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KITTICOOLA MINE

EXPLORATION REPORTS FOR THE PERIOD SEPTEMBER 1970 TO APRIL 1972

Submitted by

Kitticoola Gold Mines NL
1972

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PRIMARY INDUSTRIES AND RESOURCES SA

CONTENTS ENVELOPE 1824

TENEMENT: Not Related

TENEMENT HOLDER: Sturts Meadows Prospecting Syndicate N.L.

McPHAR GEOPHYSICS PTY. LTD.

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MEMORANDUM TO: STURTS MEADOWS PROSPECTING SYNDICATE N.L.

MEMORANDUM FROM: R.W. FIDLER, McPHAR GEOPHYSICS PTY. LTD.

SUBJECT: A BRIEF SUMMARY OF EXPLORATION WORK DONE AT KITTICOOLA MINE NEAR PALMER, SOUTH AUSTRALIA

DATE: 19TH JANUARY, 1971

INTRODUCTION

The Kitticoola Mine is situated about 42 miles from Adelaide near the township of Palmer and has a mining history dating back to 1845. The mine was worked for gold and copper by a number of groups over its 125 year history and at the beginning of 1970 the mine was being jointly worked by Sturts Meadows Prospecting Syndicate N.L. and John McIlwraith Pty. Ltd. The following report is a brief summary of work carried out on their behalf by McPhar Geophysics Pty. Ltd. but also containing relevant results from an earlier Department of Mines survey.

INDUCED POLARIZATION SURVEY

A detailed induced polarization survey was carried out over the mine and surrounding areas in 1970. The objectives of the survey were threefold. The first and most important aim was to find extensions of the known mineralisation, either laterally or vertically. The second was to determine whether or not the Horne Lode contained appreciable quantities of sulphide material and the third was to detect any sulphides that may have been associated with the eastern contact of the granite with the Kanmantoo schists.

The effects measured were generally weak and the stronger anomalies tended to coincide with workings. Interpretation of these anomalies was thus made more difficult due to the presence of numerous metallic objects (pipes, rails etc.) associated with current (and past) mining activity.

Two definite anomalies were obtained, one at 2S 5W and the other at 9S 4W. The first of these was coincident with the current mining operation, thus no attempt was made to drill it. The second anomaly was drilled (hole 3A) without intersecting economically significant mineralisation although sufficien sulphides were found to consider the anomaly "explained".

Two of the possible anomalies appear to correspond to the mineralisation found in the series of holes drilled by the Department of Mines, e.g. holes 2 and 4. However, the exact location of these holes is not recorded and so no definite conclusion can be drawn.

Although only a few "probable" anomalies have been tested, the lack of encouragement obtained from the drilling and the absence of further strong anomalies suggests that a sulphide body of size is not likely to be found within the test area.

DRILLING

(a) Surface Drilling

A series of six diamond drill holes had been drilled on the property by the Department of Mines between 1935 and 1938. A detailed account of this work may be found in Mining Reviews 63 to 68. In all some 2000' of drilling was done. The results are summarized below:

Hole 1 was drilled to a depth of 200' at a depression of 70° into what was expected to be the southern extension of the Back Lode. The drill remained in granitic gneiss and failed to intersect any copper mineralisation although 2½ dwts. per ton of gold were obtained over a 1'9" section at 140'9".

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Hole 2 was drilled at an angle of 25° in a direction 110°M to a depth of 702' from the east bank of Reedy Creek. The hole remained in granite crossed by numerous quartz veins throughout. In the interval from 286' to 376', assays ranged from 0.1% to 1.8% Cu with 1 or 2 dwts. of gold. It is difficult to assess the average grade as drilling losses were fairly great, but it must have been of the order of 0.2% overall. A few additional very minor sections of copper mineralisation were observed in the lower part of the hole.

Hole 3 was drilled some 850' north of the Masterman Shaft and failed to intersect copper mineralisation. Gold values were also low and the hole was halted at 593' in gneissic granite.

Hole 4 was collared about 200' WSW of the Anstey Shaft and directed at 70° toward the Anstey Lode. A four foot section (from 158'6" to 162'6") averaged 1.9% Cu and 2.8 dwts. per ton of gold but was otherwise very feebly mineralised.

Hole 5 was sited about 100 WSW of hole 4 and apparently drilled parallel to it. Three small sections containing copper mineralisation were found at 121', 125' and 155'9". These were 2' of 0.77% Cu, and 4 dwts. per ton gold, 6" of 0.23% copper and 1.6" of 0.23% copper respectively.

Hole 6 was drilled on the same line as the previous two holes and also presumably parallel to them. No mineralisation was found and drilling ceased at 136'.

A series of four holes was drilled in 1970 by Westgate Drilling Co. to obtain additional data. Three holes were laid out to test induced polarization anomalies and one to test for further carbonate mineralisation. Logs of each of these holes have been prepared by Mr. I.R. Pontifex and Mr. D.M. McColl. In all some 1500' of drilling was carried out.

Hole 1A was collared at 2S 3E and was intended to intersect any down dip extension of the Black Lode. The hole was depressed 50° and drilled in the direction of 125°. Some 153.92 505' of gneiss, lightly mineralised in part, were penetrated. A 6" section from 352' assayed 0.27% copper and 15" section from 381'9" to 382'3 assayed 0.29% copper. Sulphides were found in other parts of the hole but assays did not exceed 0.04% copper.

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Hole 2A was designed to intersect a possible extension of malachite-azurite mineralisation observed in a test shaft (the "Carbonate Shaft"). It was collared 120' east of the "Carbonate Shaft" and drilled at a depression of 45° in direction 270°M to a depth of 180'. A 2' section from 66' to 68' gave 0.11% copper and 1½ dwts. per ton of gold whilst a small section (believed to be about 3") taken from 131' gave 0.43% copper just over 5 dwts. per ton gold. No other mineralisation was recorded.

Hole 3A was directed at the strong I.P. anomaly at 5W on 2S which is also coincident with the projected position of the Anstey Lode. The hole was drilled from 9S 6W, with an azimuth of 120° and a dip of 55° to a depth of 400'. Sulphides were scattered between 15'6" and 45' and also between 282' and 305'6" through a gneissic granite. Three or four minor zones of sulphide veining were also found below 332'. Assays of 0.85% and 1.20% copper were obtained from the intervals 15'6" to 19' and 82' to 82'5" respectively. The most heavily mineralised other section (303' and 332') returned less than 0.04% copper and less than 0.2 dwts. per ton gold.

Hole 4A, the final hole in the series, was drilled at a 57° depression in a direction 110°M into a "possible" induced polarization anomaly, centred 200' below 14N 2E. The best results were obtained between 96' and 96'6" where 0.33% copper and slightly more than 0.6 dwts. per ton gold were recorded although very weak disseminated sulphide mineralisation and limonite, presumed to result from the oxidation of sulphides, were found scattered through most parts of the hole. Drilling was halted at 339'.

(b) Underground Drilling

A series of 5 diamond drill holes was drilled from the 360' level on the Masterman Lode. All holes commenced in lode material and passed into granite of the hanging wall.

Core recovery was not good in most of the holes. The principal reason for the poor recovery was the shattered nature of the quartz, chalcopyrite-pyrite ore which also resulted in

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particularly high bit wear due to the plucking of diamonds from their settings. The high cost and poor recovery caused this form of exploration to be discontinued.

The detailed logs and a map showing the position of each of the drill holes (360' level plan) are attached and a summary set out below.

Hole KH1 penetrated 21' of lode bearing an average of 0.48% copper and was continued a further 13' into the granite where the copper concentration dropped to $<0.01\%$ copper.

Hole KH2 contained promising amounts of copper (0.70%) in the first 6'6" but increasing amounts of granite reduced the level to about 0.20% copper thereafter to about 30' where the 0.06% copper was obtained. Gold results were uniformly poor throughout (<0.3 dwt. per ton).

Holes KH1 and KH2 were drilled from the same set up position, the latter being depressed 38^{o} below the horizontal.

Hole KH3 was depressed $4\frac{1}{2}^{o}$ and was 47' in length of which only the first 7'6" was within the lode. The interval 0 - 5' averaged 0.70% copper and about 0.5 dwt. per ton gold - but the granite beyond the lode proved to have only 0.01% to 0.12% copper and less than 0.3 dwt. per ton of gold.

No core was obtained from hole KH4 which was only 10' long but it is believed to have passed almost immediately into granite of a particularly barren nature.

The quartz in the footwall at (up to 5') the collar of hole KH5 was unusually poor in copper but chalcopyrite bearing quartz veins in the granite at 10'6" and 13' gave 2.20% copper average over the section from 10' to 15'. This figure should be regarded as a guide rather than a precise figure as recovery was poor. Surprisingly, no corresponding gold enrichment was found.

Holes KH3 and KH5 were also checked for cobalt but all values were less than 0.04% cobalt with no apparent correlation between its concentration and either that of copper or gold.

OLD WORKINGS

Examination of a number of workings was made during the exploration of the Kitticoola area. These include the numerous exploratory pits and two adits on the Horne Lode, an adit on the Anstey Lode, an unnamed adit on the east bank of Reedy Creek (near the flying fox) and several pits south of the main workings. Of these only two were considered suitable for further work.

The first of these was the adit on the eastern extension of the Anstey Lode (which was used as a Samples taken by Mr. H. Edwards on 10' centres indicate an average of 1.5% copper along the 280' adit (most of which is present at carbonates). It is unlikely that this figure is representative of the rock as a whole as there has been considerable migration of fluids into the adit causing malachite deposition in fissures etc. Sample locations and assay figures are shown on a sketch plan attached.

The second of these was the unnamed adit near the flying fox landing. It was rumoured that this adit had been successfully worked for gold during the 1930s.

A series of channel samples taken along the base of the lode gave results varying between 0.3 dwts. per ton to 3.5 dwts. per ton (over 20' sections). An average of nearly 2 dwts. per ton was obtained over a 60' section.

GEOCHEMISTRY

(a) Ore Material

Spectrographic examination of the ore was made to check for the presence of potentially economic elements that were not being extracted. In all, analysis for some 35 metals was carried out. The presence of tungsten, molybdenum, tantalum, niobium, thorium, platinum, palladium, osmium, iridium, rhodium, ruthenium, cadmium, arsenic and antimony was undetected and vanadium, beryllium, lead, zinc, tin, bismuth, gallium and germanium were not detected in quantities of more than 100 ppm. Silver failed to exceed 1 dwt. per ton. Manganese and chromium

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were both low compared with the amount required to be of interest although both were above average for a rock of granitic composition. These two elements were not concentrated by flotation but remained in the tailings. Cobalt and nickel were present in noticeable but subeconomic quantities, probably in solution in pyrite as both were strongly concentrated in the sulphide material. 0.15% cobalt and 0.10% nickel was obtained from concentrates. This corresponds to approximately 0.01% to 0.10% of each element in the rock.

(b) Soil

A fairly restricted soil geochemical survey was carried over the mine area by Mr. R. Thompson as part of his thesis. All samples taken were analysed for copper by atomic absorption spectrophotometry. Analysis for additional elements including manganese, cobalt, nickel and zinc was also done on selected samples. Whilst cobalt proved to be sympathetic with copper, (as might have been anticipated from the spectrographic data), its higher mobility caused broad anomalies which made it less useful than copper in defining mineralised zones. Manganese appeared to follow quartz veination rather than sulphide mineralisation and is probably an unreliable indicator of mineralisation.

The results of the copper survey follow closely the pattern of shafts and known lodes and no unexplained anomalies were obtained.

SIGNED
McPHAR GEOPHYSICS PTY. LTD.

R W Fidler

R.W. FIDLER
GEOLOGIST

McPHAR GEOPHYSICS PTY. LTD.

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KITTICOOLA UNDERGROUND DRILLING PROGRAMME, 1970

INTRODUCTION

In the early part of 1970, a series of five underground diamond drill holes was drilled at the Kitticoola Mine. All holes recorded were drilled from the 360' level and directed into the footwall. Total footage was 149'.

GENERAL

A Mindrill compressed air driven subsurface drill was used throughout. All holes were drilled with AQ bits although a wide variety of bit types were used in an effort to obtain reasonable bit life in the broken quartz lode.

All core was boxed and cleaned before logging. After logging was complete, the entire core of each hole was split and assayed (in 5' sections) for copper and gold.

The siting of the holes was based solely on geology but in several cases holes had to be modified in both position and direction because of space limitations in the drive. It is not felt however that this reorientation of holes is likely to have seriously affected the overall result.

In all, recoveries and bit life were poor and ultimate this form of exploration was superseded by airblast drilling which was considerably faster and cheaper although less informative with respect to small changes in rock type.

Signed R.W. FIDLER
GEOLOGIST

27.1.71

HOLE KH1

LEVEL: 360'

DEPRESSION: 0^{o}

AZIMUTH: 306^{o}M

TYPE: Diamond AQ

LENGTH: 34'

From	To	Interval	Description	Cu Assay	Au Assay	Minerals
0'	5'	5'	Mainly quartz but some green and pink felspars. Specular haematite. Chalcopyrite and pyrite present 5%+	0.58%		Chalcopyri Pyrite
5'	10'	5'	"	0.53%		"
10'	15'	5'	"	0.21%		"
15'	20'	5'	"	0.61%		"
20'	25'	5'	Increasing felspars at 21' up to 24' but other -wise as previous.	0.10%		Reduced sulphide 2
25'	30'	5'	"	0.06%		"
30'	34'	4'	As previous but felspars more prevalent in patches.	<0.01%		<1% sulphi

END OF HOLE

RECOVERY FAIR

HOLE KH2

LEVEL:	360'	TYPE:	Diamond AQ
DEPRESSION:	38^{o}	LENGTH:	34'
AZIMUTH:	304^{o}M		

From	To	Interval	Description	Cu Assay	Au Assay	Minerals
0'	5'	5'	Grey quartz bearing up to 1% of up to 3mm diam. chalcopyrite (average size <1mm). Minor pyrite.	0.70%	<0.5 dwt	Pyrite Chalcopyrit
5'	10'	5'	As before. 3" pink-green granite at 6'6" and 9'. Pyrite and specular haematite both present. Largish blobs of chalcopyrite.	0.18%	<0.5 dwt	Pyrite Specular haematite Chalcopyrit
10'	15'	5'	Stringers of kaolin through the milky quartz <1% chalcopyrite. <1% pyrite. Pistomacite present.	0.24%	<0.5 dwt	Chalcopyrit Pyrite Specular haematite
15'	20'	5'	"	0.22%	<0.5 dwt	"
20'	25'	5'	"	0.08%	<0.5 dwt	"
25'	30'	5'	Principally weathered pink and green granite cut by quartz and calcite veins. Sulphides present still. Fine disseminated pyrite, chalcopyrite(?).	0.18%	<0.5 dwt	Pyrite Chalcopyrit
30'	34'	4'	As above. 2% pyrite.	0.06%	<0.5 dwt	Pyrite Chalcopyri

END OF HOLE

RECOVERY FAIR

HOLE KH3

LEVEL: 360'

DEPRESSION: $4\frac{1}{2}^{o}$

AZIMUTH: 313^{o}M

TYPE: Diamond AQ

LENGTH: 47'

14.33

From	To	Interval	Description	Cu Assay	Au Assay	Minerals
0'	5'	5'	0 - 18" red quartz with specular haematite, some sulphides. Pistomacite(?) with specular haematite in milky quartz and calcite. <1% pyrite, 1% chalcopyrite.	0.70%	0.5 dwt	Pyrite Chalcopyrit
5'	10'	5'	At 7'6" passes into green and pink granite. Bears euhedral pyrite grains (1%) and blobs of chalcopyrite.	0.04%	<0.5 dwt	Pyrite Chalcopyrit
10'	15'	5'	Sulphide bearing pink and green granite cut by calcite and minor quartz veins. 2% disseminated 1mm diameter euhedral pyrite.	<0.01%	<0.5 dwt	Pyrite
15'	20'	5'	Pink and green granite disseminated euhedral pyrite.	<0.01%	<0.5 dwt	Pyrite
20'	25'	5'	Pink and green granite with disseminated pyrite (1%) trace of chalcopyrite, calcite veins.	0.12%	<0.5 dwt	Pyrite Chalcopyrit
25'	30'	5'	"	0.02%	<0.5 dwt	"
30'	35'	5'	"	<0.01%	<0.5 dwt	Pyrite
35'	40'	5'	As above. Trace of chalcopyrite at 36'6". Small veins of specular haematite.	0.06%	<0.5 dwt	Chalcopyrit
40'	45'	5'	"	0.08%	<0.5 dwt	Pyrite Chalcopyrit
45'	47'	2'	Weathered granite with trace of pyrite.			Pyrite

END OF HOLE

RECOVERY FAIR

HOLE KH4

LEVEL:	360'		
DEPRESSION:	-4°	TYPE:	Diamond AQ
AZIMUTH:	240°M	LENGTH:	10'

NO CORE

(Apparently barren granite throughout)

HOLE KH5

LEVEL: 360'

DEPRESSION: 35^{o}

AZIMUTH: 267^{o}M

TYPE: Diamond AQ

LENGTH: 24'

From	To	Interval	Description	Cu Assay	Au Assay	Minerals
0'	5'	5'	Fractured grey quartz up to the 5' mark. Some pyrite.	0.02%	<0.5 dwt	Pyrite
5'	10'	5'	Mainly weathered green and pink granite (aplite). Trace of pyrite.	0.11%	<0.5 dwt	Pyrite
10'	15'	5'	Still granite but with chalcopyrite (+5%) rich quartz veins at 10'6" (4") and 13' (12"). Recovery poor.	2.20%	<0.5 dwt	Chalcopyrite Pyrite
15'	20'	5'	Weathered granite. Some calcite.	0.04%	<0.5 dwt	
20'	24'	4'	Weathered granite.	0.01%	<0.5 dwt	

END OF HOLE

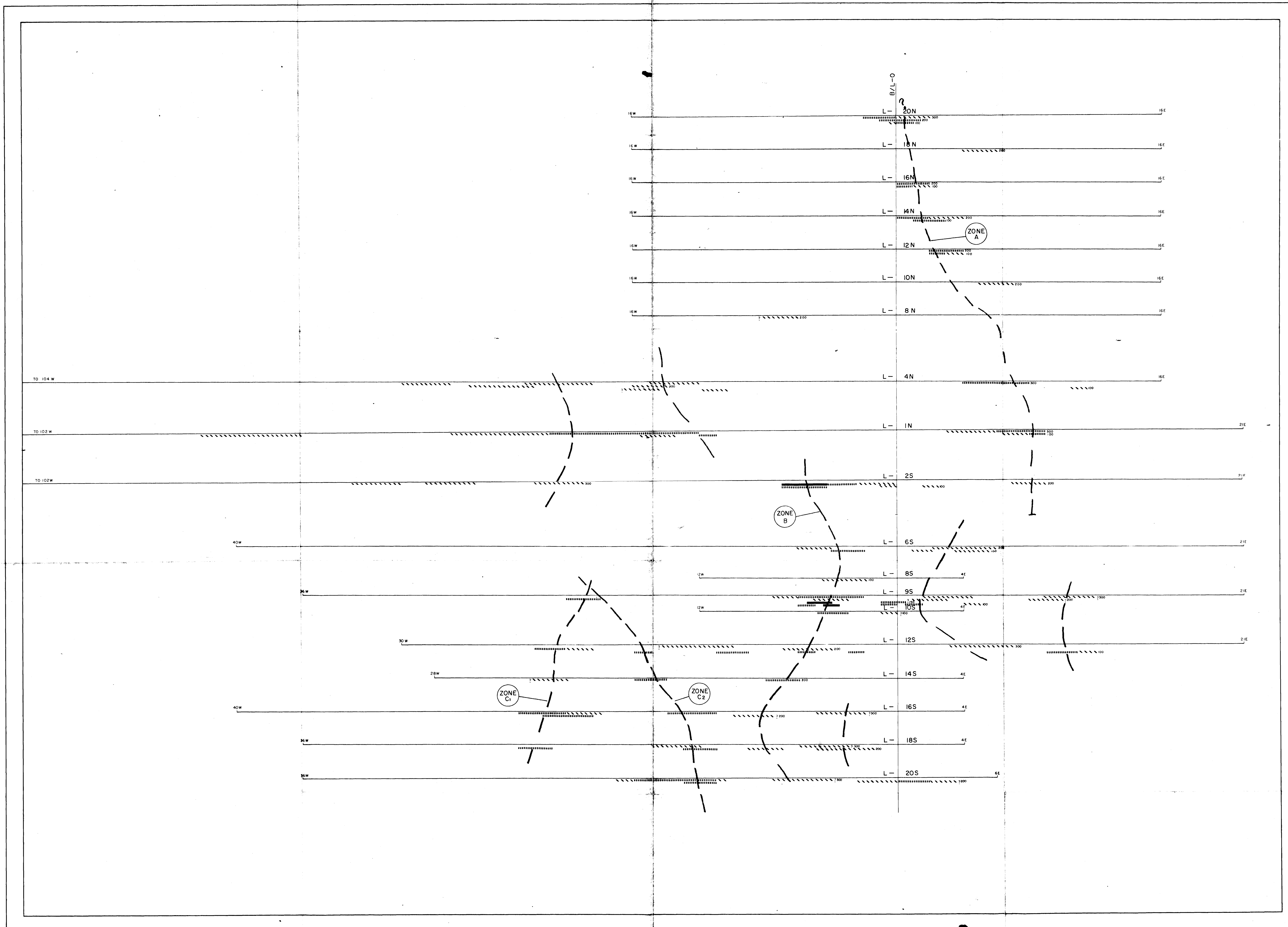
RECOVERY FAIR TO POOR


KEY TO SYMBOLS
Lode
Fault zone
Granite
Strike and dip
Fault observed, approximate or projected
Underground workings, projected
Reference Lines L6S
Base line (also shown on cross-sections)
Line and limits of cross sections A A
Grid (200) 3600N
Diamond drill holes with detail
Contours, 10' interval
SCALE
Feet 0 40 80 200 320 Feet
WOOTON SHAFT
MASTERMAN SHAFT
ANSTEY SHAFT
NEW SHAFT
ANSTEY LODE
UN NAMED LODE
MASTERMAN LODE
CUT OFF FAULT
MAIN CRUSH FAULT ZONE
SHEARED ZONE
HAGEN LODE (Approximate Position)
Concrete Tank Area
LIVING QUARTERS CANTEEN AREA ETC
Adit No.2
Anstey's Adit
WINZE
D.D.H. No.1
D.D.H. No.2
D.D.H. 3A
D.D.H. No.4
D.D.H. No.5
D.D.H. No.6
D.D.H. 1A
D.D.H. No3
NEW D.D.H No1
Granite west of boundary
Gneiss & schist to East of boundary
Boundary Approx. Only
Base Line
ENV 1824 -1
L. G. B. NIXON AND ASSOCIATES
KITTICOOLA MINE
Surface plan with projections of underground workings, etc
Kitticoola Gold Mines N L
DRAWN R.M.B.
TRACED M.R.T.
CHECKED
DATE JAN. 1972

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

PLAN MAP



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

Number at the end of anomaly indicates spread used.

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER SOUTH AUSTRALIA

SCALE

ONE INCH EQUALS TWO HUNDRED FEET

ANOMALOUS I.P. ZONE

ENV 1824-2

DRAWN: F.J.H.

APPROVED:

Sept. 25th '70

DWG. IPP-4662

ENV 1824-3

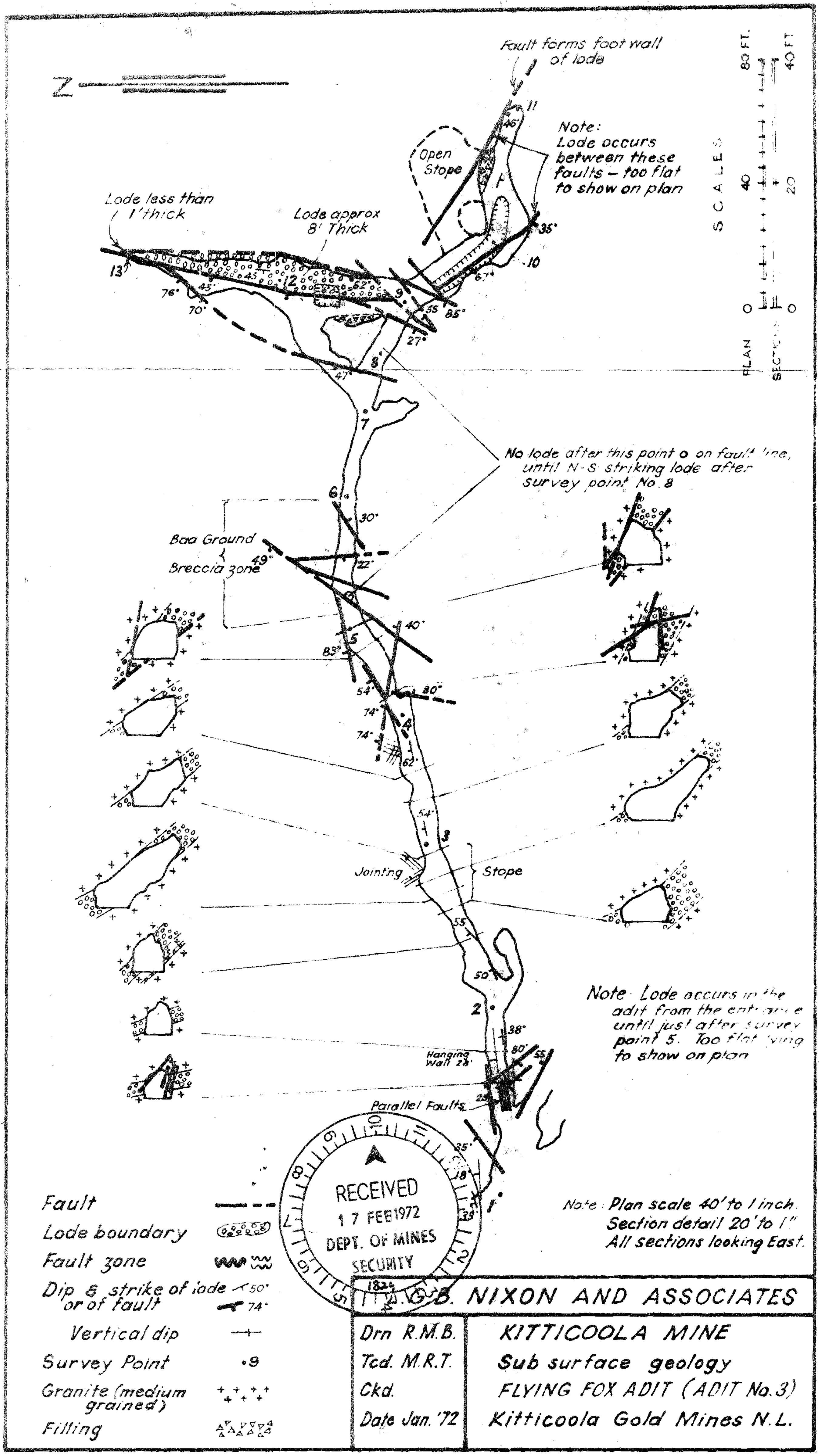
L. G. B. NIXON AND ASSOCIATES		
DRAWN	R.M.B	KITTICOOLA MINE
TRACED	M.R.T	Sections along lines 6S, 7S, 8S, 9S, 10S.
CHECKED		Kitticoola Gold Mines N.L.
DATE	JAN. 1972	

ENV. 1824 - 4

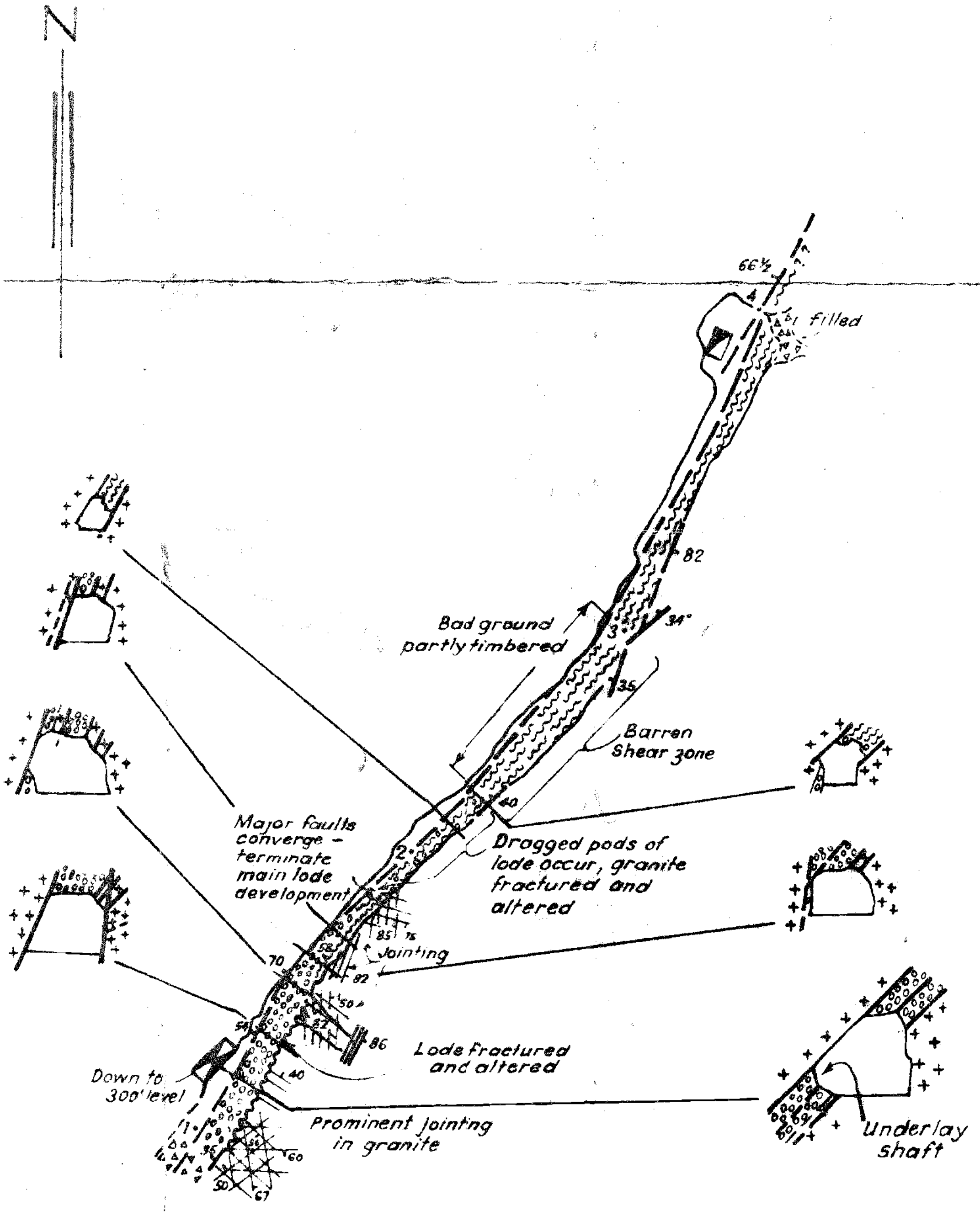
SCALE

FEET 40 0 40 80 120 160 200 FEET

L. G. B. NIXON AND ASSOCIATES		
DRAWN	R.M.B.	KITTICOOLA MINE
TRACED	M.R.T.	Sections along lines 1S, 2S, 3S, 4S & 5S,
CHECKED		Kitticoola Gold Mines N. L.
DATE	JAN. 1972	


N
Fault forms foot wall of lode
Note: Lode occurs between these faults – too flat to show on plan
Open Stope
Lode less than 1' thick
Lode approx 8' Thick
SCALES
PLAN 0 40 80 FT.
SECTION 0 20 40 FT.
No lode after this point o on fault line, until N-S striking lode after survey point No. 8
Bad Ground
Breccia zone
Jointing
Stope
Note Lode occurs in the adit from the entrance until just after survey point 5. Too flat lying to show on plan
Hanging Wall 28°
Parallel Faults
Note: Plan scale 40' to 1 inch.
Section detail 20' to 1"
All sections looking East.
Fault
Lode boundary
Fault zone
Dip & strike of lode or of fault
Vertical dip
Survey Point
Granite (medium grained)
Filling
RECEIVED
17 FEB 1972
DEPT. OF MINES
SECURITY
1824
G.B. NIXON AND ASSOCIATES
Drn R.M.B.
Tcd. M.R.T.
Ckd.
Date Jan. '72
KITTICOOLA MINE
Sub surface geology
FLYING FOX ADIT (ADIT No. 3)
Kitticoola Gold Mines N.L.

