

NORTHERN TERRITORY GEOLOGICAL SURVEY REPORT GS 75/9

DIAMOND DRILLING INVESTIGATIONS
ENTERPRISE No. 2. COPPER PROSPECT (ML 613A)
PINE CREEK

by

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1. SUMMARY

Diamond drilling was undertaken by Mines Branch, Department of Northern Australia on the Enterprise No. 2 copper prospect at the request of the leaseholder. A total of 402 metres was drilled between November, 1974 and June, 1975.

The drilling tested at depth, two narrow quartz veins in granite which carried sporadic copper mineralization and a trace of molybdenum and bismuth at the surface.

No significant mineralization was encountered in the course of diamond drilling and no further investigation of this prospect is recommended.

2. INTRODUCTION

In September, 1974, an application was made by Mr. M. J. Oates for drilling assistance from Mines Branch, Department of Northern Australia, on ML 613A. This application was subsequently approved. A drilling programme totalling 402 metres was carried out to test for possible enrichment at depth of two mineralized quartz veins in granite. The quartz veins contain some malachite and chalcocite near the surface. The drilling programme commenced on 26th November, 1974 and was completed on 13th June, 1975.

3. LOCATION AND ACCESS

Map: Pine Creek 1:250 000 Geological Series Sheet SD52-8
Co-ordinates (approx.) 13° 51' Lat.
131° 49' Long.

The Enterprise No. 2. copper prospect is situated approximately 1.5 kilometres SW of Pine Creek township. It can be reached along 3 kilometres of dirt track which leaves the Stuart Highway where it is crossed by Pine Creek about 1.5 kilometres NW of Pine Creek township. During the wet season, the dirt track is sometimes accessible by four wheel drive vehicles only.

4. GEOLOGY

The Enterprise No. 2 copper prospect lies within the Cullen Granite, a biotite-hornblende granite of Lower Proterozoic age. A mineralized quartz vein striking 15°-20° magnetic outcrops discontinuously over a strike length of 330 metres. At the surface the mineralization consists of malachite, minor cuprite and chrysocolla and patches of a green and yellow complex molybdenum-bismuth mineral (koechlinite $\text{Bi}_2\text{O}_3 \cdot \text{MoO}_3$). The mineralization occurs in veins, veinlets and disseminations in the quartz gangue. In some outcrops the quartz vein appears barren.

A shaft has been sunk to a depth of 6 metres near the northernmost outcrop of the quartz vein. Here the vein dips 60° westward (to 285° magnetic) and has a thickness varying between 0.6 and 0.9 metres.

Chalcocite and malachite are the main copper minerals present in the shaft with minor cuprite and patches of koechlinite. The walls of the vein appear sheared and consist of pink/grey fine grained granite (10% muscovite and chlorite after biotite, 30% quartz, 50% K feldspar) and greenish-grey, fine grained, altered granite (10% plagioclase, 10-20% K feldspar, 20-30% quartz, 50% muscovite and chlorite); G. Lau (pers. comm.)

A second quartz vein outcrops about 100 metres west of the shaft and also in the creek bed (plate 2) where it is seen to contain malachite and minor cuprite, chalcocite and koechlinite. About 440 metres west of the shaft a further quartz vein outcrops but this was not investigated during the current survey. Some little distance east of the prospect there is a contact between the Cullen Granite and sediments of the Burrell Creek Formation of Lower Proterozoic Age. Scattered outcrops of grey to pink medium to coarse grained granite (some porphyritic) are seen throughout the prospect area; (composition, 10-20% quartz, 20% plagioclase, 50% K feldspar, 5-10% biotite, 5% hornblende & 0-2% pyrrhotite).

Several prospects of a similar nature have been reported in the Cullen Granite but none of these have been investigated below a vertical depth of 10 metres. In 1905 and 1906 it was reported that two small copper veins in the Cullen Granite, 16 kilometres north-east and 16 kilometres north-west of Pine Creek respectively were mined but tonnages removed were very small.

