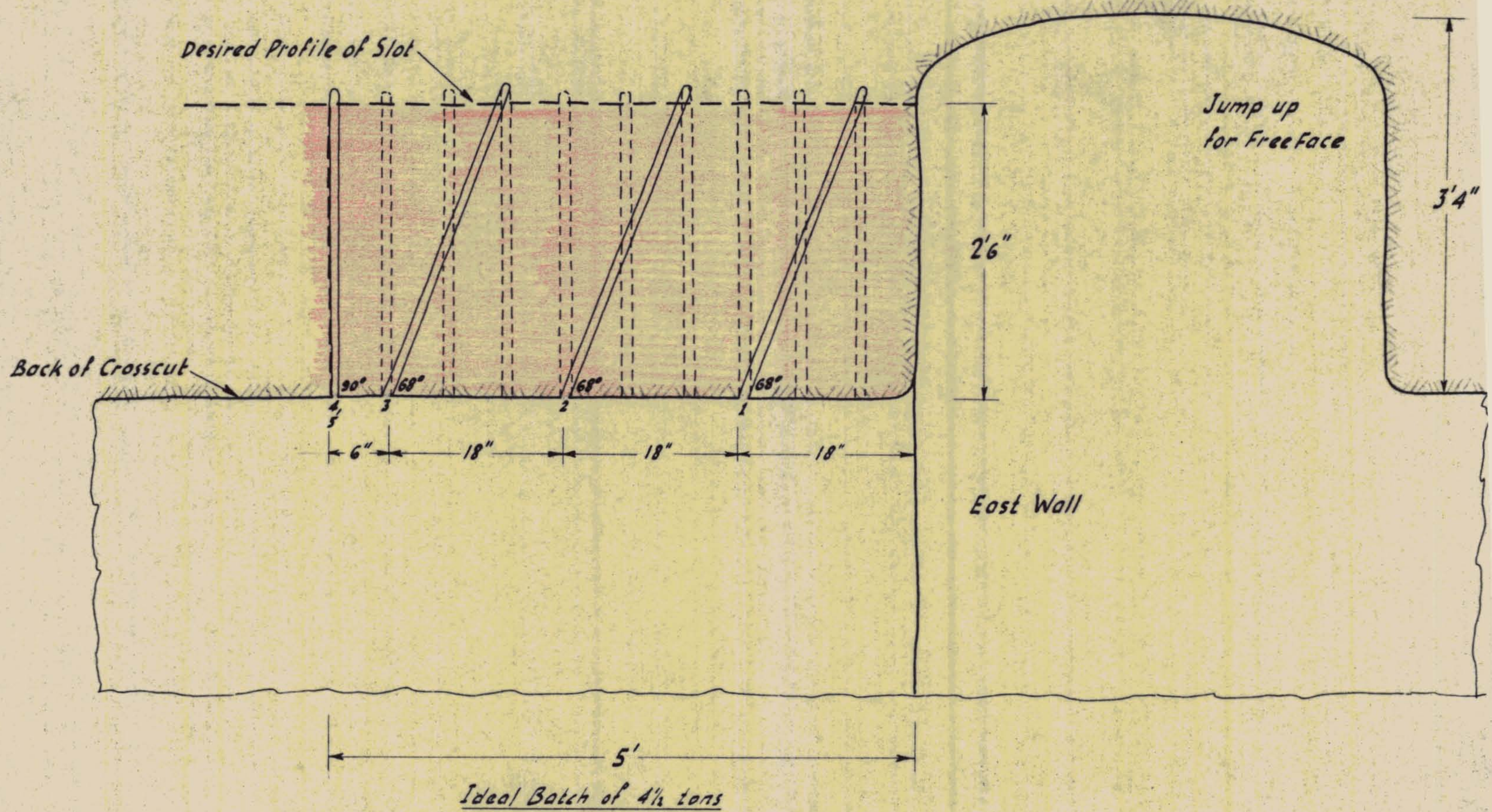
BULK SAMPLING TECHNIQUE

DETAILS OF FIRING PLAN FOR SLOT

SCALE: 1" = 1'
DATE: 30-6-'64

Fig. 3

044



1, 2, 3 Blast Holes:

2'10" Deep

68° Angle

18" Spacing

4, 5 Blast Holes, Tear Holes:

2'7" Deep

Vertical Angle

6" Spacing

BULK SAMPLING TECHNIQUE

DETAILS OF FIRING PLAN FOR SLOT

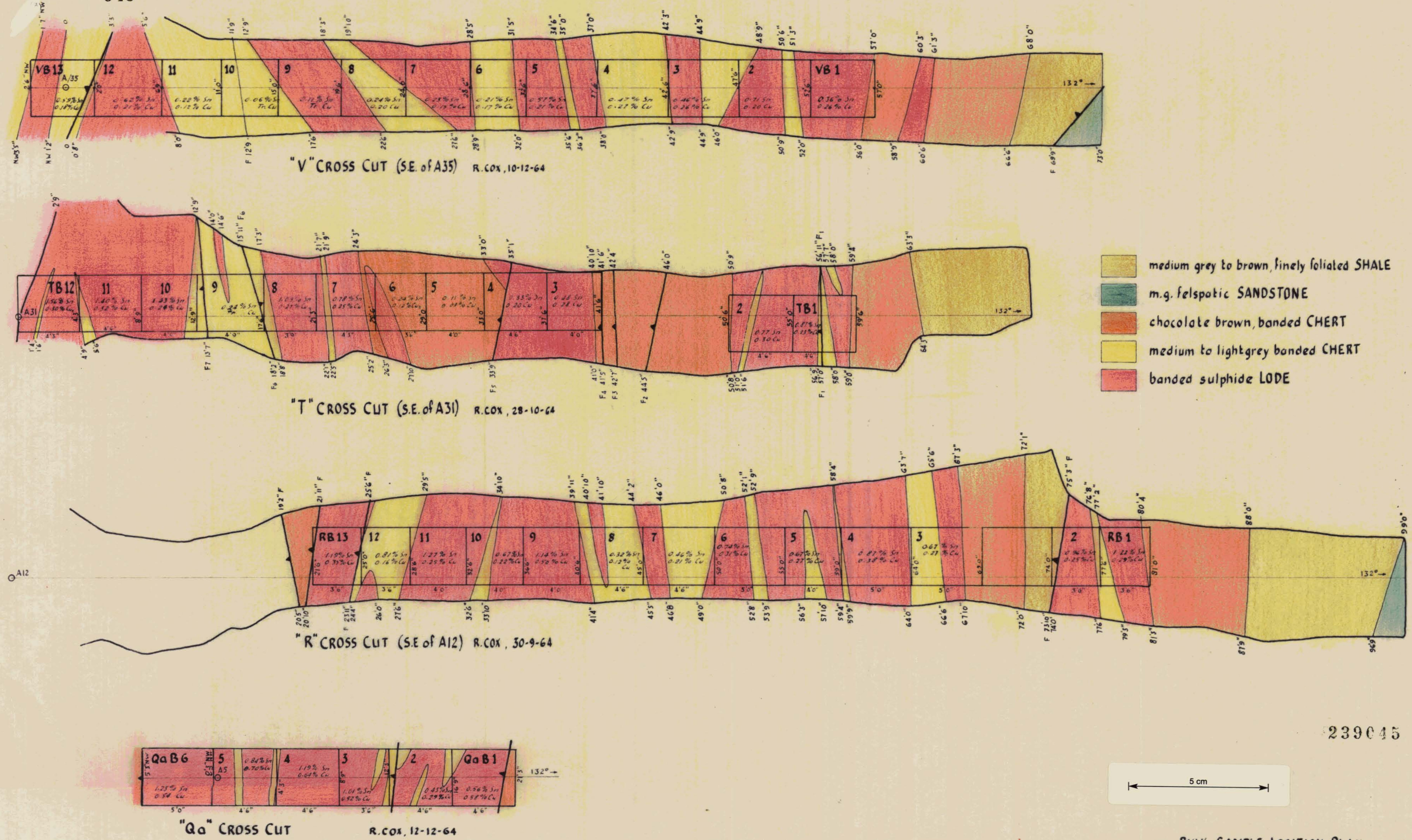
239044

SCALE: 1" = 1'