ENV 1824-5



SCALES

PLAN 0 40 80 FEET

SECTIONS 0 20 40 FEET

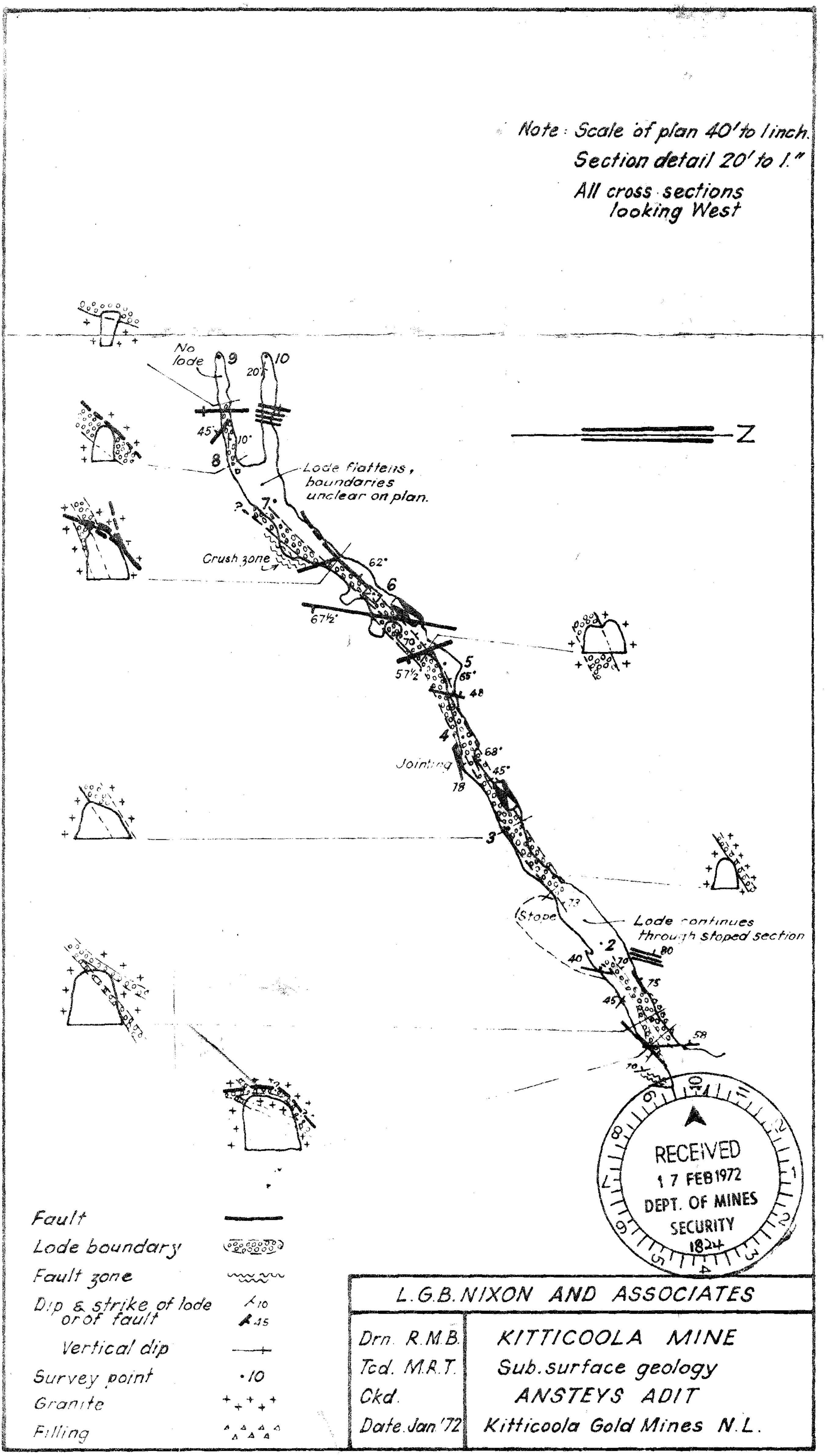
Note: Plan scale 40' to 1 inch
Section detail 20' to 1"
All sections looking North.

Faults
Lode boundary
Fault zone
Dip & strike of lode or of fault — 10, 82
Vertical dip
Survey point — ·4
Granite
Filling

L.G.B. NIXON & ASSOCIATES

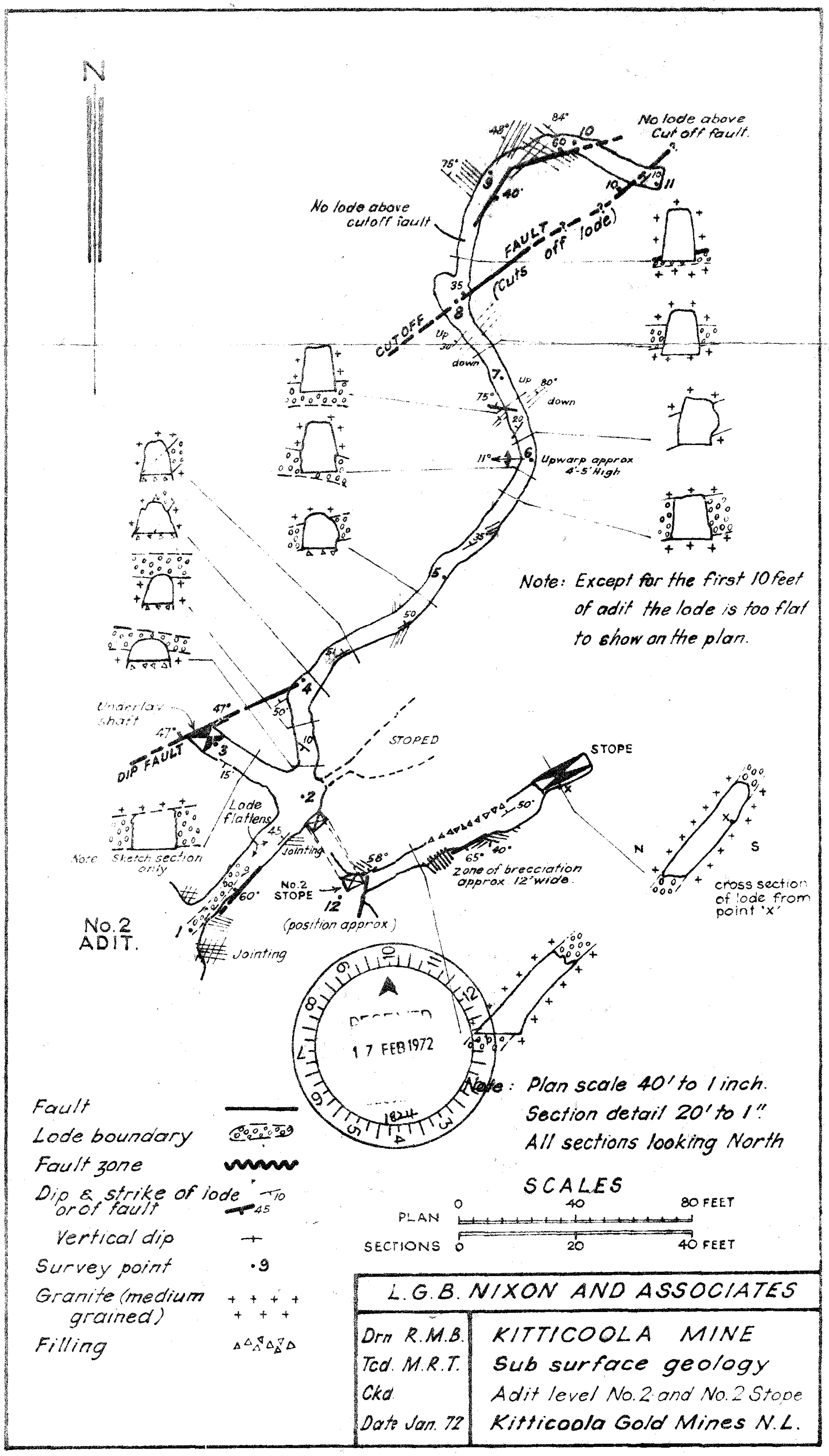
Drn. R.M.B.	KITTICOOLA MINE
Tcd. M.R.T.	Sub-surface geology
Ckd.	240' level
Date Jan. '72	KITTICOOLA GOLD MINES N.L.

ENV 1824-6

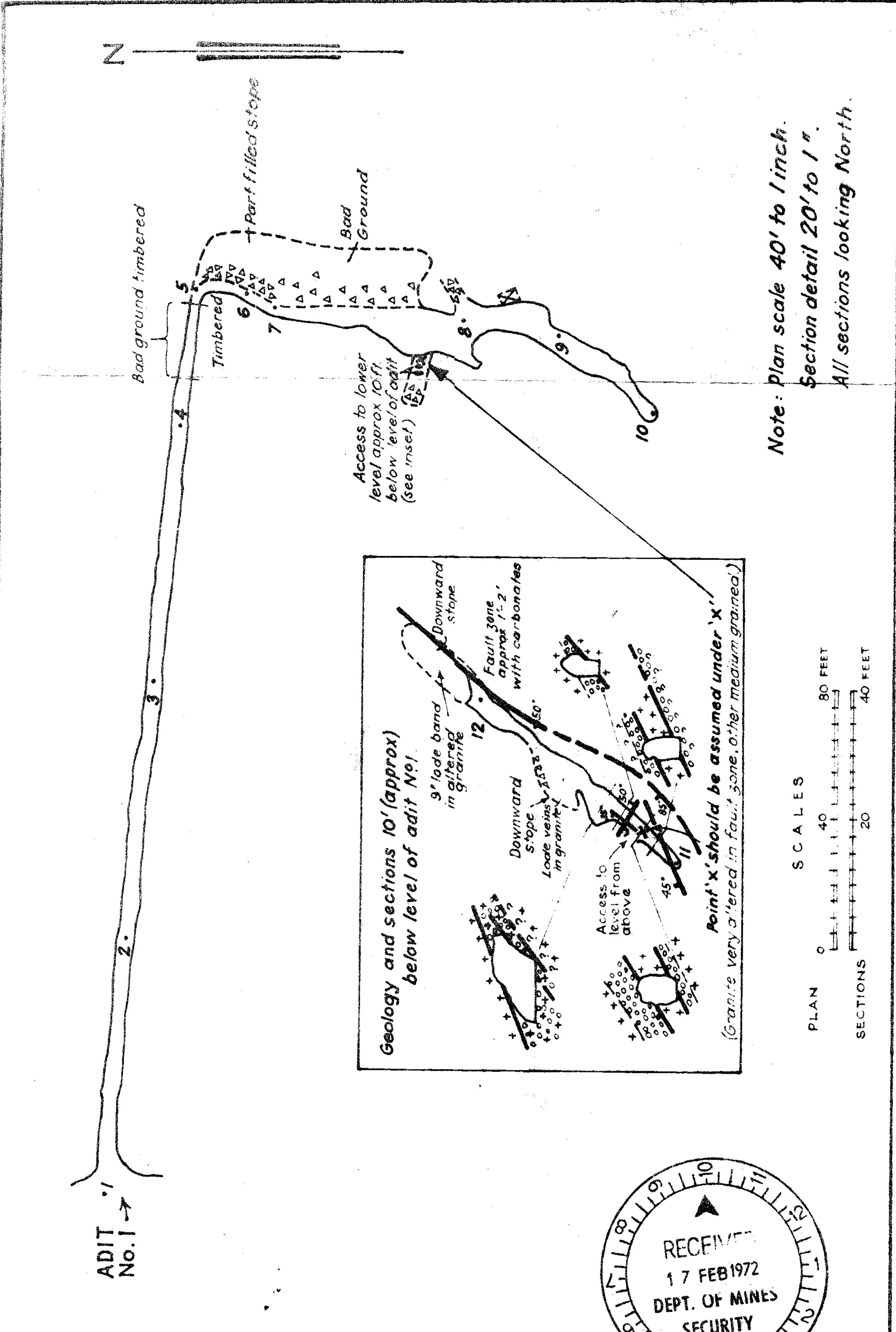


Note: Scale of plan 40' to 1 inch.
Section detail 20' to 1."
All cross sections looking West
Z
No lode
Lode flattens, boundaries unclear on plan.
Crush zone
Jointing
Stope
Lode continues through stoped section
Fault
Lode boundary
Fault zone
Dip & strike of lode or of fault
Vertical dip
Survey point
Granite
Filling
L.G.B. NIXON AND ASSOCIATES
Drn. R.M.B.
Tcd. M.R.T.
Ckd.
Date. Jan '72
KITTICOOLA MINE
Sub. surface geology
ANSTEYS ADIT
Kitticoola Gold Mines N.L.

ENV 1824 - 7


N
No lode above Cut off fault.
No lode above cutoff fault
FAULT (Cuts off lode)
CUT OFF
Up 30° down
Up 80° down
Upwarp approx 4'-5' High
Note: Except for the first 10 feet of adit the lode is too flat to show on the plan.
Underlay shaft
DIP FAULT
STOPED
STOPE
Lode flattens
Jointing
No.2 STOPE
(position approx)
Zone of brecciation approx 12' wide
cross section of lode from point 'X'
N
S
Note Sketch section only
No.2 ADIT.
Jointing
RECEIVED 17 FEB 1972
Note: Plan scale 40' to 1 inch.
Section detail 20' to 1".
All sections looking North
Fault
Lode boundary
Fault zone
Dip & strike of lode or of fault
Vertical dip
Survey point
Granite (medium grained)
Filling
SCALES
PLAN 0 40 80 FEET
SECTIONS 0 20 40 FEET
L.G.B. NIXON AND ASSOCIATES
Drn R.M.B.
Tcd. M.R.T.
Ckd.
Date Jan. 72
KITTICOOLA MINE
Sub surface geology
Adit level No.2 and No.2 Stope
Kitticoola Gold Mines N.L.

ENV 1824 - 8

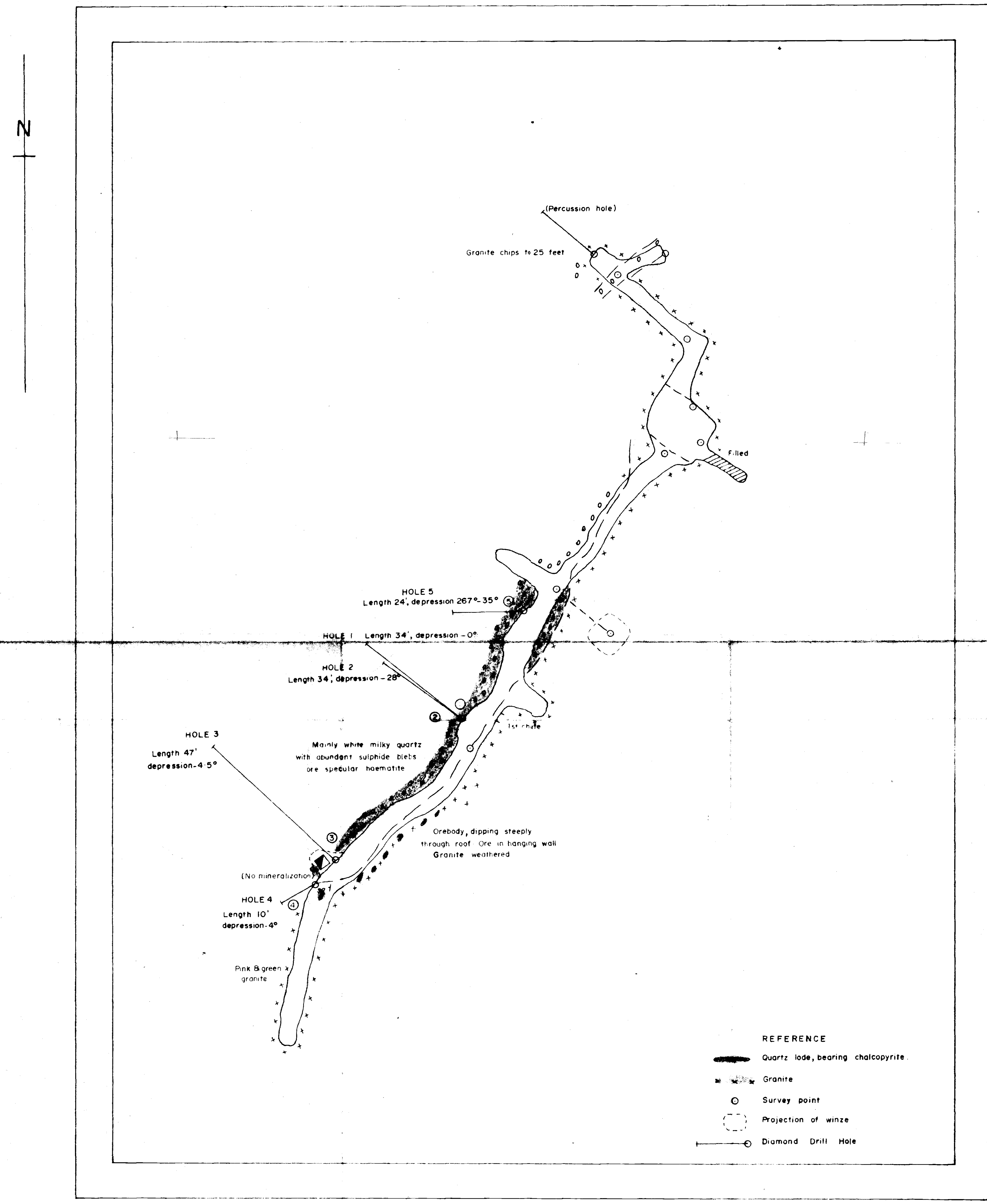


Fault
Lode boundary
Fault zone
Dip & strike of lode or of fault 25° 45°
Vertical dip
Survey point ·3
Granite
Filling

L.G.B. NIXON AND ASSOCIATES.	
Drn. R.M.B.	KITTICOOLA MINE
Tcd. M.R.T.	Sub surface Geology
Ckd.	Adit level No.1 and level 10' below
Date Jan. '72	Kitticoola Gold Mines N.L.

ENU 1824 -9

McPHAR GEOPHYSICS PTY. LTD.



STURTS MEADOWS PROSPECTING SYNDICATE N.L.

GEOLOGY OF KITTICOOLA MINE

360' LEVEL

SCALE: 20 feet to 1 inch

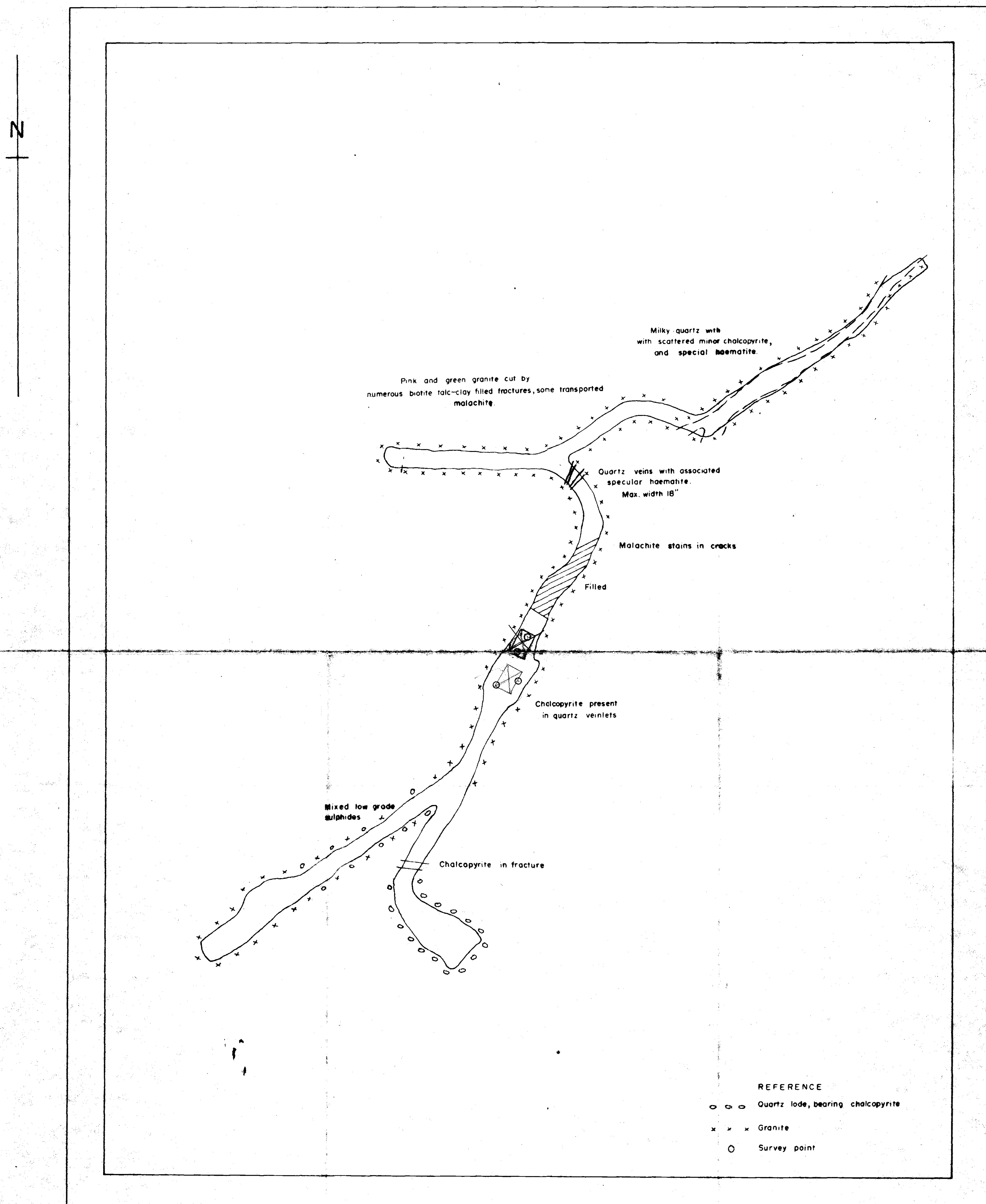
DRAWN: I.S.
DATE: 10·2·71
APPROVED: R.W.F.

DATE: 10·2·71

ENV 1824 -10

DWG. G. 3135 A

McPHAR GEOPHYSICS PTY. LTD.



STURTS MEADOWS PROSPECTING SYNDICATE N.L.

GEOLOGY OF KITTICOOLA MINE

420' LEVEL

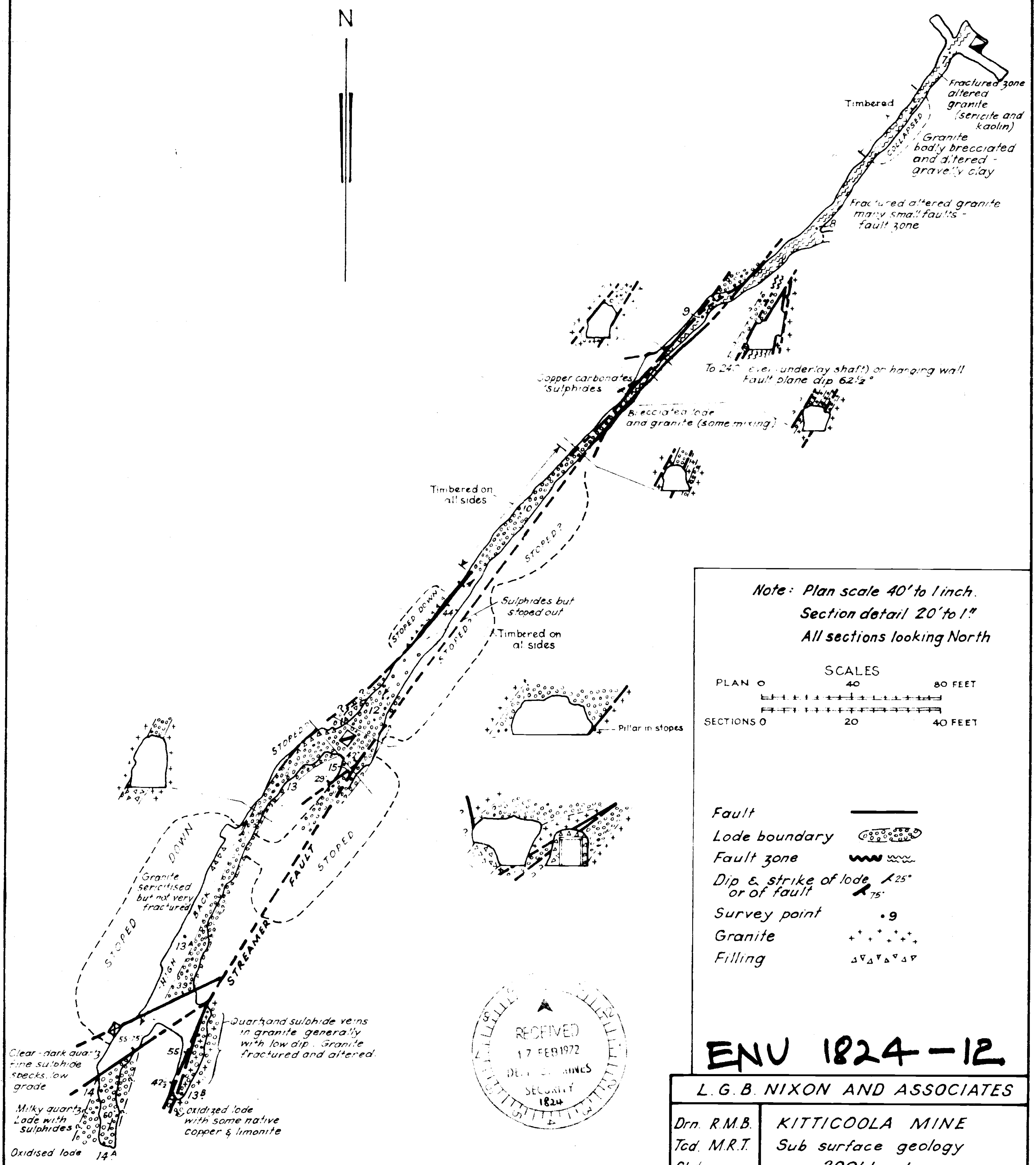
SCALE: 20 feet to 1 inch

DRAWN: I.S
DATE: 10.2.71
APPROVED: R.W.F.

DATE: 10.2.71

ENV 1824—11

DWG.G.3134A



Note: Plan scale 40' to 1 inch.
Section detail 20' to 1"
All sections looking North

SCALES

PLAN 0 40 80 FEET

SECTIONS 0 20 40 FEET

Fault	
Lode boundary	
Fault zone	
Dip & strike of lode or of fault	25° 75°
Survey point	•9
Granite	
Filling	

ENU 1824-12

L. G. B. NIXON AND ASSOCIATES

Drn. R.M.B.	KITTICOOLA MINE
Tcd. M.R.T.	Sub surface geology
Ckd.	300' level
Date Jan. '72	Kitticoola Gold Mines N.L.

016

McPHAR GEOPHYSICS

NOTES ON THE THEORY, METHOD OF FIELD OPERATION AND PRESENTATION OF DATA FOR THE INDUCED POLARIZATION METHOD

Induced Polarization as a geophysical measurement refers to the blocking action or polarization of metallic or electronic conductors in a medium of ionic solution conduction.

This electro-chemical phenomenon occurs wherever electrical current is passed through an area which contains metallic minerals such as base metal sulphides. Normally, when current is passed through the ground, as in resistivity measurements, all of the conduction takes place through ions present in the water content of the rock, or soil, i.e. by ionic conduction. This is because almost all minerals have a much higher specific resistivity than ground water. The group of minerals commonly described as "metallic", however, have specific resistivities much lower than ground waters. The induced polarization effect takes place at those interfaces where the mode of conduction changes from ionic in the solutions filling the interstices of the rock to electronic in the metallic minerals present in the rock.

The blocking action or induced polarization mentioned above, which depends upon the chemical energies necessary to allow the ions to give up or receive electrons from the metallic surface, increases with the time that a d. c. current is allowed to flow through the rock; i. e. as ions pile up against the metallic interface the resistance to current flow increases. Eventually, there is enough polarization in the form of excess ions at the interfaces, to appreciably reduce the amount of current flow through the metallic particle. This polarization takes place at each of the infinite number of solution-metal interfaces in a mineralized rock.

When the d. c. voltage used to create this d. c. current flow is cut off, the Coulomb forces between the charged ions forming the polarization cause them to return to their normal position. This movement of charge creates a small current flow which can be measured on the surface of the ground as a decaying potential difference.

From an alternate viewpoint it can be seen that if the direction of the current through the system is reversed repeatedly before the polarization occurs, the effective resistivity of the system as a whole will change as the frequency of the switching is changed. This is a consequence of the fact that the amount of current flowing through each metallic interface depends upon the length of time that current has been passing through it in one direction.

The values of the per cent frequency effect or F. E. are a measurement of the polarization in the rock mass. However, since the measurement of the degree of polarization is related to the apparent resistivity of the rock mass it is found that the metal factor values or M. F. are the most useful values in determining the amount of polarization present in the rock mass. The MF values are obtained by normalizing the F. E. values for varying resistivities.

The induced polarization measurement is perhaps the most powerful geophysical method for the direct detection of metallic sulphide mineralization, even when this mineralization is of very low concentration. The lower limit of volume per cent sulphide necessary to produce a recognizable IP anomaly will vary with the geometry and geologic environment of the source, and the method of executing the survey. However, sulphide mineralization of less than one per cent by volume has been detected by the IP method under proper geological conditions.

The greatest application of the IP method has been in the search for disseminated metallic sulphides of less than 20% by volume. However, it has also been used successfully in the search for massive sulphides in situations where, due to source geometry, depth of source, or low resistivity of surface layer, the EM method can not be successfully applied. The ability to differentiate ionic conductors, such as water filled shear zones, makes the IP method a useful tool in checking EM anomalies which are suspected of being due to these causes.

In normal field applications the IP method does not differentiate between the economically important metallic minerals such as chalcopyrite, chalcocite, molybdenite, galena, etc., and the other metallic minerals such as pyrite. The induced polarization effect is due to the total of all electronic conducting minerals in the rock mass. Other electronic conducting materials which can produce an IP response are magnetite, pyrolusite, graphite, and some forms of hematite.

In the field procedure, measurements on the surface are made in a way that allows the effects of lateral changes in the properties of the ground to be separated from the effects of vertical changes in the properties. Current is applied to the ground at two points in distance (X) apart. The potentials are measured at two other points (X) feet apart, in line with the current electrodes is an integer number (n) times the basic distance (X).

The measurements are made along a surveyed line, with a constant distance (nX) between the nearest current and potential electrodes. In most surveys, several traverses are made with various values of (n); i.e. (n) = 1, 2, 3, 4, etc. The kind of survey required (detailed or reconnaissance) decides the number of values of (n) used.

In plotting the results, the values of the apparent resistivity, apparent per cent frequency effect, and the apparent metal factor measured for each set of electrode positions are plotted at the intersection of grid lines, one from the center point of the current electrodes and the other from the center point of the potential electrodes. (See Figure A.) The resistivity values are plotted above the line as a mirror image of the metal factor values below. On a second line, below the metal factor values, are plotted the values of the per cent frequency effect. In some cases the values of per cent frequency effect are plotted as superscripts of the metal factor value. In this second case the frequency effect values are not contoured. The lateral displacement of a given value is determined by the location along the survey line of the center point between the current and potential electrodes. The distance of the value from the line is determined by the distance (nX) between the current and potential electrodes when the measurement was made.

The separation between sender and receiver electrodes is only one factor which determines the depth to which the ground is being sampled in any particular measurement. The plots then, when contoured, are not section maps of the electrical properties of the ground under the survey line. The interpretation of the results from any given survey must be carried out using the combined experience gained from field results, model study results and theoretical investigations. The position of the electrodes when anomalous values are measured is important in the interpretation.

In the field procedure, the interval over which the potential differences are measured is the same as the interval over which the electrodes are moved after a series of potential readings has been made. One of the advantages of the induced polarization method is that the same equipment can be used for both detailed and reconnaissance surveys merely by changing the distance (X) over which the electrodes are moved each time. In the past, intervals have been used ranging from 25 feet to 2000 feet for (X). In each case, the decision as to the distance (X) and the values of (n) to be used is largely determined by the expected size of the mineral deposit being sought, the size of the expected anomaly and the speed with which it is desired to progress.