Shields (1966) reported on the Expectation copper prospect about 32 kilometres south-south-east of Pine Creek. This prospect occurs in a pegmatite cutting the Cullen Granite. A lens of quartz - chalcopyrite - pyrolusite of undefined size is included in the pegmatite which is about 2400 metres long and strikes about 10° magnetic. The lode worked was about 1 metre wide and the average grade of the lens was about 2½% copper.

Watts (1969) reported on the Granite Mine copper prospect about 31 kilometres north-west of Pine Creek. This prospect appears quite similar to the Enterprise No. 2 prospect. A quartz vein in the Cullen Granite contains malachite and chrysocolla at the surface. The strike of the lode is 36° magnetic and the lode has been intermittently exposed by shallow costeans over a length of about 300 metres. The lode is from 1.2 to 1.6 metres wide and appears to be vertical.

5. RESULTS OF INVESTIGATIONS

Five diamond drill holes were put down to test two of the quartz veins at depths between 10 metres and 40 metres and in two holes an attempt was also made to drill through the granite/sediment contact to the east. A total of 402 metres was drilled. Drilling was slow due to the hard nature of the granite but core recovery was effectively 100%.

Granite similar to that described in outcrop was intersected in all five drill holes. Minor variations in the composition and grain size of the granite were noted but are not recorded in this report. Minor sulphide mineralization was noted throughout the granite. Pyrrhotite content of the granite varied between 0 and 3%. Minor chalcopyrite and rare molybdenite were noted along fractures along with some pyrite. In at least one place a trace of native copper was noted in the granite.

D.D.H.'s 1 and 2 were positioned at 8N/46W on a bearing of 105° magnetic to test the mineralized quartz vein in the shaft at vertical depths of 25 and 40 metres respectively.

D.D.H. 1 was depressed at 45° and intersected the mineralized quartz vein between 35.7 and 36.0 metres confirming the dip of 60° west (to 285° magnetic) observed in the shaft. The quartz vein contained veinlets of chalcopyrite and minor chalcocite and bornite, no marked wall rock alteration was observed. The interval 35.5 to 36 metres assayed 1.6% copper. Minor chalcopyrite was also noted in narrow quartz veins between 50.5 and 50.65 metres, at 58.9 metres and between 74.3 and 74.5 metres but assay results from these intervals were poor.

D.D.H. 2 was depressed at 75° and intersected a narrow quartz vein (2 cm. thick) containing chalcopyrite at 41.7 metres. No other copper mineralization was noted in this hole and no significant assay results were obtained.

D.D.H. 3 was positioned at 189S/85W and depressed 45° on bearing of 120° magnetic, to test at depth a second mineralized quartz vein lying to the west of the main quartz vein. The hole intersected a quartz vein containing narrow veinlets of chalcopyrite and minor cuprite and chalcocite between 28.9 and 29.45 metres. Assays over the interval 28.8 to 29.5 metres gave a copper value of less than 0.2%. D.D.H. 3 indicates that this western quartz vein dips to the west at about 75°.

D.D.H. 4 was positioned at 14N/17W and depressed 45° on a bearing of 105° to test the main mineralized quartz vein at shallow depth and to establish the nature of the granite/sediment contact to the east. The mineralized quartz vein was intersected between 13.5 and 14.25 metres and here contained minor malachite and chrysocolla. No significant assay results were obtained over this interval. The hole was terminated at 130 metres without reaching the granite/sediment contact.

D.D.H. 5 was positioned at 323S/25W and depressed 45° on a bearing of 105° to test at depth/southern extremity of the main mineralized quartz vein and to attempt to drill through the granite/sediment contact to the east. No copper mineralization was noted in this hole and a series of narrow quartz veins with some minor iron boxworks intersected between 25.35 and 26.0 metres may represent the main quartz vein. This hole was also terminated without reaching the granite/sediment contact.

