VALLEY EXPLORATION PTY. LTD.

E.L. 53/70, STANLEY RIVER AREA.

716001 TASMANIA 72-913

72-913

J.T. IRVING

TO 31-12-1972.

VALLEY EXPLORATION PTY. LTD.

REPORT ON E.L. 53/70 TO THE 31ST OF DECEMBER, 1972:

CONTENTS:

APPENDICES AND FIGURES:

1. DESCRIPTIVE:

By taking the 'Gondwanaland' continental drift concept as a starting point, genetic similarities in ore deposits can be expected. This was the basis for our preliminary appraisal of potential for carbonatite mineralisation.

By using the parameters of deep seated faults located close to stable Precambrian blocks, displaying undersaturated upper mantle rocks and known mineralised areas we were led directly to a regional appraisal of the west coast of Tasmania.

The economic base metal deposits in carbonatites are found in the carbonate cores. Library research showed reports of only one such unexplained carbonate which had not been exploited. This was the crystal dolomite 'plug' of 30 acres extent exposed in the Stanley Reward alluvial workings 9 miles north west of Renison Bell.

Applications were made by Valley Exploration Pty. Ltd. on a number of occasions for an Exploration Licence over this area. Eventually E.L. 53/70 was granted over much of the area of interest, but excluding the known dolomite area. Valley Exploration carried out preliminary regional geochemical investigations in the surrounding country by means of a helicopter. The ground near the Stanley Reward has been covered with alluvium since 1915.

Indications of a considerable degree of mineralisation were encountered, sufficient to interest Dr. G.J.H.McCall a specialist in this environment. His Company entered into a Joint Venture on the area in February, 1971, carrying out a significant test programme. About September 1971 major changes in the structure, personnel and policy of this Company were made. They sought to renegotiate the agreement which was then terminated. Since that date the area surrounding the Stanley Reward has been added to our Exploration Licence area.

This country north of Zeehan and west of Renison has had very little prospecting except for tin. Access had long been considered an insuperable problem, but this is no longer so. It is possible to construct a landing strip north of the Pieman and service men and machinery by air. Heavy plant can get across the Pieman only for about six weeks of the year with confidence, and there is no other practical access for plant from other directions

.../3

Most of the work undertaken to date has been on foot with men and pack horses and some brief helicopter traverses. Much of the area is rugged with very dense vegetation, but up the centre of the area there are bare ridges and button grass plains by which access is easy.

As prospecting to date has been limited to the areas granted to us, we have been unable to sample the area of major interest and results are incomplete. However, much was gained by detailed book research and our stream and rock geochemical data was most encouraging.

2. REGIONAL GEOLOGY:

The area adjoins the western margin of the rift valley described by Campana, Dickinson, King and Matheson, (1958). The contact between the north west trending Cambrian Renison Bell anticline and the Precambrian schist and quartzite is in the Exploration Licence area. It is terminated by the Devònian Meredith granite, believed to be the source of tin mineralisation in the general area.

At certain stratigraphic horizons within the Oonah quartzite and Crimson Creek formation, generally called the Success Creek phase, large scale mineral replacement has occurred, producing conformable lodes either in association with carbonatites or spilites. Microscopic examination suggests that large amounts of carbonate either accompanied mineralisation, or were mobilised during mineralisation.

Much of our data has been derived from Waterhouse (1914). In reading early geological reports on the West Coast we can substitute the current term 'Mount Read Volcanics' for their 'porphyroid rock'. Waterhouse carried out a most thorough regional investigation of the area in 1914 and, with the exception of some work on the Mount Lindsay Mine which is unpublished, very little has been done since. The 30 acre dolomite plug at the Stanley Reward has been covered with alluvium and the tracks substantially overgrown.

Waterhouse reported magnetite and disseminated pyrite and forsteritic olivine in the dolomite. He also reported porphyroid boulders but porphyroid was not seen in situ. The dolomite contacts are not well exposed, but at one point he observed a granitic

.../4

contact with a very fine grained version of the granite and a phlogopite-quartz-orthoclase vein adjoining. Apatite was not reported but secondary vivianite was in abundance in the roots of bushes and trees overlying the dolomite.

In sluicing the weathered pug overlying the dolomite he reports finding abundant pyrite and pyrrhotite and galena and sphalerite confined to specific areas. Some tremolite and asbestos was observed.

The nearby Mt. Lindsay mine reports considerable fluorite, axinite and calcite in the gangue with biotite in pyroxenite units nearby.

Waterhouse describes a small 'intrusive' carbonate between the Stanley Reward and Mount Lindsay. The detailed description of the Magnet Mine west of Waratah and north of this area given in Nye (1923), is strongly suggestive of a small carbonatite vein.

There are reports of 17 diamonds being recovered in the area just north west of the Exploration Licence boundary. These were substantiated by experienced geologists, including W.H. Twelvetrees. This shows that kimberlites were, and probably still are, present in the area. There is a very close relationship between occurrences of kimberlite and carbonatites, particularly in the Russian environment. Refer to Frantsesson, (1970).

3. INVESTIGATIONS TO DATE:

3.1 Geochemical

A total of 242 stream sediment samples have been taken and tested for heavy minerals by field panning of -8 mesh material to a 1½ to 2lb sample which was then treated by heavy media concentration at the laboratory. The small amount of heavy residue was scanned spectrographically or, in some cases, analysed by atomic absorption plus Xray fluoroscopy. Analysis data sheets are attached as Appendix 1.

In this highly mineralised environment we have prepared maps of geochemical anomalies (Figures 2 and 3) using the following cut off values:-

	Cu	Pb	Zn	Sn
Threshold in p.p.m.	400	150	1000	2000
Anomalous in p.p.m.	1000	400	3000	5000

Rock analyses were made of some rock samples collected. The contact(?) rocks just adjoining and north-west of the Stanley Reward show high tin figures. Grab samples from the hematite-magnetite anomaly in Livingstone Creek also show variable tin results.

Some soil samples were taken in a traverse across 'ring structure Aa'. These were subsequently put through a sieve and the -80 mesh fraction scanned for base metals and tin with results which were subnormal for this environment. Samples have been taken around some of the other 'ring structures' but they have not been analysed yet. These would be tested by heavy media concentration prior to analysis.

3.2 Petrological

Grain counts were made on many of the samples which were examined early. These are shown in Appendix 2. Thin sections were made of many of the rock types and descriptions are shown as Appendix 3.

As there had been an identification of pyrochlore from an area north of here - at ~~Skeleton~~ Creek, west of Burnie, the original sample was located at the Hobart Museum. Optically the crystals were confirmed as possibly being pyrochlore. A typical crystal was sent to the C.S.I.R.O. Perth for micro probe investigation, and this showed the crystal sampled to be uraninite. || invalid - see Catalogue of Minerals. SHEKELTON

A thin section of the highly altered volcanic rock found at 'ring structure Aa' was examined by Mr. F.L. Sutherland who reported that the rock appeared to be a typical Tasmanian Jurassic dolerite.

3.3 Geological

The granite contact was mapped on the ground. It was proved that the flat dipping Meredith Granite occurs further south than shown on the Rio Tinto map.

Contact extends almost to the Stanley Reward and the nearby Mt. Lindsay Mine. It does appear however to be well north of Mount Livingstone and remote from the two areas of base metal anomaly.

3.4 Geophysical

As reported earlier, attempts were made to show up geological changes through aerial photography, and looking for vegetation changes, particularly for variation in infra-red reflectivity. From this program we located 27 'ring structures' forming a zone which roughly followed the Stanley River.

It was noted that the one mile aeromagnetic map prepared by Rio Tinto showed very little magnetic disturbance compared to ground surveys in the Stanley Reward - Livingstone Creek area.

Brief scintillometric traverses were made in the Stanley Reward area with no indications of anomalous radioactivity.

Ultra violet response of many stream samples was measured but with no useful result.

3.5 Library Research

Much of the data presented under the Regional Geology section is derived from library research and is a condensation of considerable reading.

4. RESULTS:

4.1 Geochemical

in addition to the known tin mineralisation at Mt. Lindsay, Stanley Reward and the Livingstone Creek hematite magnetite lode, two further areas were defined as being grossly anomalous for base metals. They were subnormal (in this environment), for tin.

One area was at the headwaters of Paradise Creek, south west of Mount Livingstone. The other was just north of the Pieman River, and midway between the Stanley and Wilson Rivers. Both show plainly in Figures 2 and 3.

Other spot anomalies which justify further examination were located on the periphery of the Exploration Licence area.

Some remarkably high chromium, and occasionally some high nickel figures, were obtained from areas draining the Oonah quartzite. These geochemical anomalies appear to be roughly concordant with the Є - pЄ interface. The high chromium and nickel figures suggest ultrabasic intrusions in the Precambrian. Both the areas of base metal anomaly lie upon the proposed ultrabasic zone.

Soil geochemistry and petrology confirmed that there was little likelihood of there being economic mineralisation associated with the 'ring structures'. They are apparently morphological features.

Cumulative probability of frequency of analytical results was plotted for copper, lead, zinc and tin. Results suggest several genetic sources of each metal. They are attached as Figures 10,11,12 and 13.

4.2 Geological

The presence of the mineralised dolomite-magnetite 'pipe' at the Stanley Reward,and the nearby Livingstone Creek hematite - magnetite lode containing calcite, along the boundary between the Crimson Creek argillite and the Oonah quartzite, just near the contact with the Meredith granite suggests we are dealing with part of the Success Creek phase which may have been altered by the subsequent granite intrusion. It is probably related to the Mt. Lindsay deposits.

5. CONCLUSIONS

It would appear that initial ideas of possible carbonatitic intrusions within the area have not met with much in the way of confirmation, although the idea cannot be wholly discounted.

However, there appears to be roughly concordant bands of mineralised rocks within the higher levels of the Oonah quartzite and close to the Stanley Reward area. These are probably related to basic or ultrabasic sills or laccoliths which are reported elsewhere in this environment in the west coast of Tasmania.

It is apparent that the area is highly prospective for sulphides of base metals and tin. However, exploration in this area is economically limited because of the high rainfall, dense vegetation and major access problems.

It would appear that effective exploration will be highly dependent on good planning for access and servicing of men and equipment. Vehicular access from the north-west, north and east is considered impractical because of the terrain and vegetation. From the south and west it has been limited by the lack of a Pieman River crossing.

It is proposed that a landing strip for fixed wing aircraft be considered in detail. It is possible to get bulldozers across the Pieman at the Stanley River cage when the river is low. A track suitable for Bombardier vehicles could be easily constructed along the ridges and button grass plains. This would then be used to move men, supplies and equipment through the area.

This must all precede the cutting of prospecting lines and costeans for detailed prospecting of anomalous areas.

Unless a suitable landing strip is obtained it will not be economic to prospect the area except by the use of helicopter to deliver supplies and equipment. This is considered to be a much less efficient alternative and less likely to be a successful prospecting technique.

REFERENCES:

Campana et al, 1958 A.I.M.M., F.L.Stillwell anniversary Volume, 'The Mineralised Rift Valleys of Tasmania'

Frantsesson 1970, Translated by D.A. Brown, The Petrology of the Kimberlites, Canberra 1970

Geology of Australian Ore Deposits, Eighth Congress Melbourne, 1965.

Nye, 1923 Geological Survey Bulleting 33 'The Silver Lead Deposits of the Waratah District' Tasmania, 1923.

Waterhouse, 1914 G.S.B.15 'The Stanley River Tin Field' Tasmania, 1914.

011

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Field Sheet No —

Line No.— 716011

Project/Charge/Despatch Note No.:— APPENDIX I

Date:— 1-NOV-72

Any queries please quote Lab. Sheet Number:— 5509/1

SAMPLE		CU	PB	SN	ZN			
AA 1		5	30	<500	10			
AA 2		5	15	<500	10			
AA 4		10	5	<500	10			
AA 7		10	20	<500	10			
AA10		10	10	<500	10			
AA13		5	5	<500	10			
AA16		10	10	<500	5			
AA18		5	10	<500	5			
AA21		10	10	<500	10			
AA23		10	25	<500	30			
AA24		5	15	<500	10			
AA27		5	5	<500	10			
METHOD		101B	101B	XRF	101B			

FORM S34 FOR METHOD DETAILS SEE PRICE LIST

JOB NUMBER 5509 RACK NUMBER 4921

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Duplicated

Field Sheet No:— 716012

Line No.:—

Project/Charge/Despatch Note No.:— APPENDIX 1:

Date:— 15-NOV-72

Any queries please quote Lab. Sheet Number:— 5517/1

SAMPLE	WT.HM.	% H.M.
A 1	2.3	0.30
A 4	4.0	0.40
A 9	10.6	1.06
A 10	2.2	0.23
A 11	2.2	0.31
A 15	1.9	0.21
A 33	1.5	0.12
A 34	2.7	0.25
A 35	6.3	0.45
A 36	7.0	0.50
A 38	7.8	0.89
A 40	0.5	0.06
A 41	1.8	0.18
A 43	2.0	0.20
A 44	12.3	1.28
A 49	2.4	0.25
A 61	8.9	1.00
A 64	0.2	0.02
A 65	0.6	0.06
A 66	0.2	0.02
A 68	3.1	0.31
A 73	2.8	0.22
A 74	0.4	0.03
A 79	0.7	0.04
A 83	1.0	0.12
A 85	1.5	0.12
A 89	56.8	4.54
A102	2.2	0.18
A104	1.0	0.11
A106	0.5	0.04
A108	0.4	0.02
A109	0.5	0.04
A112	2.2	0.20
A113	1.0	0.08
A116	0.9	0.07
A117	1.7	0.14
A118	0.1	0.04
A120	7.0	0.58
A122	6.5	0.63
A124	0.8	0.06
A126	0.4	0.04
B 2	35.0	4.00
B 5	24.0	3.00
B 6	13.4	1.70
B 9	12.1	1.20
B 13	0.5	0.04
B 15	0.4	0.03
B 16	0.3	0.03
	...... WEIGHT IN GRAMS	
METHOD	109	109

FORM S34 FOR METHOD DETAILS SEE PRICE LIST

JOB NUMBER 5517 RACK NUMBER 4954

010

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Field Sheet No:— 716013

Line No.:—

Project/Charge/ Despatch Note No.:— APPENDIX 1:

Date:— 15-NOV-72

Any queries please quote Lab. Sheet Number:— 5517/2

SAMPLE	WT.HM.	% H.M.
B 17	0.7	0.08
B 21	0.5	0.04
B 22	2.0	0.10
B 24	1.0	0.09
B 25	0.5	0.04
B 26	0.4	0.04
B 28	0.8	0.10
B 30	1.2	0.13
B 31	1.3	0.14
B 33	0.4	0.03
B 36	1.2	0.14
B 37	0.3	0.03
B 38	0.3	0.03
B 50	0.3	0.03
B 52	1.2	0.15
B 54	1.1	0.13
B 55	1.2	0.17
B 59	4.2	0.62
B 60	0.3	0.03
B 63	0.2	0.03
B 64	0.7	0.09
B 69	0.5	0.06
B 70	0.2	0.02
B 73	0.3	0.03
B 74	3.3	0.47
B 76	1.4	0.20
C 3	25.0	3.57
C 7	108.0	10.04
C 8	172.5	15.00
C 9	80.5	8.28
C 11	159.2	79.60
C 13	19.8	2.82
C 14	36.2	3.71
C 16	67.4	11.20
C 19	0.4	0.04
C 20	0.4	0.05
C 27	45.6	4.44
C 30	33.0	3.88
	...... WEIGHT IN GRAMS	
METHOD	109	109

FORM S34 FOR METHOD DETAILS SEE PRICE LIST

JOB NUMBER 5517 RACK NUMBER 4955

013

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Field Sheet No —

Line No.:—

Project/Charge/Despatch Note No.:— 716014

Date:— 24-NOV-72

Any queries please quote Lab. Sheet Number:— 5517A/1

SAMPLE	AG	CU	PB	% SN	ZN
A 1	BLD	10	20	BLD	35
A 4	BLD	35	35	BLD	80
A 9	BLD	5	35	BLD	25
A 10	BLD	5	15	BLD	10
A 11	BLD	5	30	BLD	10
A 15	BLD	20	10	BLD	10
A 33	BLD	55	75	BLD	175
A 34	BLD	250	180	BLD	620
A 35	BLD	110	90	BLD	265
A 36+	BLD	30	55	0.11	590
A 38+	BLD	140	75	BLD	265
A 40+	BLD	60	135	BLD	250
A 41+	BLD	40	65	BLD	220
A 43+	BLD	95	75	BLD	245
A 44+	BLD	270	100	0.20	295
A 49	BLD	10	75	18.75	235
A 61	BLD	15	20	0.10	85
A 64+	BLD	20	60		240
A 65+	BLD	5	20	BLD	175
A 66+	BLD	1400	80		700
A 68	BLD	10	65	BLD	115
A 73+	BLD	5	55	BLD	100
A 74+	BLD	25	50		220
A 79	BLD	3600	50	BLD	1400
A 83	BLD	20	30	BLD	310
A 85	BLD	15	55	0.53	65
A 89	BLD	30	115	0.40	115
A102	BLD	530	100	1.95	137
A104	BLD	940	210	0.07	2700
A106	BLD	20	90	~~0.12~~ 0.24	550
A108	BLD	10	65		150
A109	BLD	15	120	BLD	120
A112	BLD	5	30	0.56	15
A113	BLD	5	50	0.61	35
A116	BLD	5	135	0.11	50
A117	BLD	5	70	BLD	20
A118					
A120	BLD	15	25	BLD	30
A122	BLD	5	15	BLD	30
A124	BLD	25	70	BLD	360
A126	BLD	40	260		470
B 2	BLD	15	35	BLD	30
B 5	BLD	10	30	0.08	15
B 6	BLD	10	45	BLD	30
B 9	BLD	15	25	BLD	30
B 13	BLD	10	75	~~7.28~~ 14.56	1600
B 15	BLD	10	60		110
B 16	BLD	20	60		140
.... BLD	0.05	....			
METHOD	101B	101B	101B	SN1	101B

Sn · BLD <0.05

MISSING VALUES ARE INSUFFICIENT SAMPLES.

FORM 534 FOR METHOD DETAILS SEE PRICE LIST

JOB NUMBER 5517 RACK NUMBER 5007

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012

Field Sheet No:—
Line No.:—
Project/Charge/Despatch Note No.:— 716015
Date:— 24-NOV-72

Any queries please quote Lab. Sheet Number:— 5517A /2.