The diagram in Figure A demonstrates the method used in plotting the results. Each value of the apparent resistivity, apparent metal factor, and apparent per cent frequency effect is plotted and identified by the position of the four electrodes when the measurement was made. It can be seen that the values measured for the larger values of (n) are plotted farther from the line indicating that the thickness of the layer of the earth that is being tested is greater than for the smaller values of (n); i. e. the depth of the measurement is increased. When the F. E. values are plotted as superscripts to the MF values the third section of data values is not presented and the F. E. values are not contoured.

The actual data plots included with the report are prepared utilizing an IBM 360/75 Computer and a Calcomp 770/763 Incremental Plotting System. The data values are calculated, plotted, and contoured according to a programme developed by McPhar Geophysics. Certain symbols have been incorporated into the programme to explain various situations in recording the data in the field.

The IP measurement is basically obtained by measuring the difference in potential or voltage (ΔV) obtained at two operating frequencies. The voltage is the product of the current through the ground and the apparent resistivity of the ground. Therefore in field situations where the current is very low due to poor electrode contact, or the apparent resistivity is very low, or a combination of the two effects; the value of (ΔV) the change in potential will be too small to be measurable. The symbol "TL" on the data plots indicates this situation.

In some situations spurious noise, either man made or natural, will render it impossible to obtain a reading. The symbol "N" on the data plots indicates a station at which it is too noisey to record a reading. If a reading can be obtained, but for reasons of noise there is some doubt as to its accuracy, the reading is bracketed in the data plot ( ).

In certain situations negative values of Apparent Frequency Effect are recorded. This may be due to the geologic environment or spurious electrical effects. The actual negative frequency effect value recorded is indicated on the data plot, however the symbol "NEG" is indicated for the corresponding value of Apparent Metal Factor. In contouring negative values the contour lines are indicated to the nearest positive value in the immediate vicinity of the negative value.

The symbol "NR" indicates that for some reason the operator did not attempt to record a reading although normal survey procedures would suggest that one was required. This may be due to inaccessible topography or other similar reasons. Any symbol other than those discussed above is unique to a particular situation and is described within the body of the report.

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METHOD USED IN PLOTTING DIPOLE-DIPOLE

INDUCED POLARIZATION AND RESISTIVITY RESULTS

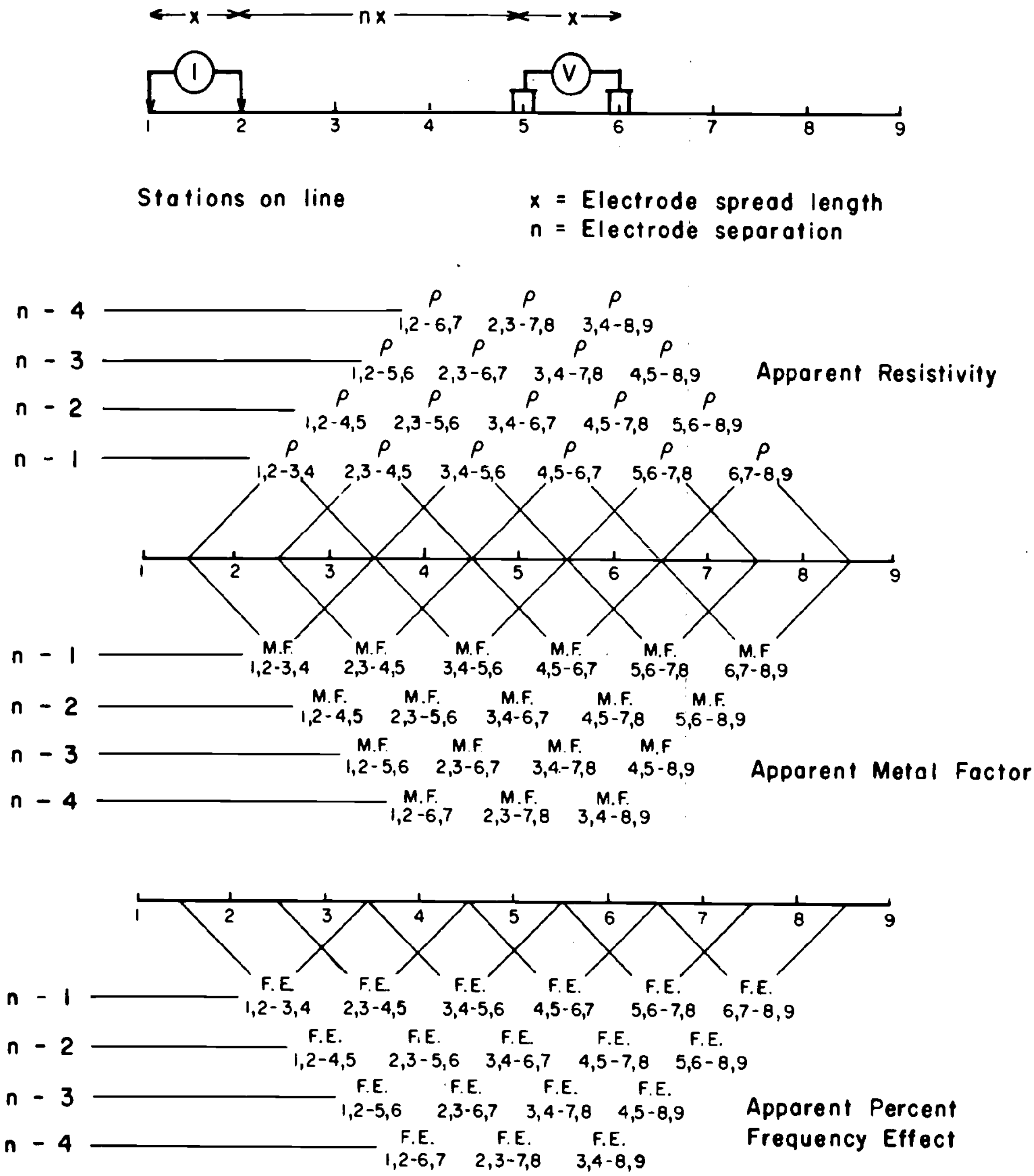

Fig. A

McPHAR GEOPHYSICS

REPORT ON THE INDUCED POLARIZATION AND RESISTIVITY SURVEY ON THE KITTICOOLA GRID PALMER, SOUTH AUSTRALIA FOR STURTS MEADOWS PROSPECTING SYNDICATE N.L.

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1. INTRODUCTION

At the request of Mr. W.T. Thompson, we have completed an induced polarization and resistivity survey at the Kitticoola Grid on behalf of Sturts Meadows Prospecting Syndicate N.L. The area of interest is near Palmer, in the Adelaide Hills of South Australia.

Extensive mining operations have previously been carried out at Kitticoola. Copper and gold ore was extracted through several adits and shafts. The mineralisation is contained within several narrow (2 to 20 feet) vein lodes. The main minerals in the lodes were quartz and pyrite. Most of the mining was confined to the enriched, weathered portion of the lodes. However, the old reports and some more recent drilling, have confirmed the presence of fresh sulphide mineralisation at depth, beneath the weathered layer.

The induced polarization and resistivity survey at Kitticoola was planned in an attempt to extend the known zones of mineralization and to locate any unknown zones of mineralization that might be present.

2. PRESENTATION OF RESULTS

The induced polarization and resistivity results are shown on the following enclosed data plots. The results are plotted in the manner described in the notes preceding this report.

Line 20N	200' electrode intervals	Dwg. IP 5526-1
	100' electrode intervals	Dwg. IP 5526-2
	50' electrode intervals	Dwg. IP 5526-3
Line 18N	200' electrode intervals	Dwg. IP 5526-4
Line 16N	200' electrode intervals	Dwg. IP 5526-5
	100' electrode intervals	Dwg. IP 5526-6
Line 14N	200' electrode intervals	Dwg. IP 5526-7
	100' electrode intervals	Dwg. IP 5526-8
Line 12N	200' electrode intervals	Dwg. IP 5526-9
	100' electrode intervals	Dwg. IP 5526-10
Line 10N	200' electrode intervals	Dwg. IP 5526-11
Line 8N	200' electrode intervals	Dwg. IP 5526-12
Line 4N	300' electrode intervals	Dwg. IP 5526-13
	200' electrode intervals	Dwg. IP 5526-14
	100' electrode intervals	Dwg. IP 5526-15
Line 1N	300' electrode intervals	Dwg. IP 5526-16
	100' electrode intervals	Dwg. IP 5526-17

Line 2S	300' electrode intervals	Dwg. IP 5526-18
	200' electrode intervals	Dwg. IP 5526-19
	100' electrode intervals	Dwg. IP 5526-20
Line 6S	300' electrode intervals	Dwg. IP 5526-21
	200' electrode intervals	Dwg. IP 5526-22
	100' electrode intervals	Dwg. IP 5526-23
Line 8S	100' electrode intervals	Dwg. IP 5526-24
Line 9S	300' electrode intervals	Dwg. IP 5526-25
	200' electrode intervals	Dwg. IP 5526-26
	150' electrode intervals	Dwg. IP 5526-27
	100' electrode intervals	Dwg. IP 5526-28
Line 10S	100' electrode intervals	Dwg. IP 5526-29
Line 12S	300' electrode intervals	Dwg. IP 5526-30
	200' electrode intervals	Dwg. IP 5526-31
	100' electrode intervals	Dwg. IP 5526-32
Line 14S	200' electrode intervals	Dwg. IP 5526-33
Line 16S	300' electrode intervals	Dwg. IP 5526-34
	200' electrode intervals	Dwg. IP 5526-35
Line 18S	300' electrode intervals	Dwg. IP 5526-36
	200' electrode intervals	Dwg. IP 5526-37
Line 20S	300' electrode intervals	Dwg. IP 5526-38
	200' electrode intervals	Dwg. IP 5526-39

Also enclosed with this report is Dwg. I.P.P. 4662, a plan map of the Kitticoola Grid at a scale of 1" = 200'. The definite and possible induced polarization anomalies are indicated by solid and broken bars respectively on this plan map as well as the data plots. These bars represent the surface projection of the anomalous zones as interpreted from the location of the transmitter and receiver electrodes when the anomalous values were measured.

Since the induced polarization measurement is essentially an averaging process, as are all potential methods, it is frequently difficult to exactly pinpoint the source of an anomaly. Certainly, no anomaly can be located with more accuracy than the spread length; i.e. when using 200' spreads the position of a narrow sulphide body can only be determined to lie between two stations 200' apart. In order to locate sources at some depth, larger spreads must be used, with a corresponding increase in the uncertainties of location. Therefore, while the centre of the indicated anomaly probably corresponds fairly well with source, the length of the indicated anomaly along the line should not be taken to represent the exact edges of the anomalous material.

3. DISCUSSION OF RESULTS

The description of the sulphide mineralization at depth in the old workings is not very complete. The mineralization appears to be less than massive, with widths of a few feet. This type of mineralization would be expected to give rise to relatively weak IP anomalies.

The induced polarization and resistivity survey on the Kitticoola Grid has located numerous weak, indefinite IP anomalies. The anomalous indications are scattered over a wide area and in several places the validity of the measurements is in doubt due to grounded fences, pipes, etc. As shown on Dwg. I.P.P. 4662, it is possible to correlate some of the more definite anomalies into tentative zones.

In most cases, the zones are discontinuous; for instance, on Line 18N there is no anomaly that correlates with Zone A. This character of the zones, and the low magnitude for the anomalies, underscores the indefinite, weak nature of the sources of the IP anomalies.

Zone A

The anomalous zone lies just to the east of the baseline on the northern part of the grid. The IP anomaly occurs at the contact between higher resistivity rocks to the west and low resistivity rocks to the east. Geological examinations have shown this to be a granite-schist contact.

The IP anomalies that form Zone A are low in magnitude, but the patterns are the most definite located at the Kitticoola Grid. The measurements with X = 200' and X = 100' on Line 14N gave anomalies that are typical. They suggest a relatively narrow, tabular zone centred at 1+00E to 2+00E. The low magnitude of the anomaly suggests that only a few percent metallic mineralisatio may be the source.

Zone B

This zone lies to the west of the baseline; it passes through the area of the old workings. The source is probably associated with the down-dip extension of the mineralization in the Anstey Lode. In the vicinity of the old workings and adits, many of the measurements are distorted by grounded pipes, fences, etc.

On Line 9S, the measurements appear to be valid. The detailed measurements with X = 200' and X = 100' show a source at depth, centred at about 4+00W to 4+50W. The pattern suggests a relatively narrow source. The anomalies that form Zone B are much the same as those from Zone A. The metallic mineralisation in the source would be expected to be weak also.

Zone C

There are numerous other weak anomalies shown on Dwg. I.P.P. 4662. As shown, some can be correlated from line to line. None of the anomalies are as definite as those that form Zone A and Zone B. Those that form Zone C_1 (Line 14S, 15+00W) and Zone C_2 (Line 16S, 20+00W) are perhaps more definite than the others remaining.

The anomalies in Zone C_1 and Zone C_2 are so weak that no further work seems warranted at this time.

4. CONCLUSIONS AND RECOMMENDATIONS

The known mineralised lodes at the Kitticoola Grid are narrow (a few feet) and contain less than massive mineralisation. The IP anomalies from this type of mineralisation would be expected to be weak. The induced polarization and resistivity survey at Kitticoola has detected numerous weak anomalies. The possible importance of these anomalies is difficult to determine.

A few of the scattered anomalies have been correlated into discontinuous zones (Dwg. I.P.P. 4662). Zone A lies along a geologic contact and Zone B passes through the area of the old workings and adits. These are the two most definite zones outlined.

Zone A has been tested by a drill hole on Line 14N. Zone B has been tested by drilling on Line 2S and Line 9S. The holes intersected only weak metallic mineralisation of no economic interest. This mineralisation seems to be enough to explain the IP effects measured.

The other IP anomalies located on the Kitticoola Grid are weaker, and less definite, than those that form Zone A and Zone B. It is therefore difficult to recommend further work to check these sources. No further work would be warranted, unless there is geological or geochemical encouragement.

REGISTERED PROFESSIONAL ENGINEER
P. G. HALLOF
PROVINCE OF ONTARIO

McPHAR GEOPHYSICS PTY. LTD.

Philip G. Hallof

Philip G. Hallof,
Geophysicist.

Robert J. Smith

Robert J. Smith,
Geophysicist.

Dated: September 25, 1970

McPHAR GEOPHYSICS

APPENDIX
THE INTERPRETATION OF INDUCED POLARIZATION ANOMALIES FROM RELATIVELY SMALL SOURCES

The induced polarization method was originally developed to detect disseminated sulphides and has proven to be very successful in the search for "porphyry copper" deposits. In recent years we have found that the IP method can also be very useful in exploring for more concentrated deposits of limited size. This type of source gives sharp IP anomalies that are often difficult to interpret.

The anomalous patterns that develop on the contoured data plots will depend on the size, depth and position of the source and the relative size of the electrode interval. The data plots <u>are not</u> sections showing the electrical parameters of the ground. When the electrode interval (X) is appreciably greater than the width of the source, a large volume of unmineralized rock is averaged into each measurement. This is particularly true for the large values of the electrode separation (n).

The theoretical scale model results shown in Figure 1 and Figure 2 indicate the effect of depth. If the depth to the top of the source is small compared to the electrode interval (i. e. d X) the measurement for n = 1 will be anomalous. In Figure 1 the depth is 0. 5 units (X = 1. 0 units) and the n = 1 value is definitely anomalous; the pattern on the contoured data plot is typical for a relatively shallow, narrow, near-vertical tabular source. The results in Figure 2 are for the same source with the depth increased to 1. 5 units. Here the n = 1 value is not anomalous; the larger values of (n) are anomalous but the magnitudes are much lower than for the source at less depth.

When the electrode interval is greater than the width of the source, it is not possible to determine its width or exact position between the electrodes. The true IP effect within the source is also indeterminate; the anomaly from a very narrow source with a very large true IP effect will be much the same as that from a zone with twice the width and 1/2 the true IP effect. The theoretical scale model data shown in Figure 3 and Figure 4 demonstrate this problem. The depth and position of the source are unchanged but the width and true IP effect are varied. The anomalous patterns and magnitudes are essentially the same, hence the data are insufficient to evaluate the source completely.

The normal practise is to indicate the IP anomalies by solid, broken, or dashed bars, depending upon their degree of distinctiveness. These bars represent the surface projection of the anomalous zones as interpreted from the location of the transmitter and receiver electrodes when the anomalous values were measured. As illustrated in Figure 1, Figure 2, Figure 3 and Figure 4, no anomaly can be located with more accuracy than the spread length. While the centre of the solid bar indicating the anomaly corresponds fairly well with the source, the length of the bar should not be taken to represent the exact edges of the anomalous material.

If the source is shallow, the anomaly can be better evaluated using a shorter electrode interval. When the electrode interval used approaches the width of the source, the apparent effects measured will be nearly equal to the true effects within the source. When there is some depth to the top of the source, it is not possible to use electrode intervals that are much less than the depth to the source. In this situation, one must realize that a definite ambiguity exists regarding the width of the source and the IP effect within the source.

Our experience has confirmed the desirability of doing detail. When a reconnaissance IP survey using a relatively large electrode interval indicates the presence of a narrow, shallow source, detail with shorter electrode intervals is necessary in order to better locate, and evaluate, the source. The data of most usefulness is obtained when the maximum apparent IP effect is measured for n = 2 or n = 3. For instance, an anomaly originally located using X = 300' may be checked with X = 200' and then X = 100'. The data with X = 100' will be quite different from the original reconnaissance results with X = 300'.

The data shown in Figure 5 and Figure 6 are field results from a greenstone area in Quebec. The expected sources were narrow (less than 30' in width) zones of massive, high-grade, zinc-silver ore. An electrode interval of 200' was used for the reconnaissance survey in order to keep the rate of progress at an acceptable level. The anomalies located were low in magnitude.

The very weak, shallow anomaly shown in Figure 5 is typical of those located by the X = 200' reconnaissance survey. Several anomalies of this type were detailed using shorter electrode intervals. In most cases the detail measurements suggested broad zones of very weak mineralization. However, in the case of the source at 20N to 22N, the measurements with shorter electrode intervals confirmed the presence of a strong, narrow source. The X = 50' results are shown in Figure 6. Subsequent drilling has shown the source to be 12.5' of massive sulphide mineralization containing significant zinc and silver values.

The change in the anomaly that results when the electrode interval is reduced is not unusual. The X = 50' data more accurately locates the narrow source, and permits the geophysicist to make a better evaluation of its importance. The completion of this type of detail is very important, in order to get the maximum usefulness from a reconnaissance IP survey.

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Theoretical Induced Polarization and Resistivity Studies

Scale Model Cases

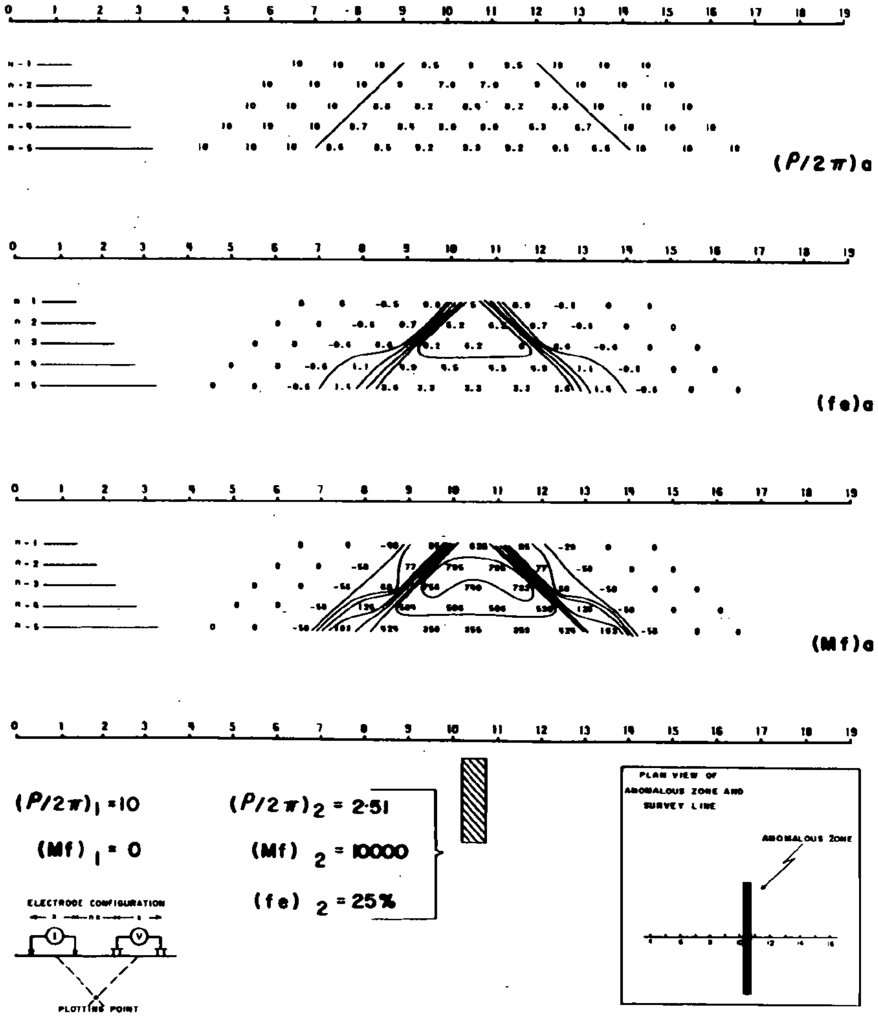

FIG 1

CASE II-0.5-BU-10-a

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Theoretical Induced Polarization and Resistivity Studies

Scale Model Cases

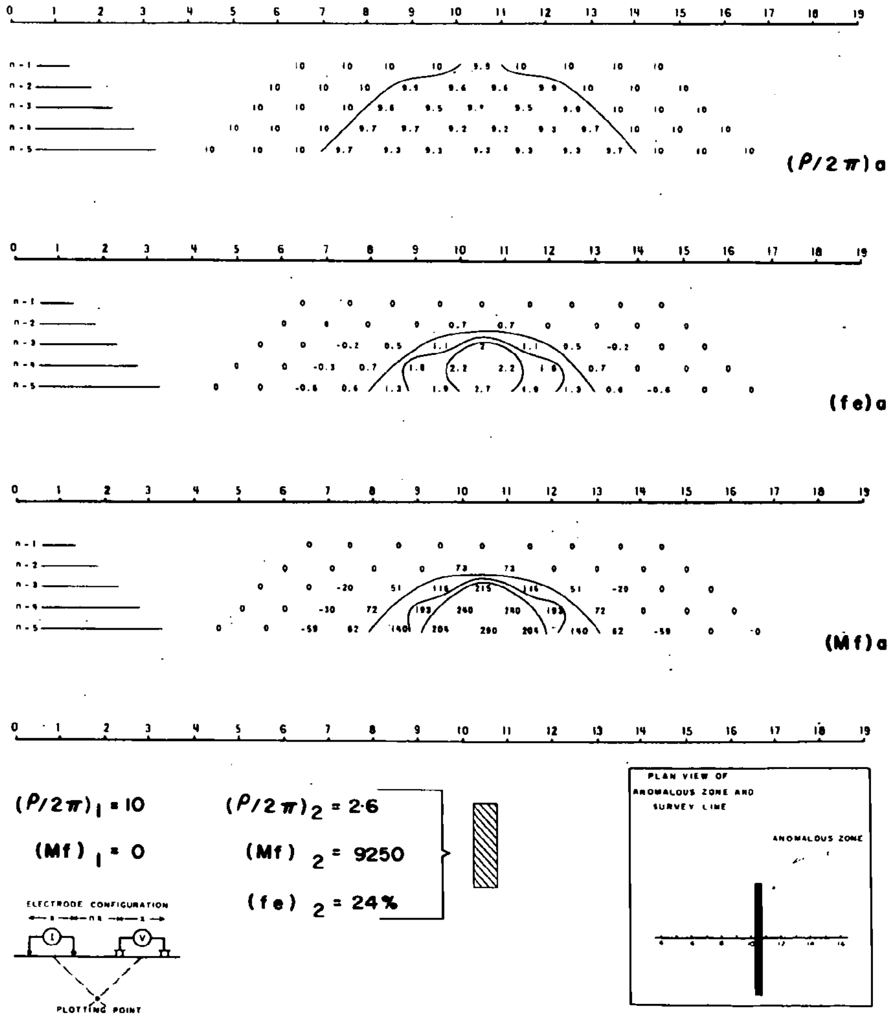


FIG 2

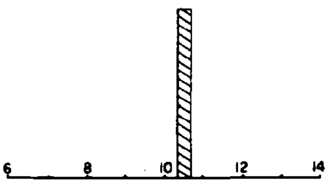
CASE II-1.5-BU-10-a

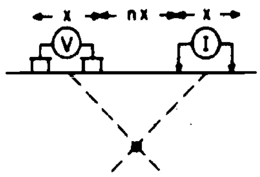
3 - 034

THEORETICAL INDUCED POLARIZATION AND RESISTIVITY STUDIES

SCALE MODEL CASE

PLAN VIEW





X EQUALS 1 UNIT

5 6 7 8 9 10 11 12 13 14 15 16

$(\rho/2\pi)a$

n-1 — 10 10 10 9.7 8.8 9.7 10 10 10
n-2 — 10 10 10 9.5 8.7 8.7 9.5 10 10 10
n-3 — 10 10 10 9.3 8.8 8.9 8.8 9.3 10 10 10
n-4 — 10 10 10 9.0 8.8 9.0 9.0 8.8 9.2 10 10 10

5 6 7 8 9 10 11 12 13 14 15 16

(Fe)a

n-1 — -0.2 0 -0.5 0.7 3.6 0.7 -0.3 -0.2 -0.2
n-2 — 0 0 -0.6 0.7 4.0 4.0 0.7 -0.6 0 0
n-3 — 0 0 -0.5 0.7 4.7 4.3 4.6 0.7 -0.6 0 0.2
n-4 — 0 -0.3 -0.6 1.1 3.5 4.2 4.2 3.5 1.1 -0.6 -0.3 0

5 6 7 8 9 10 11 12 13 14 15 16

(Mf)a

n-1 — 17 0 -49 72 410 72 -30 -17 17
n-2 — 0 0 -59 74 460 460 74 -59 0 0
n-3 — 0 0 -59 75 534 489 523 75 58 0 0
n-4 — 0 -30 -59 141 382 467 467 363 120 -59 -30 0

5 6 7 8 9 10 11 12 13 14 15 16

$(\rho 2\pi)_1 = 10$
$(Mf)_1 = 0$

$(\rho 2\pi)_2 = 2.57$
$(Mf)_2 = 11700$
$(Fe)_2 = 30\%$

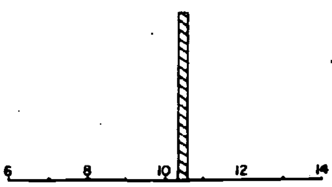
DEPTH EXTENT OF SOURCE 4 UNITS

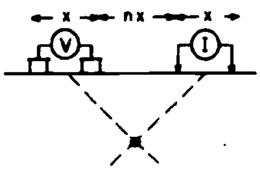
FIG. 3

THEORETICAL INDUCED POLARIZATION AND RESISTIVITY STUDIES

SCALE MODEL CASE

PLAN VIEW





X EQUALS 1 UNIT

5 6 7 8 9 10 11 12 13 14 15 16

$(\rho/2\pi)a$

n-1 — 10 10 10 9.9 9.3 9.9 10 10 10
n-2 — 10 10 10 9.7 9.1 9.1 9.7 10 10 10
n-3 — 10 10 10 9.7 9.2 9.2 9.2 9.7 10 10 10
n-4 — 10 10 10 9.6 9.3 9.3 9.3 9.3 9.6 10 10 10

5 6 7 8 9 10 11 12 13 14 15 16

(Fe)a

n-1 — 0 0 -0.3 0 3.5 0 -0.3 0 0
n-2 — 0 0 -0.8 0 3.8 3.8 0 -0.8 0 0
n-3 — 0 0 -0.8 0.5 4.5 4.5 4.6 0.5 -0.8 0 0
n-4 — 0 0 -0.7 0.8 4.2 5.1 5.1 4.2 0.7 -0.7 0 0

5 6 7 8 9 10 11 12 13 14 15 16

(Mf)a

n-1 — 0 0 -30 0 376 0 -30 0 0
n-2 — 0 0 -79 0 417 417 0 -79 0 0
n-3 — 0 0 -79 52 490 490 501 52 -79 0 0
n-4 — 0 0 -70 83 452 548 555 452 74 -71 0 0

5 6 7 8 9 10 11 12 13 14 15 16

$(\rho 2\pi)_1 = 10$
$(Mf)_1 = 0$

$(\rho 2\pi)_2 = 2.41$
$(Mf)_2 = 22800$
$(Fe)_2 = 55\%$

DEPTH EXTENT OF SOURCE 4 UNITS

FIG. 4

INDUCED POLARIZATION AND RESISTIVITY RESULTS

BATCHELOR LAKE AREA, QUEBEC.

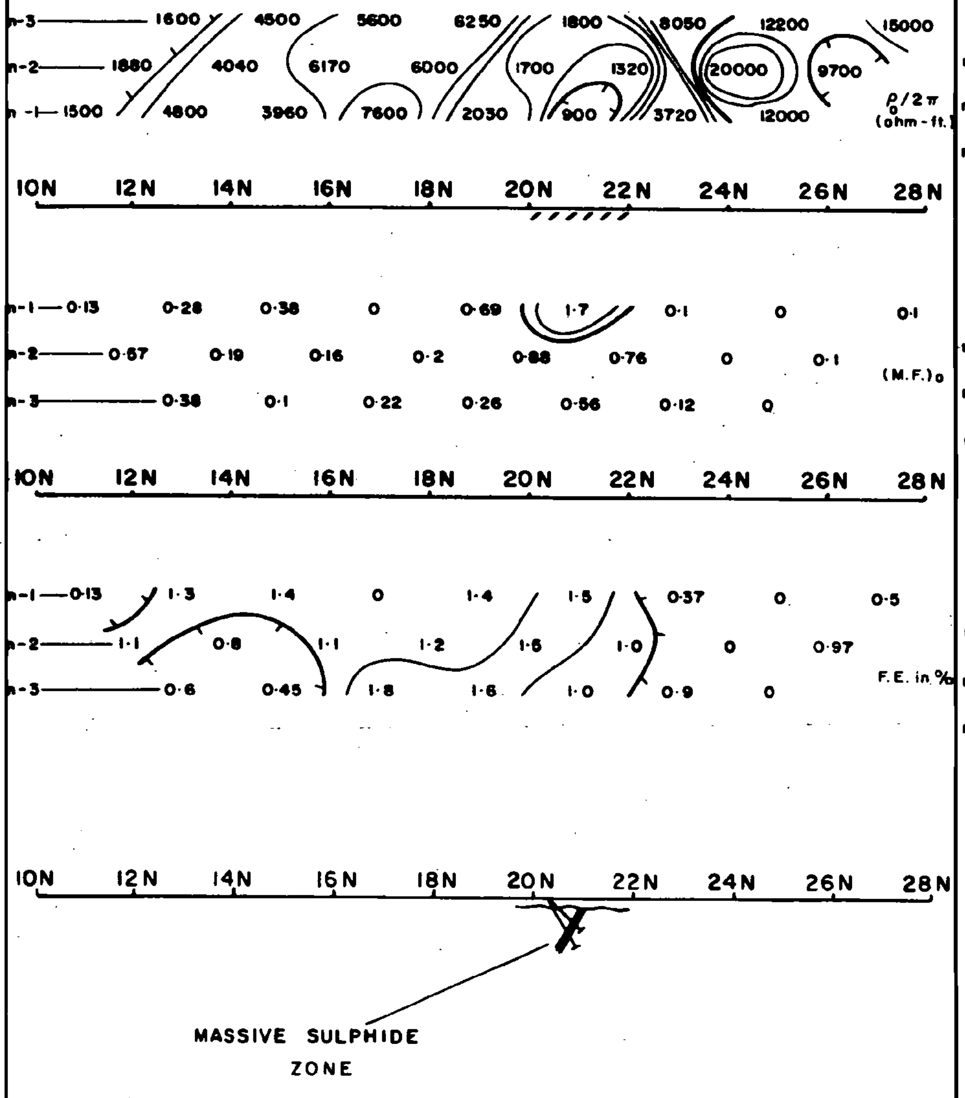


FIG. 5

INDUCED POLARIZATION AND RESISTIVITY RESULTS

BATCHELOR LAKE AREA, QUEBEC.