All mineralized quartz veins encountered in the five holes were assayed and half metre samples were taken every 10 metres in each hole to determine whether the granite contained any significant low grade mineralization. Apart from the assay of 1.6% copper between 35.5 and 36 metres in D.D.H. 1 assay results were poor.

In addition to the drilling, two costeans were put down near 30S/00 and 90S/00 (plate 2). These revealed minor copper mineralization in the main quartz vein and suggest the probable continuity of this quartz vein over 330 metres. In the course of drill site preparation quartz floaters with some malachite and cuprite were uncovered on strike, 20 metres north of the shaft increasing the indicated minimum strike length of the main quartz vein to 350 metres.

An attempt was made to define the presence of the main quartz vein beneath overburden on lines 175S and 200S by geochemical soil sampling. Negative results were obtained and further testing by such methods was not undertaken.

Tests over the main quartz vein with a scintillometer gave count rates of 100-120 c/s in a background of 60-80 c/s. This represents a perceptible variation over outcrop but where the quartz vein is buried at shallow depth it is unlikely that the scintillometer would be able to locate it, hence no further radiometric testing was carried out.

6. CONCLUSIONS AND RECOMMENDATIONS

Surface investigations have revealed the presence of a narrow quartz vein which outcrops sporadically over a strike length of 350 metres. In the main shaft this vein contains some high grade copper mineralization, in other outcrops minor copper mineralization is observed and in places the vein is barren. A second quartz vein to the west outcrops sporadically and contains some copper mineralization.

Diamond drilling investigations have shown that the grade of mineralization decreases with depth for both quartz veins. D.D.H.'s 1 and 2 indicate that the main quartz vein below the shaft both weakens in grade and decreases in width with depth.

No significant economic mineralization was encountered in any of the diamond drill holes and it is considered improbable that the small amount of high grade copper mineralization noted in the shaft could be profitably mined except possibly by a "gouging" operation.

No further diamond drilling or geological investigations are recommended on this prospect.