DATE: 30-6-'64

Fig. 4

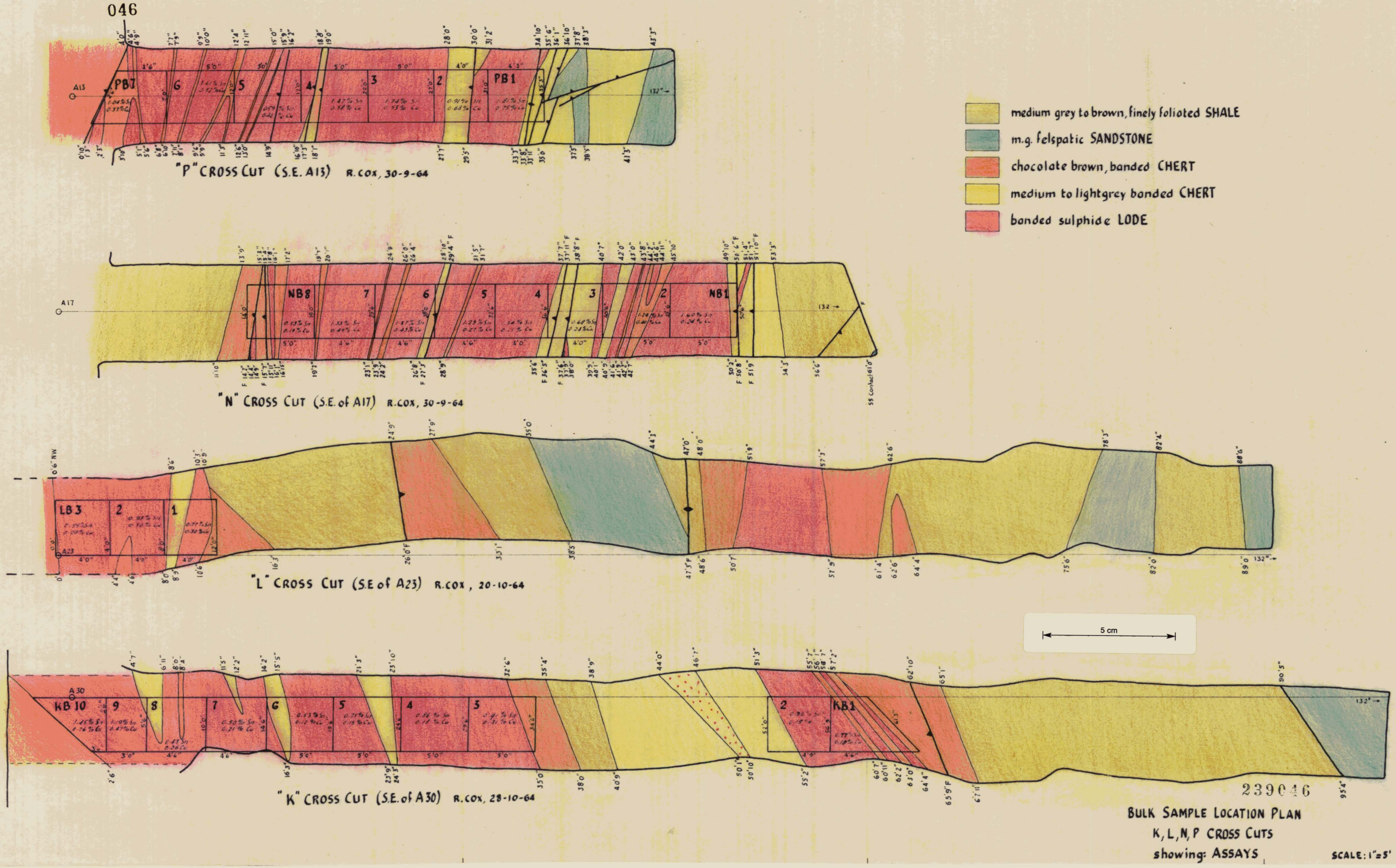
045



239045

BULK SAMPLE LOCATION PLAN
Qa, R, T, V CROSS CUTS
showing: ASSAYS

SCALE: 1"=5'


046
"P" CROSS CUT (S.E. A13) R. COX, 30-9-64
"N" CROSS CUT (S.E. of A17) R. COX, 30-9-64
"L" CROSS CUT (S.E of A23) R. COX, 20-10-64
"K" CROSS CUT (S.E. of A30) R. COX, 28-10-64
medium grey to brown, finely foliated SHALE
m.g. felspatic SANDSTONE
chocolate brown, banded CHERT
medium to lightgrey banded CHERT
banded sulphide LODE
5 cm
239046
BULK SAMPLE LOCATION PLAN
K, L, N, P CROSS CUTS
showing: ASSAYS
SCALE: 1"=5'

CLEVELAND DEVELOPMENT PROJECT.
Aberfoyle Tin Development Partnership.
BULK SAMPLING CERTIFICATE.

LOCATION ....

BATCH Nº .... REGISTERED Nº ....

DATE ....