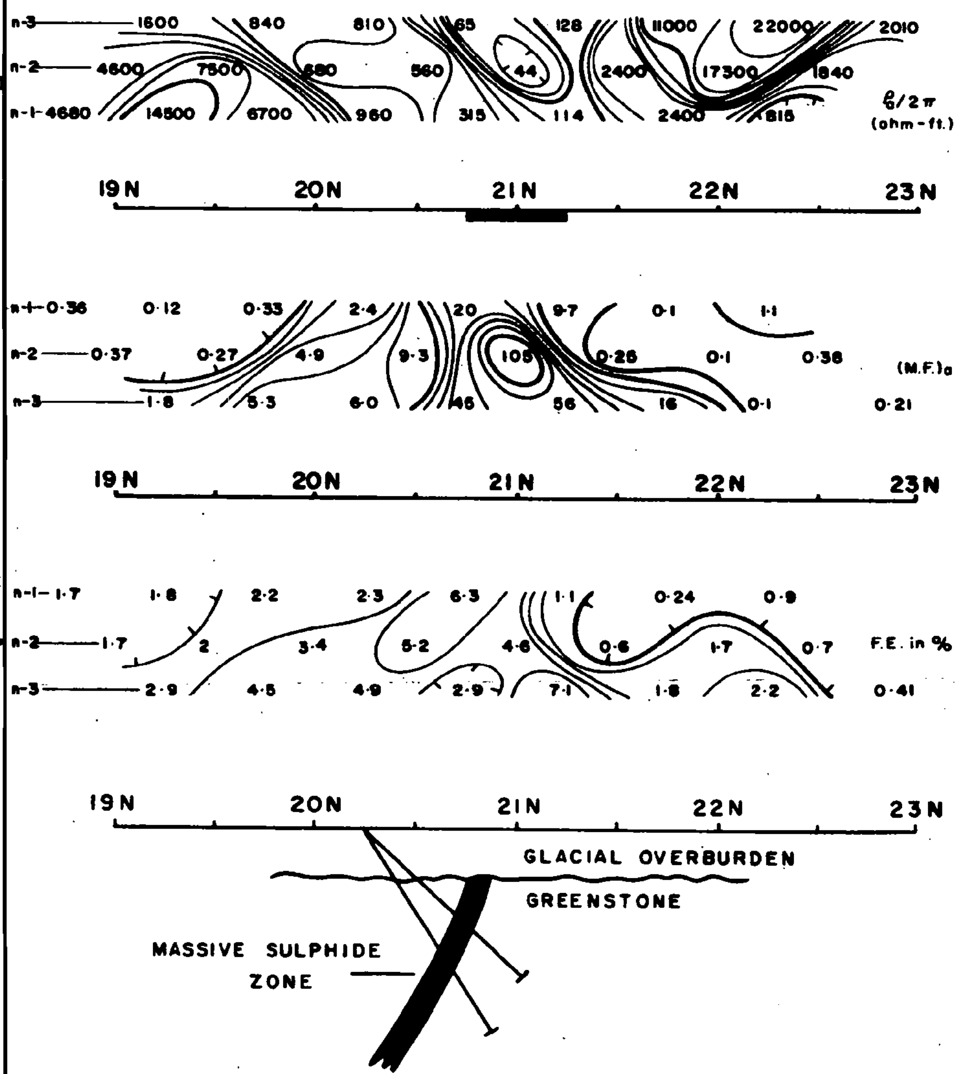


FIG. 6

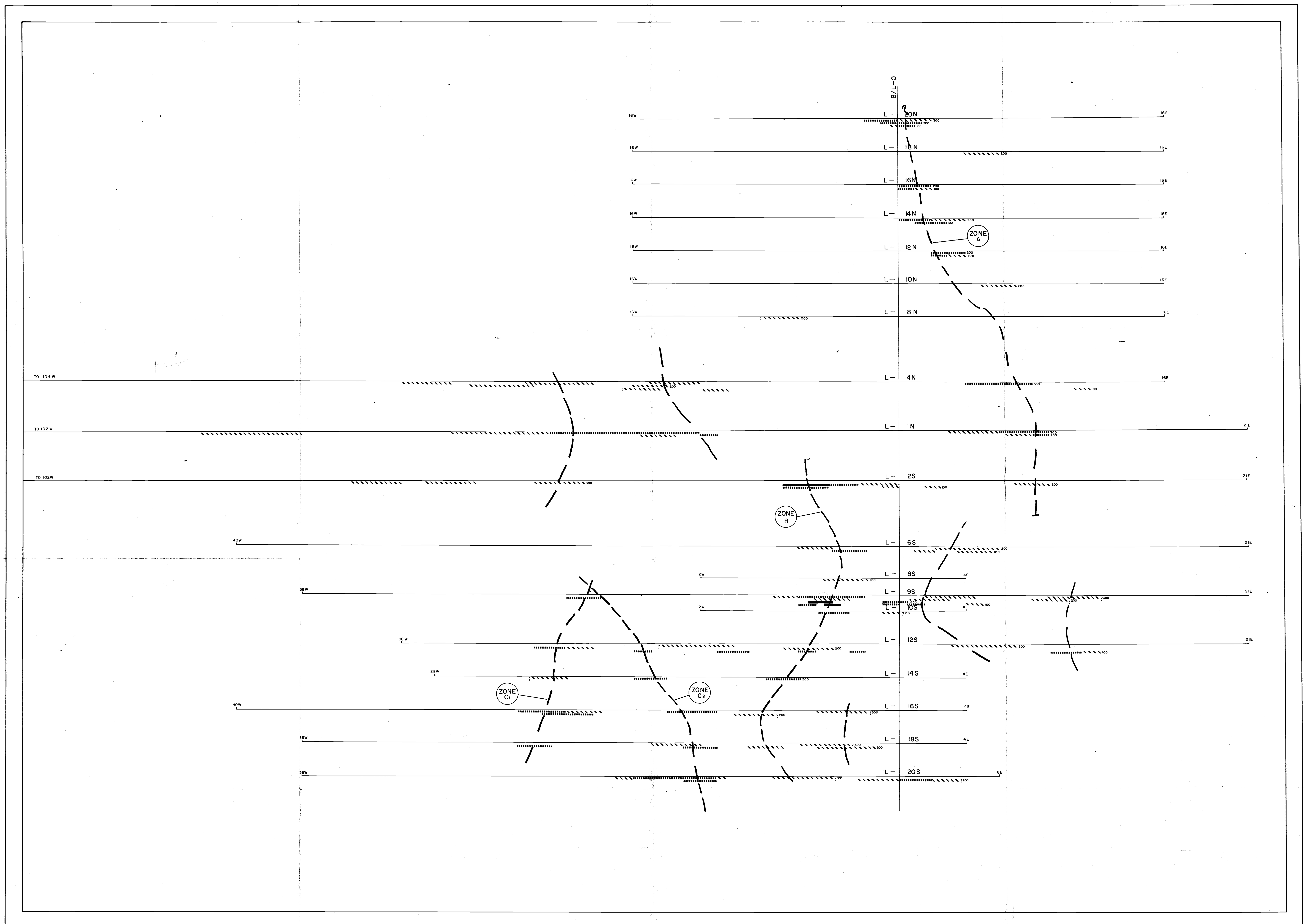
036

DWG. IPP-4662

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

PLAN MAP



SURFACE PROJECTION
OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

Number at the end of anomaly indicates spread used.

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER SOUTH AUSTRALIA

SCALE

ONE INCH EQUALS TWO HUNDRED FEET

ANOMALOUS IP ZONE

DRAWN: F.J.H.
DATE: SEPT.
APPROVED:
P. HALLOF
DATE: Sept. 25th '70

REGISTERED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

1824(11)-1

DWG. IPP-4662

DWG. NO.- I.P.-5526-1

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 20N

ELECTRODE CONFIGURATION

PLOTTING POINT X = 200'

SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: PH

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

DATE: Sept 25th '70

1824(11) - 2

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-2

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 20N

ELECTRODE CONFIGURATION

X NX X

PLOTTING POINT X = 100'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED:

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

DATE: Sept 3rd '70

1824(11)- 3

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

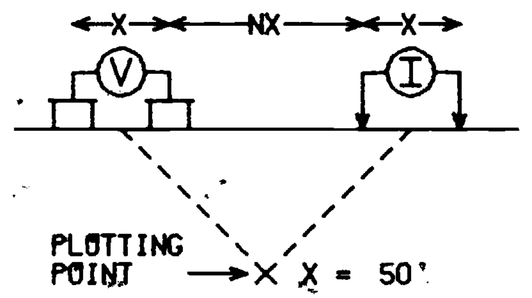
DWG. NO.- I.P.-5526-3

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO. - 20N

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: PL

DATE: Sept 25th '70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11) - 4

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

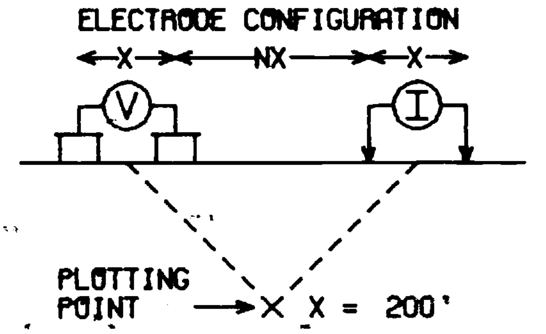
NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-4

STURTS MEADOWS
PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 18N.



SURFACE PROJECTION
OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: PH

DATE: Sept. 23rd. '70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11)-5

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-5

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 16N

ELECTRODE CONFIGURATION

PLOTTING POINT → X = 200'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: PL LOF

DATE: Sept 25th '70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11) - 6

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

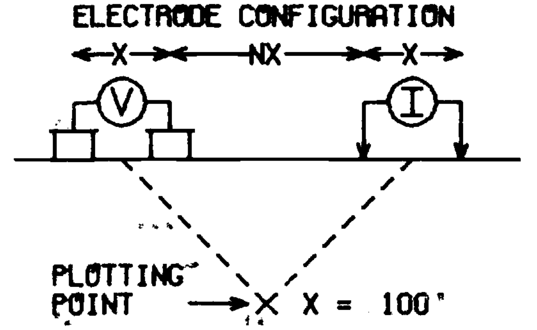
NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-6

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 16N



SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: PH

DATE: Sept. 28th. 70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11)-7

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-7

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 14N

ELECTRODE CONFIGURATION

X NX X

PLOTTING POINT

X = 200'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: PH

DATE: Sept. 25th. '70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11)-8

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

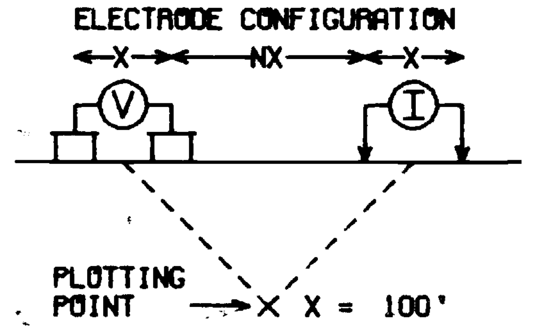
DWG. NO.- I.P.-5526-8

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 14N

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: PL

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

DATE: Sept 25th '70

1824(11) - 9

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-9

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 12N

ELECTRODE CONFIGURATION

PLOTTING POINT X = 200'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: 21

DATE: Sept. 28th '70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11)-10

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

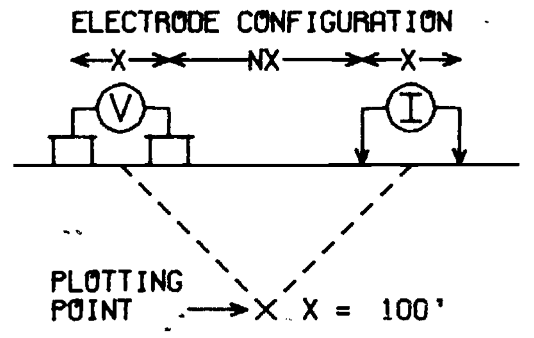
DWG. NO.- I.P.-5526-10

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 12N

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: P1

DATE: Sept. Nov. '70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11)-11

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

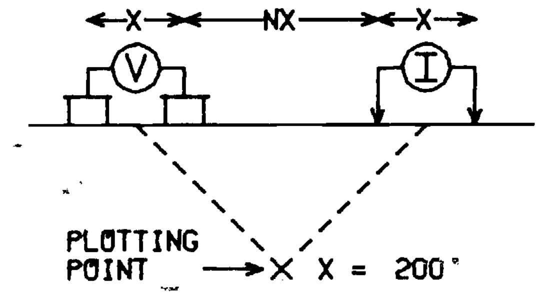
DWG. NO.- I.P.-5526-11

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 10N

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED:

DATE: Sept 25th '70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11)-12

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-12

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO. - 8N

ELECTRODE CONFIGURATION

X NX X

V I

PLOTTING POINT → X X = 200'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED:

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

DATE: Sept 25th 70

1824(11)-13

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

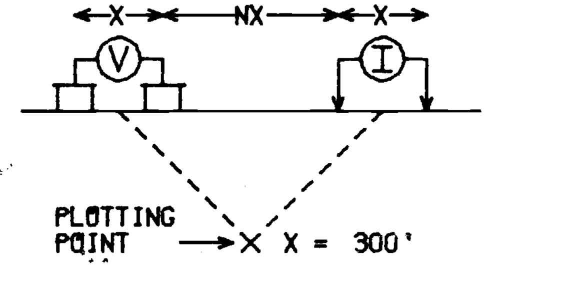
DWG. NO.- I.P.-5526-13

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 4N

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: APR 1970

APPROVED: [signature]

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

DATE: Sept. 25th. '70

1824(11)-14

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

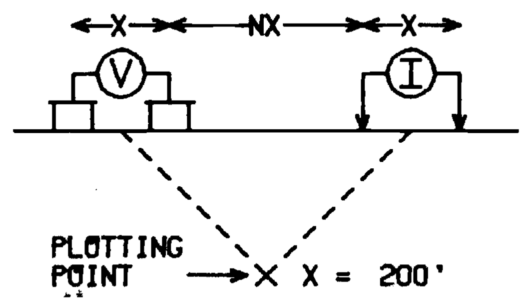
DWG. NO.- I.P.-5526-14

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 4N

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: APR 1970

APPROVED:

DATE: Sept 24 '70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11)-15

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-15

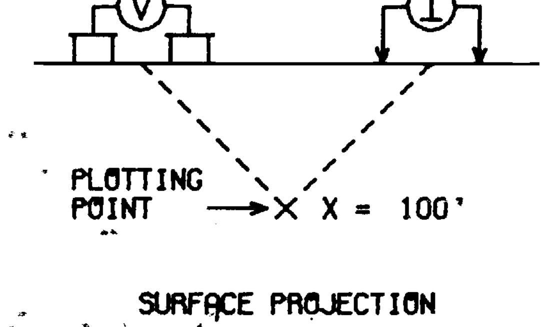
STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER

SOUTH AUSTRALIA

LINE NO.- 4N

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: APR 1970

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

APPROVED: PH

DATE: Sept. 25th. 70

1824(11)-16

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

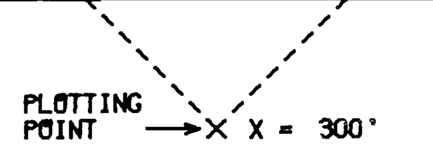
DWG. NO.- I.P.-5526 - 16

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 1N

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: APR 1970

APPROVED:

NOTE: CONTOURS AT LOGARITHMIC INTERVALS
1.-1.5-2.-3.-5.-7.5-10

DATE: Sept. 25th '70

1824(11)-17

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-17

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 1N

ELECTRODE CONFIGURATION

X — NX — X

PLOTTING POINT

X = 100'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: MAR 1970

APPROVED:

NOTE: CONTOURS AT LOGARITHMIC INTERVALS
1.-1.5-2.-3.-5.-7.5-10

DATE: Sept 25 70

1824(11)-18

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

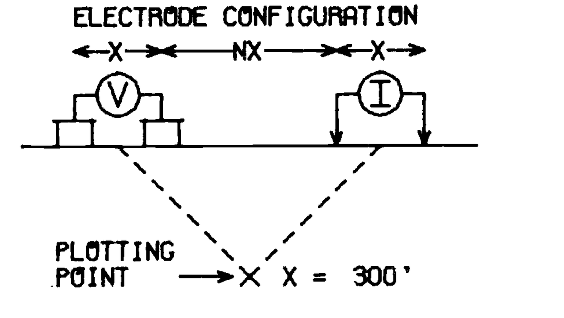
DWG. NO.- I.P.-5526-18

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 2S

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: NOV 1969

APPROVED: PH

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

DATE: Sept 25th '70

1824(11)-19

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-19

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 2S

ELECTRODE CONFIGURATION

PLOTTING POINT X = 200'

SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: NOV 1969

APPROVED:

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

DATE: Sept. 25th '70

1824(11)-20

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

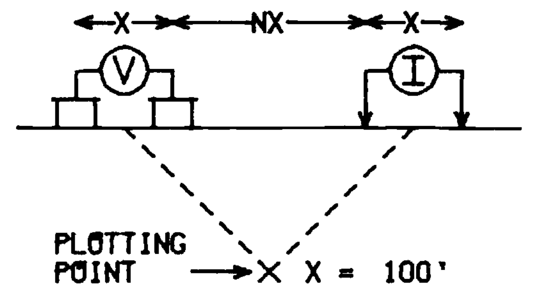
DWG. NO.- I.P.-5526-20

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 2S

ELECTRODE CONFIGURATION



PLOTTING POINT X = 100'

SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: DEC 1969

APPROVED:

DATE: Sept. 25th '70

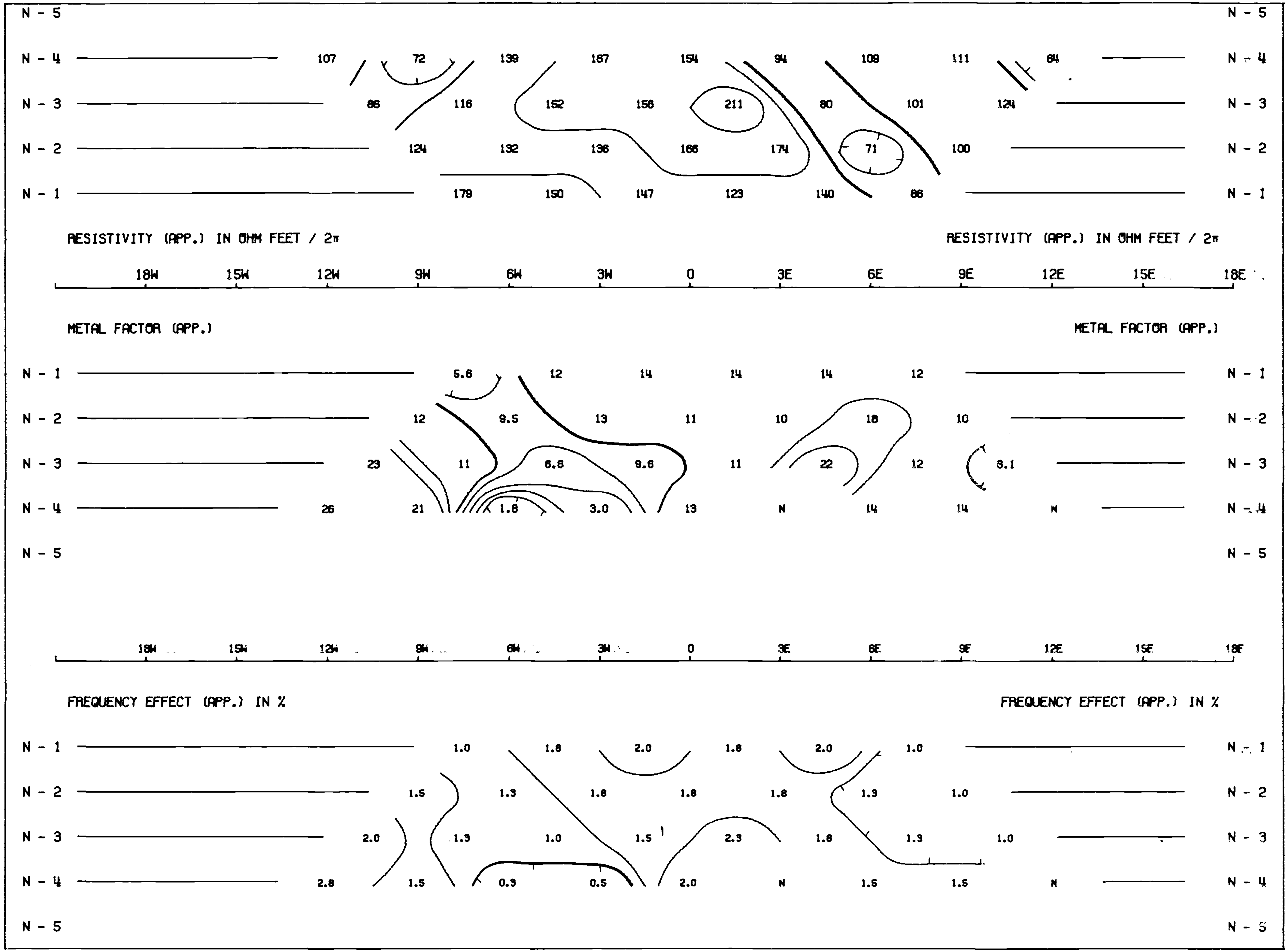
NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11)-21

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER



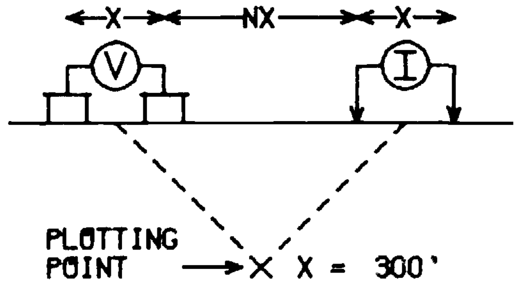
DWG. NO.- I.P.-5526-21

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 6S

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: NOV 1969

APPROVED: PH

DATE: Sept. 25th '70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS
1.-1.5-2.-3.-5.-7.5-10

1824(11)-22

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-22

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 6S

ELECTRODE CONFIGURATION

PLOTTING POINT → X = 200'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: NOV 1969

APPROVED:

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

DATE: Sept 25th 70

1824(11)-23

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-23

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 6S

ELECTRODE CONFIGURATION

X — NX — X

PLOTTING POINT — X = 100'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: DEC 1969

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

APPROVED: PH

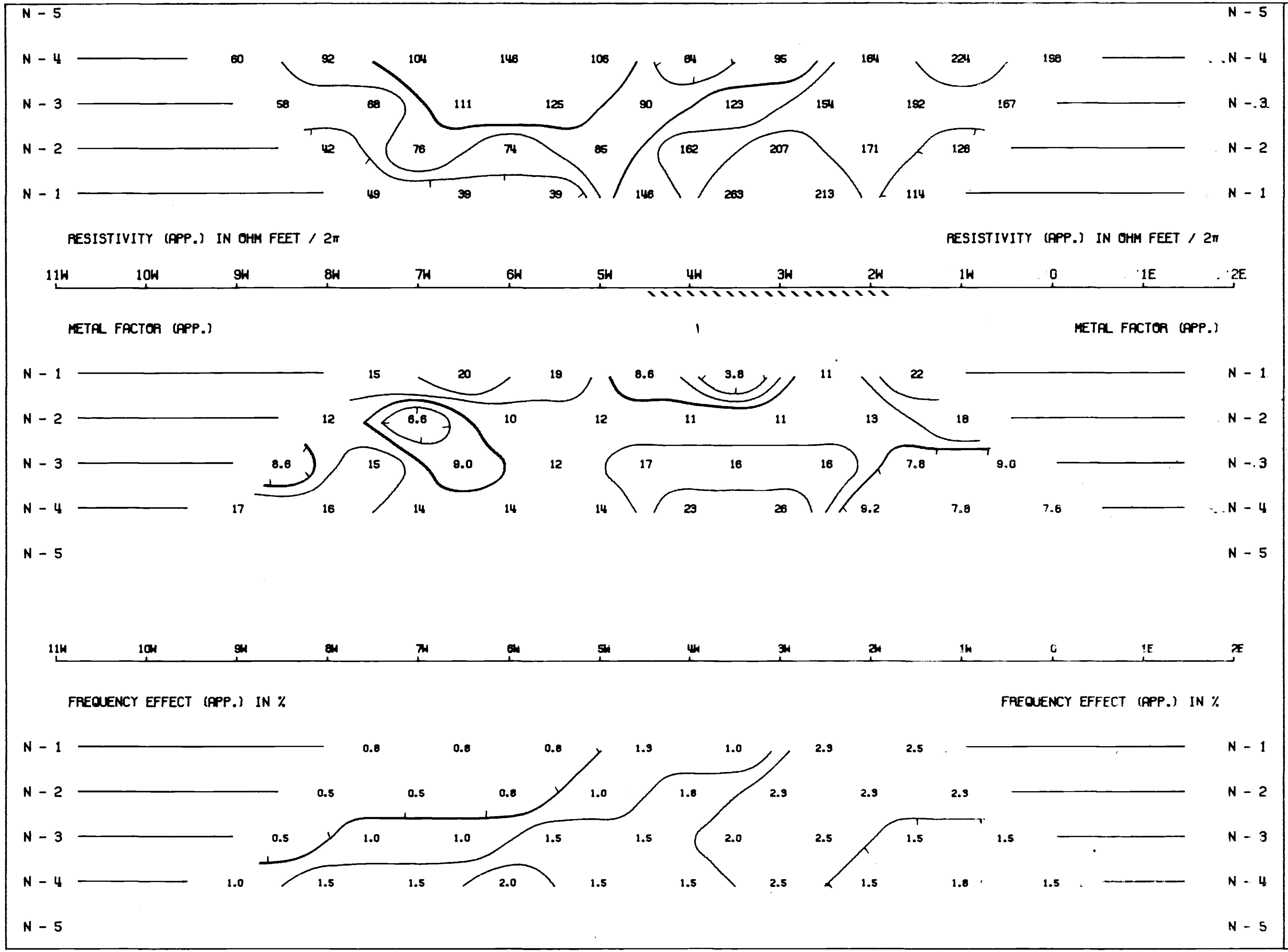
DATE: Sept. 25th '70

1824(11) -24

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER



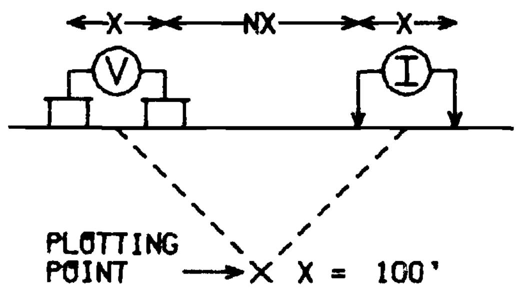
DWG. NO.- I.P.-5526-24

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 8S

ELECTRODE CONFIGURATION



SURFACE PROJECTION
OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: PH

DATE: Sept. 25th '70

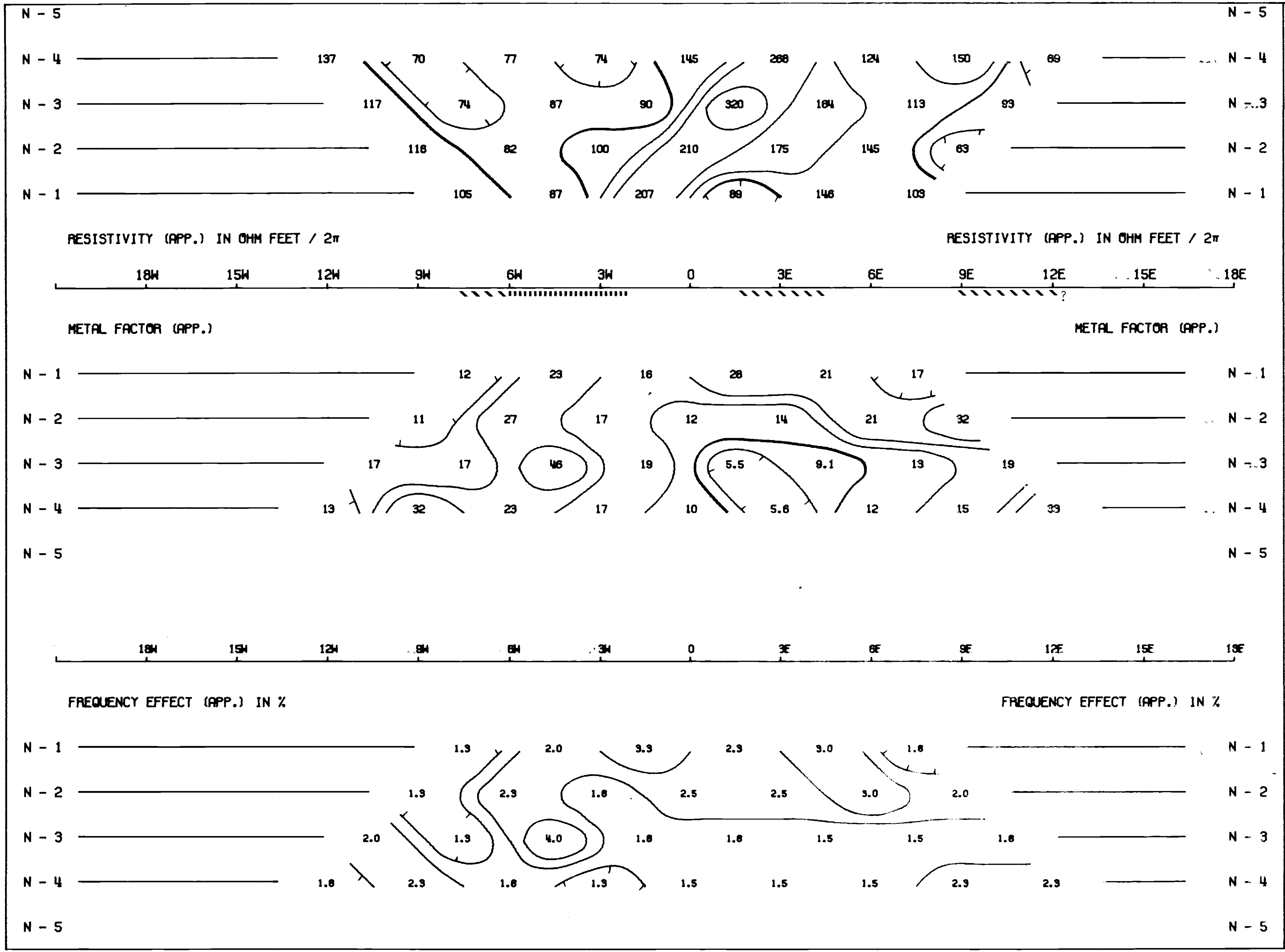
NOTE: CONTOURS AT LOGARITHMIC INTERVALS
1.-1.5-2.-3.-5.-7.5-10

1824(11)-25

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER



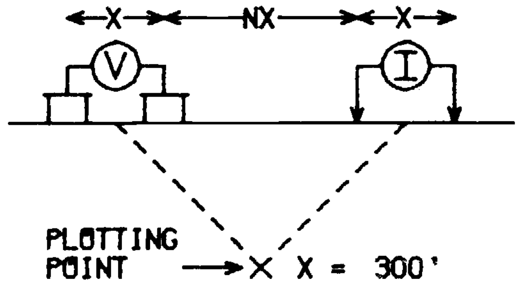
DWG. NO.- I.P.-5526-25

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 9S

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: NOV 1969

APPROVED: PH

DATE: Sept. 25th '70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11)-26

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

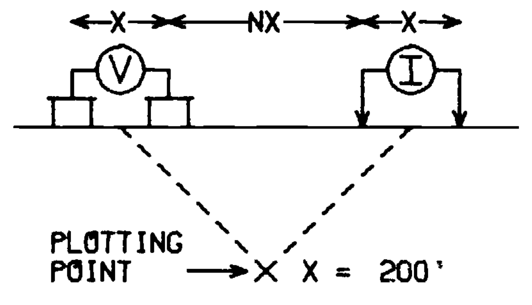
DWG. NO.- I.P.-5526-26

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 9S

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: NOV 1969

APPROVED:

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

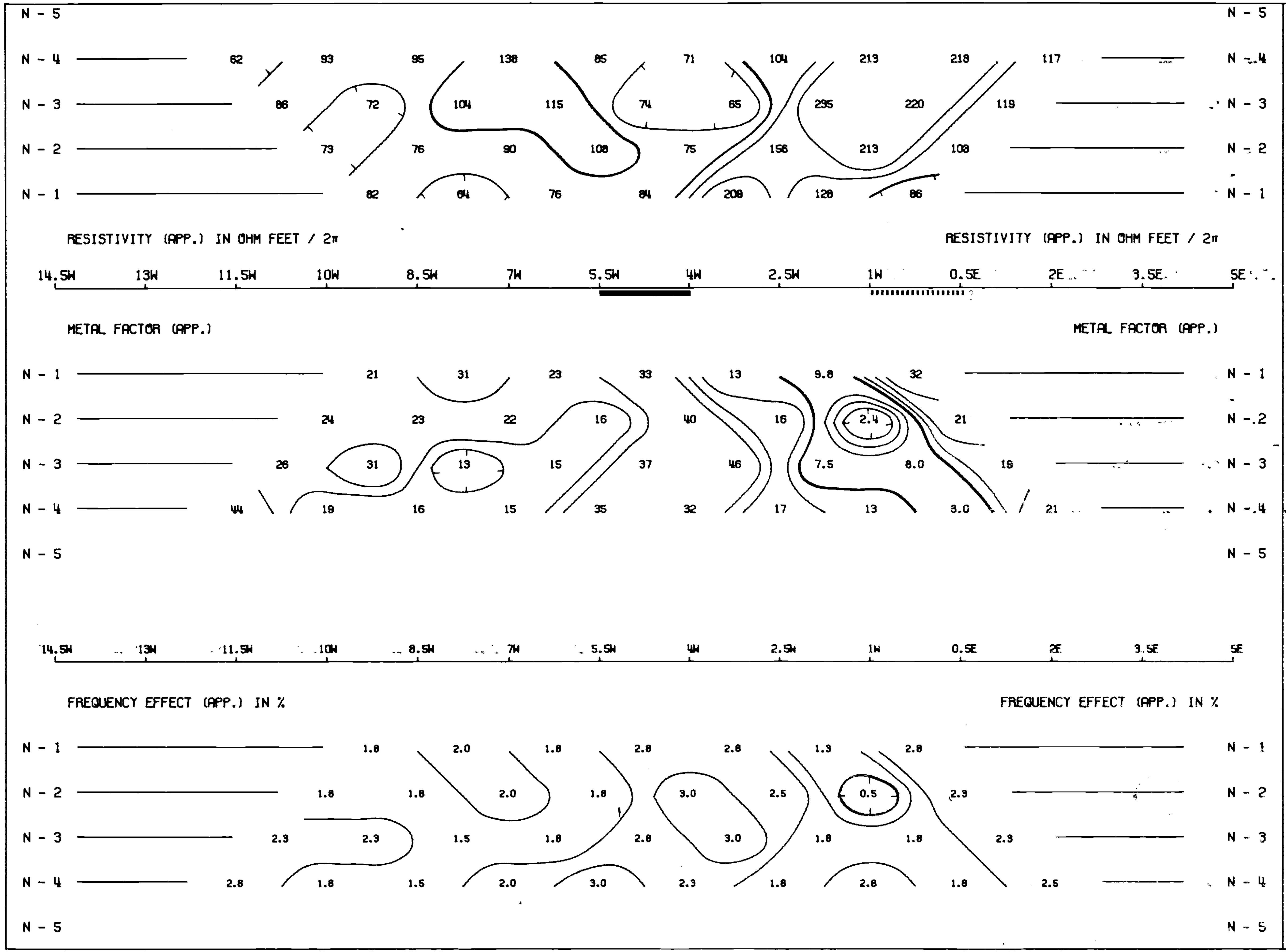
DATE: Sept. 29th '70

1824(11)-27

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER



DWG. NO.- I.P.-5526-27

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 9S

ELECTRODE CONFIGURATION

X NX X

V I

PLOTTING POINT X = 150'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: PH

DATE: Sept. 25th '70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11)-28

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

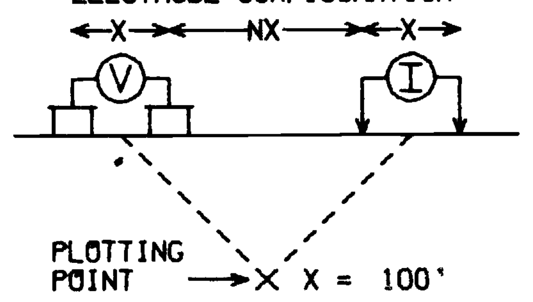
DWG. NO.- I.P.-5526-28

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 9S

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: DEC 1969

APPROVED: PH

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

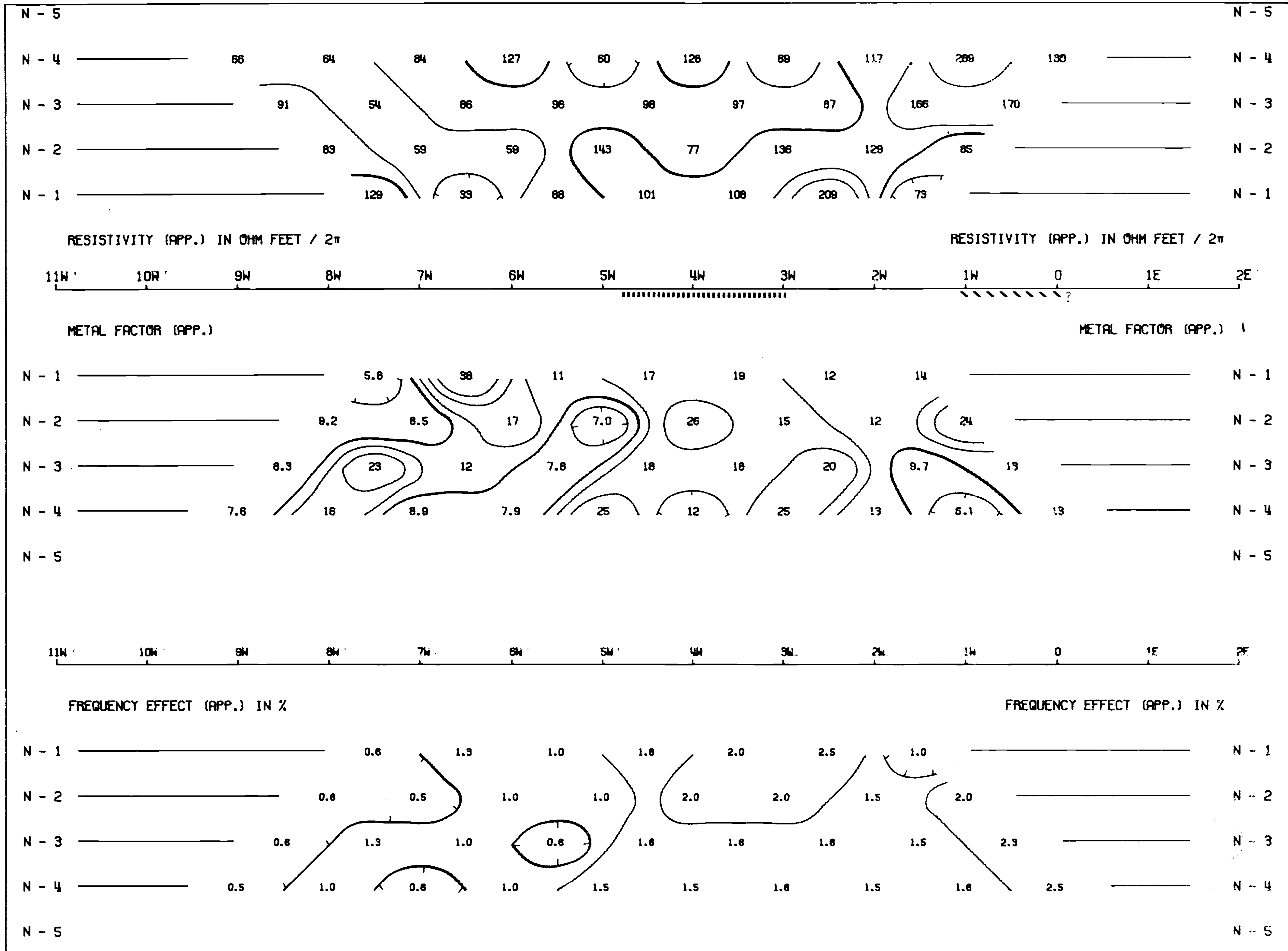
DATE: Sept. 29th '70

1824(11)-29

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER



DWG. NO.- I.P.-5526-29

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO:- 10S

ELECTRODE CONFIGURATION

X NX X

PLOTTING POINT X = 100'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED:

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

DATE: Sept 25th '70

1824(11)-30

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

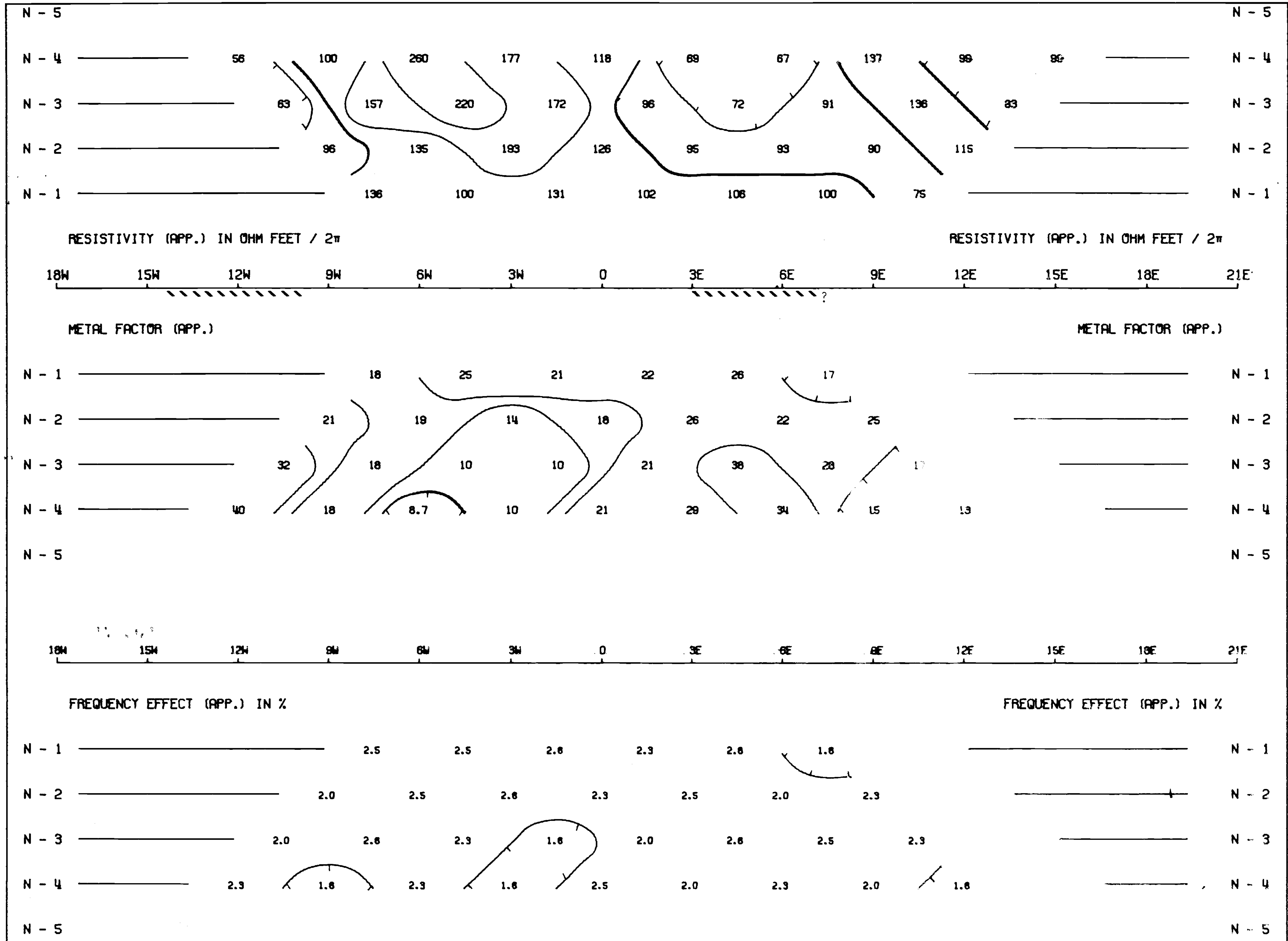
NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-30

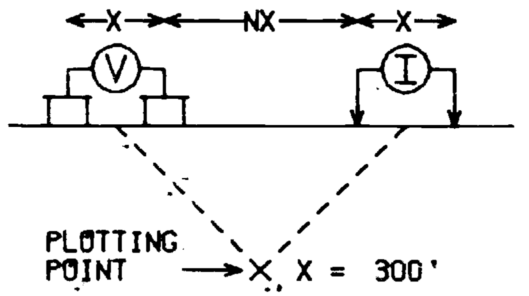
STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 12S



ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: APR 1970

APPROVED:

DATE: Sept. 25th '70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11)-31

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-31

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 12S

ELECTRODE CONFIGURATION

PLOTTING POINT X = 200'

SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: PH

DATE: Sept. 29th '70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(II)-32

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-32

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 12S

ELECTRODE CONFIGURATION

X — NX — X

PLOTTING POINT. X = 100'

SURFACE PROJECTION OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: APR 1970

APPROVED: [illegible]

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

DATE: Sept 25th '70

1824(11) - 33

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

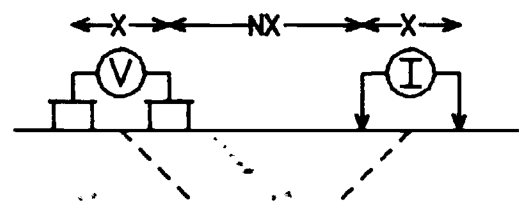
DWG. NO.- I.P.-5526-33

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 14S

ELECTRODE CONFIGURATION



PLOTTING POINT X = 200'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED:

DATE: Sept 25th '70

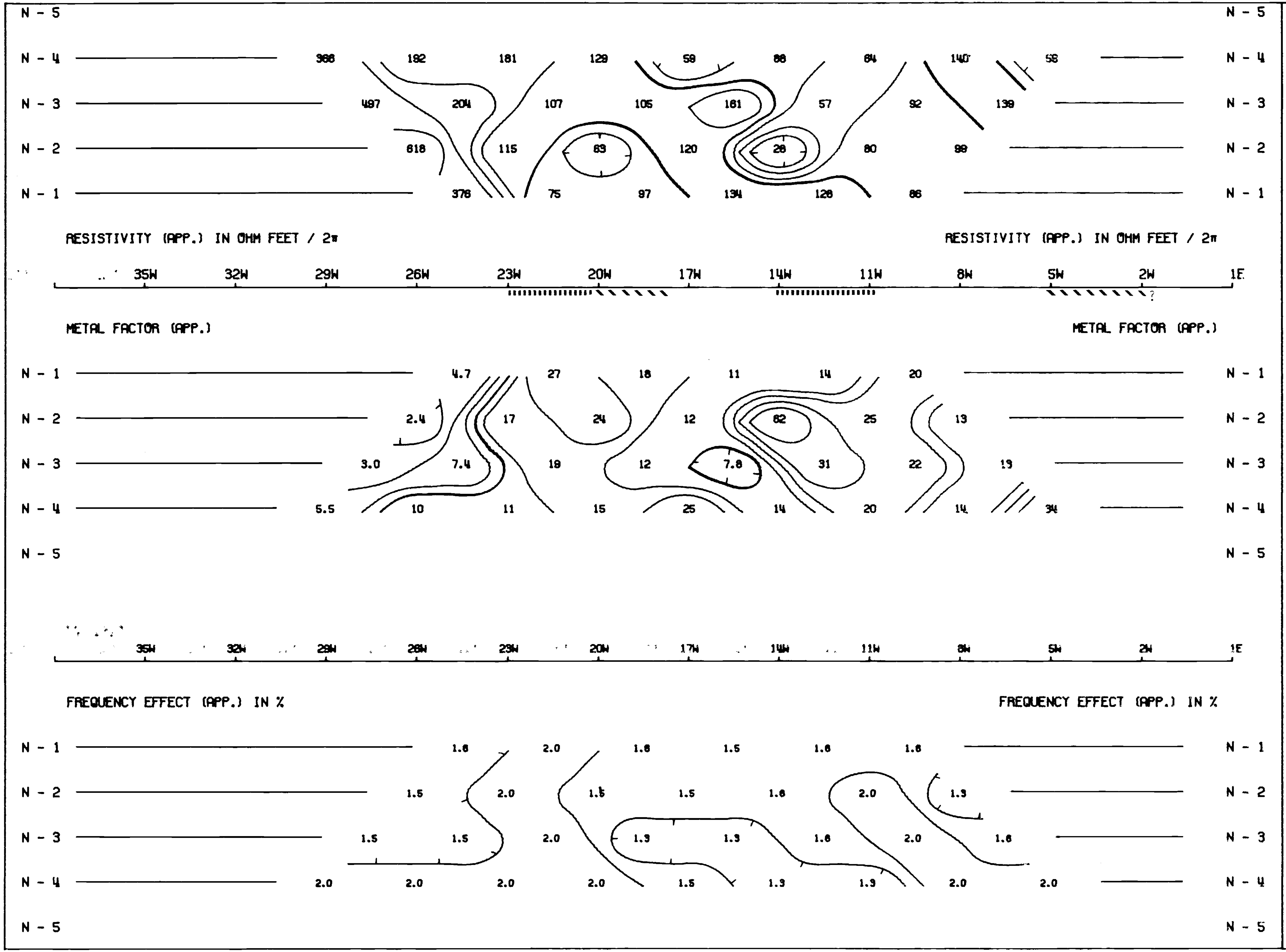
NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(H)-34

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER



DWG. NO.- I.P.-5526-34

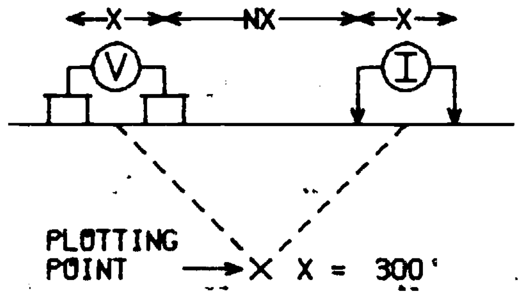
STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER

SOUTH AUSTRALIA

LINE NO.- 16S

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: PH

DATE: Sept 25th '70

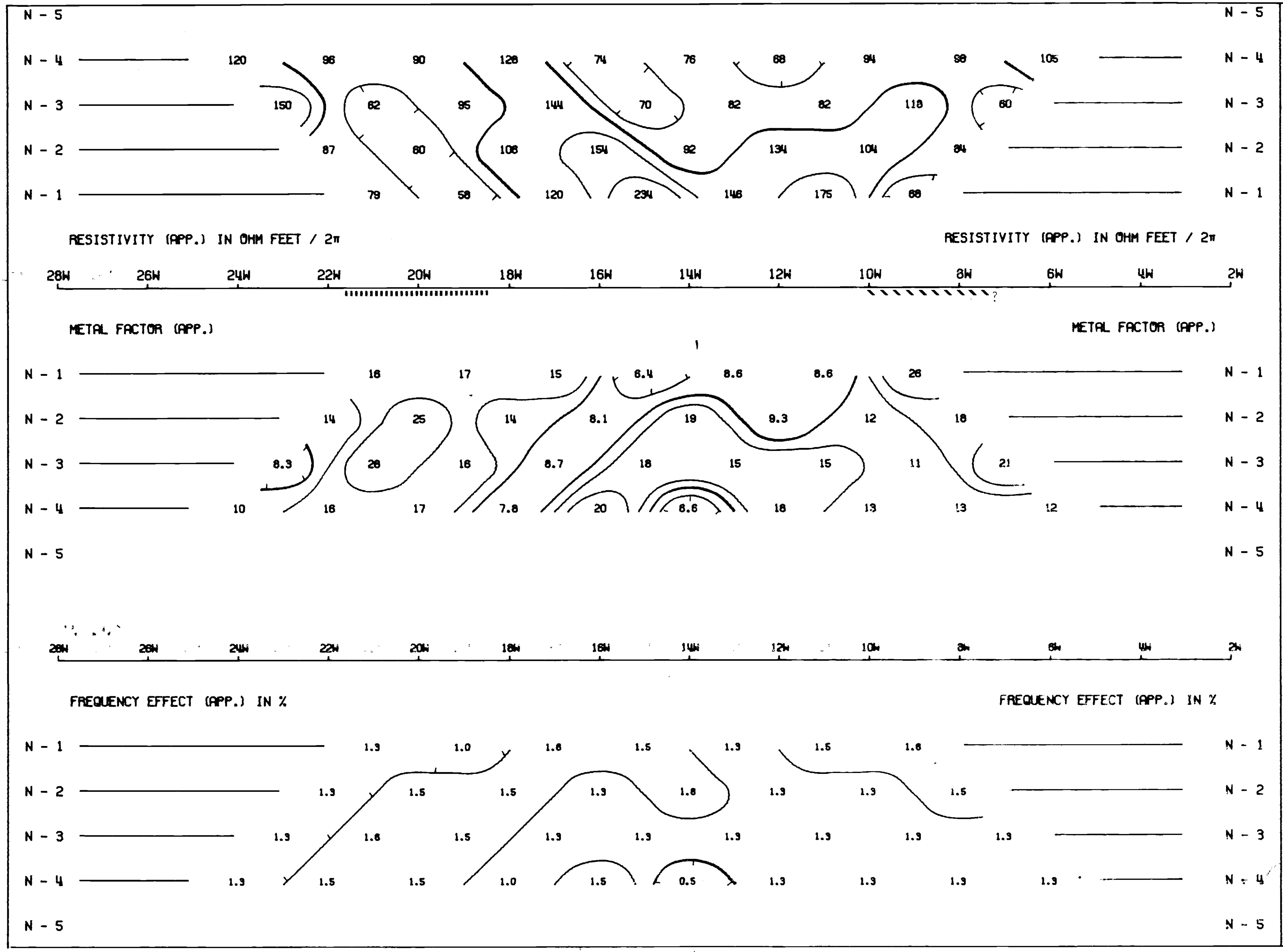
NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11)-35

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER



DWG. NO.- I.P.-5526-35

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 16S

ELECTRODE CONFIGURATION

X = 200'

PLOTTING POINT

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: PH

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

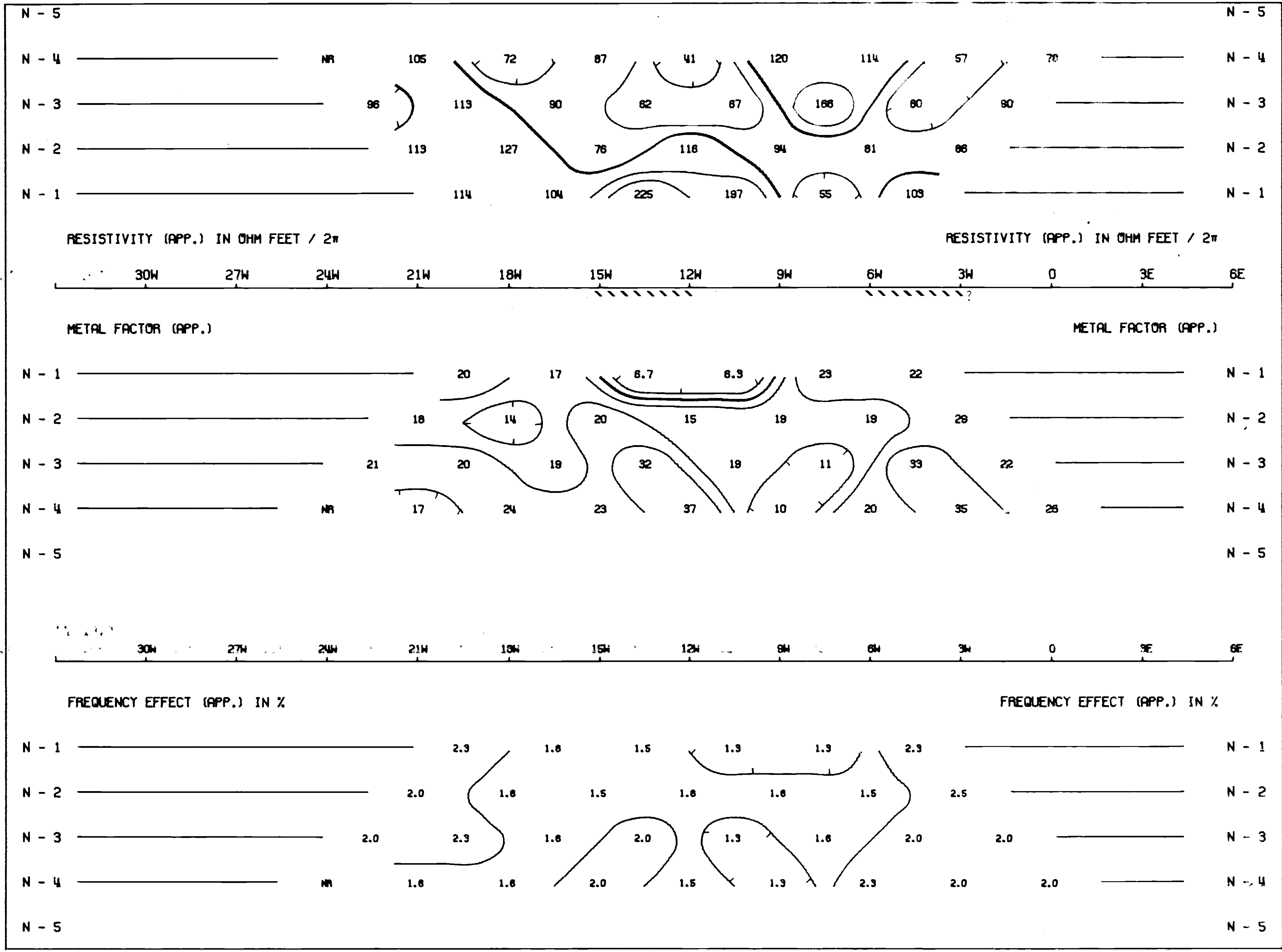
DATE: Sept. 25th '70

1824(11)-36

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER



DWG. NO.- I.P.-5526-36

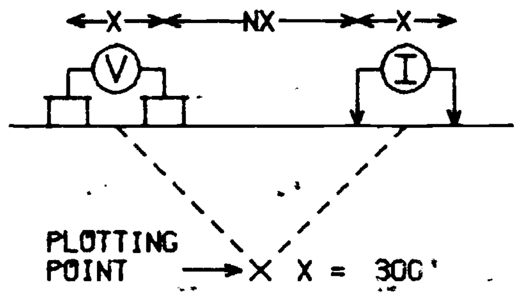
STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER

SOUTH AUSTRALIA

LINE NO.- 18S

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: PL

DATE: Sept. 25th. '70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11)-37

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5536-37

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 18S

ELECTRODE CONFIGURATION

X — NX — X

PLOTTING POINT → X = 200'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED:

DATE: Sept. 29th '70

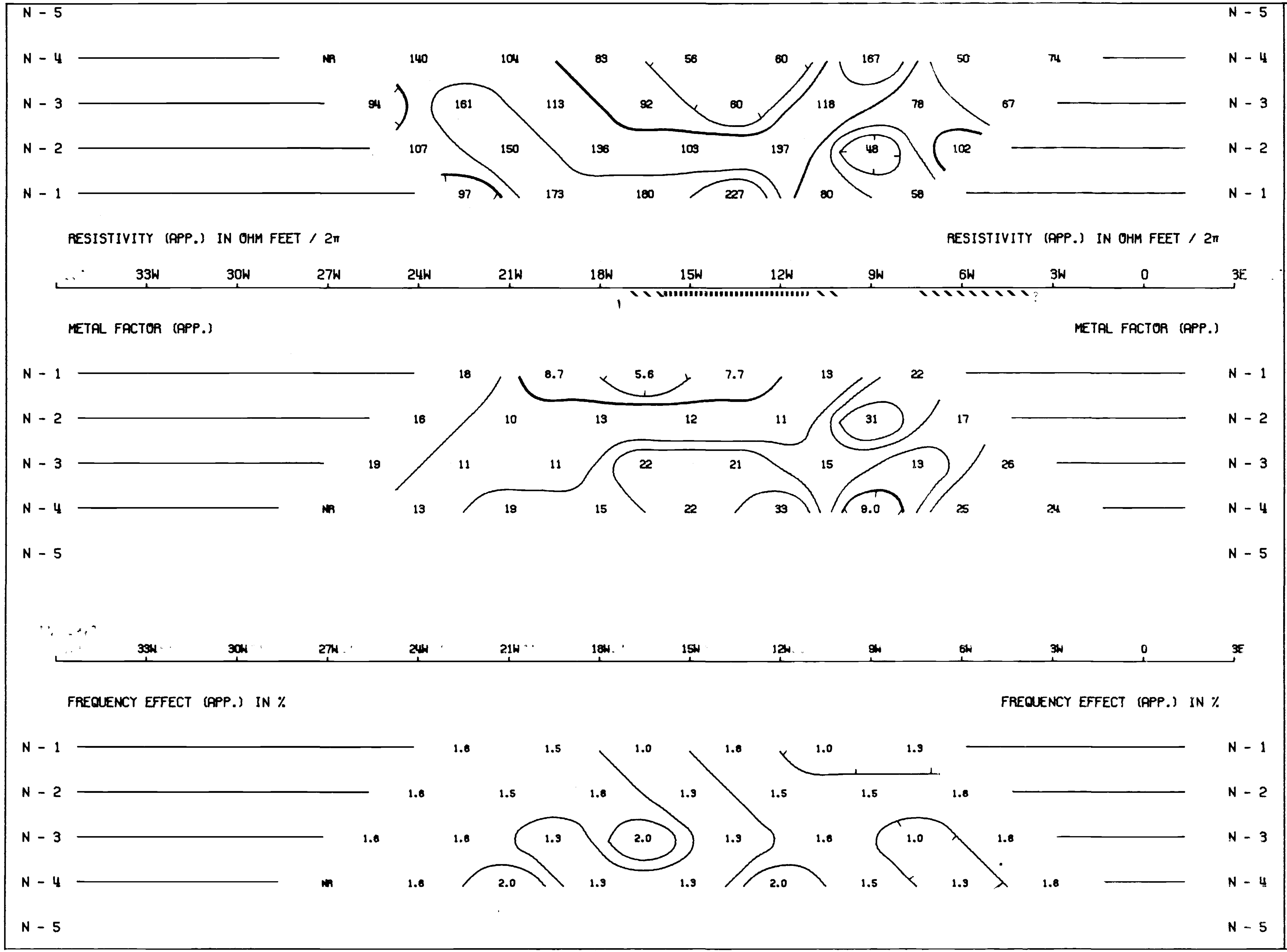
NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

1824(11)-38

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER



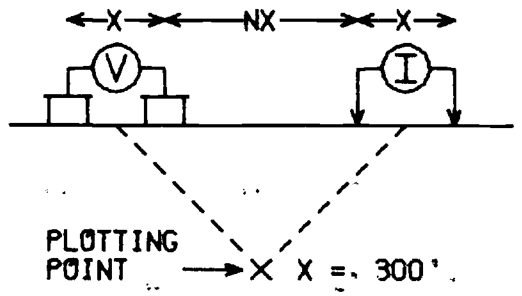
DWG. NO.- I.P.-5526-38

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 20S

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUL 1970

APPROVED: PH

DATE: Sept. 25th. 70

NOTE: CONTOURS AT LOGARITHMIC INTERVALS
1.-1.5-2.-3.-5.-7.5-10

1824(11)-39

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

DWG. NO.- I.P.-5526-39

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

KITTICOOLA GRID, PALMER
SOUTH AUSTRALIA

LINE NO.- 20S

ELECTRODE CONFIGURATION

PLOTTING POINT

X = 200'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.31-2.5 CPS

DATE SURVEYED: JUN 1970

APPROVED: PH

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1.-1.5-2.-3.-5.-7.5-10

DATE: Sept. 25th '70

1824(11)-40

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

NOTE: THIS PLOT WAS PRODUCED WITH AN IBM 360/75 COMPUTER AND A CALCOMP PLOTTER

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KITTICOOLA MINES LIMITED

EXPLORATION REPORT

THE GEOLOGY OF THE KITTICOOLA

CU, AU MINE, PALMER, S.A.