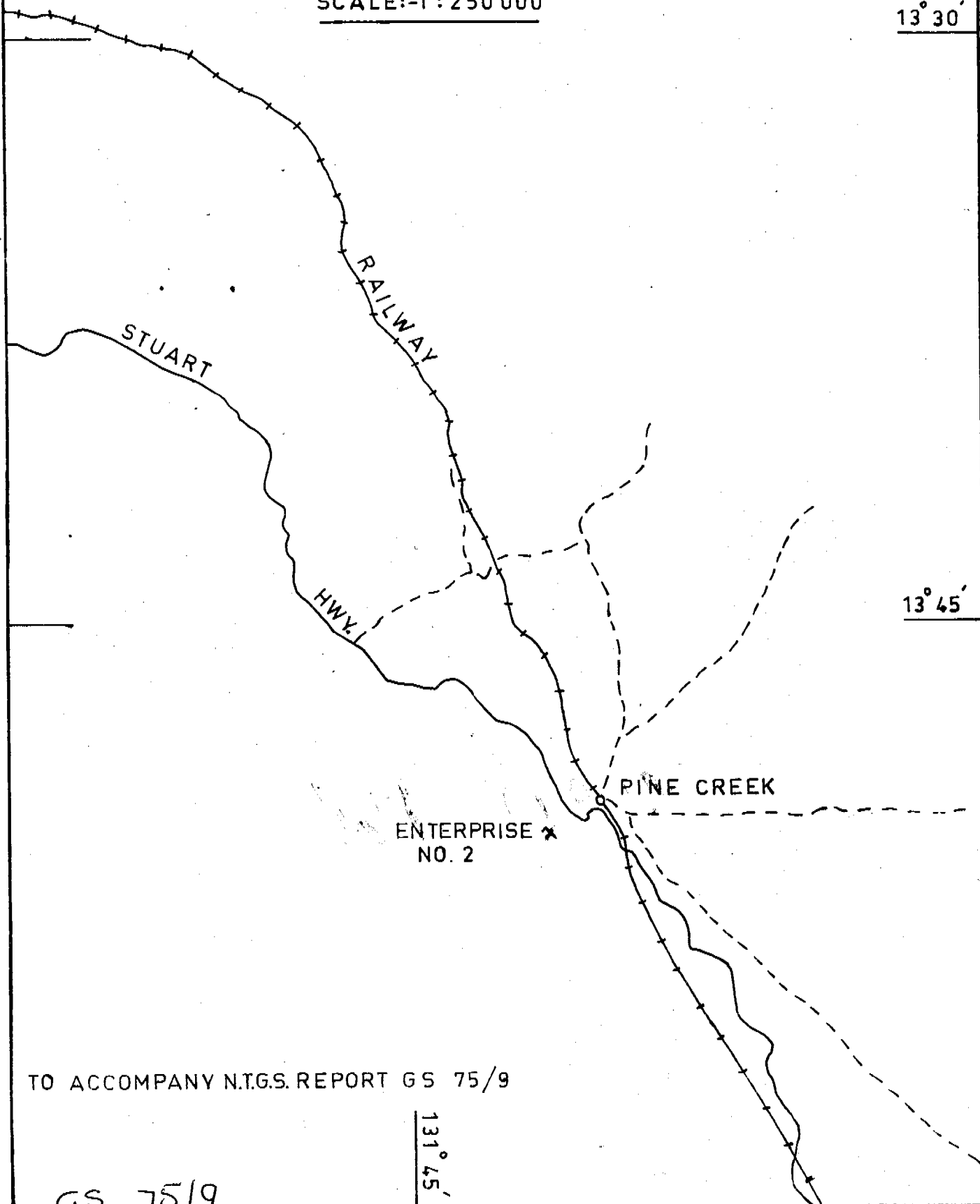
ENTERPRISE NO. 2
COPPER PROSPECT

LOCATION MAP

SCALE: -1 : 250 000

13° 30'

13° 45'



TO ACCOMPANY N.T.G.S. REPORT GS 75/9

GS 75/9

131° 45'

7. REFERENCES

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- Walpole B.P., Crohn, P.W., Dunn, P.R., and Randal, M.A. 1968 Geology of the Katherine-Darwin Region Northern Territory. Bur. Min. Resour. Aust. Bull. 82.
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TREATMENT OF COPPER ORE FROM ENTERPRISE NO.2 - PROSPECT OF J.OATES,
PINE CREEK.

Abstract

Two parcels of copper ore from the Enterprise No.2 prospect near Pine Creek were treated at Mt Wells Battery for sampling and evaluation purposes in December 1974.

Evaluation

Ore may be defined as "a naturally occurring aggregate of minerals from which a metal or metals may be extracted at a profit."

The value of the material treated at Mt Wells, assuming a copper price of \$A1000 per tonne, was -

315 A	\$1.09 per tonne
315 B	\$15.87 per tonne.

The costs of mining, milling, transport and realisation must all be charged against these values.

The material treated in parcel 315 A is of such a low grade that economic extraction would be impossible.

As the material treated in parcel 315 B was the reject fraction of a handpicking operation, no comment on the likely economics is possible. The recovery of copper could probably be raised using a flotation circuit for both the oxide and sulphide copper minerals. A significant tonnage of ore grade material would be necessary to justify such a flotation process.

Appearance of the Ore and Method of Treatment

315 A

This parcel contained a significant proportion of "bull-dust" with quartz, gossanous material, wall rock and minor copper mineralisation. The copper appeared to be solely in the form of malachite.

The material was crushed to - 16 mesh and tabled. Middlings were reground to - 20 mesh. Little copper was visible in the tailings and the concentrate contained a major portion of iron oxides.

315 B

This ore had been hand picked prior to haulage to the battery. The hand picked specimen was kept by the leaseholder and the reject forwarded to the battery. The weight and assay of the hand picked concentrate is not known, therefore the true head value of this ore, and its treatment characteristics could not be determined.

The ore contained a large proportion of quartz, some malachite and some chalcocite. Much of the quartz was stained green.