ACTIVITY

047

1 MINE TRUCKS FROM FACE
  • NUMBER

2 GRAB SAMPLE
  • CHECK
  × RECORD IDENTITY & WEIGHT

3 WEIGH EACH TRUCK
  • RECORD

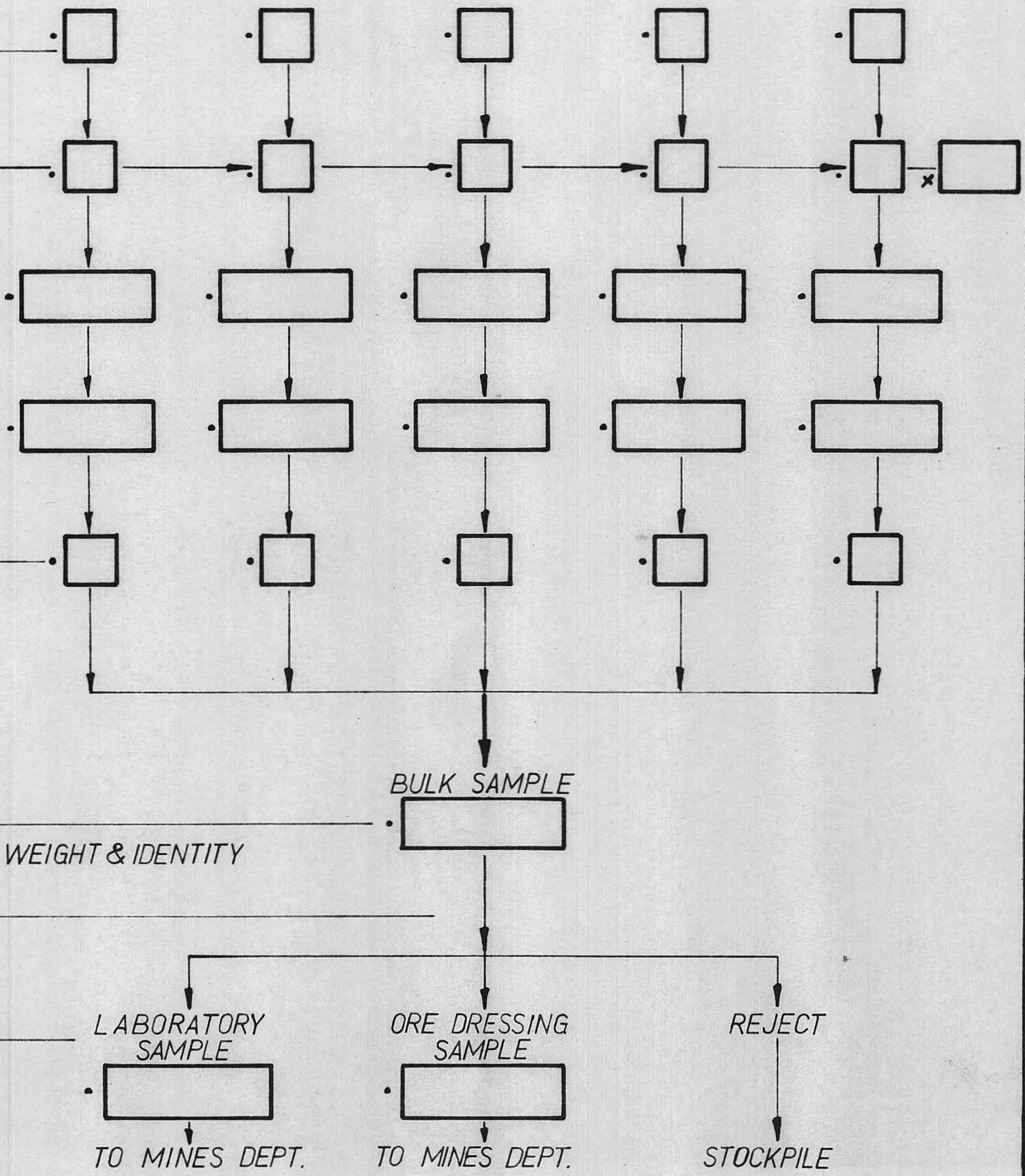
4 VOLUME EACH TRUCK
  • RECORD

5 HOIST, TIP INTO MOTOR TRUCK
  • CHECK

6 TRANSPORT TO SAMPLE MILL
  • RECORD COMPOSITE WEIGHT & IDENTITY

7 PROCESS IN SAMPLE PLANT

8 COLLECT PRODUCTS & DRUM
  • RECORD IDENTITY & WEIGHT



ACTIVITY DEFINITION

1 Hand mucked into selected trucks. Keep moisture to a minimum. Crosscut to be completely cleared. Leave no part of the sample. Handling of trucks to be such to avoid any possibility of confusing with trucks, from any other part of the mine.

2 From each truck a grab sample will be taken from 6 points with a suitable container to yield about 1 lb. Thus sample for each truck will be about 6 lb. The truck samples will be compounded to form one grab sample for each batch. This will be forwarded to Mines Department for assays of Sn & Cu.

3 Trucks used for bulk sampling will be numbered, with tares recorded. They are to be cleaned thoroughly before introducing bulk samples.

4 Similarly marked trucks will have measured volumes recorded.

5 Avoid any spillage.

6 Cover load with tarpaulin if there is any likelihood of rain on load. Ensure no possibility of sample losses in transit.

7 Operating procedure to be laid down separately.

8 Samples not to be drummed if moisture exceeds 0.5%.

CERTIFIED CORRECT ....
PROJECT SUPERVISOR.

ORIGINAL TO BE FORWARDED TO MELBOURNE OFFICE.

239047

FORM CD 6