R. BARRETT & L. NIXON

L.G.B. NIXON & ASSOCIATES

038

KITTICOOLA MINES LIMITED

EXPLORATION REPORT

ON

THE GEOLOGY OF THE KITTICOOLA CU, AU MINE, PALMER, S.A.

BY

R. BARRETT & L. NIXON

L.G.B. NIXON & ASSOCIATES

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ATTACHMENTS (CONTINUED)	SCALE
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4. KITTICOOLA MINE Subsurface geology Adit level No. 1 and level 10' below KITTICOOLA GOLD MINES N.L.	1" = 40ft.
5. KITTICOOLA MINE Subsurface geology. Adit level No.2 and No.2 stope KITTICOOLA GOLD MINES N.L.	1" = 40ft.
6. KITTICOOLA MINE Subsurface geology FLYING FOX ADIT (Adit No.3) KITTICOOLA GOLD MINES N.L.	1" = 40ft.
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11. STURTS MEADOWS PROSPECTING SYNDICATE N.L. Geology of Kitticoola Mine 420' level	1" = 20ft.

KITTICOOLA MINES LIMITED

EXPLORATION REPORT

ON

THE GEOLOGY OF THE KITTICOOLA

CU, AU MINE, PALMER, S.A.

1. SUMMARY

OBJECTIVES

This study was carried out to detect and map lode occurrences and ore controls in the Kitticoola mine area. A combination of present and past investigations was to be used to select areas of interest in which future mining or exploratory work could be directed. The objective was to locate, if possible a lode with reserves of 20,000 tons averaging 2% copper. Exploratory drilling beneath the 420' level is suggested.

Work Carried Out:

The work carried out included detailed underground mapping of those geological features which might have influenced lodeand ore development. Mapping was completed in the seven accessible adits and levels within the mine area. Surveys of these workings was necessary due to lack of plans and cross sections or inaccuracy or obsolescence of previous plans and cross-sections. Surface work was carried out where necessary to relate surface features to underground work and obtain a clearer picture of the mine geology. Research into previous investigations and results was then carried out so that areas of special interest could be determined. Geophysical work consisted of a number of traverses using a Geonics VLF-EM unit over portions of the existing I.P. grid. Only one minor anomalous area was located.

Findings:

Some of the lode occurrences in the Kitticoola mine area were found to be different from those shown on existing surface maps. Neither the Masterman nor the Baker lodes appear to be continuous instead, a series of swells occur, which are separated by pinched sections. Two lode occurrences were found which do not appear on previous maps. These are similar to the SW striking lodes such as Ansteys and Cottage, but occur to the East of the Masterman-Baker lode systems.

Structure is the main ore control, the lodes occur in shear zones and in most cases appear to be terminated either by younger flatter dipping shears or vertical faults. The mineralization and thickness of lodes, their attitude and their position as well as smaller scale features appear to be controlled by the topology of the fractures. Folding has very little to do with lode control or ore development. Most of the lodes which have been mined are worked out, or are doubtful propositions for future development. The Masterman lode has been worked out to a depth of 420ft. and any future development would have to be at greater depths. The Anstey lode which has not been developed to the same extent may still contain small amounts of ore. Most of the other lodes in that area are relatively small, but some which have not been worked do not appear to have been checked, to any extent, for mineralization. Previous investigations including geophysical and geochemical exploration and diamond drilling, in the mine area failed to locate significant mineral-isation.

Continuation of mining operations on present known ore occurrences would not be profitable. Further exploratory drilling could be carried out on the eastern side of Reedy Creek, and down the plunge of the main ore shoot. These areas of interest have not been previously tested.

There are no records of diamond drill holes being constructed to test the wider ore lens beneath the 420 level and this is one obvious drilling target.

2. INTRODUCTION

Location:

The Kitticoola Mine (also known as the Reedy Creek, Tungkillo, New Reedy Creek, Old Reedy Creek mine, or Great Wheal Oxford) is located on the Eastern Slopes of the Mt.Lofty Ranges. It lies about 2 miles SSW from the township of Palmer and 43 miles by road from Adelaide, in County Sturt, the Hundred of Tungkillo and Section 960.

Topography: Mine workings occur on both sides of Reedy Creek which forms a broad steep sided valley through bare, rounded hills. The Palmer fault scarp lies a few hundred feet to the east of the mine. The hills rise to a height of about 300ft. above Reedy Creek and have a thin, rubbly soil cover which leaves low, but fairly widespread sub-outcrop.

History and Ownership: The Australian Mining Company was formed in 1845 to work the mine and operations continued from about 1846 till 1852 in the Tungkillo or Reedy Creek Mine. The Reedy Creek Gold Mining Syndicate worked the mine from 1890 until 1891-2 when the New Reedy Creek Mining Coy. was formed and worked the mine until 1897. Since 1908 the mine has been worked by the Port Lincoln Coy. and more recently by Kitticoola Gold Mines N.L. This was a joint venture by Paruma Mines and John McIlwraith Pty. Ltd.until the former's half share was bought by Sturts Meadows Prospecting Syndicate N.L. In mid 1970 Sturts Meadows obtained the other half share and continued operations under the name of Kitticoola Gold Mines.

Previous Investigations, Exploration and Results:

Studies have been carried out on a regional scale by Rattigan and Wegener (1952); White (1956,66); and White, Compston and Kleeman (1967). A summary of exploration carried out in the mine area is included in a report by R.W. Fidler of McPhar Geophysics Pty. Ltd. (January, 1971).

A summary of the results from these investigations follows:-

i) Mining & Prospecting

Early exploration in the Kitticoola area consisted mainly of driving on outcropping lodes. Some costeans were dug on the hills prospecting for extensions to the lodes. A total of about 3000ft. of driving on seven levels has been carried out on the Masterman lode and four adits totalling at least 1000ft. on the Anstey lode.

ii) Drilling

A limited programme of exploratory diamond drilling was done by the Mines Department between 1935 and 1938. This programme consisted of drilling 6 holes totalling 2000ft. constructed to test the southern extension of the Back, Ansteys, Baker and Masterman lodes, and in the last three cases, for down dip extension of the lodes. Holes 1, 3 and 6 failed to intersect the anticipated lodes, and the others intersected minor mineralization in the target areas. In 1970 Westgate Drilling Coy. drilled four holes, again with little success. Hole 1a, was constructed to test the down dip extension of the Back Lode; Hole 2a to test the extent of mineralization found in a test shaft; Hole 3a to test a definite I.P. anomaly; Hole 4a to test a possible I.P. anomaly. In all cases minor copper mineralization was found in the target areas but none was of interest for mining operations.

Underground drilling from the 360ft. level was carried out by Kitticoola Mines in 1970 under the direction of McPhar Geophysics Pty.Ltd. Operations ceased after five holes had been drilled due to poor recovery and high bit wear caused by the brecciated quartz lode. In all cases the holes were drilled from the lode into the hanging wall granite. Although copper occurred in promising quantities in the remaining lode, in Holes KH.2 and KH.3, there was very little copper in the adjacent lode. In hole KH.5 copper mineralization was found disseminated in the granite rather than the lode. Once again results were generally discouraging.

iii) Geology and Geochemistry

R.L. Thompson (1970) did geological mapping, petrographic and geochemical work in and around the mine area for his Honour B.Sc. thesis. This included geochemical soil analysis using Atomic Absorbtion Spectrophotometry. Although copper gave the clearest and most meaningful geochemical results the anomalies only occurred over known mineralized zones. The geochemistry of the ore material has been examined spectrographically to determine the economic potential of minerals other than copper and gold. A wide range of minerals were found to occur, but always at sub-economic levels.

iv) Geophysics

McPhar Geophysics Pty. Ltd. carried out Induced Polarization (I.P.) and Resistivity Surveys on the Kitticoola Grid in 1970. The anomalous zones were very weak, in general, and only two could be described as definite anomalies. One occurred over mine workings and may have been influenced by mining equipment. Drilling has shown that the other definite anomaly and more possible anomalies are due to minor sulphide mineralization developments and does not give encouragement for further testing.

Previous detailed underground geological mapping was done by R.W. Fidler of McPhar Geophysics and on the 300; 360; and 420ft. levels.

PRODUCTION	Recorded production	1971
Copper:-	No published records	
Gold:-	No published records	

3. EXPLORATION

Work Program: Current underground mapping was carried out on three levels and in four adits, mainly on the east side of Reedy Creek. The levels mapped were the 240ft. level, the 300ft. level and the level 10ft. below the Montefiore Cross Cut, the other workings being inaccessible due to flooding or rock fall. The adits mapped on the east side of Reedy Creek are allon the Anstey lode, these include the Flying Fox adit (adit 3), the adit running into the east bank of Reedy Creek from the road, (adit 2) the adit immediately above and forming part of a stope from adit 2 (stope 2). The adit running into the west bank of Reedy Creek, directly opposite adit 2 (adit 4) was also mapped. In all cases new or amended plans of the workings were drawn for this report.

In all cases the geological features in the back (roof) of the workings were mapped, projected to waist level and plotted onto these plans. Limited surface mapping was concentrated on the east side of Reedy Creek and in the area of lode outcrop. It consisted mainly of plotting positions of lodes, and where possible fractures, in order to correlate surface and underground features. Cross sections were drawn on grid lines 1 to 10 south since these passed through underground workings. Comparisons were made with previous exploration results at Kitticoola to evaluate previous findings with current assessments.

Controls on work done: The work done underground was restricted by the inaccessibility of many of the levels. No access was found to levels above the 240ft. level and the 360ft. and 420ft. levels were flooded. This restricted the possibilities of correlation between the levels to a considerable extent. The dust coating on the adit and level walls masked geological features especially in high backed sections, and extensive timbering in some levels had the same effect.

Orientation of the Work: The work carried out was orientated to structural interpretation in order to determine ore controls and to detect, if possible, any previously unknown lode occurrences. As lode occurrence is obviously controlled by structure, this has an important part in the work carried out. Other factors such as rock alteration which might have affected ore and lode development were also noted.

4. PRODUCTION METHODS

Mining: Mining at Kitticoola has been done underground, mainly by driving on the ore face. In the upper levels open stoping has been used to mine the ore, and some shrinkage stoping has been carried out in ore in the lower levels.

Concentration: Two types of copper ore occur at the mine viz. the Chalcopyrite - hematite- milky quartz ore and the altered ore, which contains copper carbonates. The sulphide ore is concentrated by wet grinding and floatation. Several different hematite depressing agents have been tried at the mine, without great success. The carbonate ore is crushed and concentrated by leaching in sulphuric acid. The concentrates are sold in that form after shipping to Port Kembla.

5. GEOLOGY

GENERAL GEOLOGY:

Regional Geology: The Regional Geology of the area is outlined in the Adelaide Sheet of the Geological Atlas 1:250,000 series and the area surrounding the mine is described by Thompson in his thesis (1970), and is summarised follows

The main rock types in the area are the Palmer Granite (Rb/Sg dating; 490 $\pm$ 15 my - White 1967) which is associated with megmatites, high grade schists and gneisses, and Kanmantoo Meta-sediments (Lower Paleozoic-Johnson 1965) which, in this region, consist mainly of quartzo-feldspathic schists and gneissics, with calc silicate rocks and marble near the base and the Nairne Pyrite Formation high in the sequence. The granite occurs in the eastern limb of a broad syncline which plunges at about 25°SSW. The Palmer Fault zone, which runs north-south immediately to the east of the Palmer Granite in this area is probably a Paleozoic feature which has experienced movements in the Tertiary (Fenner 1930).

Geology of the Mine Area: In the actual area of study, the rock types encountered were dominantly granite and quartz lode. Some schists, gneisses and minor migmatites were encountered during surface work, near the Back Lode. Thompson gives detailed macroscopic and microscopic descriptions of the various rock types and their alteration in his thesis. Some of the following summary particularly on the microscopic properties of the granite and lode are based on his work.

The Palmer Granite is the only host rock type encountered in the workings studied. It is intensely shattered, especially to the east of Reedy Creek, where it is closer to the Palmer Fault Zone. The granite is generally medium to coarse grained, and fairly massive, but becomes quite fine-grained in the transitional contact zone with the metasediments. The granite consists of quartz, pinkish microcline and palgioclase which is white to green in colour, depending on the degree of sericitization. Microscopic examination by Thompson (1970) revealed the presence of muscovite, replacing biotite and an approximately equal abundance of microcline and plagioclase. Thompson suggests that the granite is best described as an altered adamellite.

The mine area lies in a zone of kaolinite and sericite alteration within the granite. The intensity of this alteration appears to increase close to the lode and shear zones. Although the occurrence of true kaolinite has not been definitely proven most evidence suggests it is. The granite in the adit on the west bank of Reedy Creek was generally much less altered and this may be an indication of a gradational decrease of alteration towards the centre of the Granite. Thompson op.cit.suggests a sequence of alteration as follows: Kaolinization of potash feldspar followed by Sericite replacement of plagioclase and kaolinite and then by formation of quartz and carbonate veins which cut both kaolinite and sericite. In places on the eastern side of Reedy Creek, especially near the lode, the granite is altered to the stage where it consists of quartz gravel in a crumbly light green mass of sericite and kaolinite.

The lode itself consists usually of granular sulphide aggregates in a gangue of milky buck quartz and ankerite. In places the quartz is clearer and darker, and in such cases contains very little fine-grained sulphide at best. The mineralization consists of chalcopyrite, pyrite, specular hematite and, perhaps, some bornite. The specularite, which occurs throughout the granite as well as the lode, occurs in two forms, i) either as a fine network or ii) as a mass of coarser grains. The quartz occurs either as hexagonal prisms or as finer mosaics of anhedral grains. The sequence of mineralization is not clear as mineral relationships are complicated and variable. Although Thompson has suggested a sequence of deposition he admits that it is an oversimplification. He also notes that the relatively low pyrite content of the ore, and the presence of specularite indicate a sulphur poor ore forming solution. The occurrence of specular hematite and ankerite in the lode may be due to contamination of the ore forming fluids by the marbles and calc silicates which occur near the base of the metasedimentary sequence.

The oxidized lode consists of quartz of both types, limonite, copper carbonates, disseminated gold and in places native copper. Where the lode has been partially oxidized it consists of chalcopyrite, pyrite, carbonates, specularite and quartz, with boxwork structures after chalcopyrite (Thompson 1970).

The lodes occur along two fracture systems, one striking about SW and dipping at an average of about 40°N, on which the Hagen, Anstey, Cullingworth and Cottage lodes occur. The other fracture system runs approximately S-SSW and includes the Horne, Masterman, Baker and Back lodes, with an average dip of about 50°N. Another fracture system dipping generally at a lower angle than the lodes has a strike approximately the same as the second of the above fracture systems, and cuts the other lode systems. These structural elements may be related to the major Palmer Fault.

<u>Ore Controls</u>: The lodes occur in three main forms, namely, i) massive buck quartz with sulphides, ii) banded lode or iii) brecciated lode. The banding in the banded lode is attributed to variations in the type of quartz, changes in the specularite concentration the occurrence of granite lenses or differences in the ankerite percentage. The main ore minerals associated with this type are sulphides and/or carbonates, and the specularite content is usually fairly high. The brecciated lode occurs as a mass of blocky quartz fragments, usually with carbonates and sometimes (especially where oxidized), gold and native copper. Lode also occurs as narrow stringers in altered granite, and in places these stringers contain quite high percentates of chalcopyrite, although the overall grade would be low. The different lode types are not necessarily separate, and may occur in different zones in a single cross section. The lodes observed in this study all occurred entirely within granite (although the Back Lode, which was observed on the surface only, appears to run along the eastern edge of a lense of quartzofeldspathic schistose country rock included in the granite). Variation in the host rock was in the form of variations in grain size, extent of alteration and extent of brecciation. The grain size of the host rock appeared to have little effect on the ore content of the adjacent lode, and did not show a great deal of variation from a medium size in any case. Where the granite contained larger grains,

especially of feldspars there was no apparent change in lode type or ore occurrence.

The extent of alteration of the lode and granite appeared to be related to the occurrence of the shear zones in which the lode occurs. Because it is related to the shear zones, and not necessarily the lode itself it is not a clear indicator of lode occurrence. The only other control which is not clearly related to structure is the variation in the form of the lode from massive to banded, with the tendency for the massive white quartz to contain better sulphides.

STRUCTURAL CONTROLS OF LODE: The attitudes of fractures in the mine area influences the extent of lode development, the position and orientation of the lode, the extent of alteration and brecciation of the lode and wall-rock, and because of this, the type of ore which occurs in the lode and the concentration of ore within the lode. Faulting is by far the major structural element in the mine area, with folding taking little or no part in determining the occurrence of lode within the granite. The most basic structural control in the mine area is that the lode has formed along old shear zones within the granite. This is especially clear in the Masterman lode where the lode occurs as a band or bands parallel to and within an intensely fractured and altered zone at least six feet wide and probably much wider. These zones contain shattered kaolinised granite, often altered to clay, sericite and quartz gravel. The overall fault zone is generally a breccia type, but is cut by numerous narrower fractures along which gouge is developed. In the sections of Masterman lode observed, the dip of these shear zones, and of the lode within them was quite constant. This is not the case on the Anstey lode, however, as the shear zone and associated lode form a series of steps dipping step like at varying angles towards the NNW. Generally the steeper portions of these steps are longer than the horizontal or near horizontal sections and the dips vary from $50-60^{o}$N, on the steep sections, to horizontal in the flatter dipping zones.

The lode thickness is controlled in some places by the attitude of the fracture, that is, the strike and dip angle. From observations in adit 2 it would appear that a pronounced thickening of the lode from 3-4ft. to 5-10ft. occurs as the lode flattens off. This thickening does not appear to occur in flatter sections above this, however, so this may not general feature since, if it was,it would fit in with the development expected where the relative movement was east side down as on the Palmer fault and some faults in the mine area. The ore development within the lode does not appear to follow this pattern, as mineralization appears to be greatest in the steeper portions where the lodes have been stoped while in the flatter portions the lodes have been neglected.

It is noted that no intersections of the two lode systems has been reported by previous workers. All westerly striking lodes are shown terminating well before they reach the northerly trending ones. The terminations as observed by the writers are by later faults but as there is no sign of any intersections on the Masterman lode it would appear that the lodes do not intersect it. This could be explained if the more westerly striking shear zones were earlier than and were truncated by the more northerly striking ones.

The later faulting mentioned above occurs on a series of planes striking very nearly parallel to the Masterman and Baker lodes, but branching to the south. This causes dislocation of the more northerly trending lodes by faults cutting across the lode at a low angle, causing a tapering effect. These faults cut the Anstey lode, but at a high angle and are responsible for terminating it. They tend to develop gouge on the fracture plane with brecciation between some of the larger fractures and are responsible for most of the brecciation of the lode. Alteration is frequently found along these shear zones, this is especially noticeable near the ends of workings where lode is narrowing on converging fractures and the lode is often found to be highly brecciated and altered. The reason for this effect is probably that the fault zones form good channelways for hydrothermal solutions and for oxygen circulating surface waters. The fault pattern appears to be converging on the Palmer Fault zone in a northerly direction and it is possible that movements on the faults were related to movement on the Palmer Fault. The locations and occurrences of some lodes mapped in this survey were different from those shown on previous maps of the area. The "lodes" shown on many earlier maps are really shear zones in which lode occurs and some lodes mapped at the surface in the present survey in the mine area, are not shown on existing maps. One of these, which lies along line 8.S to the east of the main shear zone may be the surface expression of the southern end of the north-south lode exposed in No. 3 Adit. Another lode further to the south but also on the eastern side of the main N-S shear zone appears to be possible extension of the Anstey lode. Generally lodes occur as discontinuous lenses, although the Masterman lode is continuous over a distance of about 300ft. and Anstey's lode is continuous for   feet, (underground at least), along the length of adit 4 and most of adit 2 (and stope 2) and may extend further east than do the workings. The Masterman lode is terminated by a roll on a plane striking at 10^{0} (magnetic) exposed on the edge of one of the large pits near the Masterman shaft. Anstey's lode is terminated at its eastern end, in Adit 3, by a shear zone striking at $213\frac{1}{2}^{0}$. The termination of a lode by a fault plane which postdates the shears along which lode occurs seems to be a common feature in the mine area.

Ore Reserves: Very little ore appears to remain in the Masterman lode above the 420ft. level. Extensive stoping of the good ore has left only a few pillars, a thin cover of lode on the walls, and some poor grade material. It would seem that existing reserves on the present levels, would not be of sufficient to warrant mining. Most of the other lodes are either too narrow or too low grade to warrant exploitation.

The Anstey lode still contains plenty of unmined lode material, but most of this is in the shallowly dipping sections which are generally poorly mineralized. Reserves here may be considerable but not at workable grades.

6. FEASIBILITY

The feasibility of continuing mining operations at the Kitticoola Mine, does not appear to be practical. The reserves remaining within the present workings areestimated to be very low in volume and grade. For profitable operations to be started new mineralized areas would have to be found.

7. FURTHER WORK

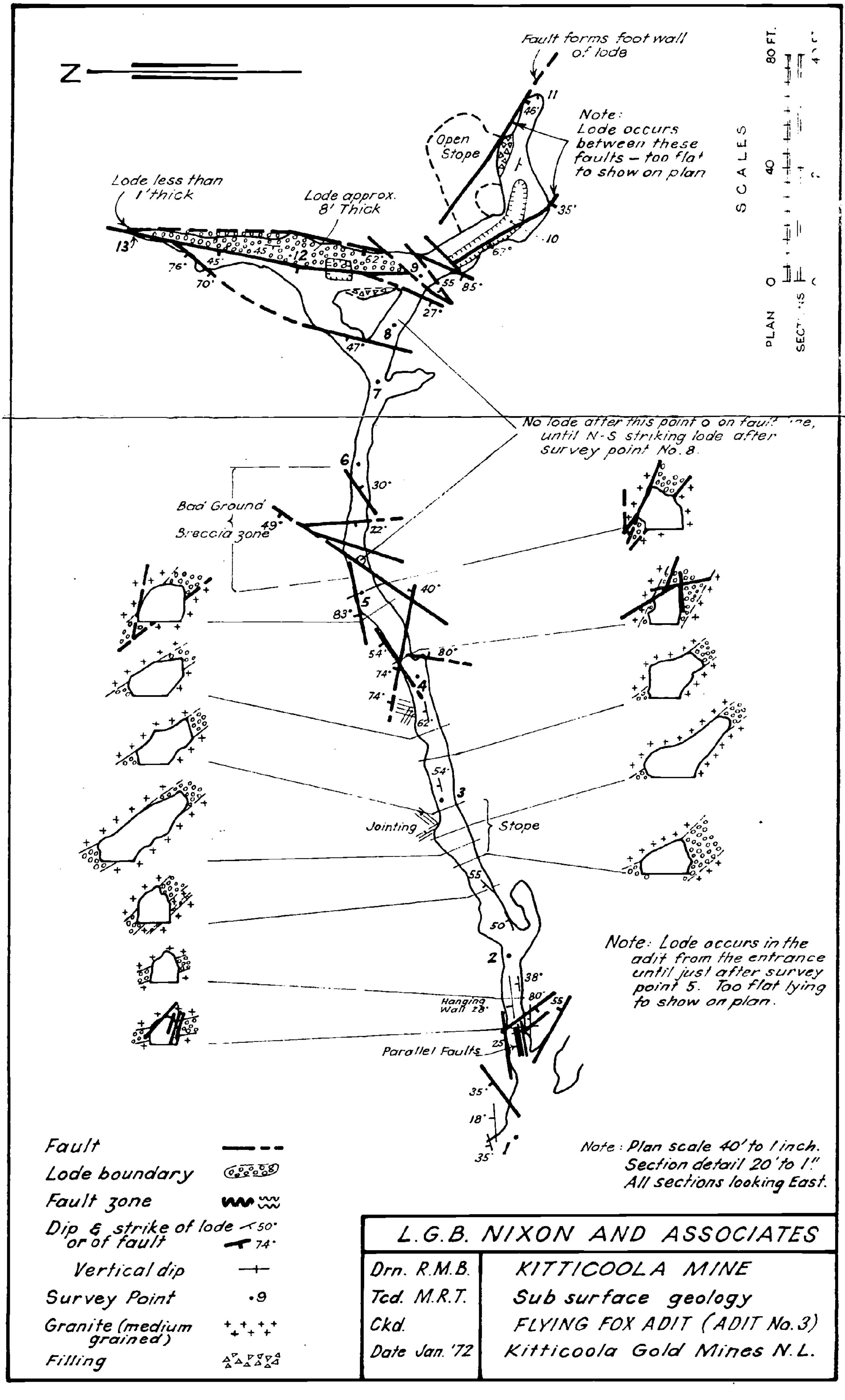
First priority for further work should be given to diamond drilling beneath the 420ft. level of the existing workings. Two diamond drill holes were proposed to test this area by F.E. Hughes in 1955 (see Mining Review No. 98, p. 116) but the holes were not drilled.

This zone appears to be an obvious drilling target and the holes as proposed by Hughes should now be drilled. In addition a third hole should be sunk to the southwest of the other two holes.

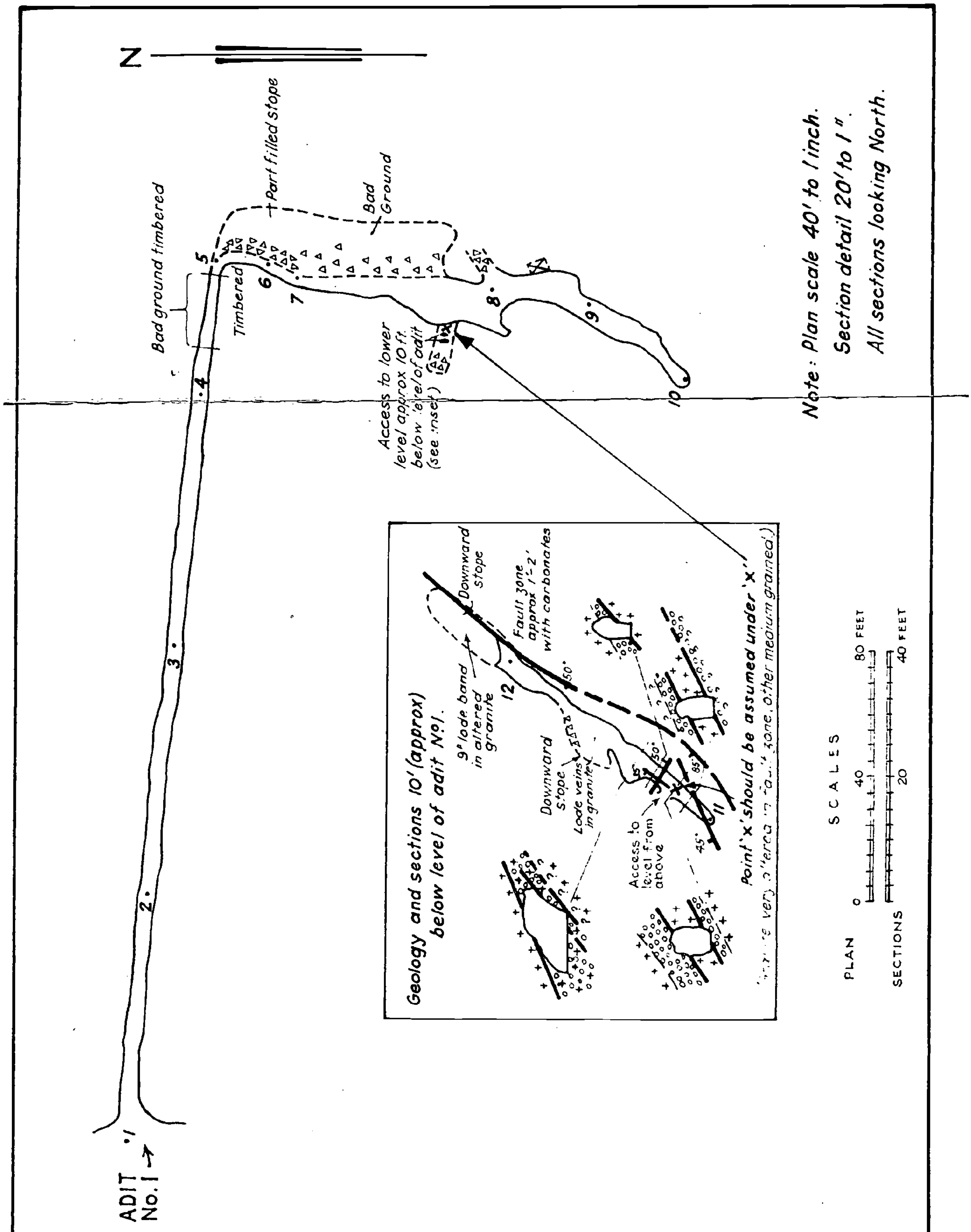
Each hole would be of the order of 500ft. Assuming drilling costs at between $8.00 to $10.00 per foot the anticipated costs are between $12,000.00 and $15,000.00

R. BARRETT & L.G. NIXON
L.G.B. NIXON AND ASSOCIATES

15th February, 1972



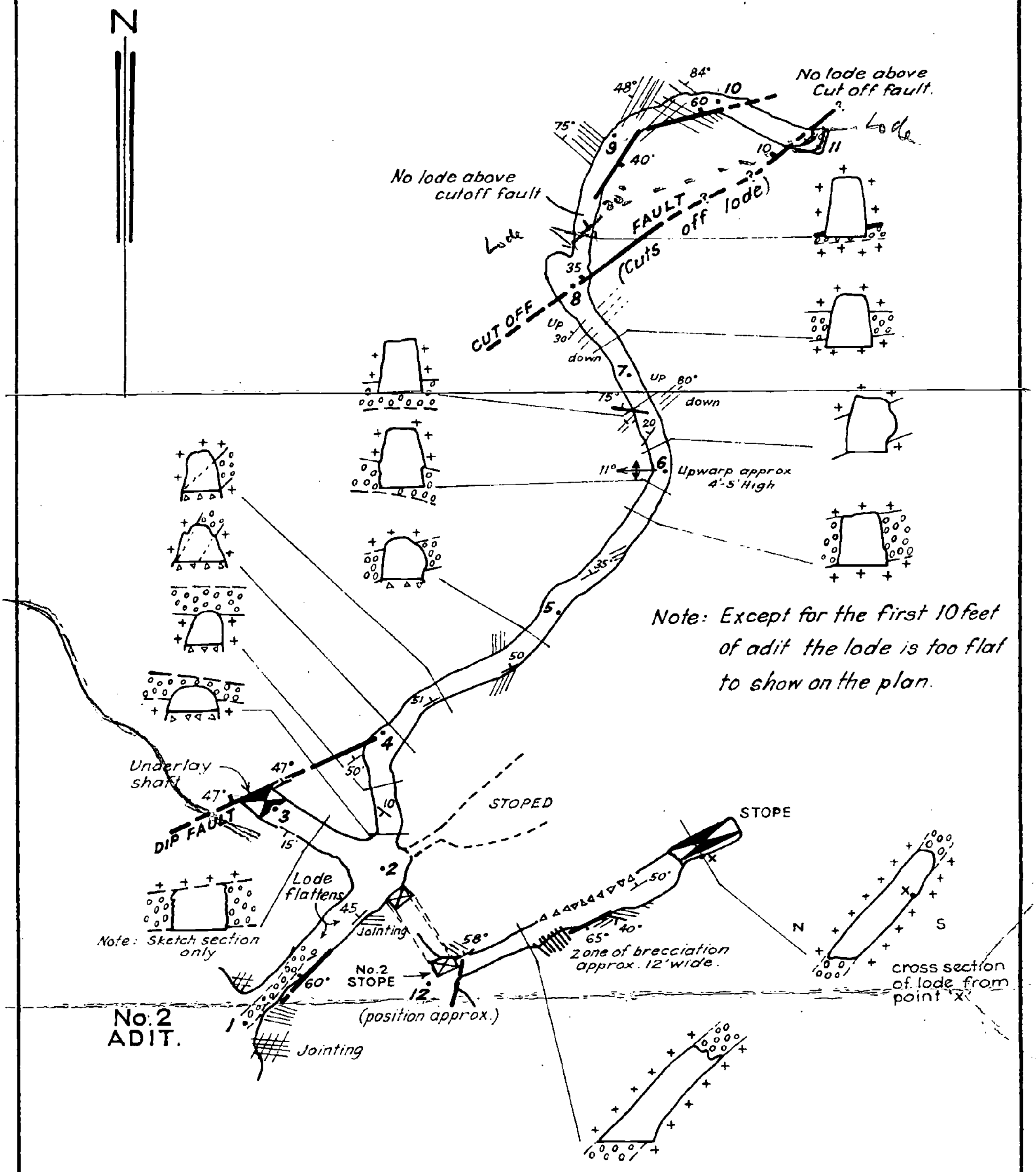
Fault forms foot wall of lode
Note: Lode occurs between these faults – too flat to show on plan
Open Stope
Lode less than 1' thick
Lode approx. 8' Thick
SCALES
PLAN 0 40 80 FT.
No lode after this point o on fault line, until N-S striking lode after survey point No. 8.
Bad Ground
Breccia zone
Jointing
Stope
Note: Lode occurs in the adit from the entrance until just after survey point 5. Too flat lying to show on plan.
Hanging Wall 28°
Parallel Faults
Note: Plan scale 40' to 1 inch. Section detail 20' to 1". All sections looking East.
Fault
Lode boundary
Fault zone
Dip & strike of lode or of fault
Vertical dip
Survey Point
Granite (medium grained)
Filling
L.G.B. NIXON AND ASSOCIATES
Drn. R.M.B.
Tcd. M.R.T.
Ckd.
Date Jan. '72
KITTICOOLA MINE
Sub surface geology
FLYING FOX ADIT (ADIT No. 3)
Kitticoola Gold Mines N.L.