SAMPLE	AG	CU	PB	% SN	ZN
B 17	BLD	15	75	BLD	90
B 21	BLD	10	110	BLD	60
B 22	BLD	10	105	BLD	120
B 24	BLD	55	65	BLD	85
B 25	BLD	20	55	0.15	170
B 26	BLD	110	50	BLD	280
B 28	BLD	75	100	BLD	640
B 30	BLD	10	55	BLD	80
B 31	BLD	15	70	BLD	1600
B 33	BLD	15	95		285
B 36	BLD	55	240	BLD	1800
B 37	BLD	85	125		50
B 38	BLD	640	70		4700
B 50	BLD	170	80		990
B 52	BLD	115	75	0.11	650
B 54	BLD	115	65	BLD	1100
B 55	BLD	240	60	BLD	95
B 59	BLD	10	70	BLD	130
B 60	BLD	20	70		70
B 63					
B 64	BLD	275	65	BLD	55
B 69	BLD	15	60	BLD	115
B 70					
B 73	BLD	15	40		50
B 74 +	BLD	95	80	BLD	145
B 76 +	BLD	80	75	BLD	1700
C 3	BLD	15	25	BLD	25
C 7	BLD	10	50	BLD	650
C 8	BLD	10	50	0.25	650
C 9	BLD	10	75	0.32	1500
C 11	BLD	5	35	BLD	1150
C 13	BLD	5	50	BLD	15
C 14	BLD	10	30	BLD	30
C 16	BLD	15	45	0.05	900
C 19	BLD	25	60		1900
C 20					
C 27	BLD	10	45	0.34	1000
C 30	BLD	15	50	0.15	540
....	BLD	0.05	....		
METHOD	101B	101B	101B	SN1	101B

Sn = BLD < 0.05

MISSING VALUES ARE INSUFFICIENT SAMPLE.

FORM S34 FOR METHOD DETAILS SEE PRICE LIST

JOB NUMBER 5517 RACK NUMBER 5008

014

716016

23 JUN 1972

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Please address all correspondence to the Director
In reply quote: AN3/281/0 - 5737/

21 June 1972

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REPORT AN5737/72

YOUR REFERENCE:	Order 1928 (ref. no. 5267)
IDENTIFICATION:	As listed
DATE RECEIVED:	8/6/72

Enquiries quoting AN5737/72 to Officer in Charge please.

Analysis by: R.R. Robinson

Officer in Charge, Analytical Section: A.B. Timms

for F.R. Hartley
Director

jw

c.c. Labtech Pty Limited
237 Great East Highway
MIDLAND WA 6056

AMDEL ANALYTICAL SERVICE

JOB 5737/77 — Semi-Quantitative Spectrographic Analysis Scheme A1+A3 — BATCH ....1.......

Form 25 — Results in ppm unless otherwise stated. Detection limits in brackets.

015

	Sample No.	Co (5)	Ni (5)	Cr (20)	Os (10)	W (50)	Mo (3)	Mn (10)	Ta (100)	Nb (20)	Be (1)	Pt (10)	A3 P (100)
√+ 1	A 50	x	30	300	x	100	3	2,000	x	200	5	x	3,000
√· 2	51	5	10	300	x	300	3	500	x	100	5	x	2,000
√ 3	52 √+	x	30	200	x	1500	x	1,500	x	150	3	x	10,000
√ 4	53 √+	30	50	5,000	x	x	x	1,500	x	20	1	x	x
√	54 +	20	30	10,000	x	50	3	300	x	x	1	x	x
– 6	(55) +	500	1000	[illegible]	x	x	x	1200	x	x	1	x	x
√ 7	58	10	30	3,000	x	x	3	[illegible]	x	20	1	x	x
8	69	50	500	5,000	x	300	3	600	x	80	10	x	500
9	70	30	10	200	x	3,000	x	1,000	x	50	5	x	3000
10	71	30	400	3,000	x	50	3	800	x	100	10	x	500
√ 11	82	10	30	300	x	80	3	1,000	x	50	15	x	100
√ 12	86	80	30	300	x	x	x	3,000	x	200	x	x	x
√ 13	87	50	30	250	x	x	x	4,000	x	200	x	x	x
√ 14	90	10	30	300	x	500	x	4,000	x	150	10	x	1,000
√ 15	91	x	50	100	x	1,000	3	1,000	x	200	5	x	10,000
√ 16	92	5	30	200	x	50	x	500	x	50	5	x	200
√ 17	93	10	50	100	x	1,000	3	2,000	x	150	3	x	10,000
√ 18	94	20	30	150	x	x	x	3,000	x	200	x	x	x
√ 19	95	20	30	150	x	50	3	1,200	x	50	5	x	1,000
√ 20	96	10	20	300	x	50	3	500	x	20	3	x	x

Results are semi-quantitative. Elements apparently present in concentrations of economic interest should be redetermined by an appropriate accurate analytical technique. X = Not detected

Geo A1, A2. 54 x 197

APPENDIX 2 71601

AMDEL ANALYTICAL SERVICE

JOB 5737/72. Semi-Quantitative Spectrographic Analysis Scheme A1+A3 BATCH ...2......

Form 25 Results in ppm unless otherwise stated. Detection limits in brackets. A3

	Sample No.	Co (5)	Ni (5)	Cr (20)	Os (10)	W (50)	Mo (3)	Mn (10)	Ta (100)	Nb (20)	Be (1)	Pt (10)	F (100)
1	A 97	20	30	300	x	800	3	800	x	80	10	x	500
2	100	10	300	200	x	x	3	1500	x	100	1	x	1,000
3	121	20	50	300	x	x	x	300	x	50	1	x	x
4	B 1	10	50	200	x	x	x	500	x	50	3	x	500
5	3	20	500	200	x	50	x	800	x	50	10	x	500
6	4	10	30	500	x	50	x	1,000	x	50	5	x	x
7	7	10	50	100	x	x	x	800	x	20	5	x	2,000
8	10	5	30	150	x	x	x	800	x	30	10	x	x
9	11	10	40	5,000	x	x	x	1,500	x	80	15	x	100
10	18	30	30	200	x	50	x	1,500	x	80	15	x	300
11	35	30	40	4,000	x	x	x	1,200	x	100	15	x	x
12	40	80	500	5,000	x	x	x	3,000	x	100	x	x	x
13	41	500	1,000	>10,000	x	x	x	500	x	x	1	x	x
14	43	500	1,500	>10,000	x	100	x	250	x	x	1	x	x
15	45	20	30	2,000	x	100	x	1,000	x	50	5	x	5,000
16	46	300	200	>10,000	x	x	x	1,500	x	20	1	x	x
17	47	80	100	4,000	x	x	x	2500	x	20	1	x	x
18	48	200	150	>10,000	x	x	x	300	x	20	1	x	x
19	49	100	150	10,000	x	x	5	300	x	x	1	x	x
20	53	50	50	300	x	x	5	500	x	50	5	x	x

Results are semi-quantitative. Elements apparently present in concentrations of

016

716C18

JOB [illegible] Semi-Quan tative Spectrographic Analysis Schem AI+A3 BATCH [illegible]

Form 25 Results in ppm unless otherwise stated. Detection limits in brackets. A3

017

	Sample No.	Co (5)	Ni (5)	Cr (20)	Os (10)	W (50)	Mo (3)	Mn (10)	Ta (100)	Nb (20)	Be (1)	Pt (10)	P (100)
1	B 72	500	1,000	>10,000	x	x	3	300	x	x	1	x	x
2	75 +	30	50	10,000	x	50	3	800	x	20	5	x	100
3	C 1	20	50	2,000	x	50	x	1,500	x	20	5	x	100
4	6	80	80	4,000	x	50	3	2,500	x	80	3	x	x
5	10	80	100	3000	x	x	3	500	x	x	3	x	x
6	12	80	80	500	x	100	3	300	x	x	5	x	x
7	17	50	50	5,000	x	x	x	2,500	x	20	1	x	x
8	18	300	100	>10,000	x	80	x	2,000	x	50	3	x	100
9	21	500	1,500	>10,000	x	50	x	1,000	x	x	1	x	x
10	24	1,000	1500	>10,000	x	x	x	1,000	x	x	1	x	x
11	25	1,000	1,000	>10,000	x	50	x	1,500	x	20	1	x	x
12	26	800	500	>10,000	x	x	x	1,000	x	x	1	x	x
13	28	200	150	>10,000	x	50	x	2,000	x	50	3	x	500
14	29	1,000	2,000	>10,000	x	[illegible]	x	1,000	x	x	1	x	x
15													
16													
17													
18													
19													
20													

Results are semi-quantitative Elements apparently present in concentrations of economic interest should be

716019

AMDEL ANALYTICAL SERVICE

JOB .5737./72

Form 23

Semi-Quantitative Spectrographic Analysis Scheme A2

BATCH ....4......

Results in ppm unless otherwise stated. Detection limits in brackets.

	Sample No.	Cu (0.5)	Pb (1)	Zn (20)	Sn (1)	Cd (3)	Bi (1)	Ag (0.1)	Au (3)	Ga (1)	Ge (1)	As (50)	Sb (30).
1	A 50	250	20	200	4,000		5	0.1	x			50	
2	51	20	20	60	2,500		x	0.1	x			20	
3	52+	10	30	100	>10,000		3	0.1	x			50	
4	53+	100	10	200	150		x	x	x			x	
5	54+	8	30	400	50		x	x	x			x	
6	55+	10	5	1,500	1,000		x	x	x			x	
7	58	20	3	40	10		x	x	x			x	
8	69	20	20	200	3,000		x	0.1	x			50	
9	70	20	50	x	300		x	x	x			x	
10	71	20	50	400	1,000		x	x	x			50	
11	82	150	10	200	8,000		1	0.1	x			100	
12	86	200	30	400	50		x	x	x			x	
13	87	150	30	400	80		x	x	x			x	
14	90	20	20	80	>10,000		1	x	x			x	
15	91	20	50	30	>10,000		x	x	x			300	
16	92	5	20	100	10,000		1	x	x			x	
17	93	80	50	300	>10,000		5	0.1	x			x	
18	94	300	150	100	500		x	x	x			x	
19	95	10	20	80	800		x	0.1	x			x	
20	96	5	5	80	2,000		x	0.1	x			100	

Results are semi-quantitative. Elements apparently present in concentrations of economic interest should be

013

716020

Job ..F....... Semi-Quantitative Spectrographic Analysis Scheme A2 Batch ....

Form 23

Results in ppm unless otherwise stated. Detection limits in brackets.

	Sample No.	Cu (0.5)	Pb (1)	Zn (20)	Sn (1)	Cd (3)	Bi (1)	Ag (0.1)	Au (3)	Ga (1)	Ge (1)	As (50)	Sb (30)
1	A 97	10	20	80	10,000		30	0.1	x			x	
2	100	10	40	400	3,000		3	0.1	x			50	
3	121	10	15	100	800		x	0.1	x			x	
4	B 1	10	10	50	300		x	0.1	x			x	
5	3	100	10	300	800		50	0.1	x			50	
6	4	10	5	50	200		x	0.1	x			x	
7	7	3	30	100	20		x	0.1	x			x	
8	10	20	10	200	3,000		1	0.1	x			200	
9	11	5	20	500	1,500		x	0.1	x			x	
10	18	30	20	100	10,000		1	0.1	x			200	
11	35	100	20	80	2,000		20	0.1	x			50	
12	40	250	120	50	400		x	x	x			50	
13	41	20	3	2,000	800		x	x	x			x	
14	42	25	5	1,000	10,000		x	x	x			x	
15	45	30	30	100	3,000		x	x	x			50	
16	46	20	10	600	2,000		x	x	x			x	
17	47	50	10	150	80		x	x	x			x	
18	48	80	30	800	800		x	0.1	x			x	
19	49	150	20	300	80		x	x	x			x	
20	53	30	5	100	1,000		20	0.1	x			50	

Results are semi-quantitative. Elements apparently present in concentrations of [illegible]

019

716021

JOB 5737/74 — Form 23

AMDEL ANALYTICAL SERVICE

Semi-Quantitative Spectrographic Analysis Scheme A2

BATCH ....9.......

Results in ppm unless otherwise stated. Detection limits in brackets.

	Sample No.	Cu (0.5)	Pb (1)	Zn (20)	Sn (1)	Cd (3)	Bi (1)	Ag (0.1)	Au (3)	Ga (1)	Ge (1)	As (50)	Se (30)
1	B 72	10	5	1,500	1,000		x	x	x			x	
2	75r	10	10	30	50		x	x	x			x	
3	C L	10	10	80	800		x	x	x			50	
4	6	300	30	300	10,000		10	0.1	x			100	
5	10	80	5	200	400		x	0.1	x			50	
6	12	1200	10	300	8,000		30	0.1	x			200	
7	17	20	20	400	300		x	x	x			x	
8	18	5	20	600	3,000		1	x	x			x	
9	21	5	10	1,000	2,000		x	x	x			x	
10	24	10	5	800	500		x	x	x			x	
11	25	5	20	600	2,000		x	x	x			x	
12	26	10	15	600	100		x	x	x			x	
13	28	10	80	500	1,000		3	x	x			x	
14	29	5	3	1,500	1,000		x	x	x			x	
15													
16													
17													
18													
19													
20													

Results are semi-quantitative. Elements apparently present in concentrations of economic interest should be

020

716022

021

AMDEL ANALYTICAL SERVICE

JOB: 4303/72.

Semi-Quantitative Spectrographic Analysis Scheme A1,A2,A3,A4,A5 & A6 BATCH ......1...

Results in ppm unless otherwise stated. Detection limits in brackets

Sample No.	0	1	2	3	4	5	6
A1	N°2	N°3	N°5	N°6	N°7	N°8	N°12
Co (5)	5	10	20	5	5	30	5
Ni (5)	20	30	50	30	10	50	20
Cr (20)	500	100	300	50	400	500	500
V (10)	150	200	250	150	150	250	100
W (50)	x	x	50	x	x	50	x
Mo (3)	x	x	x	x	x	x	x
Mn (10)	100	50	800	50	100	800	3,000
Ta (100)	x	x	x	x	x	x	x
Nb (20)	x	x	50	20	20	50	100
Be (1)	3	3	3	3	3	3	3
Th (100)	x	x	x	x	x	x	x
Pt (10)	x	x	x	x	x	x	x
Pd (10)	x	x	x	x	x	x	x
Os (10)	x	x	x	x	x	x	x
Ir (2)	x	x	x	x	x	x	x
Rh (2)	x	x	x	x	x	x	x
Ru (2)	x	x	x	x	x	x	x
A2							
Cu (0.5)	2,000	50	100	1,500	50	1,000	150
Pb (1)	20	50	3	30	3	20	20
Zn (20)	1,000	3,000	200	3,000	500	2,500	2,500
Sn (1)	50	10	100	300	3	120	10
Cd (3)	x	x	x	x	x	x	x
Bi (1)	x	x	x	x	x	x	1
Ag (0.1)	1	0.5	x	1	0.1	1	0.1
Au (3)	x	x	x	x	x	x	x
[illegible] (1)	30	20	10	80	10	50	50

Sample No.	0	1	2	3	4	5	6
A2 Contd.	N°2	N°3	N°5	N°6	N°7	N°8	N°12
Ge (1)	1	1	x	1	x	1	1
As (50)	x	x	x	x	x	x	x
Sb (30)	x	x	x	x	x	x	x
A3							
Te (20)							
Tl (1)							
P (100)							
A4							
Na (50)							
Li (1)							
A5							
K (5)							
Rb (10)							
Cs (30)							
A6							
Ba (50)	200	300	200	200	200	200	200
Sr (10)	x	x	x	x	x	x	x
Y (10)	50	50	200	100	150	50	50
La (100)	300	600	200	800	200	100	200
Ce (300)	600	1,200	400	1,600	400	x	400
Nd (300)	300	300	x	300	x	x	x
Pr (100)	x	x	x	x	x	x	x
Ti (100)	>10,000	>10,000	>>10,000	>10,000	>10,000	>>10,000	>>[illegible]
Er (100)	x	x	x	x	x	x	x
Sc (50)	50	50	100	100	100	100	100
Eu (50)	x	x	x	x	x	x	x

716023

1

AMDEL ANALYTICAL SERVICE

JOB: ..A3023/72

Semi-Quantitative Spectrographic Analysis Schemes A1,A2,A3,A4,A5 & A6 BATCH .... 2.

Results in ppm unless otherwise stated. Detection limits in brackets

Sample No.	7	8	9
A1	N° 13	N° 14	N° 16.
Co (5)	30	5	×
Ni (5)	80	10	10
Cr (20)	1,000	1,000	400
V (10)	30	250	10
W (50)	50	×	×
Mo (3)	×	×	×
Mn (10)	500	50	30
Ta (100)	×	×	×
Nb (20)	80	×	×
Be (1)	3	3	1
Th (100)	×	×	×
Pt (10)	×	×	×
Pd (10)	×	×	×
Os (10)	×	×	×
Ir (2)	×	×	×
Rh (2)	×	×	×
Ru (2)	×	×	×
A2			
Cu (0.5)	10,000	500	2,000
Pb (1)	3,000	5	100
Zn (20)	>10,000	1,000	200
Sn (1)	800	20	250
Cd (3)	×	×	20
Bi (1)	1	×	20
Ag (0.1)	30	0·1	20
[illegible] (3)	×	×	×
[illegible] 1)	10	50	10

Sample No.	7	8	9
A2 Contd.	N° 13	N° 14	N° 16.
Ge (1)	3	3	×
As (50)	×	×	200
Sb (30)	×	×	50
A3			
Te (20)			
Tl (1)			
P (100)			
A4			
Na (50)			
Li (1)			
A5			
K (5)			
Rb (10)			
Cs (30)			
A6			
Ba (50)	×	200	300
Sr (10)	×	×	×
Y (10)	1,000	100	200
La (100)	6000	200	3,000
Ce (300)	12,000	400	6,000
Nd (300)	9000	×	2,000
Pr (100)	1000	×	200
Ti (100)	>10,000	>10,000	>10,000
Er [illegible]100)		×	
Sc (50)	50	×	×
Eu (50)		×	

022

716024

ANALYSIS OF ROCK SAMPLES, E.L. 53/70:

No.	Sn%	Ba	S	Ag	Cu	Pb	Zn	Co	Ni	Mn	Cr
ASR 9					840	5	20	-	-	-	-
11					75	65	70	-	-	-	-
15	8.50										
BSR 1	0.17	< 10	< 5	< 1	130	10	85	20	15	150	-
12	0.53	10	< 5	< 1	5	15	520	30	25	3700	-
13	0.11										
14	0.31	< 10	< 5	< 1	190	10	210	25	20	2000	-
23					45	45	40				
24/4	0.025	< 10	5	< 1	45	10	60	25	20	4000	-
24/7	0.79	< 10	5	< 1	20	10	160	25	5	1600	-
26	0.68	20	< 5	< 1	310	20	320	75	15	1800	-
27	0.01										
CSR 6					25	-	30	-	4600	-	1100
7					10	-	75	500	1900	-	6400
12	0.76	< 10	< 5	< 1	810	70	230	25	20	200	-
13	2.50	< 10	< 5	< 1	150	15	70	25	5	280	-
27	0.92	< 10	< 5	< 1	280	15	110	20	5	130	-
34c	0.025										

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024

JOB NO. 5114

Sample No.	A 2	A 3	A 5	A 6	7	8	12	13	14	16
Opaques	tr	tr	20	tr	tr	15	30	65	5	10
Limonite	5	5	tr	5	5	tr	tr	tr	tr	10
Leucoxene	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr
Andalusite	50	45	60	55	65	60	55	?tr	70	20
Tourmaline	25	40	10	20	10	10	10	10	15	10
Quartz ± Felspar	20	10	10	20	20	15	5	15	10	20
Zircon	tr	tr	tr	tr	tr	tr	tr	10	tr	-
Rutile	-	-	tr	tr	tr	tr	tr	tr	tr	-
Spinel	-	-	tr	-	-	-	-	-	-	-
Cassiterite	-	-	-	-	-	-	tr	tr	tr	-
TOTAL	100	100	100	100	100	100	100	100	100	100*

* includes 30% altered rock fragments.