The material was treated in a similar manner to parcel 315 A. The concentrate was visibly better but far more copper was present in the tailings. The tailings losses appeared to be malachite only, but some chalcocite may have been lost as slimes.

Results

A. "Low" Grade Ore

	Weight (Tons)	Assay (%Cu)	Distribution (%)
Concentrate	0.0540	3.5	7.0
Tails	24.9460	0.10	93.0
Calculated Head	25.0	0.11	100.0

B "High" Grade Ore

	Weight (lbs)	Assay (%Cu)	Distribution (%)
Concentrate	200	29.7	47.8
Tails	7640	0.85	52.2
Calculated Head	7840	1.6	100.0

Comments

Parcel 315 A of 25 tons was extremely low grade, as expected, yielding a poor concentrate of 121 lbs assaying only 3.5% copper. Only 7% of the copper in this material was recovered by tabling.

Parcel 315 B of 3.50 tons was of better grade, although still poor. An acceptable concentrate was prepared by tabling but recovery of only about 50% of the contained copper was achieved.

Assay Results

		315 A	315 B
Concentrate	copper %	3.5	29.7
	gold gm/tonne	2.4	4.0
	silver gm/tonne	19.0	26.0
	iron %	23.0	32.4
	bismuth %	0.29	0.37
	molybdenum %	0.05	0.08
	tin %	1.04	0.01
Tails	copper %	0.10	0.85

Individual Table Results parcel 315 A -

	TABLE 1	TABLE 2	TABLE 3	TAIL
copper %	3.3	2.0	0.56	0.09
tin %	3.0	3.3	10.9	0.03
bismuth %	0.25	0.21	0.05	0.01
molybdenum %	0.02	0.03	0.01	0.01



(J. HEMPHILL)
Senior Battery Manager

APPENDIX I

Diamond Drill Hole Assays

Enterprise No. 2 Copper Prospect N.T.

D.D.H.'s 1-5

Rock Samples

Split core and rock samples were analysed by the Atomic Absorption Spectrophotometer at the East Point Laboratory, Department of Northern Australia, Darwin. All the results are in parts per million (ppm) unless otherwise stated.

Detection limits are as follows:-

Cu	5	ppm
Pb	10	ppm
Zn	2	ppm
Au	0.2	ppm
Ag	2	ppm
Bi	20	ppm
Mo	10	ppm

A minus sign (-) in front of a number means the value is less than the detection limit.

ENTERPRISE NO. 2 D.D.H. 1

Interval (metres)	Cu	Pb	Zn	Au	Ag	Bi	Mo
9.5 - 10.0	40	20	25	-0.2	-2	-20	-10
19.5 - 20.0	10	20	35	-0.2	-2	-20	-10
29.5 - 30.0	30	30	35	-0.2	-2	-20	-10
35.5 - 36.0	16,000	20	15	0.2	2	190	210
39.5 - 40.0	110	20	25	-0.2	-2	-20	-10
49.5 - 50.0	340	20	25	-0.2	-2	-20	10
50.3 - 50.8	450	10	25	-0.2	-2	-20	380
59.5 - 60.0	10	15	40	-0.2	-2	-20	-10
69.5 - 70.0	30	-10	40	-0.2	-2	-20	-10
74.0 - 74.5	110	20	30	-0.2	-2	-20	-10

ENTERPRISE No. 2 D.D.H. 2

Interval (metres)	Cu	Pb	Zn	Au	Ag	Bi	Mo
9.5 - 10.0	30	15	30	-0.2	-2	-20	-10
19.5 - 20.0	10	20	25	-0.2	-2	-20	-10
29.5 - 30.0	50	-10	25	-0.2	-2	-20	-10
39.5 - 40.0	20	20	20	-0.2	-2	-20	-10
41.5 - 42.0	570	-10	30	-0.2	-2	-20	-10
49.5 - 50.0	30	-10	25	-0.2	-2	-20	15
59.5 - 60.0	15	-10	30	-0.2	-2	-20	-10