Fault	
Lode boundary	
Fault zone	
Dip & strike of lode or of fault	25° 45°
Vertical dip	
Survey point	•3
Granite	
Filling	

L.G.B. NIXON AND ASSOCIATES.

Drn. R.M.B.	KITTICOOLA MINE
Tcd. M.R.T.	Sub surface Geology
Ckd.	Adit level No.1 and level 10' below
Date Jan. '72	Kitticoola Gold Mines N.L.



Note: Plan scale 40' to 1 inch.
Section detail 20' to 1"
All sections looking North

Legend	
Fault	
Lode boundary	
Fault zone	
Dip & strike of lode or of fault	10, 45
Vertical dip	
Survey point	•9
Granite (medium grained)	+ + + +
Filling	

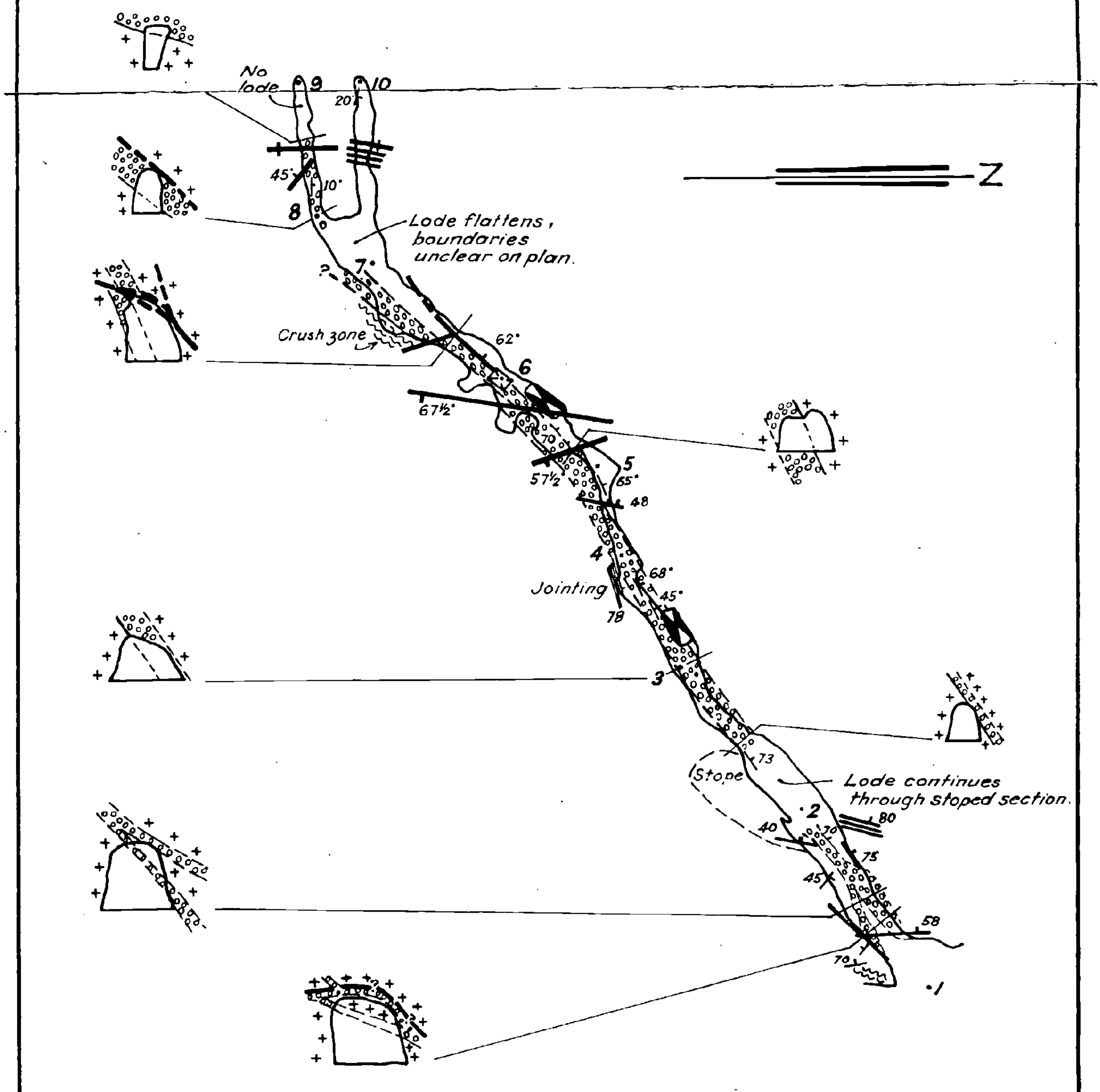
SCALES

PLAN 0 40 80 FEET

SECTIONS 0 20 40 FEET

L. G. B. NIXON AND ASSOCIATES	
Drn. R.M.B.	KITTICOOLA MINE
Tcd. M.R.T.	Sub surface geology
Ckd.	Adit level No. 2 and No. 2 Stope
Date Jan. 72	Kitticoola Gold Mines N.L.

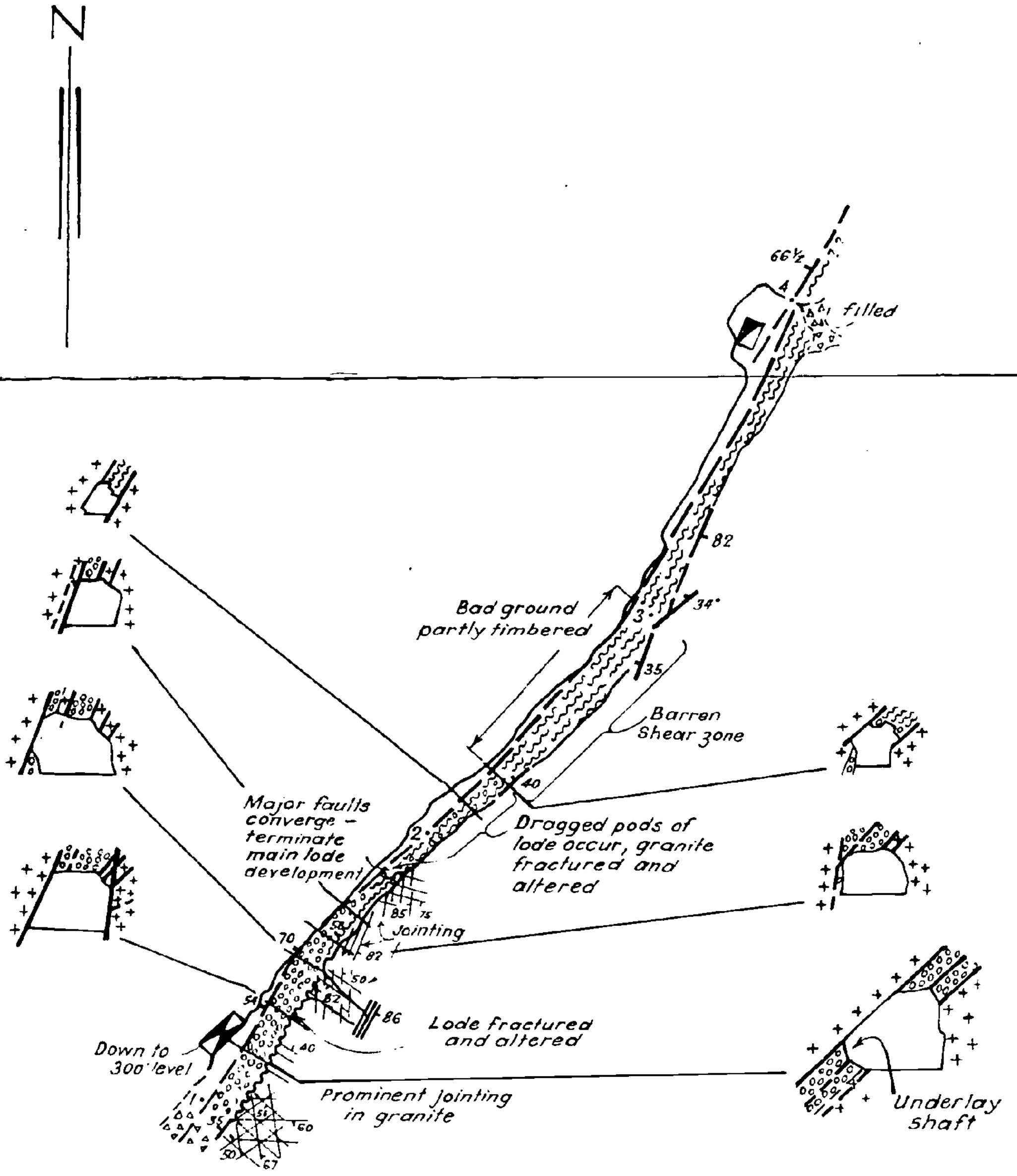
Note: Scale of plan 40' to 1 inch.
Section detail 20' to 1."
All cross-sections looking West



Fault
Lode boundary
Fault zone
Dip & strike of lode or of fault — 10, 45
Vertical dip
Survey point — ·10
Granite
Filling

L.G.B. NIXON AND ASSOCIATES

Drn. R.M.B.	KITTICOOLA MINE
Tcd. M.R.T.	Sub.surface geology
Ckd.	ANSTEYS ADIT
Date. Jan. '72	Kitticoola Gold Mines N.L.



SCALES

PLAN 0 40 80 FEET

SECTIONS 0 20 40 FEET

Note: Plan scale 40' to 1 inch
Section detail 20' to 1"
All sections looking North.

Faults

Lode boundary

Fault zone

Dip & strike of lode or of fault 10 82

Vertical dip

Survey point ·4

Granite

Filling

L. G. B. NIXON & ASSOCIATES

Drn. R.M.B.
Tcd. M.R.T.
Ckd.
Date Jan.'72

KITTICOOLA MINE
Sub-surface geology
240' level
KITTICOOLA GOLD MINES N.L.

Vol. I

CONFIDENTIAL

054

DEPARTMENT OF MINES
SOUTH AUSTRALIA

KITTICOOLA MINES

APPRAISAL

ADELAIDE

Mannum

by

J. GORDON-SMITH
Senior Geologist
Metallic Minerals Section

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27th April, 1972

Rept.Bk.No.769
G.S.No.4836
D.M.No.244/72

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Rept.Bk.No.769
G.S.No.4836
D.M.No.244/72

KITTICOOLA MINES

APPRAISAL

ADELAIDE

Mannum

ABSTRACT

Kitticoola Mine is situated within the outcrop of the Palmer Granite near the Palmer Fault. Copper bearing sparingly auriferous sulphides occur in lodes following a conjugate fracture pattern. Early workings, dating from 1844, exploited enriched secondary oxide material. Sulphide ore could be explored by diamond drilling as already recommended in 1953. Oxide remnants are extensive and suitable for in situ leaching. More widespread disseminated ores are not impossible.

The mine is shut down, in decrepit and ill-run condition. Departmental assistance could be given in development, but managerial safeguards would be necessary.

INTRODUCTION

Appraisal of the mine was carried out following a request for Departmental assistance in diamond drilling by the leaseholders, Sturts Meadows Prospecting Syndicate No Liability. Reports of recent exploration were provided by the Syndicate, earlier departmental reports were examined and a one day inspection of the mine carried out.

Kitticoola Mine is situated two miles south-south-west of Palmer in County Sturt, Hundred of Tungkillo, Section 960, Block 33. It lies about forty miles from Adelaide by road, at the eastern margin of the Mount Lofty Ranges, adjacent to the trace of the Palmer Fault. The land is privately owned, with mineral rights alienated from the Crown. Since 1970 the mine has been in the hands of Sturts Meadows Prospecting Syndicate No Liability, who were previously part owners with John McIlwraith Pty. Ltd. The syndicate has an agreement with the landowner for mining rights, current until 30th April, 1992.

The mine was visited on April 6th in the company of Mr. H. Edwards, a mining engineer engaged by the owners a short time before they terminated active operations, and Mr. L. Nixon of L.G.B. Nixon and Associates, Consulting Geologists. At the time of the visit the mine had been shut down for about eighteen months, it was flooded up to an estimated five feet above the floor of the 300ft level at Wooton Shaft.

The purpose of the visit was to assess the quality of available data and to form an opinion of the remaining potential of the mine.

HISTORY

There are no records of the earliest prospecting and development work at Kitticoola but traces of old pits and trenches are widespread. The Australian Mining Company was formed in 1845 to work the mine, which it did until 1852. Reedy Creek Mining Syndicate worked from 1890 to 1897, and the Port Lincoln Copper Company from 1908 to 1918. Kitticoola Gold Mines operations date from 1933 to 1937 and were renewed more recently. "Tributing" was carried out intermittently between these periods of more regular work.

The Masterman and Baker lodes have been worked more or less extensively down to the 240ft. level. Other lodes have been worked sporadically. Earlier writers estimate total production as nearly 300,000 tons of ore, but no precise figures of tonnage or grade are available.

Six exploratory diamond core holes were drilled by the Department of Mines between 1935 and 1938, when this work was curtailed at the request of the holder of the mineral rights. The results of this drilling are shown in the relevant Mining Reviews 63, 65, 66, 67, 68.

More recently McPhar Geophysics carried out an I.P. survey over Kitticoola for Mines Exploration Pty. Ltd. (?) and later, in 1970, another one for Sturts Meadows Prospecting Syndicate. Following the second I.P. survey, four surface and five underground diamond drill holes were made by Westgate Drilling Co. R.W. Fidler of McPhar Geophysics reported on this work in 1971.

R.L. Thompson, an Honours Student of Adelaide University, worked on Kitticoola in 1970, but his report has not been seen by the writer.

Finally, in 1972, L.G.B. Nixon and Associates reported on the property. Mr. Nixon has advised the writer that this investigation and report was made to a strictly limited budget, after he had been asked to assess McPhar's results. The relevant underground mapping was carried out by Mr. R. Barrett, a student of Adelaide University who, although meticulous, had not before worked underground. Mr. Nixon's part in the investigation was limited. It is unfortunate that mention of these constraints is omitted from their report.

Departmental reports include those of Jack (1914), which gives a concise account of the Kitticoola workings and mineralisation, and of Hughes (1955) which summarised the mine geology and recommended further diamond drilling. Hughes' report includes a complete list of departmental references.

GENERAL IMPRESSIONS

Seldom has the writer had cause to form such an unfavourable impression of the general competence of any mining operation as is now the case at Kitticoola. Recent exploration, development and mining work are characterised alike by a complete lack of system or of informed technical guidance.

Early work on the property appears to have been in accord with good practice, early reports were lucid. Jack (1914) quotes Lowe (an early manager?) in warning against confusion between lode walls and nearly parallel later strike faults. This had already led to loss of the lode on various drives and to the deviation of the lower part of the Masterman Shaft into the hanging wall. Hughes (op.cit), although he did not recognise the division between the Baker and Masterman Lodes which is implied by Jack's assay data, drew attention to the plunge of richer ore down what may be called the Masterman ore shoot. He proposed diamond drilling to explore and develope this.

These warnings and recommendations have of late been completely ignored in favour of an ill-chosen scatter of futile I.P. work. The directions of potential continuation and extension of the lodes remain as untested today as they did forty years ago.

GEOLOGICAL SETTING

The mine lies within the outcrop of the Palmer Granite, an elongated body some 3½ miles long and 3/4 mile wide, near its southern extremity. The Palmer Granite is Lower Palaeozoic in age (490 ± 15 m.y.b.p.) and conforms to the structural grain of the enveloping Kanmantoo metasediments. It is associated with granite gneiss and (?) migmatites which suggest granitisation origin.

The lodes at Kitticoola comprise the Baker, Masterman, Critchley and Back Lodes, striking north-north-east with a fairly regular dip of about 60° to the west; the Hagan Anstey and Cullingworth Lodes, striking west-south-west with a northely dip, but alternating between steep and flat portions after the style of a flight of steps; lastly the Horne and Cottage Lodes strike approximately north-west, and dip steeply to south-west and north-east respectively.

The Baker and Masterman Lodes are the largest and most significant past producers, where contiguous they appear locally to have reached a combined width of 30ft. The Anstey and parallel Lodes are probably mainly significant for the thickening effect their junctions may have on the Baker and Masterman Lodes. The Anstey junction in particular appears responsible for the north-west plunging Masterman ore shoot. The Horne and Cottage Lodes are relatively narrow and have not been worked extensively. The nine lodes form a rude conjugate pattern, apparently related to shear movement on the nearby Palmer Fault, and modified by the variations in rock competence between the relatively brittle Palmer Granite and the surrounding metasediments. If assay data were available, it would probably be possible to relate mineralisation to lode attitude, and to establish by careful mapping sequences of mineralisation and fracturing.

The granite county rock in the mine area is a medium grained biotite-adamellite. Kaolinisation is common in the neighbourhood of the lodes but seems more closely related to barren late fractures than to those carrying mineralisation.

The lode material comprises granite debris, quartz, calcite, dolomite/ankerite, specular hematite, pyrite and chalcopyrite. In the oxidised zone the sulphides are mostly absent, their place has been taken by limonite with more or less malachite, azurite, cuprite, tenorite (?) and native copper. Traces of bornite and chalcocite have been reported below the water table, suggesting that some secondary sulphide enrichment has taken place. Gold was apparently widely distributed in the oxidised ores where the highest values were associated with the Masterman Lode. There is a suggestion that gold and pyrite are associated, but although this seems probable, data to confirm it are lacking. A little disseminated sulphide is reported in the granite and gneiss cut by Mines Department diamond drill holes Nos. 2 and 3. The associated granite is mostly described as "calcareous" and it is uncertain whether these disseminated sulphides and calcareous matter are introduced "lode material" or the sulphides are of primary origin.

DISCUSSION

There is little doubt that the mine's early success was due to the presence of "rich bunches' of oxidised ore above the 240ft. level. Its subsequent failure combined difficulties of treating sulphide ores with inefficiency and ineptitude in following the ore bodies and in development work.

Hughes suggests that some 10,000 tons of oxidised ore remain in the upper part of the Masterman Lode. Taking the whole mine the figure must be considerably greater, but it seems quite certain that to re-open and secure the upper part of the workings with a view to mining this material would be prohibitively expensive and impracticable. Its recovery by in situ leaching appears both practicable and attractive. The present mine-water standing in the lower part of the mine appears richly cupriferous. In the recent mill, flotation has been combined with heap leaching and a certain amount of cement copper produced.

The grade of underlying primary sulphide ore is so far only suggested by the intersection in the Mines Department diamond drill hole No.2, which assays slightly less than 1% copper over 10ft. from 351'2" to 361'2". This intersection lies outside the limits of the conjectured richer ore shoot, in a region where strike faulting has probably "stretched" and impoverished the lode. It is possible that the grade may be better further north, but this can only be demonstrated by diamond drilling as suggested by Hughes.

It is pertinent to consider whether the copper and gold values were derived locally from the Palmer Granite, or from more distant sources by way of the Palmer Fault. The Fault, from the numerous mines and mineralized showings located along its trace, has clearly been an important channel for the supply and/or circulation of mineral bearing fluids. Both extremities of the Palmer Granite show some evidence of mineralization and the granite itself is emplaced in, and may well be formed from, sediments which carried more-or-less extensive syngenetic mineralization.

The Kitticoola lodes are small and narrow features on a regional scale. Their importance is purely local, but their interest centres upon the much wider bearing which local studies may have on the possibility of the development of extensive disseminations of sulphides in, or associated with, the granitic rocks of the area.

RECOMMENDATIONS

1a. The probable continuation of better grade sulphide ore, both in the footwall of the present northerly development workings on the 360 and 420ft. levels, and as a north-westerly plunging ore shoot, has already been recognised by Hughes (1955) and appropriate drilling recommendations are included in his report. (The description in his text of the westerly dipping Masterman ore shoot as having a north-easterly instead of a north-westerly plunge is surely an error in transcription).

b. The broken and caved remnants of largely oxidised ore lying above the 300ft. level are probably amenable to treatment by in situ leaching and the mine appears ideally situated for the conduct of large scale in situ leaching experiments.

A number of private leaching ventures have been carried out in the State and many of the small disused mines are potentially suitable for in situ leaching. Although laboratory research has been undertaken, there appears to be a lack of controlled field scale or full scale testing. Kitticoola operations could remedy this.

2. In view of the record of performance of Sturts Meadows Prospecting Syndicate, it would plainly be imprudent to expend public moneys on the investigations outlined above, without provision of effective controls to ensure that the work was competently carried out, and that the results were directed towards bona fide mining operations.

Without some such measure of departmental control it would be impossible to recommend assistance to the Syndicate. The mineral rights of Kitticoola are alienated from the Crown and are likely to remain so for at least the next three years. Such control as exists under the terms of present Special Mining Leases is therefore ruled out. The Mining Act (1971) is understood to provide for assistance "upon such terms and conditions as may be determined by the Minister" and it would not appear impossible for acceptable and effective terms to be agreed between the Department and the Syndicate.

3. On the larger scale it is recommended that the Department should carry out a detailed geochemical survey of the whole of the Palmer Granite. This would seek to determine whether a recognisable pattern of copper mineralization could

be linked to the geometry of the granite, or with that of the fault system. Such a survey might form the first stage of a regional study of base metal trends across geological time and thus prepare the way for an intergrated search for porphyry coppers and similar large scale low grade deposits in South Australia.

JG-S:MFV
27th April, 1972

J. GORDON-SMITH
Senior Geologist
Metallics Minerals Section

REFERENCES

Barrett R, and Nixon L. (1972) The Geology of the Kitticoola Cu, Au Mine, Palmer - S.A. Exploration Report for Kitticoola Mines Limited by L.G.B. Nixon and Associates; unpublished.

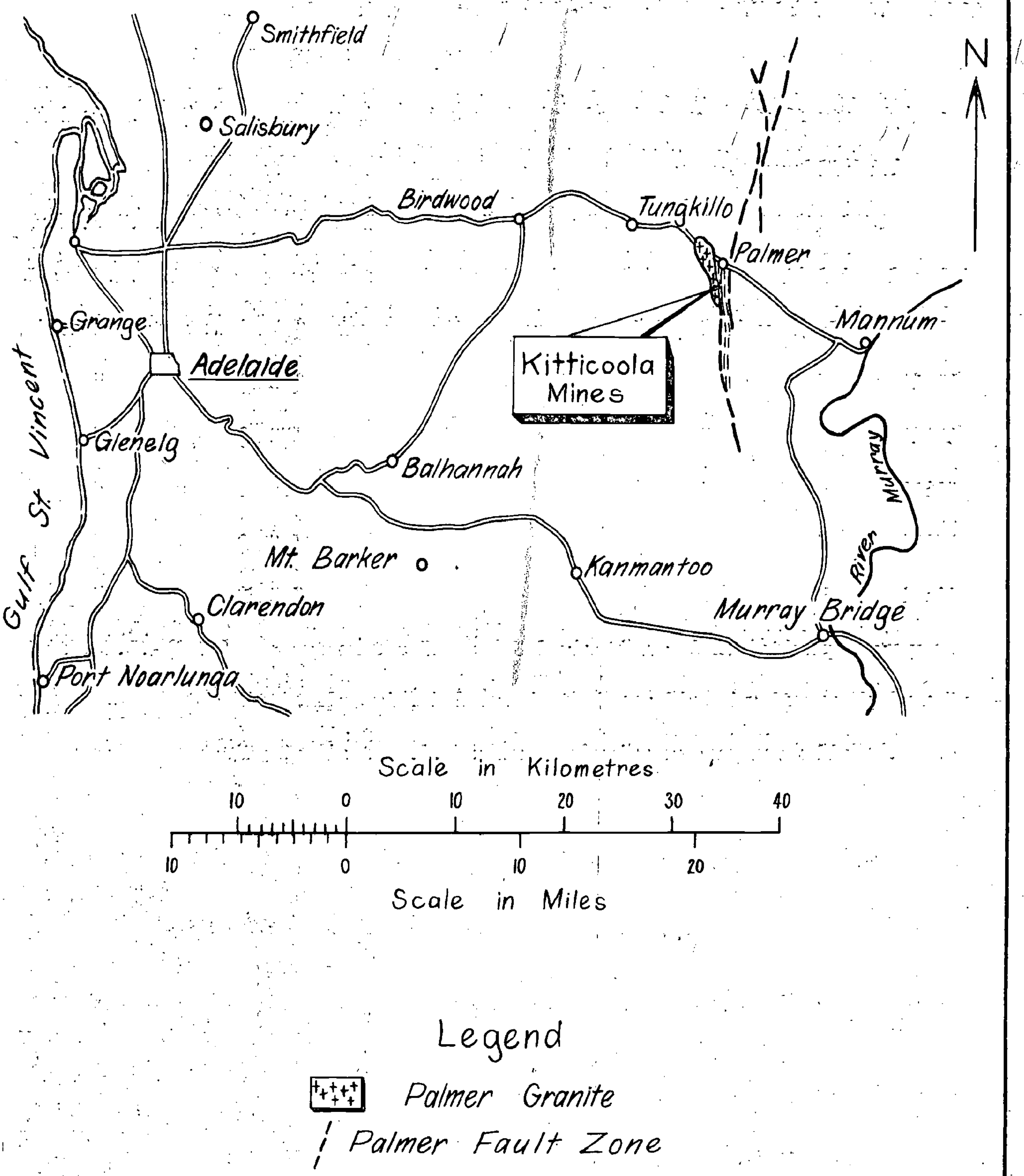
Fidler, R.W. (1971) Exploration of the Kitticoola Mine Area for Sturts Meadows Prospecting Syndicate, McPhar Geophysics report; unpublished.

Hughes, F.E. (1955) Kitticoola Mine, Mining Review, Adelaide, 98:113-117.

Jack, R.L. (1914) Report on the Kitticoola Mine, Mining Review, Adelaide 19:43-50.

Mines Department.	(1936)	Diamond drilling report,	Mining	Review,	Adelaide	63:59
"	(1936)	"	"	"	"	65:55
"	(1937)	"	"	"	"	65:55
"	"	"	"	"	"	66:45
"	(1938)	"	"	"	"	67:53
"	(1938)	"	"	"	"	68:52

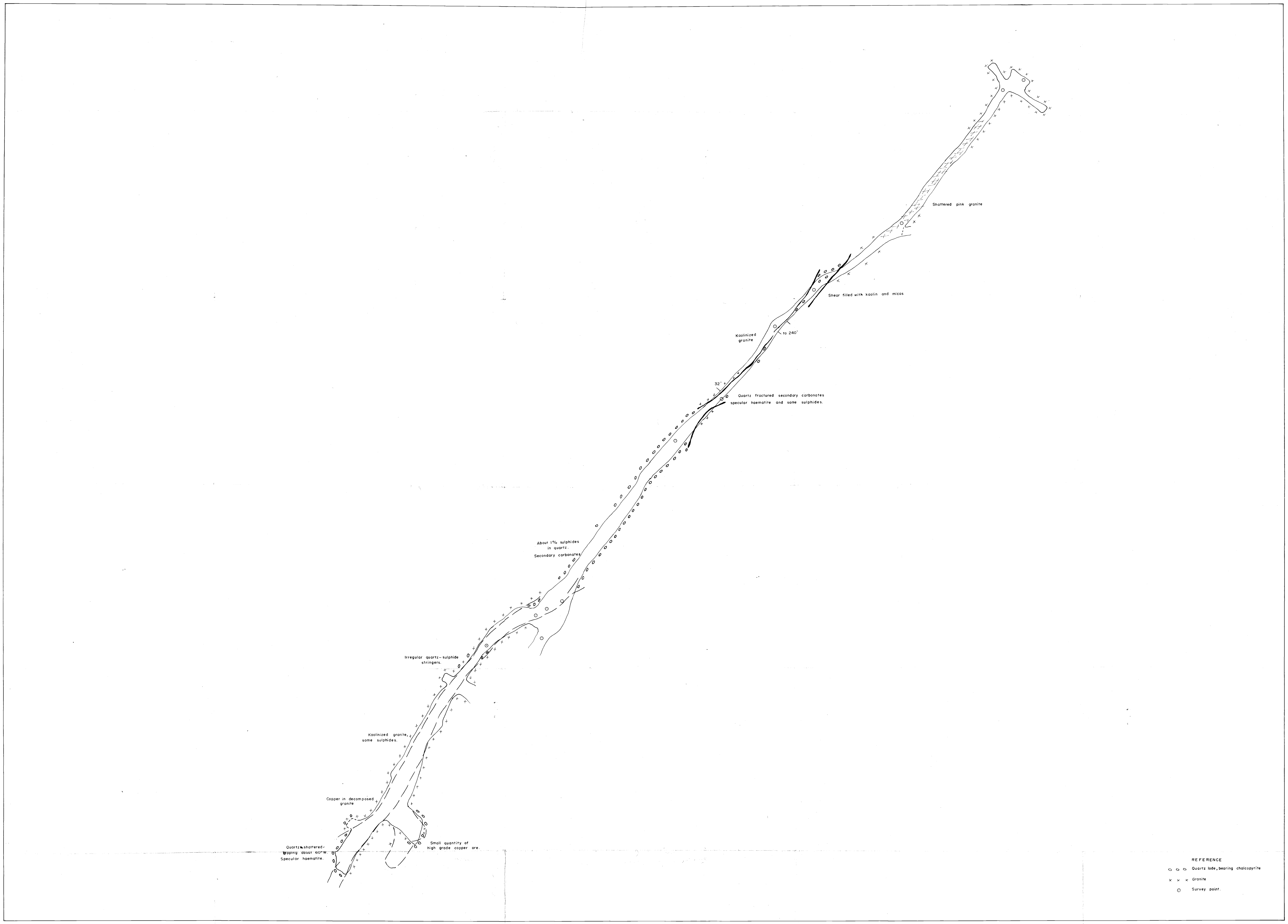
Smith, R.J. (1970) Report on the Induced Polarization and Resistivity Survey on the Kitticoola Grid, Palmer, South Australia, for Sturts Meadows Prospecting Syndicate N.L. McPhar Geophysics report; unpublished.



METALLIC MINERALS SECTION	DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale: 1in.=8miles
Compiled: J. G-S.	KITTICOOLA MINES	Date: 27 April 1972
Drn. D.J.M. Ckd. L.V.W.	LOCALITY PLAN	Drg. No. S9800 Hb4

1M–2.70 A1810

McPHAR GEOPHYSICS PTY. LTD.



STURTS MEADOWS PROSPECTING SYNDICATE N.L.

GEOLOGY OF KITTICOOLA MINE

300' LEVEL

SCALE: 20 feet to 1 inch

DRAWN: I.S.
DATE: 10·2·71
APPROVED: R.W.F.