NOTE:

1. Opaques generally appear to be mainly ilmenite (except sample 13 where they cannot be identified).

2. Compositions are given in estimated volume percentages. Relative error approx. ± 30% of values given.

3. The mineralogy indicates that the main rocks in the source area are argellaceous sediments, probably intruded by granite with associated tourmaline metasomatism.

...hone 621 414), Botany, N.S.W. (666 9021), Kalgoorlie, W.A. (211 395).

71626

APPENDIX 3:

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025

JOB NO. 5267

APPROXIMATE COMPOSITION OF HEAVY MINERAL *FRACTIONS:*

NOTE:

1. Values given are only very approximate and are in volume %.

2. The presence of weathered fragments of schistose rocks, and of an extremely wide range of grainsize precludes accurate estimation and identification.

3. Approximate analyses for Pb, Zn, Cu, Ag, Ni, Sn, and possibly W, should be made on the more interesting samples.

C.I. Mathison

26th June, 1972

RECEIVED 30 JUN 1972

Telephone: 74 2566 • Telegrams: "Exserv" Perth
Offices at: Albion Qld. (Phone 621 414), Botany, N.S.W. (666 9021), Kalgoorlie, W.A. (211 395).

026

716027

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JOB NO. 5267: APPROXIMATE COMPOSITION OF HEAVY MINERAL FRACTIONS

Sample Number	Schist	Limonite + ilmenite	Magnetite	Zircon	Rutile	Cassiter-ite	Monazite	Chromite	Sulphide	Tourmal-ine	Garnet	Carbonate	Andalus-ite	Amphibole	?Diopside	?Corundum
A32	80	12		3			tr	tr		5						
A37	35	40	2	10	tr		tr	3		10						
A39	95	2	1	2			tr	tr		tr						
A42	30	50	2	10	tr		1	2		5						
A45	20	65	tr	10	tr		tr	tr		5	tr					
A46	-	10	-	tr				tr		tr	tr				90	
A47	-	10	tr	2	tr			tr	85	3	tr					
A48	42	45	5	tr			tr	tr	tr	3	tr					tr
A56	50	40	tr	3			tr	tr	tr	3		tr		3		tr
A57	20	60	5	1		?tr	tr		10	5	2			tr		2
A59			no	samples						no	samples					
A60	15		tr		5	?tr	tr		tr	10	tr			tr		5
A62	-	5	tr	2	tr		tr			3	tr		?90	tr		1
A63	-	15	tr	2	tr			tr		3			?80			tr
A67	50	40	tr	6	tr			tr	tr	4				tr		
A75	5	45	tr	6	1		3	tr		15	tr	tr	?25	tr		
A76	-	30	tr	10	tr			tr		10			?50			
A78	10	35	tr	5	tr		5	tr		25			?20	tr		
A80	40	20	tr	10	tr		10			20				tr		
A81	10	50	tr	10	tr		10	tr	5	15			tr			
A84	30	50	tr	10	tr		tr	tr		10			tr			
A88	50	45	tr	3	tr		tr			2						
A101	10	75	tr	10	tr		tr		tr	5						
A103	70	10	tr	12	2	?tr				6						
A105	40	30	tr	15	tr		5	tr		10						
A110	5	50	tr	15	tr		5			20	tr		?5			
A114	-	55	tr	10	3	?tr	2	tr	tr	20			?10			tr
A115	-	50	tr	7	3		2	tr		13			?25			
A119	30	15	tr	7	tr	?tr	tr		40	5			?3			
A123	-	60	tr	12	2	?3	tr			13			?10			
A125	-	45	tr	20	tr	?tr	2		tr	18			?15			
B12	5	35	tr	25	3	?	5	tr		27	tr					
B14	10	30	tr	20	3	?	7			30						
B19	5	40	tr	25	tr		tr			30						
B23	10	35	tr	30	3	?	7			15						
B27	25	40	tr	12	2	?1	5			15						
B29	40	40	tr	10	tr	?	2			8						
B34	55	10	tr	20	tr	?	2			13				tr		
B51	50	30	tr	15	tr	?	1			4						
B57	10	20	tr	55	2	?	2	tr		11						
B58	30	30	tr	30	2	?	1			7						
B62	-	18	tr	65	2	?2	3			10			tr			
B65	-	15	tr	60	2	?1	2			15			tr			
B66	5	10	tr	15	2	?2	1			63			2	tr		
B67	15	20	tr	20	tr	?3	2		tr	40		tr				
C4	50	40	tr	6	tr	?				4		tr		tr		
C5	40	55	tr	3	tr		tr			2						
C15	45	50	tr	3	tr		tr	tr		2		tr		tr		
C22	-	6	tr	12	tr	?2	10			70				tr		
C23	50	10	tr	10	tr	?	5	tr		20		5				

APPENDIX 3:

ROCK SAMPLES :

THIN SECTION DESCRIPTIONS

AND LOCALITIES

VALLEY PROJECT

Compiled : Alistair Barton

Date : 25/9/1972.

1. INTRODUCTION

From the rock samples collected from the Stanley River area, twenty were thin sectioned. These were:-

ASR 5	BSR 13	CSR 5
ASR 7	BSR 24	CSR 6
ASR 9	BSR 25	CSR 16
ASR 10	BSR 27	CSR 18
ASR 11		CSR 21
ASR 15		CSR 22
		CSR 30
		CSR 33
		CSR 34 (c)
		CSR 36

Hogen-Esch and Lee collected series "A", Barton and Masters collected series "B", and Milne and Buckingham collected series "C".

Thin sectioning and microscopic descriptions was done by A. Barton with help from J. Leishman.

A summary of the thin section descriptions will be given, together with the location of samples. An appendix with the full descriptions will follow.

2. ROCK DESCRIPTIONS AND LOCALITIES

2.1 ASR 5 :- The rock is a vein rock which is composed of anhedral quartz - 50%, tourmaline (schorlite) - 50%, and minor accessories - $<1\%$. The rock was formed when magmatic volatiles crystallized in fissures or joints through which it was permeating.

The sample was taken 100 yards upstream from the sediment sample A71, in the granite.

2.2 ASR 7 :- The sample is a holocrystalline medium-grained, hypidiomorphic granular granite which is composed of quartz - 40%, biotite - 5%, plagioclase - 15%, orthoclase - 35%, sericite - 4%, opaque minerals - $<1\%$, and monazite - $<1\%$. The biotite is thought to have crystallized first and was embayed, and gathered in clumps when it passed into a higher thermal zone. The crystallization of the other minerals, except sericite, followed.

The sample was taken 10 yards upstream from sediment sample A2 which was taken in a small stream just off from Stanley River.

2.3 ASR 9 :- The sample which was described as banded quartz-tourmaline with sulphides along jointing in the granite, in the hand specimen, was taken 100 yards upstream from A3 creek in the Stanley River.

The rock is a hypidiomorphic granular, fine-grained vein rock which is composed of quartz - 70%, tourmaline - 25%, and sulphides - 5%. There seems to be two stages of crystallization; firstly, the subhedral quartz, followed by the anhedral quartz-tourmaline-sulphide assemblage.

2.4 ASR 10 :- This sample is the parent granite for ASR9 and was taken next

../2

to the ASR 9 sample.

The rock is a holocrystalline, medium grained granite with a hypidiomorphic granular fabric. It consists of quartz - 64%, tourmaline - 10%, feldspar - 20%, sericite - 5%, and sulphides - 1%. It is thought to be a late stage crystallization granite because it contains the volatile minerals.

2.5 ASR 11:- This silicified slab of Crimson Creek Formation was taken about midway between A 90 and A 89 on Salmon Creek.

The rock can be called a sandy claystone which is texturally immature, and it is composed of quartz - 30%, rock fragments - 5%, sulphides - 12%, sericite - 2%, minor accessories - 1% and the clay matrix - 50%. The rock fragments consist mainly of metasediments. The rock type could be indicative of a lagoon type environment.

2.6 ASR 15:- This sample was picked up in a boulder pile from old workings near where A 100 was taken.

The rock is a holocrystalline vein rock which is composed of a quartz - 65%, tourmaline (schorlite) - 20%, cassiterite - 15% and accessories - < 1%. Most of the anhedral to subhedral cassiterite crystals occur in clumps. The rock was probably formed when emanating fluids crystallized in cracks or fissures within the granite.

2.7 BSR 13:- This sample which was taken in the small creek bounding the Livingstone Creek Iron Anomaly, was described in the hand specimen as thinly banded quartz-tourmaline.

The thin section description confirms this. The rock is composed of quartz - 60%, tourmaline - 40% and a black opaque mineral (magnetite?). The banding is due to concentrations of quartz and tourmaline respectively. It was probably formed when emanating fluids metasomatized the country rock.

2.8 BSR 24:- This sample was taken from the Livingstone Creek Iron Anomaly and is described as spherulitic hematite.

The spherulitic texture was not discernable in the thin section and the minerals occurred in irregular masses. Gas vesicles occur in some abundance (2 - 3%), while the rock consists of hematite, -25%, limonite - 15%, geothite - 5%, while 55% of the slide area has been lost to slide cutting processes.

2.9 BSR 25:- This sample was found at the base of the Livingstone Creek Iron Anomaly but was not found in situ.

The rock consists of angular quartzite fragments cemented by hematite (or magnetite?), goethite and limonite. It is composed of quartz - 70%, hematite - 15%, and limonite and goethite - 15%. The quartz occurs in the quartzite fragments or as single grains cemented in the iron oxides. Because a fault is thought to divide the iron anomaly, this rock could be fault breccia which was cemented by iron oxides.

2.10 BSR 27:- This sample was taken 200' N.E. from Livingstone Creek downstream of the iron anomaly.

The rock is a poikilitic, holocrystalline, hypidiomorphic granular granite

../3

which is slightly porphyritic. The rock consists of quartz - 45%, plagioclase - 5%, orthoclase -45%, biotite - 2%, sericite - 2%, muscovite - <1%, and kaolin (?) - <1%. The plagioclase is strongly zoned, with the inner zone being strongly sericitized. The orthoclase gives the granite its slightly porphyritic texture, with crystals up to 10mm in length.

2.11 CSR 5:- This sample was collected from a small conical hill on the left bank of the Harman River. The hand specimen was described as a serpentinite with abundant chromite.

The thin section description showed it to be a dunite which has been serpentinized, with a dominant mesh structure prevailing. The rock is composed of olivine - 40%, antigorite - 59%, and opaque minerals (spinel or chromite ?) - 1%.

2.12 CSR 6:- This sample was taken in the same locality as CSR 5, and was described in the hand specimen as a serpentinized peridotite.

The rock has a mesh structure and is composed of antigorite - 75%, talc - 10%, olivine - 5%, enstatite - <1%, limonite - 6%, chromite or magnetite - 1%, and chlorite - 1%. The original rock was probably a peridotite which has been serpentinized, with later weathering to produce limonite and chlorite.

2.13 CSR 16:- This rock was taken from a rock traverse across the granite-quartzite contact. The rock can be described as a "granitic" quartzite because of the development of large feldspar and quartz crystals. The rock has a granoblastic, poikiloblastic and porphyroblastic texture but no orientation is present. It is composed of quartz - 90%, orthoclase - 3%, biotite - 2%, plagioclase - 1%, tourmaline - 1%, muscovite - 1%, and secondary sericite - 2%. The rock was probably formed when emanating fluids from the granite intrusion metasomatized the psammite at the contact.

2.14 CSR 18:- This rock was taken from the same rock traverse as CSR 16.

This rock can be described as a "granite-quartzite", because there is a greater development of a granite texture even though the sample was taken closer to the quartzite. The rock has a granoblastic and porphyroblastic texture but no orientation is present. It is composed of quartz - 80%, plagioclase - 7%, orthoclase - 5%, biotite - 5%, sericite - 2% and minor accessories - 1%. Metasomatism of the country rock by emanating fluids probably caused its formation.

2.15 CSR 21:- The rock was taken from the same traverse as CSR 18, but was taken further away from the granite.

The rock is a quartz-muscovite-hornfels, showing typical hornfels texture. The original bedding of the psammite(?) is still preserved and is due to varying concentration of quartz, muscovite and chlorite, as well as bands of larger and smaller quartz grains. The hornfels consist of quartz - 50%, muscovite - 35%, tourmaline - 1%, black opaques (magnetite?) - 1%, chlorite - 10%, limonite - 1%. The hornfels was formed due to contact metamorphism at the contact when the granite intruded the psammite ?

../4

2.16 CSR 22:- This rock comes from the same granite contact zone as CSR 21, but it is taken further away from the granite.

The rock is a quartzite showing a typical hornfels texture. The bedding of the original psammite is still preserved (same reasons as CSR 21). It consists of quartz - 65%, muscovite - 30%, tourmaline - <1%, heavy opaques (magnetite) - 2%, and limonite staining - 3%. Contact metamorphism at the contact produced the quartzite.

2.17 CSR 30:- The rock was taken south of the actual granite-quartzite contact.

It is a quartz-tourmaline metasomatic replacement rock with a polygonal texture developed in the quartz. This polygonal texture indicates that the tourmaline-sulphide fluids entered the country rock and replaced the psammite, but the quartz was recrystallized. The rock consists of quartz - 70%, tourmaline - 29%, and sulphides - 1-2%.

2.18 CSR 33:- This weathered volcanic rock was taken just east of the Stanley River, downstream from Livingstone Creek.

The volcanic rock is extremely weathered with very few original minerals able to be properly identified. The rock consists of plagioclase - 10%, orthoclase - 15%, clinopyroxene - 15%, black opaque mineral (magnetite?) - 5%, the secondary minerals due to weathering process; chlorite (penninite) - 15%, limonite staining - 2%, and the unknown dirty, speckeldy secondary mineral - 15%. Due to slide cutting; 22% of unknown grains have been removed. The black opaque mineral occurs in a long thin needle-like form. Because of the extreme weathering, the type and paragenesis cannot be given.

2.19 CSR 34 (c) :- This rock was collected at the Livingstone Creek Iron Anomaly.

The rock is a tourmaline-zoisite (?) metasomatic rock which was found in a quartzite. Irregular banding occurs due to concentrations of tourmaline and zoisite respectively. The rock is composed of zoisite - 50%, tourmaline - 45%, opaques (magnetite or sulphides ?) - 2%, and quartz - 3%. The zoisite ? is hard to distinguish due to the smallness of the grain and the anhedral shapes. Metasomatism of the psammite by emanating tourmaline-zoisite-opaque fluids replaced the psammite and formed the banded rock.

2.20 CSR 36 :- This rock was collected from along the Wilson River.

This rock is a homogeneous, equi-grained orthochemical sediment which is composed of microcrystalline calcite ooze - 35%, the euhedral calcite crystals (maybe dolomite ?) - 60%, quartz - 2%, and carbonaceous matter - 3%. The rock can be described as a carbonaceous coarse calcilutite which has been formed due to the possible recrystallization of a micrite.

3. APPENDIX

DETAILED THIN SECTION DESCRIPTIONS

3.1 ASR 5 :- The vein rock is slightly poikilitic, hypidiomorphic, and holocrystalline. It is fine-grained; the crystals varying in length from 4 mm to very small crystals.

The rock is composed of tourmaline - 50%, quartz - 50%, and minor accessories - <1%; the accessories consisting of a little limonite staining and some very small opaque crystals.

The tourmaline variety is schorlite and it is identified by its slate blue, olive, buff and neutral grey colours with strong pleochroism. Zoning is also characteristic. Birefringence is moderate to strong with cross sections showing no birefringence. The crystals are 2mm to very small crystals (0.05mm) in size. There are some subhedral grains but most crystals are anhedral and have very irregular shapes.

The quartz consists of anhedral grains made up of composite grains with some grains showing strong undulose extinction. Crystals are generally 1 to 2mm in size, with some larger and smaller grains. The absence of cleavage and twinning, lack of alteration, and the low birefringence and relief are all characteristic of quartz.

Paragenesis :- The rock is composed of magmatic volatiles which crystallized out in fissures through which it was permeating.

3.2 ASR 7 :- The rock is a holocrystalline, medium-grained, hypidiomorphic granular granite.

The granite is composed of quartz (40%), biotite (5%), plagioclase (oligoclase ? 15%), orthoclase (35%), sericite (4%), opaque minerals (<1%), and monazite (<1%).

The quartz is composed of anhedral grains which show undulose extinction, hence indicating that pressure was involved during formation. The quartz envelops biotite crystals and embayed crystals of quartz, but is at times enveloped by potash feldspar. The quartz is distinguished from the feldspars due to its unaltered state.

The biotite occurs as single grains or in clumps, but without any orientation; the grains being ½ to 1mm in length. The brown to olive-brown colour and the strong pleochroism identify the biotite. Pleochroic haloes are also present.

The type of plagioclase is difficult to identify because of the sericitization of the grains, which masks the extinction, and the very few grains present. Those crystals which were present indicate it to be oligoclase. The plagioclase was identified by the albite twinning.

The orthoclase, which has been sericitized to some extent encloses subhedral grains of quartz, plagioclase, and crystal clusters of biotite which have been embayed. Zoning occurs and twinning (simple) within the orthoclase crystals which range in sizes from 7mm to 1mm in length.

The sericite is formed by secondary processes from the alteration of feldspar to sericite. It occurs as small flecks and minute shreds.

The opaque minerals occur as anhedral grains of about 0.05mm. Most opaques occur in the biotite or are associated with it.