ENTERPRISE No. 2 D.D.H. 3

Interval (metres)	Cu	Pb	Zn	Au	Ag	Bi	Mo
9.5 - 10.0	10	15	30	-0.2	-2	-20	-10
19.5 - 20.0	-5	-10	20	-0.2	-2	-20	-10
28.8 - 29.5	1370	70	150	-0.2	-2	30	-10
29.5 - 30.0	20	-10	35	-0.2	-2	-20	-10

ENTERPRISE No. 2 D.D.H. 4

Interval (metres)	Cu	Pb	Zn	Au	Ag	Bi	Mo
9.5 - 10.0	340	40	50	-0.2	-2	-20	-10
12.8 - 13.5	1680	-10	15	-0.2	-2	-20	-10
13.5 - 14.2	1650	40	10	-0.2	-2	290	210
14.2 - 14.8	1100	10	15	-0.2	-2	20	-10
19.5 - 20.0	30	-10	20	-0.2	-2	-20	-10
29.5 - 30.0	20	50	30	-0.2	-2	-20	-10
39.5 - 40.0	70	120	35	-0.2	-2	-20	-10

Cont.
../3

Interval (metres)	Cu	Pb	Zn	Au	Ag	Bi	Mo
49.5 - 50.0	80	20	30	-0.2	-2	-20	-10
59.5 - 60.0	30	20	25	-0.2	-2	-20	-10
69.5 - 70.0	20	15	20	-0.2	-2	-20	-10
79.5 - 80.0	15	30	45	-0.2	-2	-20	-10
89.5 - 90.0	90	40	30	-0.2	-2	-20	-10
99.5 - 100.0	40	40	35	-0.2	-2	-20	-10
109.5 - 110.0	-5	30	20	-0.2	-2	-20	10
119.5 - 120.0	5	20	20	-0.2	-2	-20	20
129.5 - 130.0	20	15	25	-0.2	-2	-20	-10

ENTERPRISE No. 2 D.D.H.5

Interval (metres)	Cu	Pb	Zn		Ag	Bi	Mo
9.1 - 10.4	50	90	75		-2	-20	-10
19.5 - 20.0	30	60	25		-2	-20	-10
25.2 - 25.7	80	20	12		-2	-20	-10
25.7 - 26.2	15	-10	20		-2	-20	-10
29.5 - 30.0	-5	20	18		-2	-20	-10
39.5 - 40.0	60	180	120		-2	-20	-10
49.5 - 50.0	40	50	18		-2	-20	-10
59.5 - 60.0	10	15	16		-2	-20	-10
69.5 - 70.0	10	40	18		-2	-20	-10
79.5 - 80.0	30	40	20		-2	-20	20
89.5 - 90.0	10	30	14		-2	-20	-10
91.6 - 92.1	-5	-10	10		-2	-20	-10
99.5 - 100.0	20	30	16		-2	-20	-10

ENTERPRISE No. 2 ROCK SAMPLE

Location	Cu	Pb	Zn	Au	Ag	Bi	Mo
Shaft-copper ore	29.3%	70	20	-	17	670	480
Shaft-copper ore	26.8%	-	-	-	-	190	25
Granite country	30	-	-	-	-	-20	-10
rock	40	-	-	-	-	-20	-10
"	20	-	-	-	-	-20	-10
"	20	-	-	-	-	-20	-10
"	35	-	-	-	-	-20	-10
"	10	-	-	-	-	-20	-10
"	80	-	-	-	-2	-20	-10
Small pit quartz	2680	-	-	-0.2	-2	30	40
" 3258/08 "	4720	-	-	-	-2	110	160
Western Quartzvein	6160	-	-	0.3	-2	360	-10

APPENDIX II

SUMMARIZED GEOLOGICAL DRILL LOGS

ENTERPRISE NO. 2 COPPER PROSPECT, N.T.