DATE: 10·2·71

1824(III)-1

DWG: G.C. 4120A

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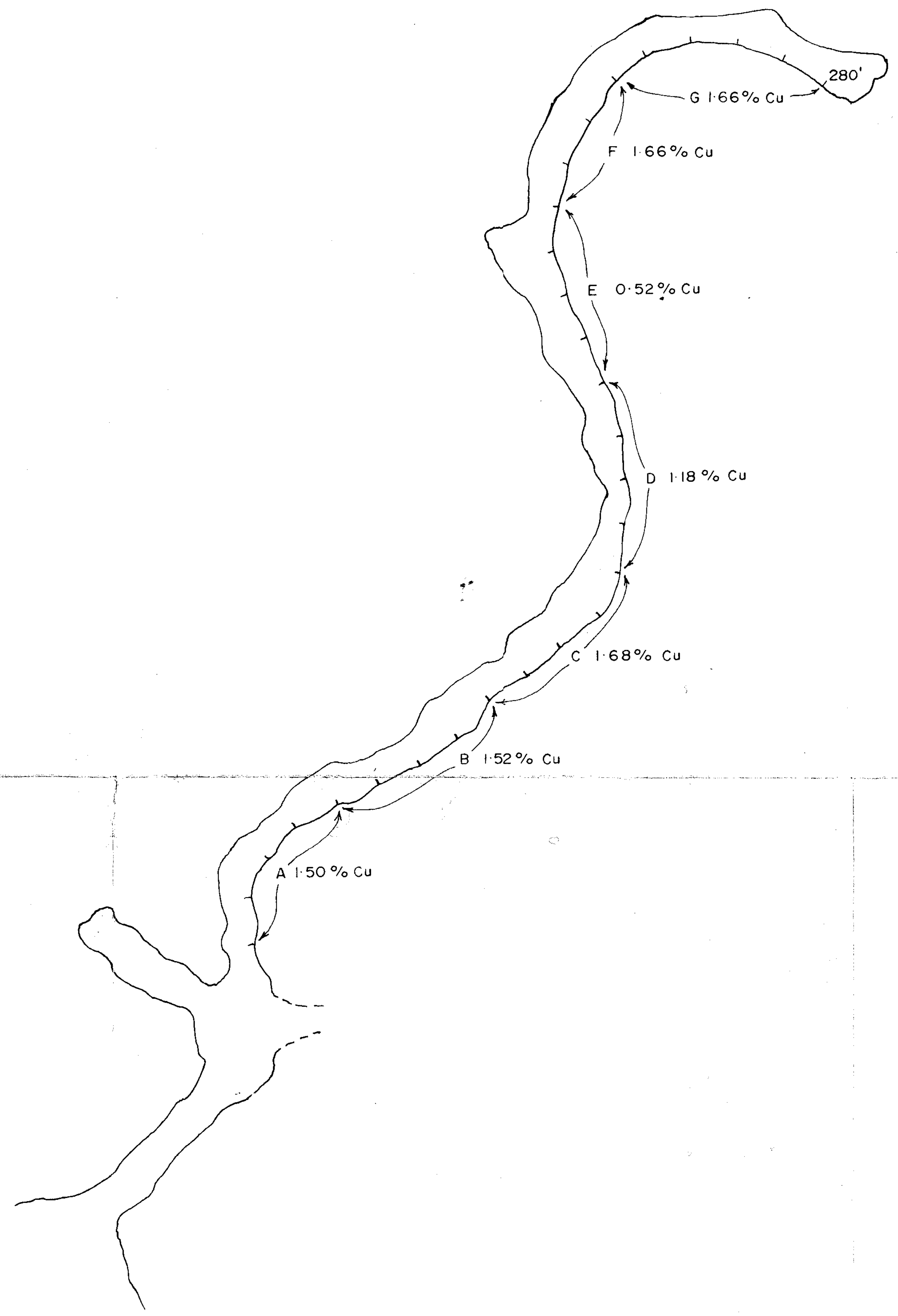


SAMPLES ABCDEF COMPOSED OF CHIPS TAKEN AT 10' INTERVALS OVER 40'
SAMPLE G COMPOSED OF CHIPS TAKEN AT 210' 220' 230' & 280'

Samples taken by Mr. H. Edwards.

DRAWN: I.S.
DATE: 10·2·71
APPROVED: R.W.F.

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

UNDERGROUND SAMPLING PLAN
KITTICOOLA MINE
ANSTEY'S LODE (EAST OF CREEK)

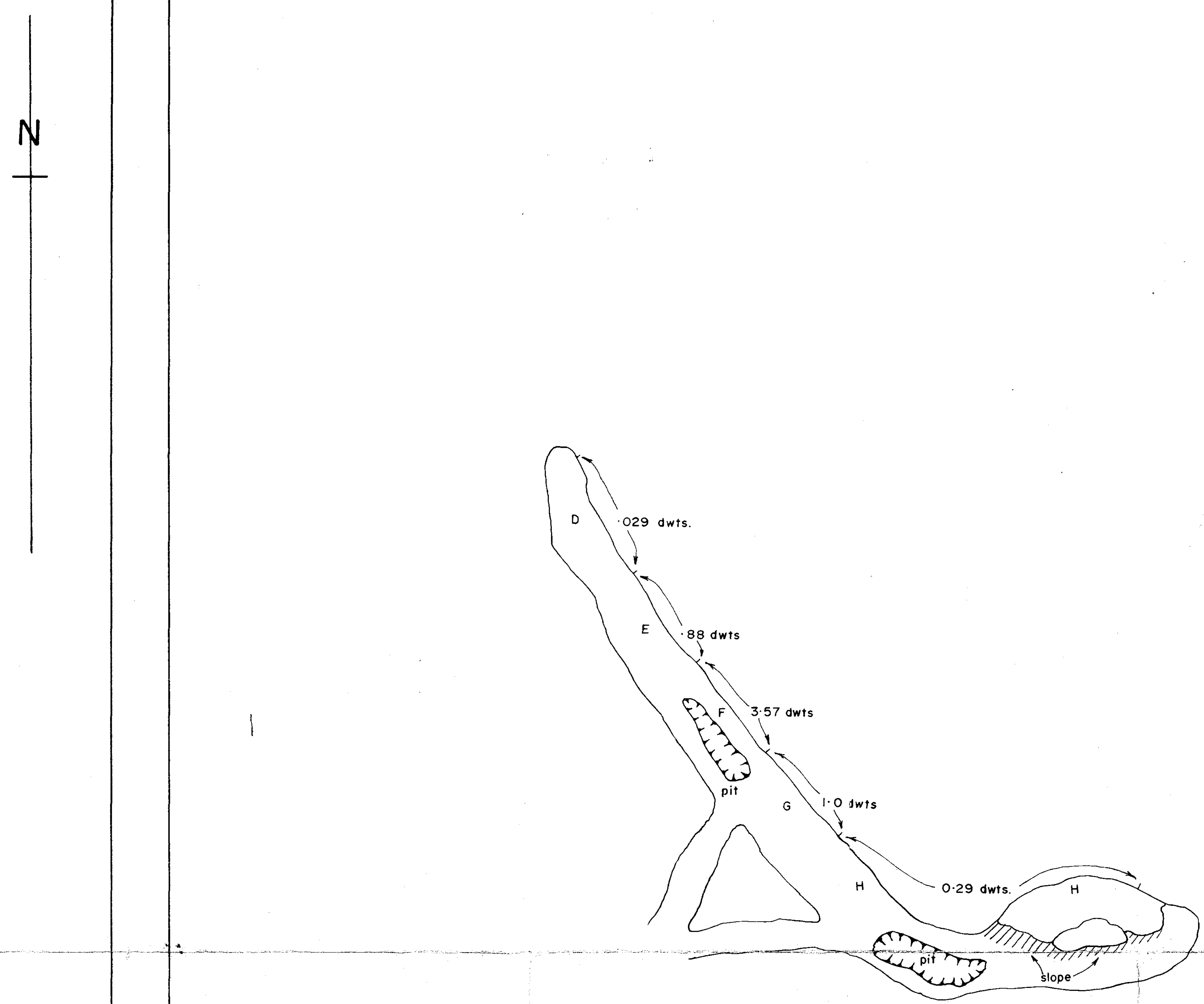
SCALE: 30 feet to 1 inch

DATE: 10·2·71

1824(III) - 2

DWG: G.3132 A

McPHAR GEOPHYSICS PTY. LTD.



Gold determined by AAS following the solvent extraction of Au – Rhodanine complex in amyl acetate.

GOLD RESULTS (dwts/ton) AV 1·174

DRAWN: I.S.
DATE: 10·2·71
APPROVED: R.W.F.

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

UNDERGROUND SAMPLING SKETCH PLAN

KITTICOOLA MINE

FLYING FOX ADIT

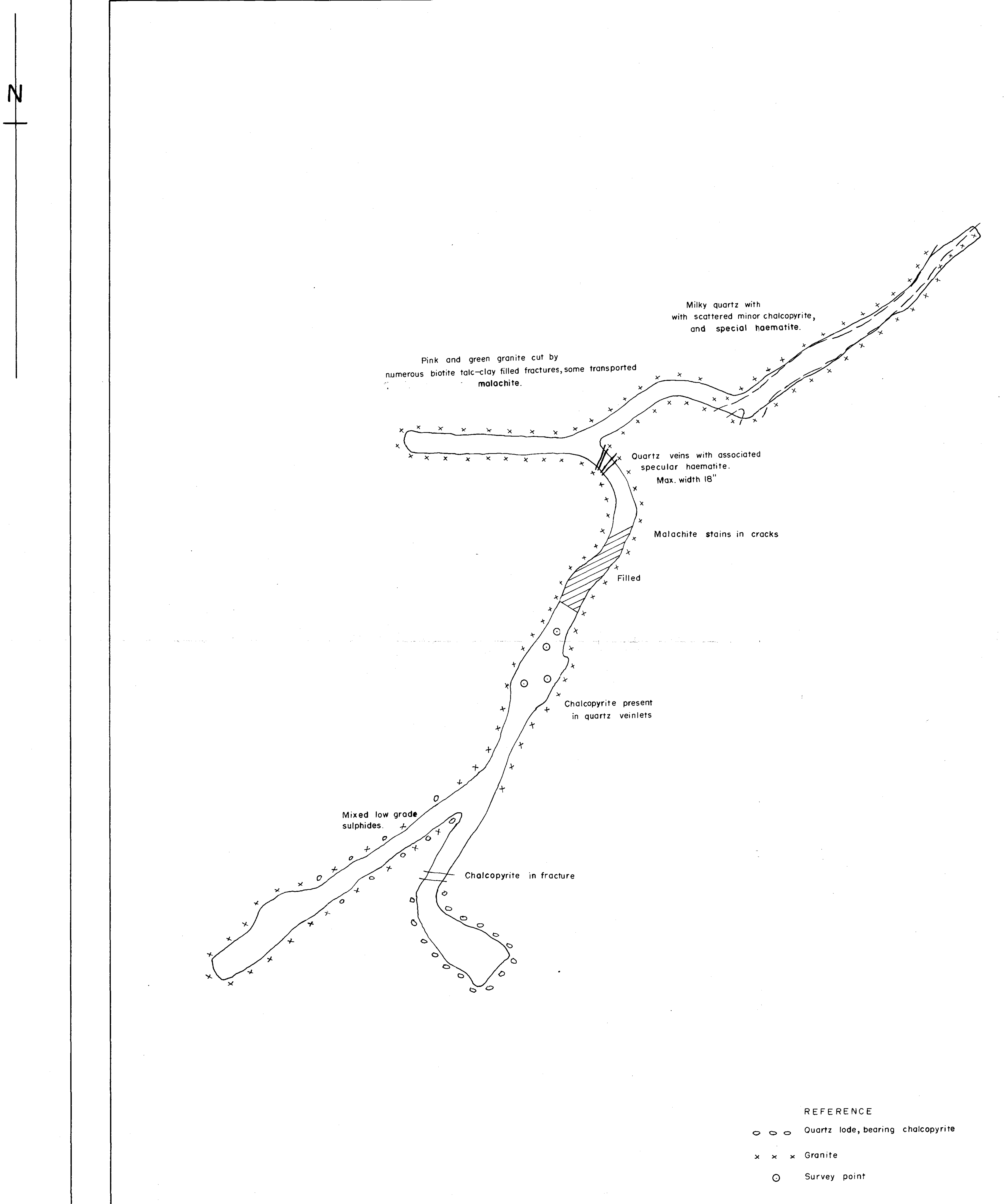
SCALE: 20 feet to 1 inch

DATE: 10·2·71

1824(III) - 3

DWG. G.3133A

McPHAR GEOPHYSICS PTY. LTD.



STURTS MEADOWS PROSPECTING SYNDICATE N.L.

GEOLOGY OF KITTICOOLA MINE

420' LEVEL

SCALE: 20 feet to 1 inch

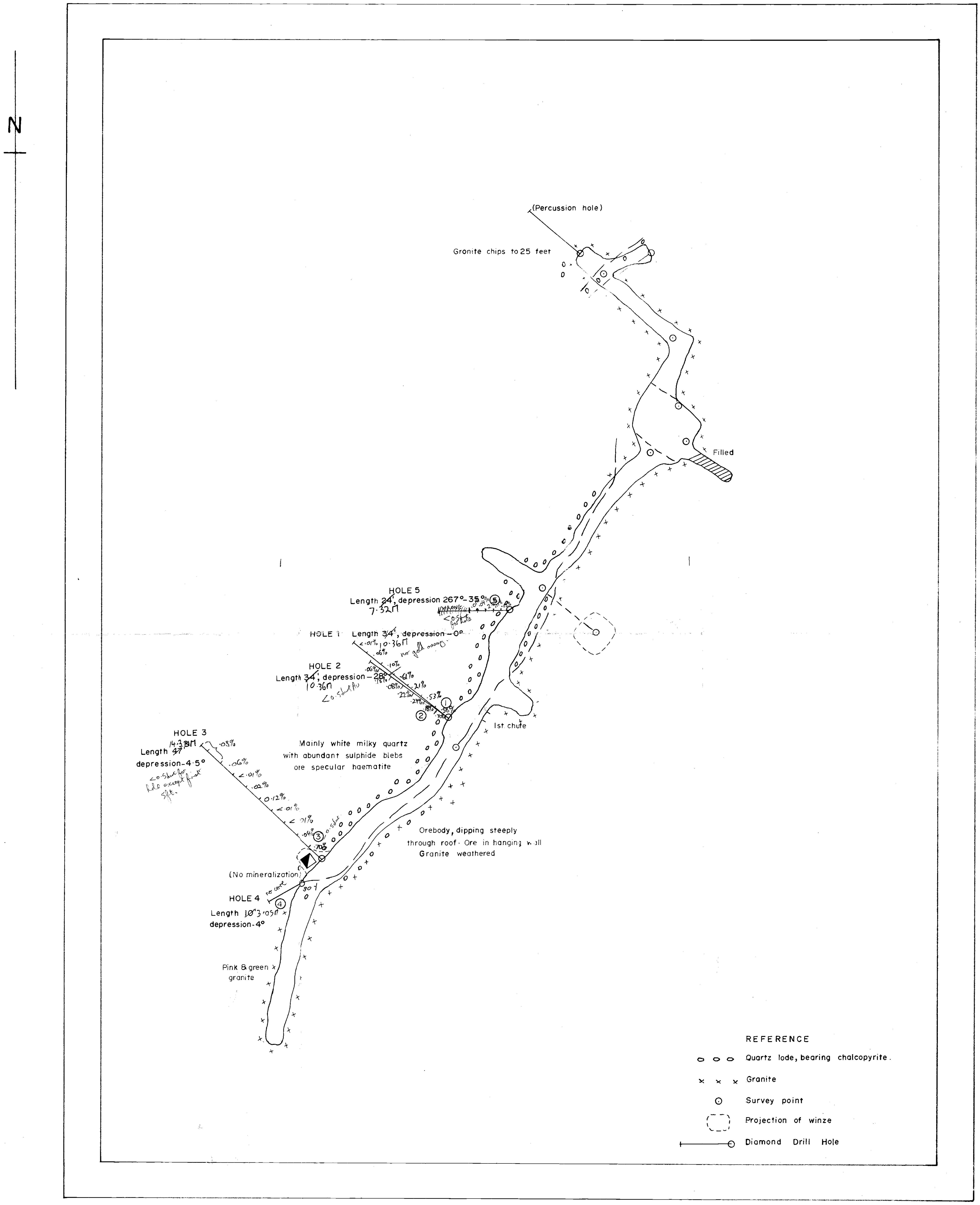
DRAWN: I.S.
DATE: 10·2·71
APPROVED: R.W.F.

DATE: 10·2·71

1824(III)-4

DWG. G.3134A

McPHAR GEOPHYSICS PTY. LTD.



STURTS MEADOWS PROSPECTING SYNDICATE N.L.

GEOLOGY OF KITTICOOLA MINE

360' LEVEL

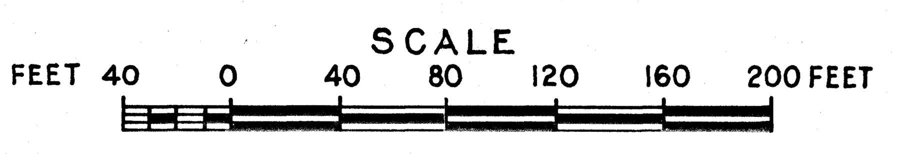
SCALE: 20 feet to 1 inch

DRAWN: I.S.
DATE: 10·2·71
APPROVED: R.W.F.

DATE: 10·2·71

1824(III)-5

DWG. G. 3135 A



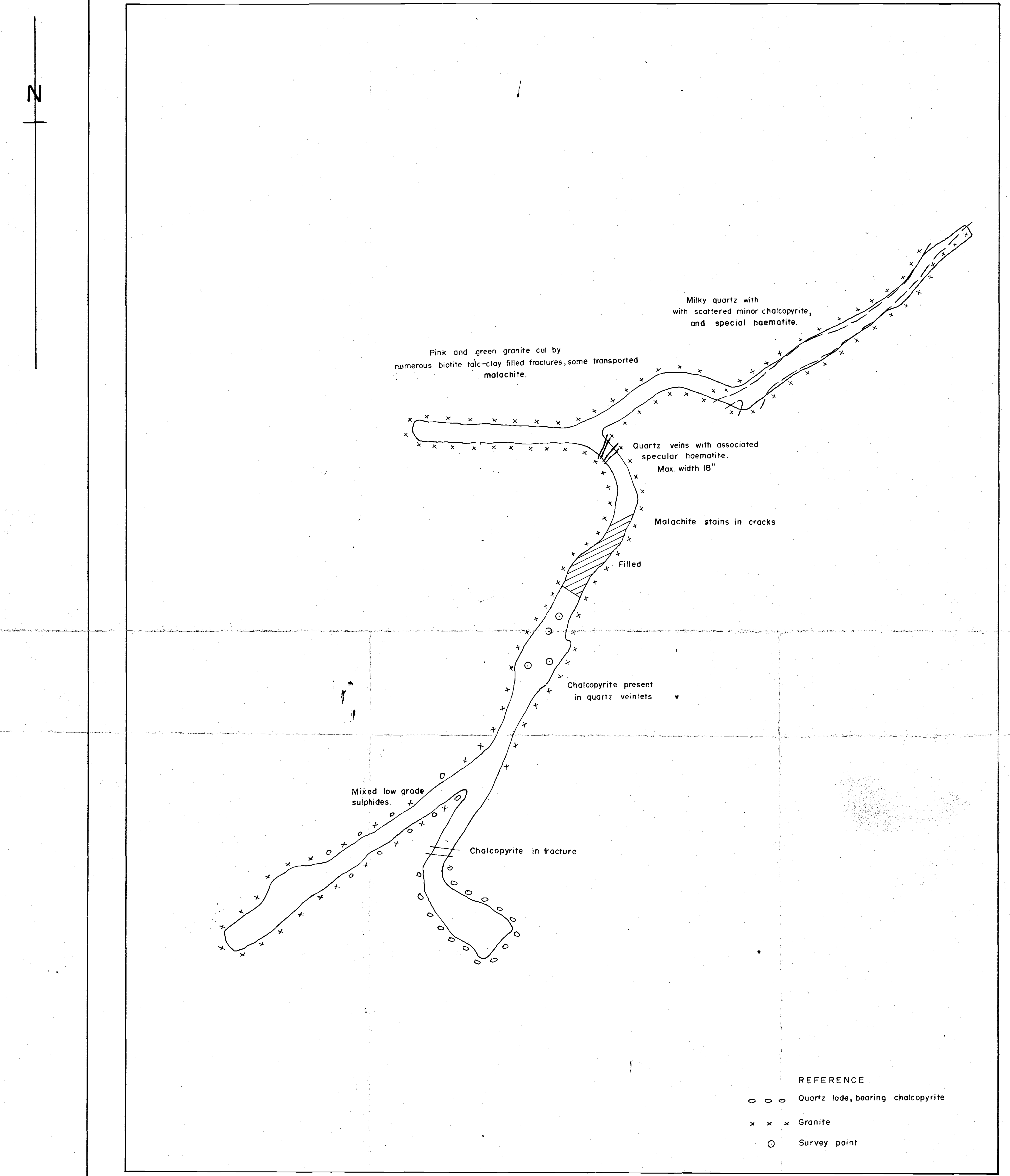
1824(IV)-1

L. G. B. NIXON AND ASSOCIATES

DRAWN	R.M.B.	KITTICOOLA MINE
TRACED	M.R.T.	Sections along lines 6S, 7S, 8S, 9S, 10S
CHECKED		Kitticoola Gold Mines N.L.
DATE		


SECTION A-A ALONG LINE 1S
SHAFT
Granite
MAJOR SHEAR ZONE ?
Road
Haulage Adit
240'
300'
SECTION B-B ALONG LINE 2S
SHAFT
Dump
Pit
D.D.H. 1A.
Granite
Gneisses and schists
Boundary approx. only
Gneiss, slight mineralisation down to 505'
505'
FAULT ZONE
Haulage Adit Cross Cut
Hanging Wall Fault
Underlay shaft
Lode & fractured granite – more granite with depth
Footwall Fault
SECTION C-C ALONG LINE 3S
Gneisses & schists
Boundary approx. only
Surface slumping
Mill Area Office
Road
Haulage Adit
300'
420'
SECTION D-D ALONG LINE 4S
Gneisses
Boundary approximate only
Surface slumps
CRUSH ZONE FAULT (PROJECTED)
PILLAR FAULT ETC. PROJECTED
LODE
Stope
SECTION E-E ALONG LINE 5S
Dump
PIT-COLLAPSED STOPE
PIT
CRUSH ZONE FAULT PROJECTED
PILLAR FAULT ETC. PROJECTED
Boundary approx. only
Surface Slumping
360'
SCALE
FEET 40 0 40 80 120 160 200 FEET
1824(IV)-2
L. G. B. NIXON AND ASSOCIATES
DRAWN R.M.B.
TRACED M.R.T.
CHECKED
DATE JAN. 1972
KITTICOOLA MINE
Sections along lines 1S, 2S, 3S, 4S & 5S,
Kitticoola Gold Mines N. L.

McPHAR GEOPHYSICS PTY. LTD.



DRAWN: I.S.
DATE: 10·2·71
APPROVED: R.W.F.

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

GEOLOGY OF KITTICOOLA MINE

420' LEVEL

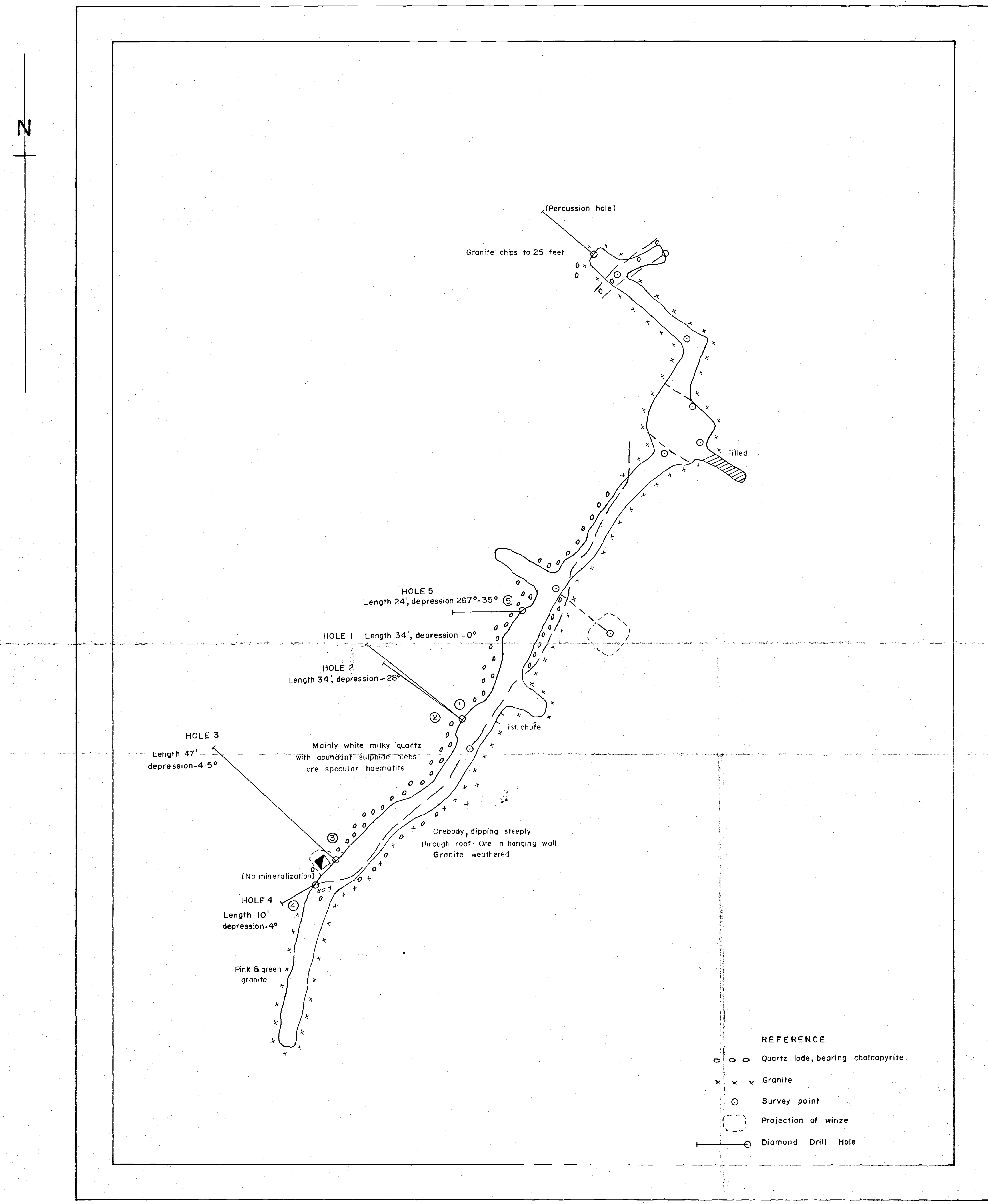
SCALE: 20 feet to 1 inch

DATE: 10·2·71

1824(IV)-3

DWG.G.3134A

McPHAR GEOPHYSICS PTY. LTD.



DRAWN: I.S.
DATE: 10·2·71
APPROVED: R.W.F.

STURTS MEADOWS PROSPECTING SYNDICATE N.L.

GEOLOGY OF KITTICOOLA MINE

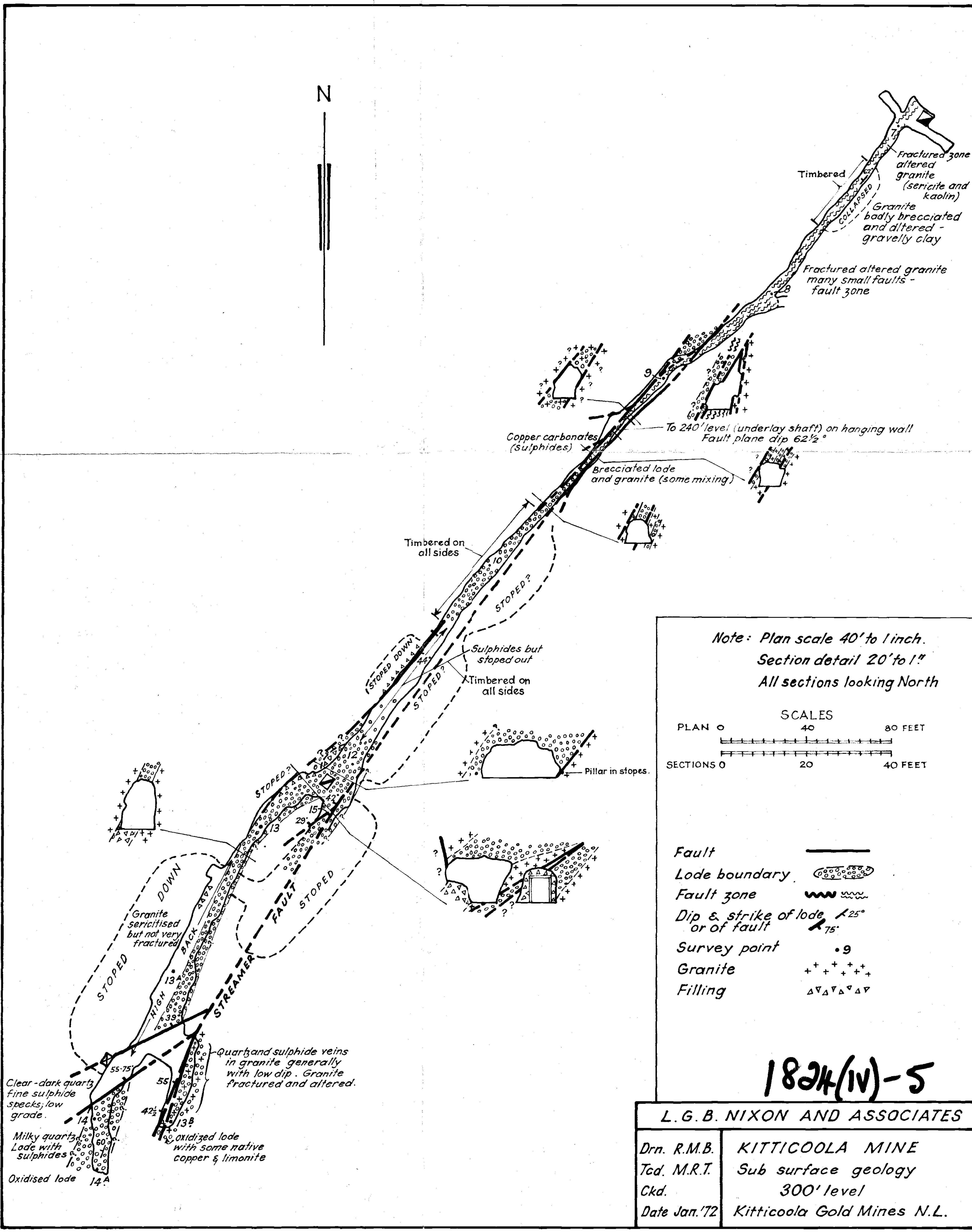
360' LEVEL

SCALE: 20 feet to 1 inch

DATE: 10·2·71

1824(V)-4

DWG. G. 3135 A


N
Timbered
Fractured zone altered granite (sericite and kaolin)
COLLAPSED
Granite badly brecciated and altered - gravelly clay
Fractured altered granite many small faults - fault zone
Copper carbonates (Sulphides)
To 240' level (underlay shaft) on hanging wall
Fault plane dip 62½°
Brecciated lode and granite (some mixing)
Timbered on all sides
STOPED?
STOPED DOWN
Sulphides but stoped out
Timbered on all sides
Pillar in stopes.
STOPED
DOWN
STOPED
Granite sericitised but not very fractured
HIGH BACK
STREAMER FAULT
Quartz and sulphide veins in granite generally with low dip. Granite fractured and altered.
Clear-dark quartz fine sulphide specks; low grade.
Milky quartz Lode with sulphides
Oxidised lode
oxidized lode with some native copper & limonite
Note: Plan scale 40' to 1 inch.
Section detail 20' to 1"
All sections looking North
SCALES
PLAN 0 40 80 FEET
SECTIONS 0 20 40 FEET
Fault
Lode boundary
Fault zone
Dip & strike of lode or of fault
Survey point
Granite
Filling
1824(IV)-5
L. G. B. NIXON AND ASSOCIATES
Drn. R.M.B.
Tcd. M.R.T.
Ckd.
Date Jan. '72
KITTICOOLA MINE
Sub surface geology
300' level
Kitticoola Gold Mines N.L.