../6

The rock is a granite if based on *Nockold's Classification.

Paragenesis :-

The biotite crystallized from the magma first but was embayed when it passed into a higher thermal zone. This was followed by the crystallization of the other minerals except the sericite which was formed due to secondary processes.

* A Petrography of Australian Igneous Rocks - Joplin, G.

3.3 ASR 9 :- This rock is a hypidiomorphic granular fine-grained vein rock which is composed of quartz - 70%, tourmaline - 25%, and sulphides - 5%.

The quartz occurs as anhedral grains with some subhedral grains which are no larger than 2mm but they do occur as very tiny crystals. The subhedral crystals are generally enclosed in other quartz grains or partly or wholly enclosed in the tourmaline grains and the sulphide grains. There seems to be two stages of crystallization, firstly, the subhedral quartz grains (which contain specks of unidentifiable minerals), and secondly, the quartz, tourmaline sulphide mineral assemblage.

The tourmaline occurs mostly as anhedral grains with some subhedral grains. The tourmaline, together with the sulphides, seem to be the last to crystallize out because of their irregular shape. The crystal sizes vary from 2mm to very tiny crystals. The tourmaline variety is schorlite due to the olive green, slate blue, and brown colours together with strong pleochroism.

The sulphides (hand specimen identification) occur as the late stage crystallizing mineral. Crystals are irregularly shaped and commonly enclose quartz crystals. The grains vary from 2-3mm in size down to very small crystals, but some of them occur as composite grains.

Paragenesis :-

These are vein minerals which have orientation in the field specimen, but due to the size of the slide, the orientation is not observable. There are two stages of crystallization. Firstly, the subhedral quartz, which was followed by the anhedral quartz, tourmaline and sulphides.

3.4 ASR 10 :- The rock is a holocrystalline, medium-grained granite with a hypidiomorphic granular fabric, and it consists of quartz - 64%, tourmaline - 10%, feldspar - 20%, sericite - 5%, and sulphides - 1%.

The quartz occurs as anhedral, with some subhedral crystals, which vary in size from 2 to ¼mm in length. Many are embayed, and vacuoles and microlites are common in many crystals. Undulose extinction is present, indicating that strain was present during formation. The quartz is distinguished from the feldspar by the lack of alteration.

The type of feldspar could not be distinguished because of the high degree of alteration or sericitization which has occurred. The

../7

716035

feldspar crystals vary in length from 2mm to <1mm.

Schorlite is the tourmaline variety and it is distinguished by the olive-brown, slate blue, greenish colours and the distinct pleochroism and zoning. Most crystals are 1 to 2mm in length but some are much smaller. The crystals are subhedral to anhedral in shape and occur mainly in association with the pockets of quartz, and the sulphides.

The sericite occurs due to the secondary alteration of the feldspar, and is present as small radiating crystals and shards throughout the feldspars.

The black opaque minerals which have been described as sulphides in the hand specimen, occur with the quartz-tourmaline clumps. The crystals vary in size from 1mm to <0.25mm.

<u>Paragenesis</u> :- The so-called "granite" is a late stage crystallization product which contains the volatile minerals tourmaline and sulphides. Secondary processes have sericitized the feldspars.

<u>3.5 ASR 11</u> :- The rock is a highly silicified grey slab of the Crimson Creek Formation which contains pyrite mineralization.

<u>Texture</u> :- The rock consists of 90% terrigenous material and 10% orthochemical material. The rock is bedded or layered with some thick grey clay bands developed and a small fault cuts the actual slide. The rock is non porous.

The grain sizes vary from sand size (0.5mm to 0.25mm)- 35%, to silt size - 2%, down to clay sized particles - 50%. The sand size fraction is moderately sorted and ranges from medium sized sand grains to very fine sand grains. These grains are sub-angular to rounded and occur as elongate to compact grains.

The silt size fraction consists of subangular but compact grains.

The mud fraction has a ratio of silt sized particles to clay particles of 1:25. Therefore, the textural name (based on Folk's classification) is a sandy claystone.

Because of the high clay percentage, the rock is texturally immature. The bonding agents are the clay matrix with later cementation provided by silicification.

<u>Mineral Composition</u> :- The rock is composed of quartz - 30%, rock fragments - 5%, sulphides - 12%, sericite - 2%, minor accessories - 1%, and the clay matrix - 50%.

The rock fragments consist of quartzite - 2%, and highly sericitized unidentifiable grains - 3%.

The rock fragments are well rounded.

The quartz grains are well rounded to subangular and have straight to undulose extinction.

The sericite occurs as small flecks and platy aggregates and is recognized by its colourlessness and second order interference colours.

The silicified clay matrix is brown and in the clay bands it is a strong moderate brown colour.

The pyrite development occurs in the clay matrix and in some rock

../8

fragments. Perfect cubic crystals have formed in the clay bands, while irregular development occurs in the sandy claystone areas.

Accessories include sphene, a little limonite staining, and some small muscovite flakes.

Paragenesis :-

The rock seems to be formed in a lagoon type environment where clay particles can settle together with sand grains which could have been wind blown into position. The grey colour of the rock which is probably due to the pyrite, indicates a reducing environment. The textural name of the rock could be called a sandy claystone. Later compaction and local metamorphism resulted in the silicification.

3.6 ASR 15 :- The rock is a holocrystalline vein rock which is composed of quartz - 65%, tourmaline - 20%, cassiterite - 15%, and accessories - 1%.

The quartz occurs as anhedral crystals which range in size from 4mm to 0.2mm. Many crystals show undulose extinction due to stain. The quartz is identified by its low relief (< balsam), grey, white and yellowish interference colours, and its unaltered state.

The tourmaline variety is schorlite which is distinguished by its duck-egg blue, green to olive colours, the zonal structure in the cross section and the strong pleochroism. Most crystals are anhedral to subhedral which vary in length from 3mm to ½mm in size.

The cassiterite occurs as anhedral to subhedral grains of 1 to 2mm in length with some crystals being very small. It is distinguished by its colour, which is colourless but a brown flecked colour occurs due to the very high relief. Simple twinning occurs and one set of cleavage is distinct. Extinction occurs obliquely to the twin plane. The high order interference colours are masked by the neutral colour of the mineral. Most of the cassiterite crystals occur in groups of crystals.

The accessories include small crystals of muscovite enclosed in quartz and a black opaque mineral (sulphides?) which occurs as anhedral grains.

Paragenesis :-

The rock is formed when emanating fluids crystallize out along a joint plane or crack.

3.7 BSR 13 :- The rock consists of thinly banded quartz-tourmaline which was probably formed when a volatile quartz-tourmaline fluid was injected into the country rock and metasomatism occurred. The banding occurs due to concentrations of alternating quartz and tourmaline crystals. Most crystals are xenoblasts and are mostly equigranular.

The rock consists of quartz - 60%, tourmaline - 40%, black opaque mineral (magnetite) - 1%.

The xenoblastic quartz has straight extinction and the crystal size is no greater than 0.5mm in length. The quartz is recognised by its low relief, white interference colour, and unaltered state (due to weathering).

The tourmaline consists mainly of xenoblastic crystals, but some odd subidioblastic crystals occur. The size of the crystals is no greater than 0.5mm. The tourmaline variety is schorlite and is distinguished

../9

by the olive-green to orangy-brown colour and the strong pleochroism. Parallel extinction and "isotropic" cross sections are also indicative of schorlite.

The magnetite? occurs as very small crystals and is generally associated with the tourmaline.

Both the tourmaline and quartz have a slightly sutured crystal outline but a hornfelsic texture is certainly not developed.

Paragenesis :-

The rock was possibly formed when introduced fluids from the emplacement of the granite magma metasomatized the country rock to form banded quartz-tourmaline.

3.8 BSR 24 :-

Spherulitic Hematite :- The spherulitic texture is not discernable although there are some straight thin blank spaces in the slide where crystals could have been plucked out, but these are not radiating in texture. 55% of the grains or matrix could have been lost in the slide cutting process, depending on the original amount of solids present.

Gas vesicles up to 1mm in length but generally ½mm in diameter occur with some abundence, 2-3%.

Very small anhedral to subhedral crystals of a high relief mineral occurs. These occur within the iron matrix and in the gas vesicles but due to the very high relief, and second order interference colours, the crystals could be the corundum in the grinding powder ?

The rock consists of goethite, limonite and hematite. The goethite is distinguished by its crystalline form and parallel extinction. Limonite has not these properties. The hematite is opaque and black in colour. Goethite - 5%, limonite - 15%, hematite - 25%.

The iron oxides all occur in irregular masses.

3.9 BSR 25 :- The rock consists of quartzite fragments cemented by an opaque oxide, (hematite and/or magnetite), goethite, and limonite. It is composed of quartz - 70%, hematite - 15%, and limonite-goethite - 15%.

The quartzite fragments consist of anhedral quartz grains ranging in size from 1mm to less than 0.25mm. Some secondary quartz cementing occurs. Limonite and/or goethite, together with hematite or magnetite, occur as grains and veinlets in the quartzite fragments.

As well as the quartzite fragments, quartz grains are cemented into a limonite-goethite-hematite matrix. Most of these grains are embayed and very angular in shape. There was no undulose extinction in the quartz grains, or in the quartz particles comprising the quartzite fragments. This could indicate recrystallization of the quartz particles in the original quartzite.

The goethite distinguished from the limonite and hematite by its reddish colour and parallel extinction. Limonite is distinguished from the opaque oxides by its brownish colour, whereas hematite is present in the areas which are completely black.

Paragenesis :- The rock could have been formed in a fault zone as a fault is thought to be near where the rock was picked up. The fault occurred in quartzites, and fragments of quartzites were later cemented by iron oxides.

3.10 BSR 27 :- The rock is a poikilitic, holocrystalline, hypidiomorphic granite which is slightly porphyritic.

The rock consists of quartz - 45%, plagioclase - 5%, orthoclase - 45%, biotite - 2%, sericite - 2%, muscovite - 1%, and kaolin? - 1%.

The quartz crystals are anhedral and vary in size from 4mm to 0.25mm. Most quartz grains have undulose extinction and some enclose biotite, plagioclase and muscovite. Secondary vein quartz occurs between grain boundaries and is generally less than 0.01mm thick.

The plagioclase occurs as subhedral crystals which range in length from 6mm to 1mm. Most crystals are highly sericitized. The plagioclase is distinguished by the albite twinning and by using the Michel-Levy method, the type of plagioclase is found to be oligoclase. Strong zoning occurs in most crystals and the inner zone of these crystals is more susceptible than the outer to secondary alteration.

The subhedral grains of orthoclase range from 10mm to 1mm and most grains have been altered in part to sericite. The orthoclase encloses plagioclase in some crystals and hence has a slightly perthitic texture. The carlsbad twinning, the secondary alteration and the extinction angles distinguish the orthoclase.

The typical biotite crystals are ½ to 2mm in length and are subhedral. Pleochroic haloes are present. The typical olive brown colour, the form, and the straight extraction are distinctive of biotite.

The sericite occurs as minute shard-like grains and is formed by secondary processes.

The tourmaline (schorlite) occurs as small graphic crystals of less than ½mm in length and are enclosed in orthoclase crystals. The schorlite is distinguished by its colour and strong pleochroism.

The muscovite occurs in small subhedral crystals of less than 0.05mm in length and are enclosed in the feldspars. The colourless crystals, the slight change in relief on rotation of the stage, the interference colours and the low to zero extinction angle determines muscovite.

The kaolin? occurs due to the weathering of the plagioclase. The kaolin is distinguished by the veinlet type replacement form and the low relief. The slight iron oxide colouration could explain the brownish-yellow colour and the yellowish interference colours which are not distinctive of kaolin.

Paragenesis :-

Crystallization of the granite magma with the orthoclase (remnant) crystallizing out very early. Possible remelting of the granite with the remnant orthoclase remaining (it encloses tourmaline and muscovite). Recrystallization occurs and hence the slight porphyritic nature of the rock.

3.11 CSR 5 :- The rock is a holocrystalline, equi-grained ultrabasic which has a dominant mesh structure. It is allotriomorphic granular.

The rock is composed of olivine - 40%, antigorite - 59% and accessory

../11

opaque minerals - 1%.

The olivine is distinguished by its high relief, large axial angle and higher birefringence from diopside. Irregular fractures can be distinguished where serpentinization has occurred. Before serpentinization of the rock, the olivine occurred in crystals of about 1 to 3mm in size, but since serpentinization, the maximum crystal size is ½mm. Weak carlsbad twinning occurs. The olivine crystals remaining are anhedral, but the crystal outlines before serpentinization cannot be properly defined.

The antigorite has low relief, and a slightly anomalous maximum interference yellow colour. It occurs as anhedral aggregates of fibro-lamellar structure. It occurs between the original olivine crystals and the fractures in the olivine crystals.

The opaque minerals are euhedral to subhedral grains of spinel or chromite (described as chromite in the hand specimen). The euhedral grains occur as equant octahedra, and most grains are very small.

Paragenesis :-

The rock is a dunite which has been emplaced and later serpentinized to give the typical mesh structure.

3.12 CSR 6 :- The rock has a mesh structure with some remnant crystals of olivine remaining. Limonite has replaced the olivine in some places but mostly the original rock type has been serpentinized.

The serpentinite consists of antigorite, talc, olivine, limonite, magnetite? or chromite?, chlorite and enstatite.

The antigorite forms the mesh structure and replaces the olivine and enstatite. It comprises 75% of the rock. The low interference colours, structure, colour (colourless) and low relief distinguish the antigorite.

The talc occurs as long fibrous aggregates with a parallel arrangement. Some shreds are bent. The upper third order interference colours, parallel extinction, relief, and colour indicate that it is either talc or sericite, but due to hand specimen observations of the rock, it can be considered to be talc. It comprises 5% of the total rock.

The remnant olivine occurs in small crystals (½mm) of which many show cleavage traces. The olivine has been serpentinized or has been replaced by limonite (weathering effects). The olivine comprises 5% of the total rock, but the grains which have been plucked from the slide (7% of slide area) are likely to be olivine.

The remnant enstatite occurs in small crystals of the same length as the olivine. It is distinguished from olivine by the low order interference colour and the slightly lower relief. It comprises 1% of the total rock.

The limonite replaces? the olivine and enstatite? due to weathering?. In some places it has only partly replaced the olivine. It occurs in small lumps no greater than 0.25mm. It comprises 5% of the total rock.

The chromite or magnetite occurs as small black anhedral crystals scattered throughout the rock. It comprises 1% of the rock.

The green chlorite occurs in one crystal and is probably due to weathering. It comprises 1% of the rock.

../12

Paragenesis :-

The original rock was probably a peridotite (due to olivine and enstatite remnants) which has been serpentinized to produce antigorite and talc, with later weathering to produce limonite and chlorite.

3.13 CSR 16 :- The rock can be described as a "granitic" quartzite in that there is a development of large quartz and feldspar crystals. The rock has a granoblastic, poikiloblastic, and porphyroblastic texture but no orientation is present.

The quartzite is composed of quartz - 90%, orthoclase - 3%, biotite - 2%, tourmaline - 1%, muscovite - 1%, plagioclase - 1%, secondary sericite - 2%.

The quartz occurs as large porphyroblasts (4-5mm) with abundant vacuoles and undulose extinction, and as very small xenoblasts. These small xenoblasts are poikiloblastic. Many of the xenoblasts have undulose extinction.

The orthoclase occurs as large subidioblastic porphyroblasts (4mm long) as well as small xenocrysts. The porphyroblasts are poikiloblastic.

The biotite crystals have a slightly radiating structure indicating formation from nucleation.

The tourmaline and muscovite both occur as small embayed crystals and are found in the porphyroblasts and the "groundmass". These were probably volatiles introduced during the later stages of the granitic emplacement.

The plagioclase occurs as subidioblastic crystals (large and small) and was probably introduced with the orthoclase at the same time as the other volatiles.

The sericite was formed due to secondary processes acting on the feldspars, and to the alteration? of the biotite during the granite emplacement.

Paragenesis :-

The granitic magma intruded the quartzites and emanating magmatic fluids metasomatized the quartzite at the contact. This resulted in the formation of biotite, feldspars, and possibly quartz.

3.14 CSR 18 :- This rock, which was taken in and about the granitic contact, is nearly the same as CSR 16. It can be described as a "granite-quartzite", except that there is a greater development of a granitic texture.

The rock has a granoblastic and porphyroblastic texture but no orientation is present.

The "granite-quartzite" consists of quartz - 80%, plagioclase - 7%, orthoclase - 5%, biotite-5%, sericite - 2%, and minor accessories - 1%.

The quartz occurs as porphyroblasts (3-4mm), most of which have undulose extinction, and as very small xenoblasts which also have undulose extinction.

The plagioclase, the orthoclase and the biotite were probably introduced as fluids when the emplacement of the granite took place. Metasomatism resulted in the formation of porphyroblasts, which range in size from 4mm to 1mm; and in smaller subidioblasts and xenoblasts. All the porphyroblasts have sutured outlines. The Michel Levy's extinction

../13

angle method indicates that the plagioclase is oligoclase. Both the feldspars have been sericitized to a small extent.

The plagioclase is distinguished by the albite twinning, whereas the orthoclase has simple twinning or none at all. The alteration of the orthoclase distinguishes it from the clear, unaltered quartz. Biotite is distinguished by its colour, pleochroism and parallel extinction. The alteration product of the feldspars, sericite, occurs as small shards or aggregates. It is distinguished by its colourlessness, straight extinction, and form.

The minor accessories include magnetite ?, muscovite and very high relief, colourless, anhedral crystals which are too small to be identified.

Paragenesis :-

The granitic magma intruded the quartzite and magmatic fluids permeated the quartzite at the contact. Metasomatism resulted in the formation of biotite, quartz and feldspar crystals. The rock could be defined incorrectly as a "granite-quartzite".

3.15 CSR 21 :- This rock was taken from the same rock traverse as CSR 18 but is further away from the granite.

The rock is a quartz-muscovite-hornfels showing typical hornfels texture. The original bedding of the psammite? is still preserved and is due to the varying concentrations of the muscovite, chlorite and quartz grains respectively, but is also highlighted by the bands of larger and smaller quartz grains as well.

The hornfels consist of quartz - 50%, muscovite - 35%, tourmaline - 1%, black opaques (magnetite?) - 3%, chlorite - 10%, limonite - 1%.

The quartz exists as small xenoblastic grains, but in some cases dissolution has occurred to 2 or 3 grains and they have formed one irregular grain. The original bedding seems to be due to bands of fine sand size alternating with bands of silt size grains. The quartz is distinguished by its low relief and white interference colour.