D.D.H.'s 1 - 5

Note: A grey to pink, coarse to fine grained granite (Porphyritic in part) was the principal rock type encountered in all five drill holes. It had the following approximate composition: microcline 50%, plagioclase 20%, quartz 10-20%, biotite 5-10%, hornblende < 5% and pyrrhotite 0-3%.

Only marked variation in the composition of the granite, together with alteration, weathering and the presence of quartz veins and mineralization are noted in the following summaries.

D.D.H. 1 Depth - 75 metresInterval
(Metres)

0- 12	Weathered and altered granite, many fractures.
20.25- 20.35	Barren quartz vein.
35.55	Barren quartz vein (2 cm. thick).
35.7 - 36.0	Quartz vein with veinlets of chalcopyrite, minor chalcocite and bornite. No marked wall rock alteration.
50.5 - 50.65	Barren quartz vein, granite altered below vein (increase in microcline and some green epidote present) minor pyrite and a trace of chalcopyrite and grey metallic mineral - molybdenite ? observed.
58.9	Quartz vein with disseminated chalcopyrite (<2cm. thick)
69.6	Barren quartz vein (5 cm thick).
74.3 - 74.5	Vein of light green rock (K-felspar 30-40%, plagioclase 30-40%, quartz 20%, minor epidote and a trace of chalcopyrite, biotite and hornblende < 1%).

D.D.H. 2 Depth - 60 metres

0 - 12	Weathered and oxidised granite.
38.2 - 39.5	Light grey-green medium grained rock (Plagioclase 40%, K-felspar 30%, quartz 20%, mica 10% and minor chlorite.
42 - 50	Epidote common in the granite 41.7 - Quartz vein with some chalcopyrite (2 cm. thick). This vein runs at 70° to drill direction and a grey-green hornfelsic rock lies below this.
Note:	Several minor quartz veins also noted in the granite.

D.D.H. 3 Depth - 37 metres

0 - 11	Weathered granite, poor core recovery.
28.9 - 29.45	Quartz vein with some narrow veinlets of chalcopyrite, minor cuprite and chalcocite. Granite wall rock is enriched in pink K-felspar above the vein but little alteration is apparent below the vein.