The poikilitic muscovite has a subparallel orientation along the different bedding, and also highlights the bedding by its concentration along bedding which consists of very small grained quartz; the coarse quartz particle bands being practically free of muscovite and chlorite. The muscovite is distinguished by its moderate relief, parallel extinction, one developed set of cleavage and its colourlessness. No radiating structure occurs.

The chlorite,which is penninite due to the anomalous "Berlin blue" interference colour, occurs in the same form as the muscovite, except that a radiating structure of the crystals is developed. The penninite occurs along bands where the silt sized quartz grains occur. It is distinguished by its greenish colour, the pleochroism, and the anomalous "Berlin blue" interference colour.

The tourmaline occurs as small xenoblasts, but larger ones (up to 1mm) do occur and these are usually poikiloblastic. These crystals are scattered throughout the rock.

The black opaques occur as small xenoblasts scattered throughout the rock in the same way as the tourmaline.

../14

The limonite has had a secondary introduction due to small fissures developing in the rock. It has coated and filled the fissures and has stained the surrounding muscovite grains.

Paragenesis :-

The original psammite was intruded by the granite and contact metamorphism resulted in the production of a quartz-muscovite hornfels. The original bedding has been preserved but muscovite growth has occurred, with greater concentrations occurring in the very fine-grained or silt size layers.

3.16 CSR 22 :- This rock comes from the same granite contact zone as CSR 21, but it is taken further away from the granite.

The rock is a quartzite showing typical hornfels structure. The bedding of the original psammite is due to the concentrations of different sized quartz grains while the concentration of the muscovite grains only occurs in the bands of very fine sized quartz grains. There is no preferred orientation of the muscovite crystals.

The quartzite consists of quartz - 65%, muscovite - 30%, tourmaline - <1%, heavy opaques (magnetite?) - 2%, and limonite - 3%.

The muscovite occurs as embayed xenoblastic grains which have a slight porphyroblastic and poikiloblastic development. Some crystals have limonite staining and a slight radiating structure while the other crystals have an idioblastic development. According to A. Spry, (Metamorphic Textures) this is due to free growth beginning from nucleation.

The quartz occurs as small granoblastic xenoblasts which generally have straight to slightly undulose extinction, and these crystals cause the embayments and poikiloblastic nature of the muscovite.

The magnetite or heavy opaques occur as very small xenoblasts evenly scattered throughout the rock.

The limonite staining in the muscovite probably owes its occurrence to the weathering of the magnetite grains because many magnetite grains have a brownish tinge around them.

The tourmaline, which is distinguished from the muscovite by its orange-brown colour and strong pleochroism, occurs in xenoblasts which are slightly poikiloblastic and are the same size as the muscovite crystals.

Paragenesis :-

The original psammite was intruded by the granite and contact metamorphism produced a quartzite with typical hornfels structure. The muscovite was developed due to growth from nucleation, and tourmaline was probably developed by the same process due to its similar form to muscovite.

3.17 CSR 30 :- The rock (in the hand specimen) is a quartz-tourmaline metasomatic rock which is typical to BSR 13, but a polygonal texture is present, i.e., in the quartz the rock is polygonized or recrystallized quartz found within the granite itself. Irregular banding occurs and this is again due to concentrations of alternating quartz and tourmaline. Emanating fluids (tourmaline-sulphides) have entered the quartzite and replacement takes place with recrystallization of the quartz.

../15

The rock consists of quartz - 70%, tourmaline - 29%, sulphides ± 1-2%.

The quartz occurs in xenoblastic or anhedral crystals and vary in size from 2mm to 0.1mm but most crystals are 0.25mm in size. Some quartz crystals are enclosed in the tourmaline. In the quartz rich bands, polygonal texture exists. This is thought to occur when stained quartz grains, when metamorphism occurs, break down due to the lattice structure, being unstable.

All the quartz grains have straight extinction, no undulose extinction being present; hence recrystallization indicated. The quartz is distinguished by the low relief, uniaxial positive interference figure, and the low interference colours.

The tourmaline is brownish-orange in colour and it exhibits strong pleochroism. This is indicative of schorlite. The schorlite crystals are mostly xenoblastic but some subidioblastic crystals do occur. The length varies from 2mm down to 0.1mm but most crystals are 0.25mm long. Many tourmaline crystals are slightly poikiloblastic. There is an alignment of tourmaline crystals along the bands.

The sulphides were recognised under reflected light by its yellow colour. It occurs as mostly anhedral crystals but some occur as subhedral crystals. It is mostly associated with the tourmaline rich bands. One long streak of crystals about 4 mm long occurs.

Some secondary quartz veining running parallel and within the tourmaline rich bands occurs, but why it occurs in such a way is not known.

Paragenesis :-

The rock is probably a metasomatic replacement rock which was formed when tourmaline and sulphide fluids entered and replaced the quartzites in bands. The quartz was recrystallized, producing the polygonal texture.

3.18 CSR 33 :- The volcanic rock is extremely weathered with very few original minerals able to be properly identified. The texture is also unrecognizable.

The rock consists of plagioclase - 10%, orthoclase - 15%, clinopyroxene - 15%, black opaque mineral (magnetite?) - 5% and the secondary minerals, due to weathering processes; chlorite (penninite) - 15%, limonite staining - 2%, and the unknown dirty, speckeldy, secondary mineral - 15%. Due to the slide cutting process, 22% of unknown grains have been removed.

The remnant clinopyroxene is most likely aegerine-augite because the extinction angle is 15-20°. Twinning occurs. All crystals are embayed and highly weathered. The crystals were subhedral and ranged from 1 mm to ½ mm.

The feldspars are all highly weathered and the crystal lengths are generally 1 mm. long. The plagioclase is identified by the albite twinning, but the identification of orthoclase is risky because it was based on the high degree of weathering, low relief, and the absence of albite twinning.

The penninite is distinguished by the anomalous "Berlin"blue interference colour and the greenish colour with slight pleochroism. The relief is moderately high, which distinguishes it from antigorite. The crystals occur up to 1 mm. in length and there is twinning according to the pennine law.

The black opaque mineral occurs in a long thin, needle like form, the needles generally being ½ mm. in length. It is most likely magnetite.

../16

043

Because of the extreme weathering of the rock, no paragenesis is given.

3.19 CSR 34 (c) :- The rock is a tourmaline-zoisite metasomatic rock which was found in a quartzite. There is no bandind as found in BSR 13, but a concentration of tourmaline and zoisite respectively which thins and thickens irregularly to give the irregular bands.

The rock is composed of zoisite? - 50%, tourmaline - 45%, opaques (magnetite? or sulphides?) - 2%, and quartz - 3%.

The zoisite is hard to distinguish due to the smallness of the grains which are no larger than a ¼ mm., but the mineral is most likely a member of the Epidote group. The mineral must be the ferrian variety of zoisite which has normal interference figures. The high relief, weak birefringence, slight yellow to grey interference colours and the biaxial interference figures are indicative of zoisite. All grains are anhedral.

The tourmaline is easily distinguishable by the brownish to olive green colours and strong pleochroism which is indicative of schorlite. The schorlite occurs as small anhedral granule aggregates; the same as for the zoisite.

The opaques, which could be either magnetite or sulphides, occurs mainly with the tourmaline in the tourmaline rich streaks. The crystals are anhedral and sutured in texture and occur scattered around in small clumps within the streaks.

The quartz occurs as small anhedral crystals in the same form as the zoisite but is scattered throughout the rock. The quartz is distinguished by its low relief. Some of the grains have undulose extinction. These could be the remaining quartz grains remaining from the psammite into which the granite intruded.

Paragenesis :-

The quartz was probably the remnant of the psammite into which the granite intruded. Introduced magmatic fluids metasomatized the psammite and tourmaline, zoisite, and the opaques were formed into an irregularly banded rock.

3.20 CSR 36 :- The rock is a homogeneous equi grained calcilutite which could have possibly been dolomitized ? Because the thin section was not stained, dolomite cannot be detected.

The euhedral crystals of carbonate which make up the majority of the rock range in size from 0.1 to 0.02 mm. These crystals have most likely been recrystallized from a former limestone type, although no former structures or texture can be found. Microcrystalline calcite ooze occurs between these euhedral crystals, and a possible source type for the recrystallized euhedral crystals could be a micrite (Folk)* . (The euhedral crystals could also be dolomite).

The composition of the rock is microcrystalline calcite ooze - 35%, the euhedral crystals - 60%, quartz - 2%, carbonaceous matter - 3%.

The microcrystalline calcite ooze has a blackish tint about it which is caused by very fine carbonaceous matter. The carbonaceous matter also occurs as small round grains scattered throughout the rock, although clusters of grains occur in places.

* Folk, R.L. - Petrology of Sedimentary Rocks.

../17

The quartz occurs as detrital grains, but there is a slight development of secondary quartz from the dissolution of the detrital grains.

Secondary veins of white calcite also occur.

Paragenesis :-

The rock can be described as a carbonaceous coarse calcilutite which has been formed due to the possible recrystallization of a micrite.

* * * * * * * *

4. REFERENCES

Folk, R.L.	1968	Petrology of Sedimentary Rocks. Univ. of Texas.
Joplin, G.A.	1968	A Petrology of Australian Igneous Rocks. 2nd Edition. Angus and Robertson.
....	1968	A Petrology of Australian Metamorphic Rocks. Angus and Robertson, Publishers.
Kerr, P.F.	1959	Optical Mineralogy. 3rd Edition. McGraw-Hill Book Co.
Pettijohn, F.J.	1957	Sedimentary Rocks. Second Edition. Harper and Row, Publishers.
Spry, A.	1969	Metamorphic Textures. Permagon Press.

* * * * * * * * * * * *

046

716C47

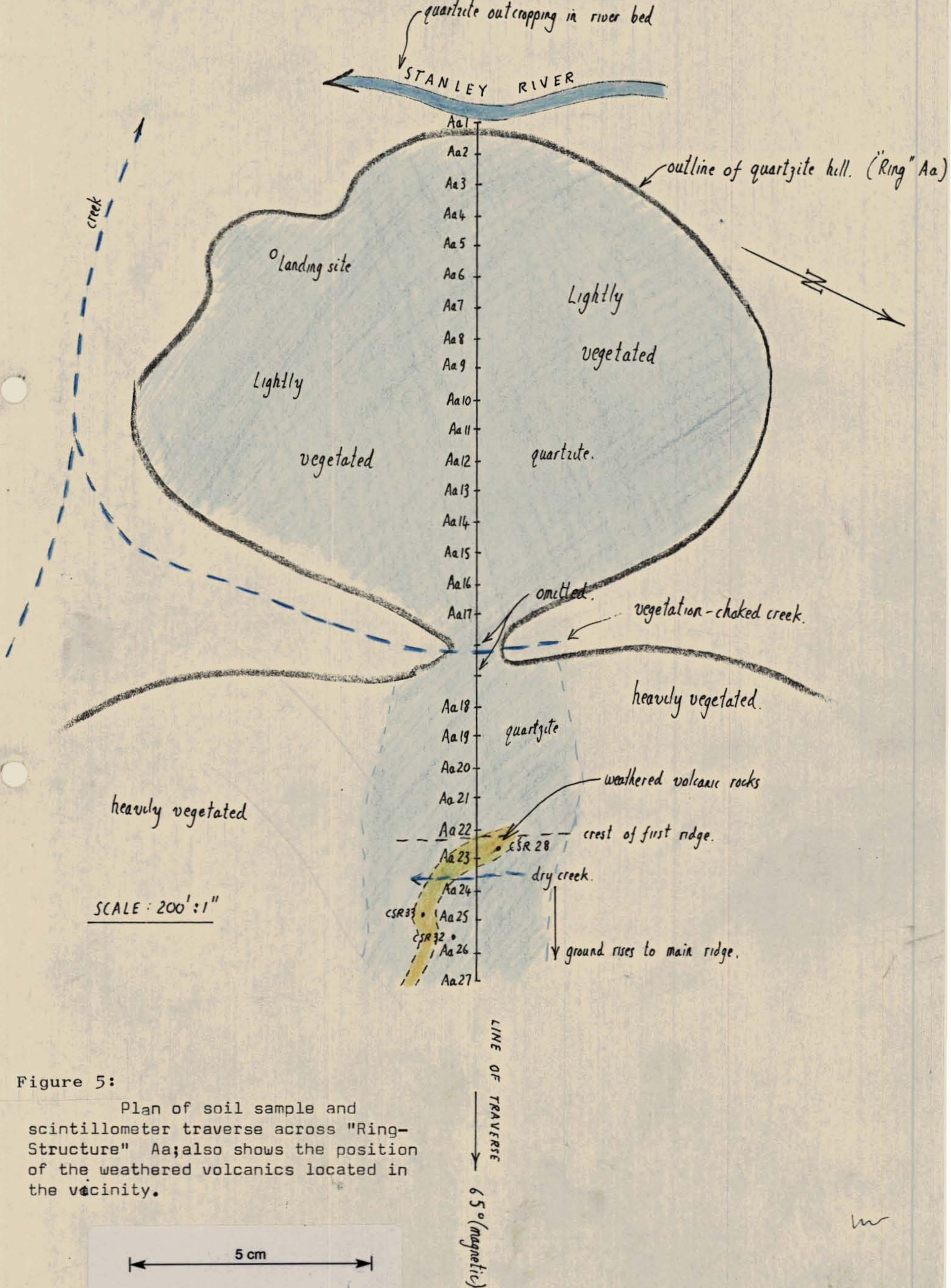


Figure 5:

Plan of soil sample and scintillometer traverse across "Ring-Structure" Aa; also shows the position of the weathered volcanics located in the vicinity.

5 cm

047

716048

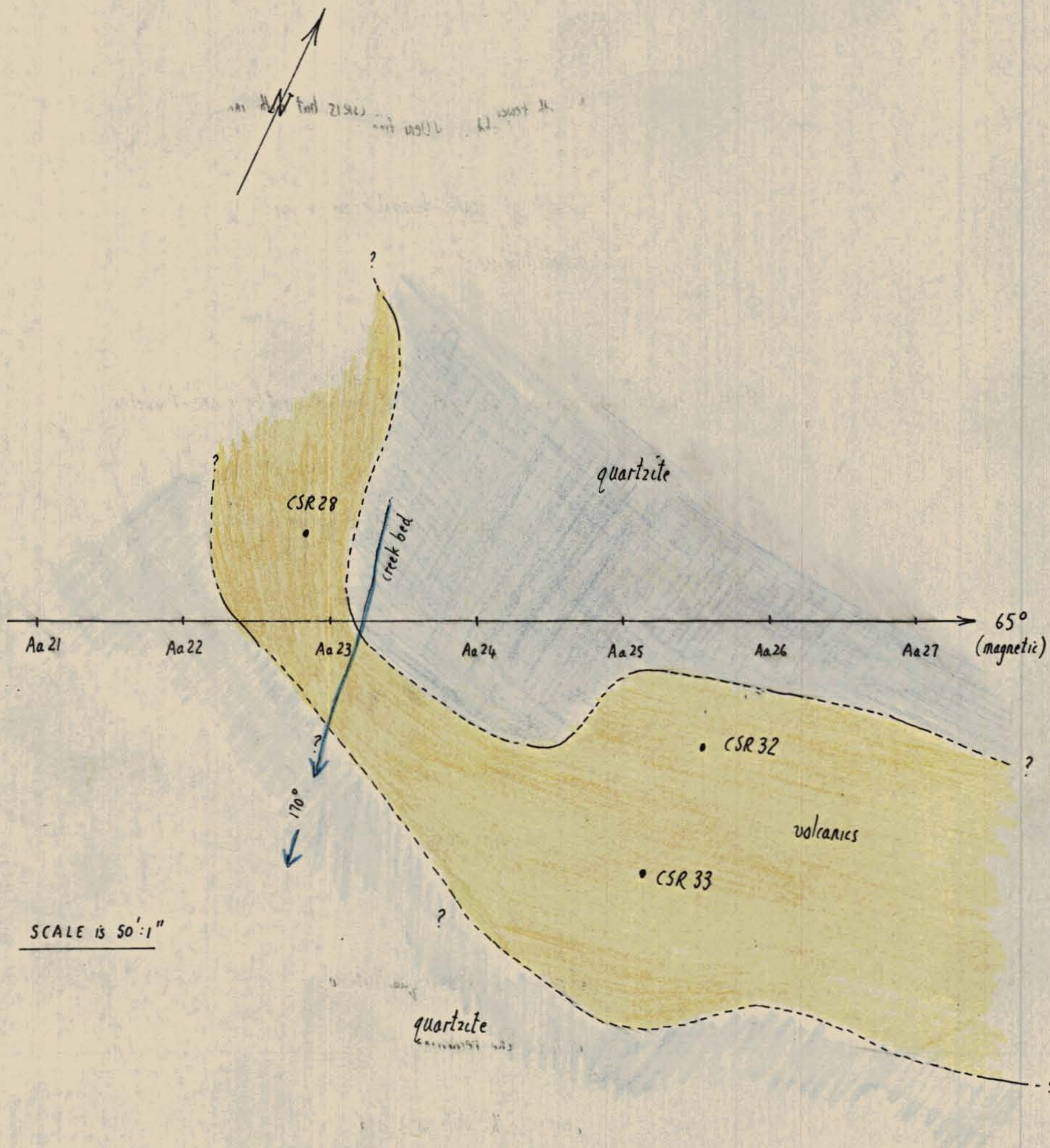


FIGURE 6: Sketch map showing the approximate distribution of highly weathered volcanic rocks found east of "Ring Structure" Aa.

5 cm

043

716049

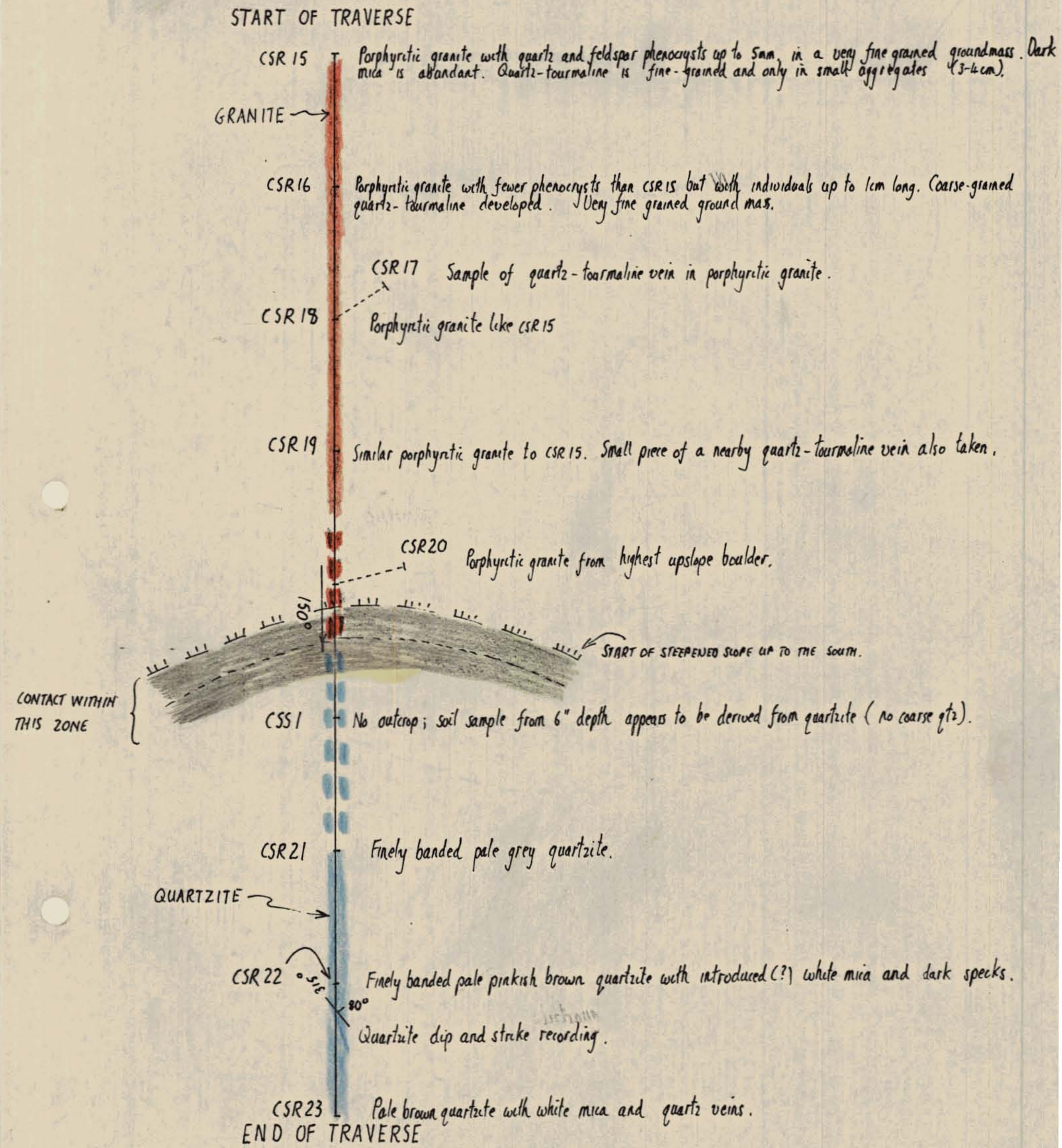


FIGURE 7: Plot of rock sample traverse across granite - quartzite contact on the crest of a spur approximately $\frac{3}{4}$ mile on a bearing of about 310° from Mount Livingstone trig. point. Scale is fifty feet to an inch. Traverse bears 150°.

049

716050

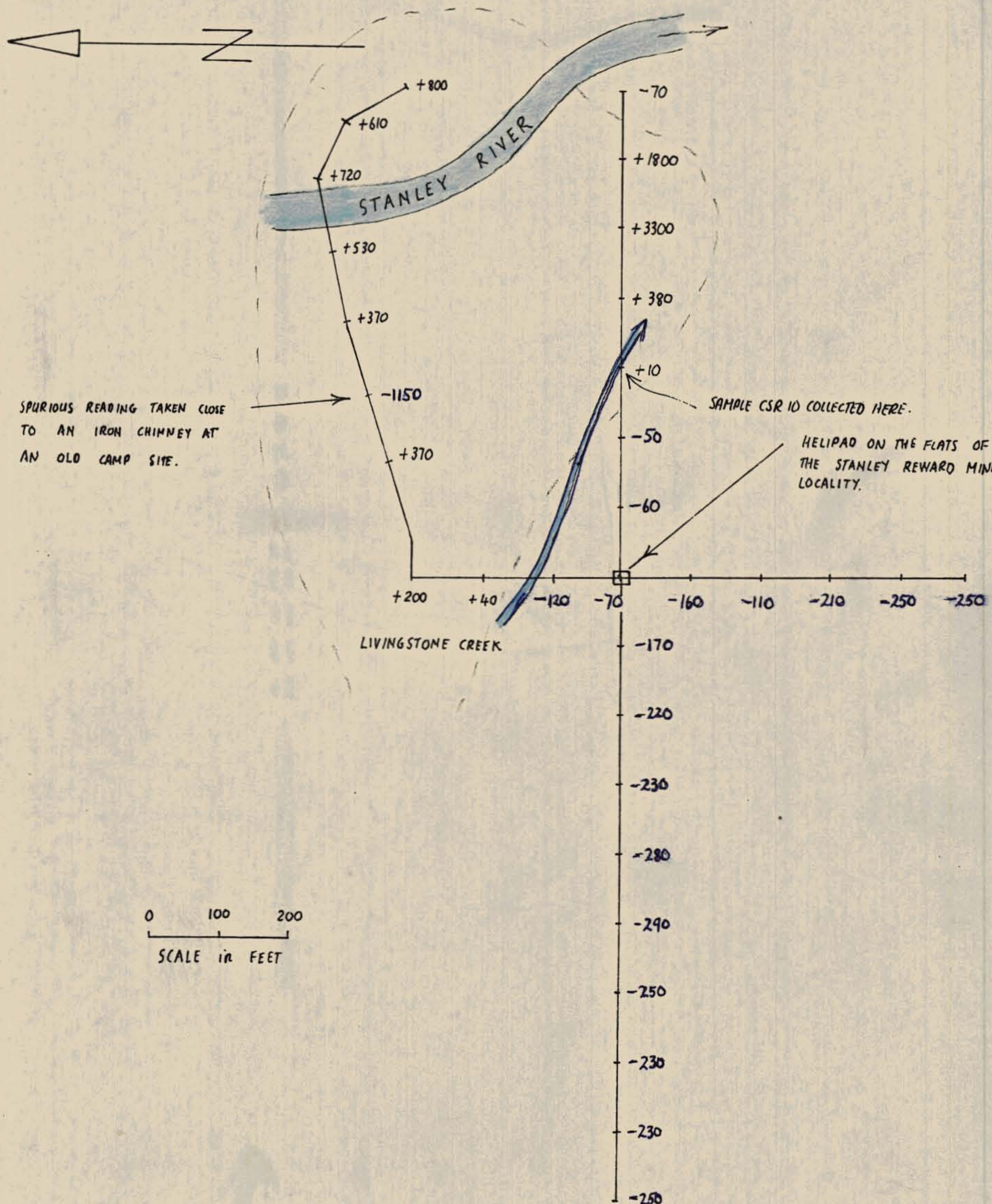


FIGURE 8: Plot of reconnaissance magnetometer survey in the area of the Stanley Reward workings. Units are gammas. Area of positive values possibly co-incides with reported dolomite (Waterhouse, 1915).

050

716051

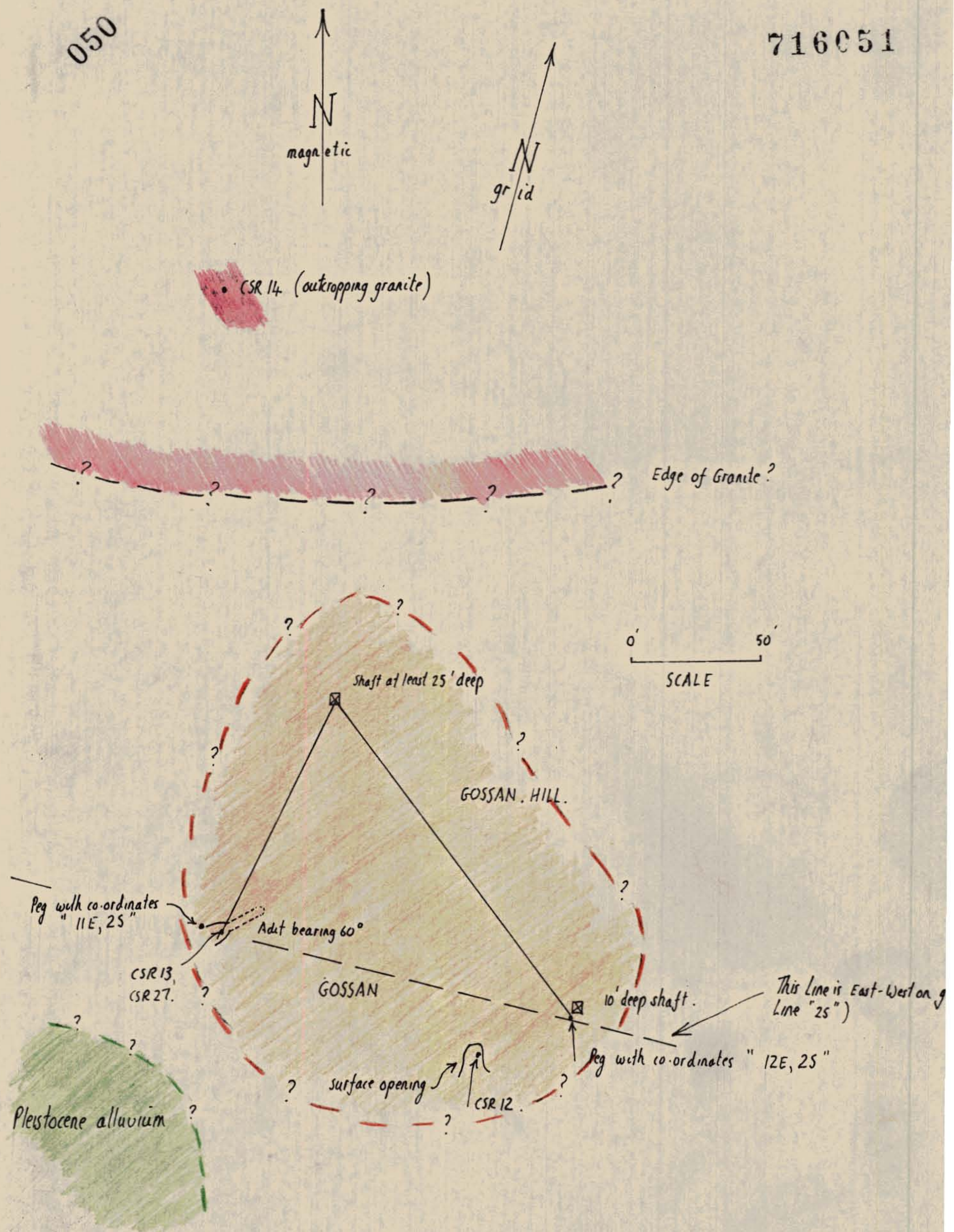


FIGURE 9: Sketch map showing sample locations and general geology of the stanniferous gossan in the Stanley Reward area.

5 cm

051

Log Probability Cumulative Frequency Percentage of Copper

FIGURE 10:

716052

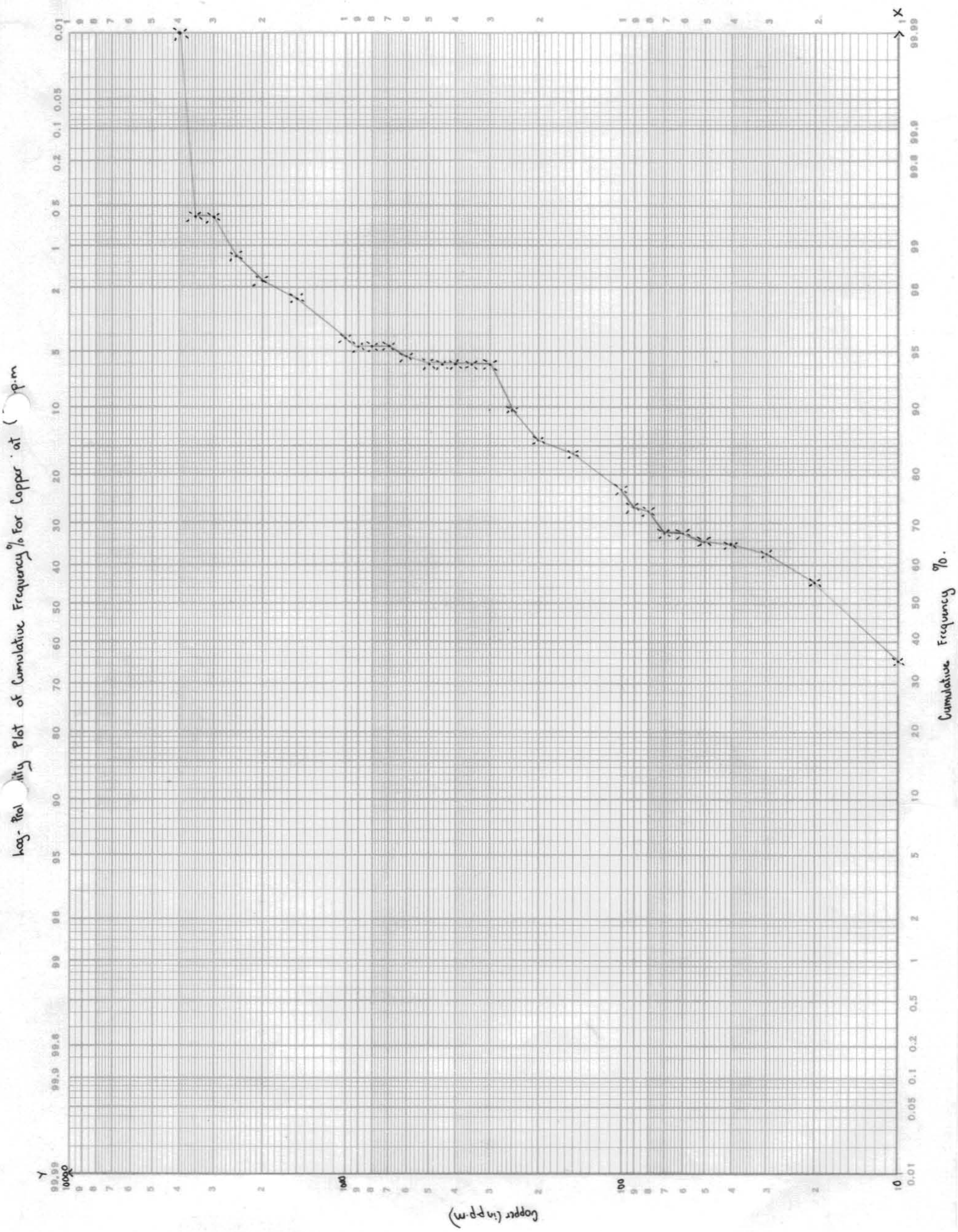


FIGURE 10:

5 cm

GORMACK GRAPH PAPERS : CHRISTCHURCH N.Z. No. 1223 Probability × 3 cycle log

716053

FIGURE 11:

052

Log Probability Cumulative Frequency % for Lead

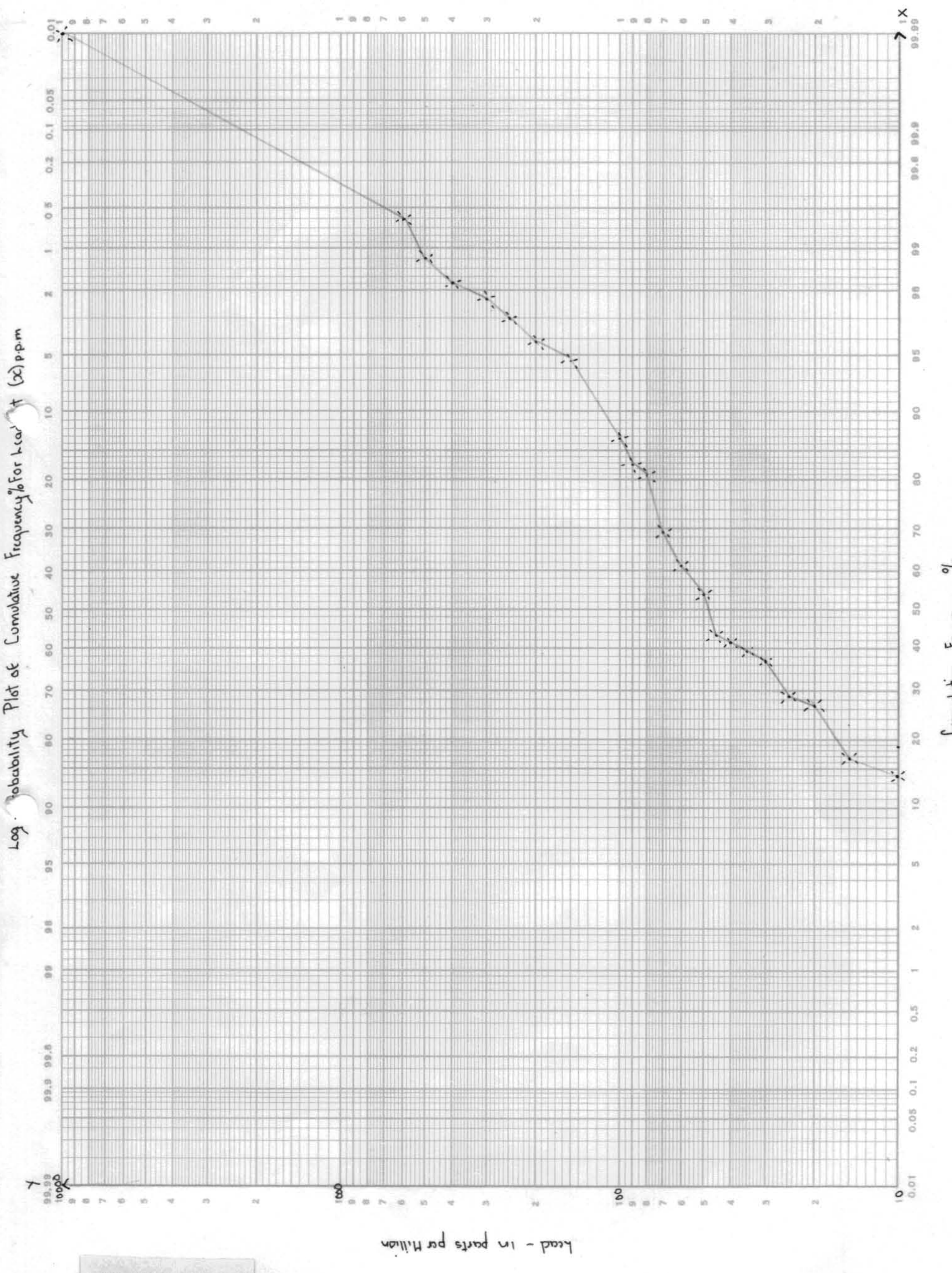


FIGURE 11:

5 cm

053

FIGURE 12: 716054

Log Probability Cumulati ve Frequency % of Zinc

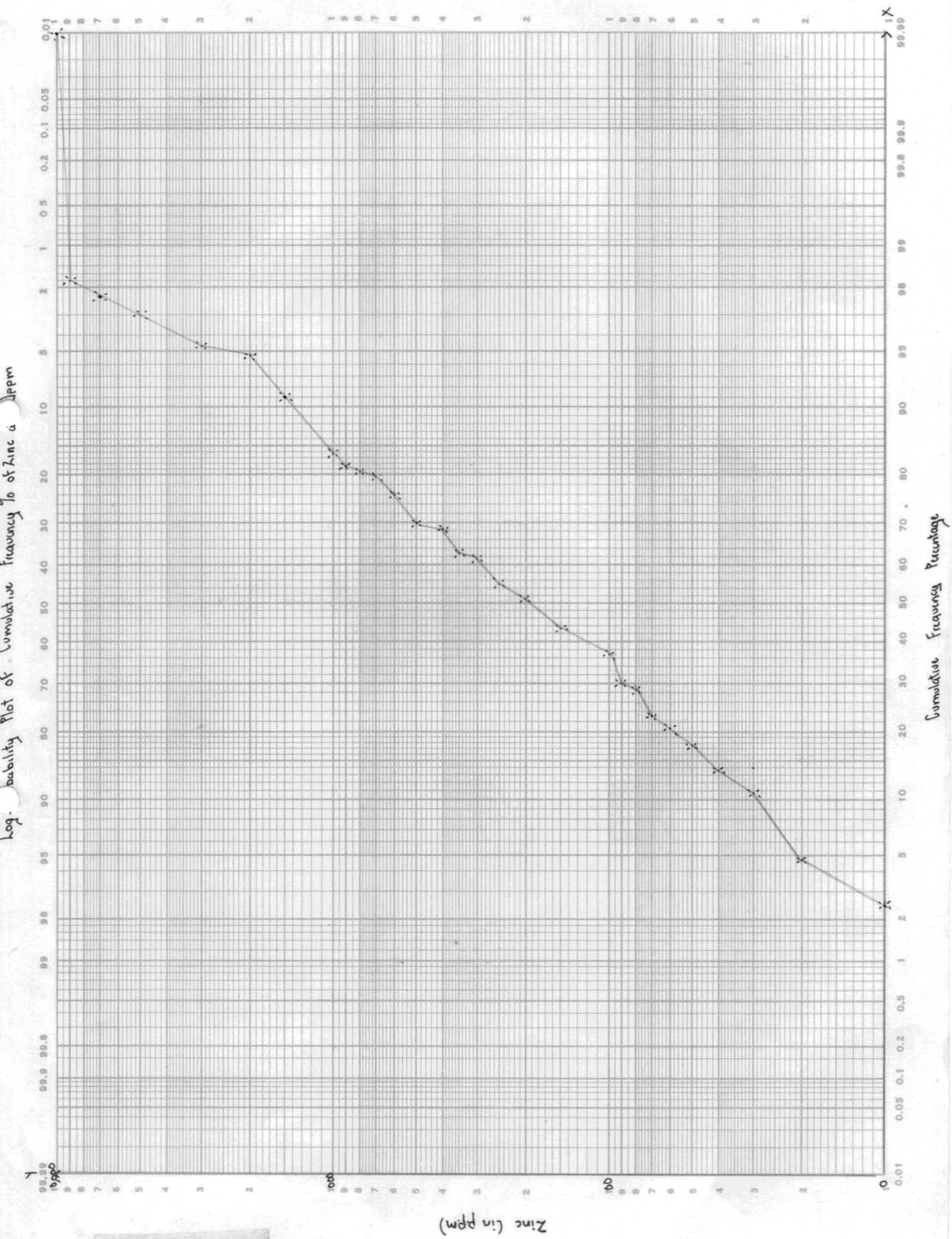


FIGURE 12:

716055

054

Log Probability Cumulative Frequency % of Tin:

FIGURE 13:

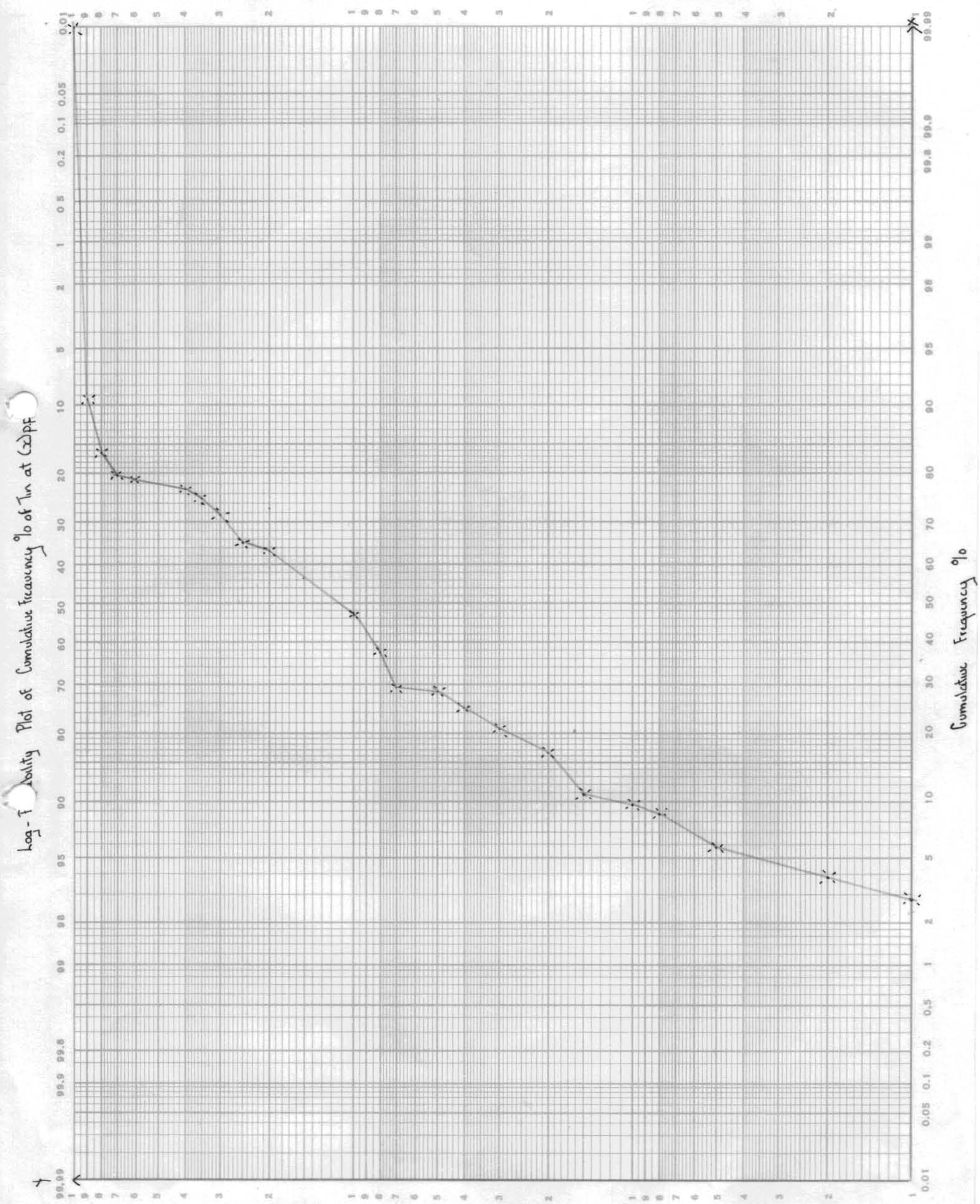
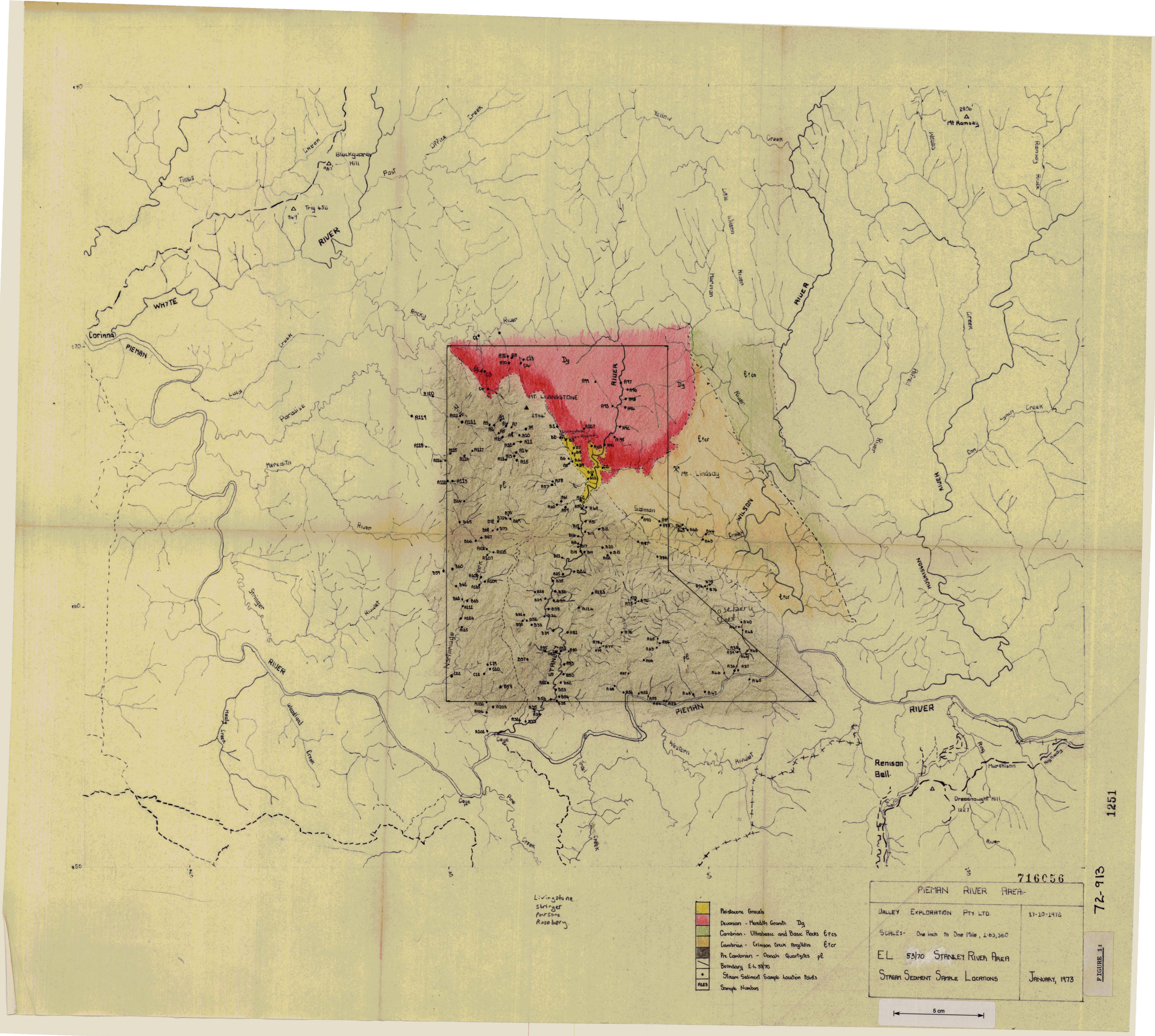
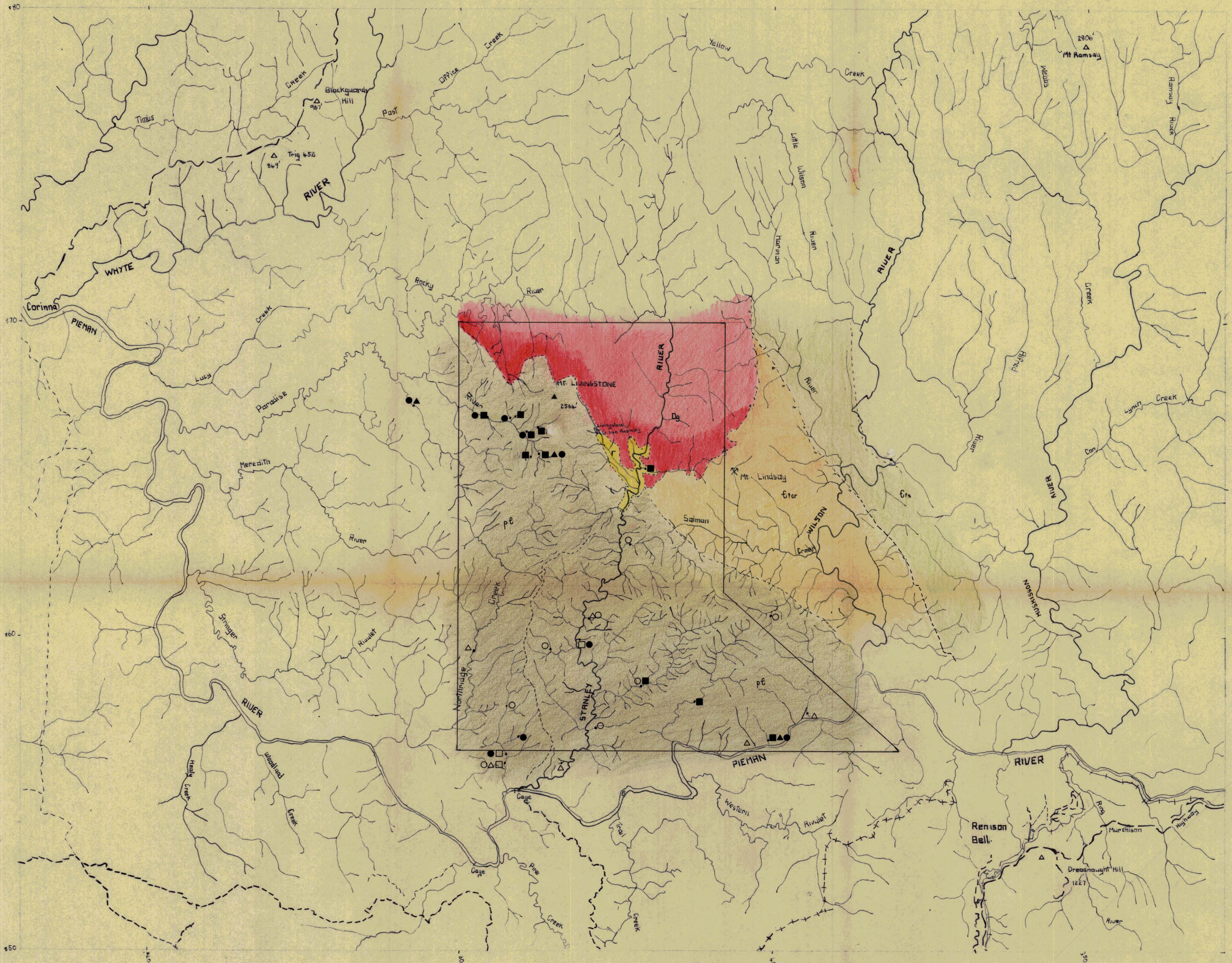


FIGURE 13:



Corinna
WHYTE
RIVER
PIEMAN
Blackquarry Hill
Trig 654
Tinkus
Pipe
Creek
Rocky
River
Yellow
Creek
Mt Ramsay
2906
Ramsay
River
Lake Wilson River
Huntsman
Luck
Paradise
Meredith
Mt. Livingstone
Dg
E?cs
E?cr
Mt. Lindsay
Salmon
WILSON
Creek
pE
STANLEY
Rosebery Creek
Renison Bell
Dreadnought Hill
Murchison
Highway
Western
Rivulet
Smithton
HASKINSON
RIVER
Livingstone
Stringer
Parsons
Rosebery
Pleistocene Gravels
Devonian - Meredith Granite Dg
Cambrian - Ultrabasic and Basic Rocks E?cs
Cambrian - Crimson Creek Argillites E?cr
Pre Cambrian - Oonah Quartzites pE
Boundary E.L. 53/70
Stream Sediment Sample Location Points
A123
Sample Numbers
716056
PIEMAN RIVER AREA:-
VALLEY EXPLORATION PTY. LTD.
17-10-1972
SCALE:- One inch to One Mile, 1:63,360
EL 53/70 STANLEY RIVER AREA
STREAM SEDIMENT SAMPLE LOCATIONS
JANUARY, 1973
FIGURE 1:
72-913
1251
5 cm



- ■ Cu:- 1,000+ p.p.m (Anomalous)
- □ Cu:- 400 → 1,000 p.p.m
- ▲ Pb:- 400+ p.p.m (Anomalous)
- △ Pb:- 150 → 400 p.p.m
- ● Zn:- 3,000+ p.p.m (Anomalous)
- ○ Zn:- 1,000 → 3,000 p.p.m
- • Sample Location Points.

- Pleistocene Gravels
- Devonian - Meredith Granite Dg
- Cambrian - Ultrabasic & Basic Rocks Ꞓ?s
- Cambrian - Crimson Creek Argillites Ꞓ?Cr
- Pre-Cambrian - Oonah Quartzites pꞒ
- E.L. 53/70 Boundary

PIEMAN RIVER AREA:-

VALLEY EXPLORATION PTY. LTD.