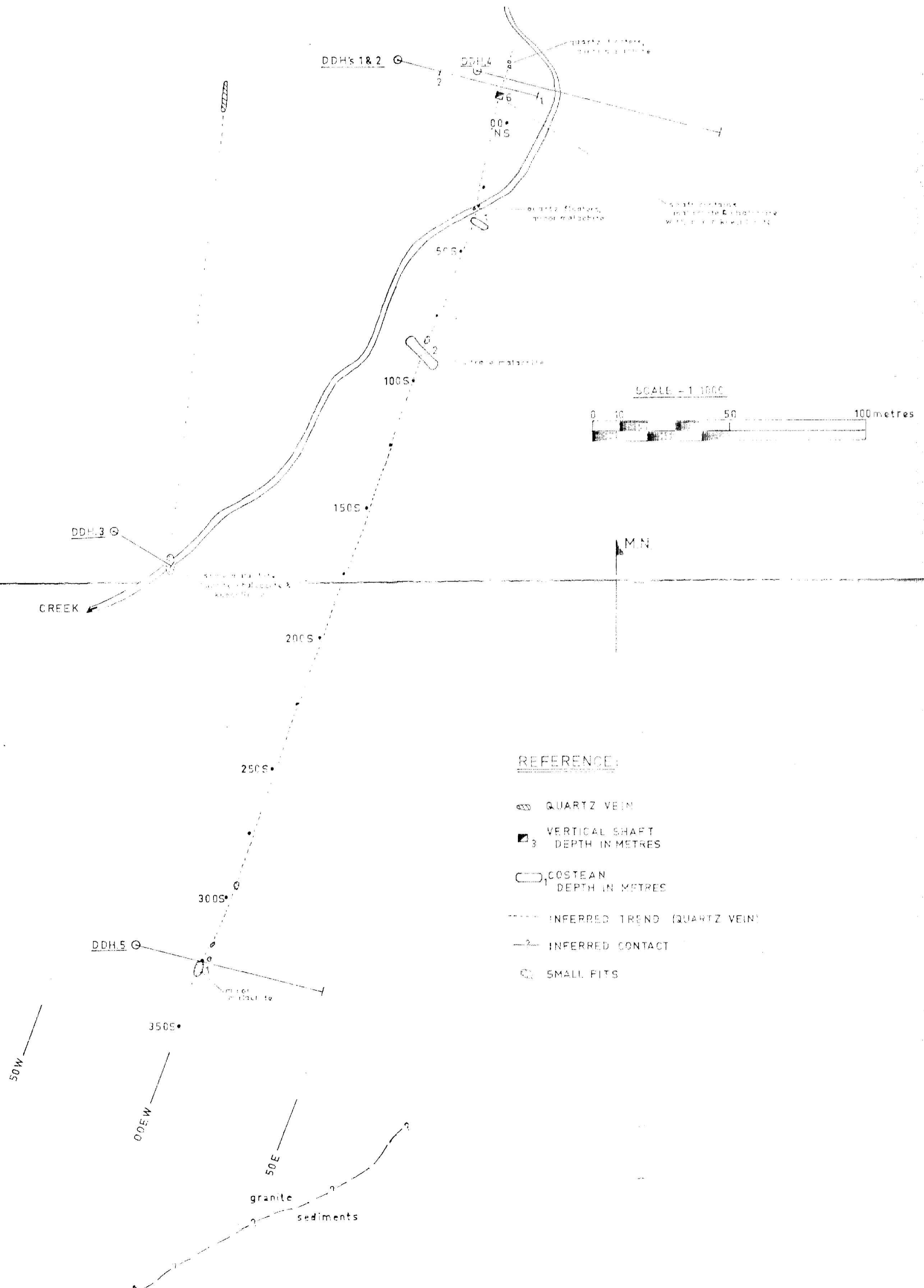
D.D.H. 4 Depth - 130 metres

Interval (metres)	
0- 12	Weathered, oxidized and highly fractured granite.
12.8 - 13.5	Pink granitic rock (K-felspar 60-70%, quartz 10-15%, green plagioclase 10-15%, hornblende + biotite < 5%. Trace of chrysocolla. Malachite and koechlinite along fracture at 12.9 metres.
13.5 - 14.25	Quartz vein with minor malachite and chrysocolla. (Core recovery about 70%).
14.25- 15	Pink granite rock as for 12.8 - 13.5 m. No chrysocolla apparent.
30.85- 31	Barren brecciated quartz vein.
57.7	Minor chalcopyrite and silver-grey metallic mineral-molybdenite ? noted in the granite.
83	Barren quartz vein (2 cm thick)
89.4 - 90	Green altered hornfelsic rock with barren quartz vein (2 cm thick).
101.6 -102	Light grey-green hornfelsic rock.
112.3 -112.45	Barren quartz vein.

D.D.H. 5 Depth - 100 metres

0- 13	Weathered and fractured granite.
20 - 27	Granite is fairly fractured, some epidote present, sections of silicate hornfels. 25.35 - 25.6m. Series of barren quartz veins. 26 m. Thin vein of iron boxwork (1 cm thick).
76.3	Quartz vein, some pyrite (5 cm. thick)
86.5- 86.8	Very coarse porphyritic granite with minor pyrite.
91.6- 92.1	Quartz veins with abundant red and green mica.
90 -100	Several slickensided fractures, muscovite and biotite are more in evidence.

SURFACE PLAN
ENTERPRISE NO. 2
COPPER PROSPECT



- REFERENCE:
- QUARTZ VEIN
 - VERTICAL SHAFT DEPTH IN METRES
 - COSTEAN DEPTH IN METRES
 - INFERRED TREND (QUARTZ VEIN)
 - INFERRED CONTACT
 - SMALL PITS