17-10-1972

SCALE:- One Inch to One Mile, 1:63,360

E.L. 53/70

GEOCHEMICAL RESULTS:- Cu; Pb; Zn

JANUARY 1973

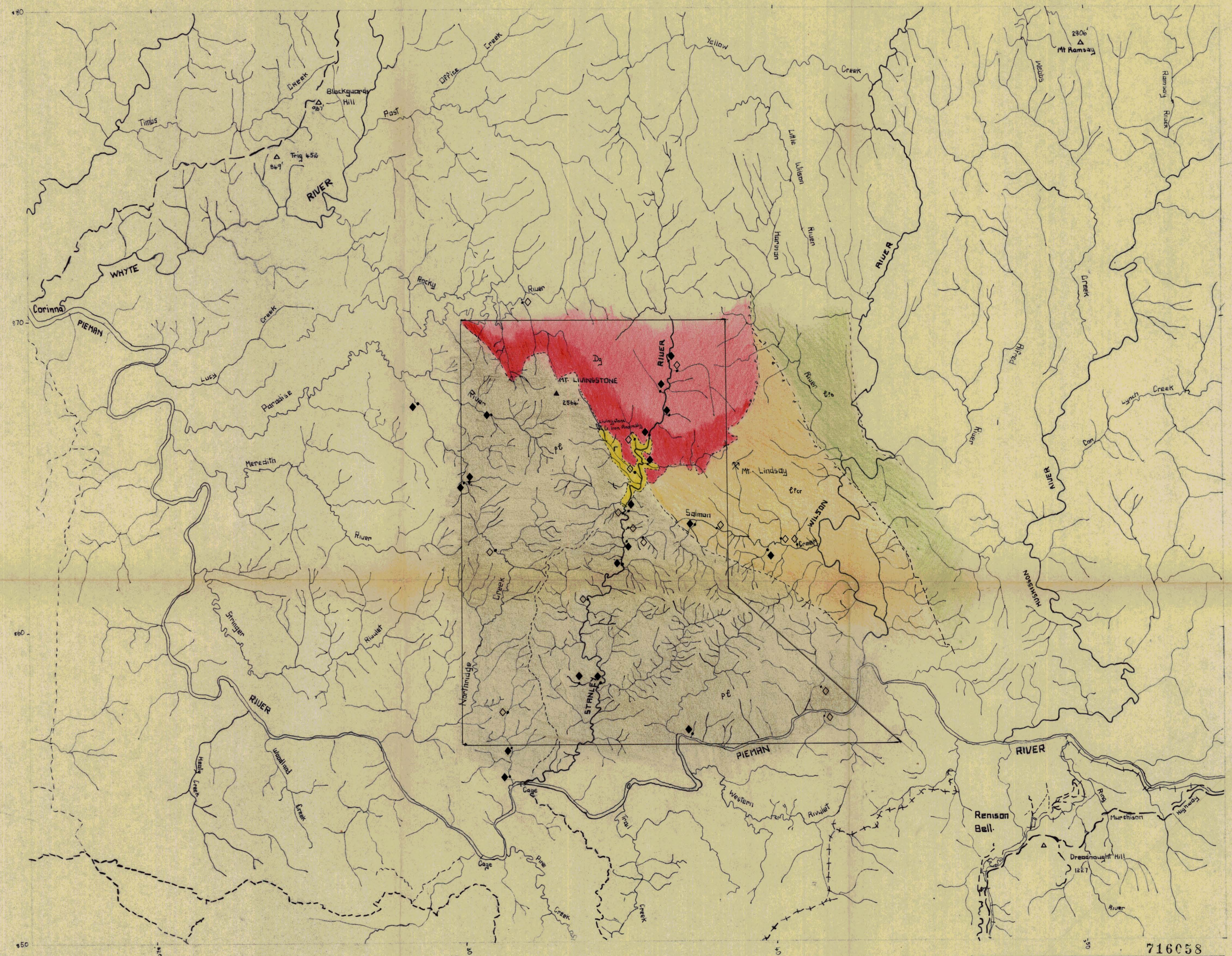
72-913

FIGURE 2:

5 cm

716057

1252



PIEMAN RIVER AREA:-

Valley Exploration Pty. Ltd. — 17-10-1972

Scale:- One Inch to One Mile, 1:63,360

E.L. 53/70

Geochemical Results :- Sn. — January 1973

◆	Sn:- 5,000 + p.p.m (Anomalous)
◇	Sn:- 2,000 → 5,000 p.p.m.
•	Sample Location Points
/	E.L. 53/70 Boundary
Yellow	Pleistocene Gravels
Red	Devonian - Meredith Granite Dg
Green	Cambrian - Ultrabasic + Basic Rocks Є?s
Orange	Cambrian - Crimson Creek Argillites Є?cr
Grey	Pre-Cambrian - Oonah Quartzites pЄ

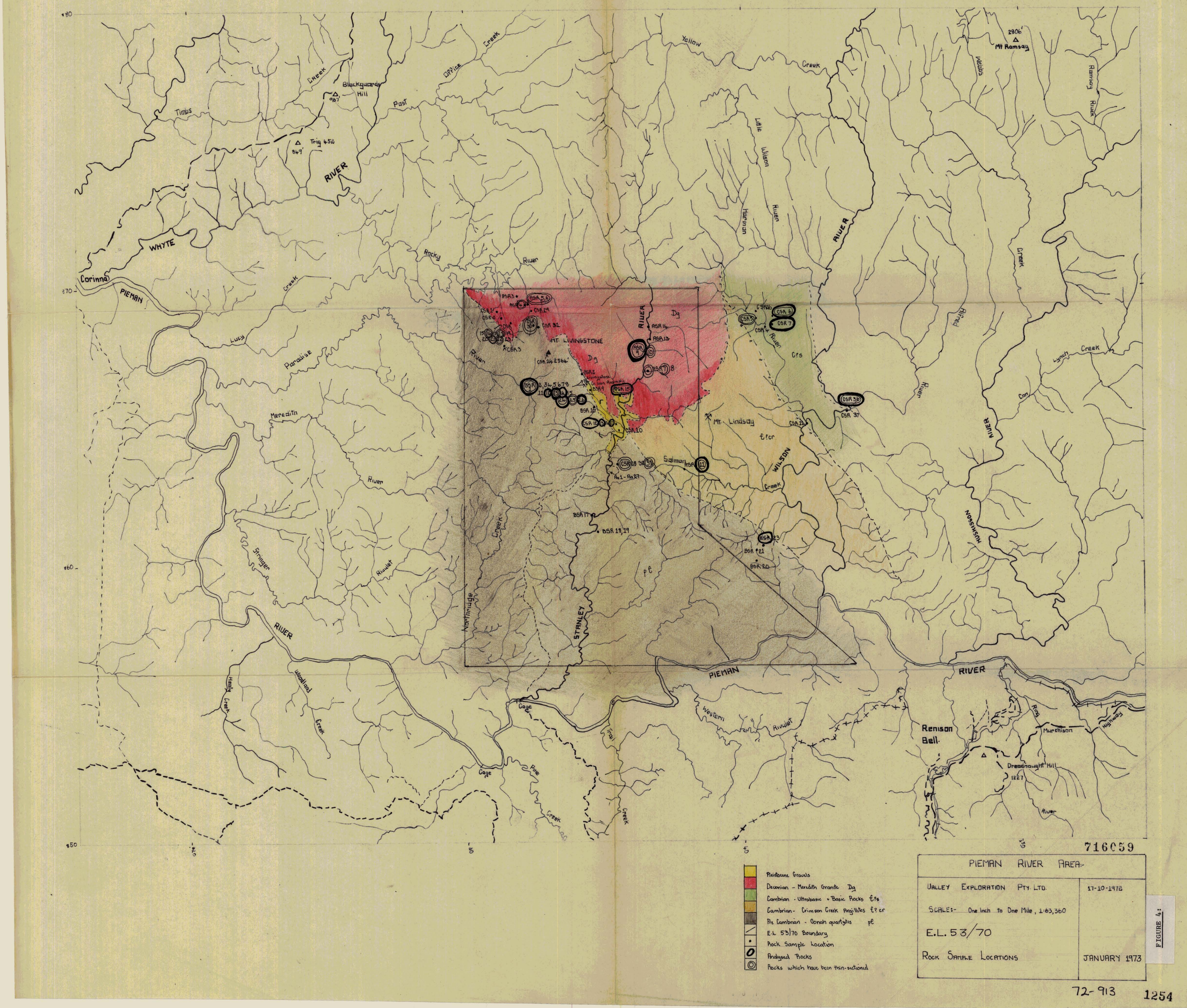
5 cm

716058

72-913

1253

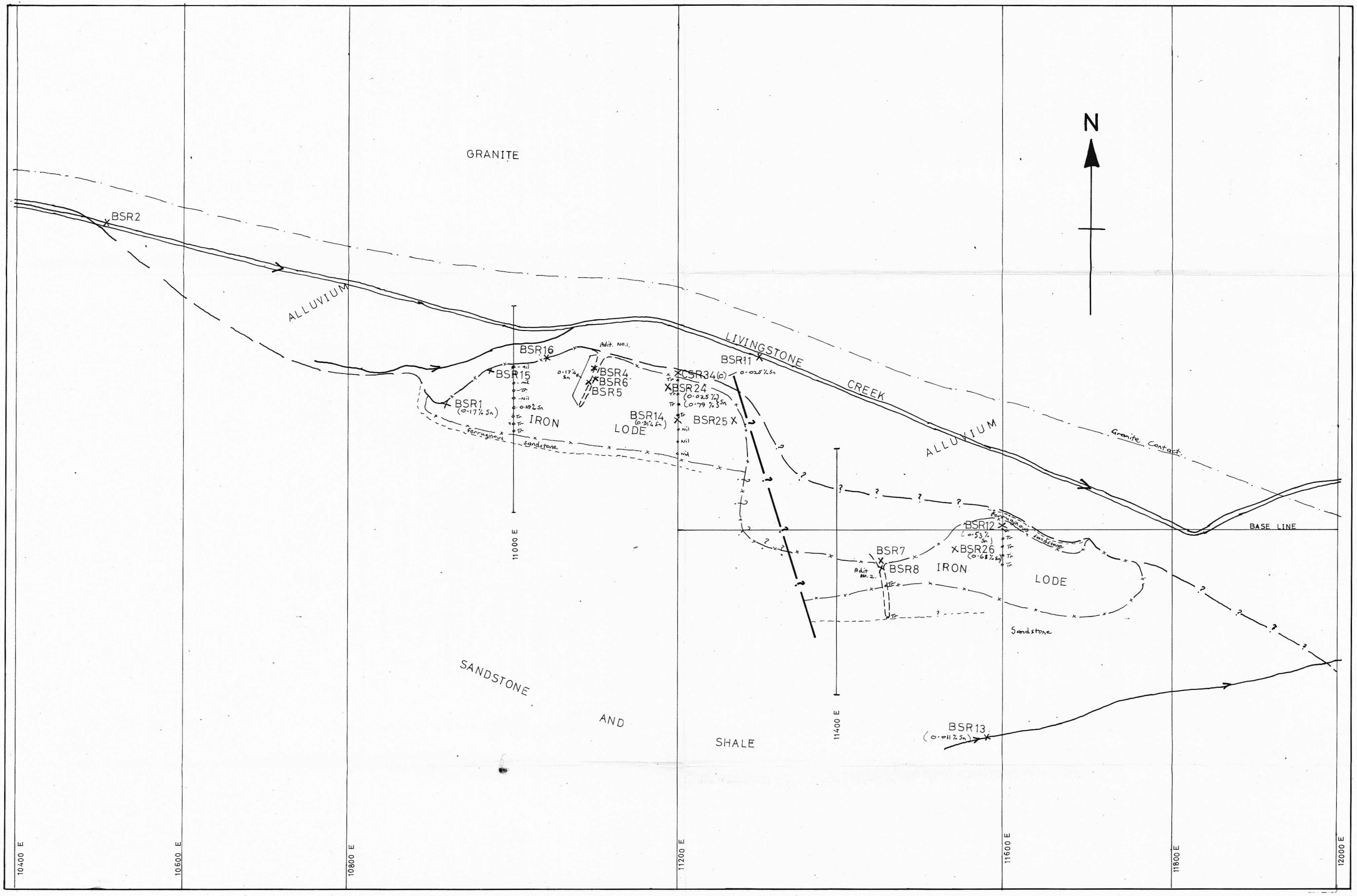
FIGURE 3:


Corinna
WHYTE
RIVER
PIEMAN
Timbs
Creek
Blackguard Hill
Trig 456
Post Office Creek
Rocky River
Yellow Creek
Mt Ramsay
Little Wilson River
Harman River
RIVER
Lucy Creek
Paradise River
Meredith River
Stringer Creek
Rivulet
RIVER
MT. LIVINGSTONE
Mt. Lindsay
WILSON
Creek
Salmon
Dg
Crs
pC
Northridge Creek
STANLEY
PIEMAN
RIVER
Western Rivulet
Cage
Renison Bell
Murchison
Dreadnought Hill
HUSKISSON
RIVER
Lynch Creek
716C59
Pleistocene Gravels
Devonian - Meredith Granite Dg
Cambrian - Ultrabasic + Basic Rocks £?s
Cambrian - Crimson Creek Argillites £? cr
Pre Cambrian - Oonah quartzites p£
E.L. 53/70 Boundary
Rock Sample Location
Analysed Rocks
Rocks which have been thin-sectioned
PIEMAN RIVER AREA:-
VALLEY EXPLORATION PTY. LTD.
17-10-1972
SCALE:- One Inch to One Mile, 1:63,360
E.L. 53/70
ROCK SAMPLE LOCATIONS
JANUARY 1973
FIGURE 4:
72-913
1254

GEOLOGY

OF THE

LIVINGSTONE CREEK IRON ANOMALY



SCALE : 1" : 80'

80 60 40 20 0 80 160
FEET

5 cm

- IRON LODE OUTLINE.
- GEOLOGICAL CONTACT (ALLUVIUM - SANDSTONE). POSITION APPROXIMATE.
- GRANITE CONTACT.
- FERRUGINOUS SANDSTONE BOUNDARY. (INFERRED)
- FAULT (ATTITUDE UNKNOWN)

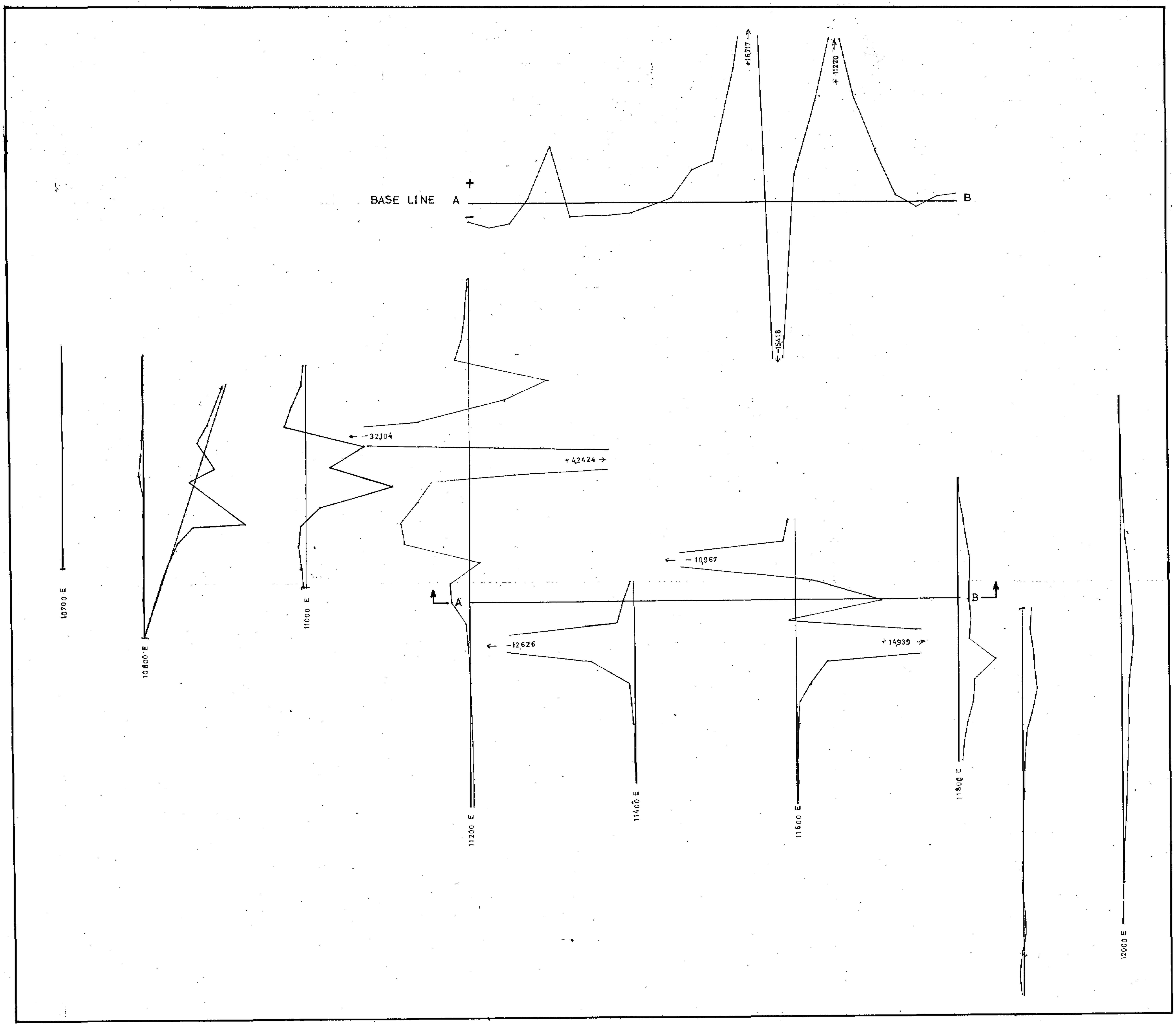
RESEARCH AND EXPLORATION MANAGEMENT PTY. LTD.	
716060	
Valley Project	1255
DRAWN : A.H. BARTON.	DATE : 16 - 9 - 72

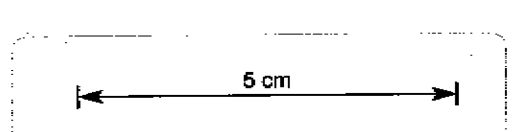
Figure 14

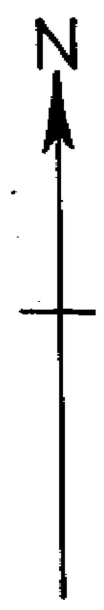
MAGNETIC SURVEY

OF THE

LIVINGSTONE CREEK IRON ANOMALY



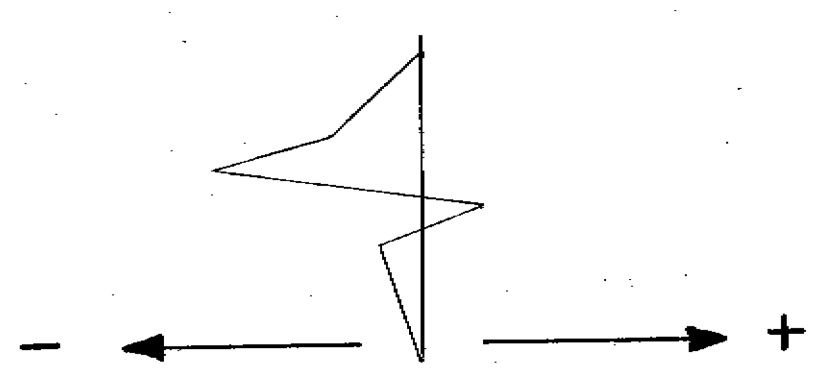




VERTICAL SCALE : 1" : 4000 Gammas

HORIZONTAL SCALE : 1" : 80'

Magnetometer readings were taken at 25' intervals.



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1256

DRAWN : A.H. BARTON . | DATE : 25 - 9 - 72

Figure 15