# THE PHLOGOPITE MINE BASE METAL PROSPECT

# STRANGWAYS RANGE, N.T.

by

James S. Morlock

# THE PHLOGOPITE MINES BASE METAL PROSPECT
# STRANGWAYS RANGE
# ALICE SPRINGS 1:250,000 SHEET AREA SF 53-14
# NORTHERN TERRITORY

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## SUMMARY

In 1971, three diamond drill holes were drilled by Mines Branch, N.T. Administration, as part of an investigation of the ultrabasic intrusive rocks at the Phlogopite Mine prospect in the Strangways Range near Alice Springs N.T.

A maximum zinc value of 2.25% was recorded, at a down-hole depth of 26 to 28 feet, in drill hole D.D.H.3, and a surface grab sample at the site of D.D.H.3 yielded 1.05% zinc. In both cases, the mineralization occurred in a carbonate rock, thought to have been formed from solutions associated with the emplacement of nearby pegmatite dykes; these solutions may have extracted primary mineralization from the ultrabasic rock and concentrated it as secondary, carbonate, mineralization.

## INTRODUCTION

The Phlogopite Mine is located in the Strangways Range, approximately thirty-six miles northeast of Alice Springs. Road access is provided by a good dry-weather road which leads eastwards from the Stuart Highway thirty-two miles north of Alice Springs across the Burt Plain to "The Garden" Homestead. At a point twenty-two miles east of the Stuart Highway, this road is joined by a four-wheel-drive track which leads north for approximately two miles to the Phlogopite Mine.

The area has considerable local relief. Vegetation consists of bushes and stunted trees. The altitude of the Mine itself is approximately 3000 feet above sea level.

Interest is centered on a zone of ultrabasic rocks which intrude the surrounding quartz-garnet gneiss.

Geographically; the mine is located at : Alice Springs 4-mile Sheet SF 53-14, grid reference 188104.

## PREVIOUS INVESTIGATIONS AND MINING

The area was investigated by H.B. Owen in 1940. In 1942, the Phlogopite Mine was opened and 3.52 tons of good-quality phlogopite mica were mined until July 1944 when the mine was closed. Development, at that time, was undertaken by the Allied Works Council.

In 1943/44, detailed investigations were carried out in the area by H.I. Jensen, who subsequently produced a detailed report (Jensen 1943/44).

Minor investigations were also carried out by Stillwell, Crohn and others.

In 1968, prospecting in the area was resumed by K. Rankin and is still underway at the time of writing (December 1971).

In September, 1969, the mine was visited by O. Fruzzetti, N.T. Administration Resident Geologist, Alice Springs. He collected a number of samples of ultrabasic rock from the area, and recorded finding sphalerite, hemimorphite and smithsonite in the dump of Number One Shaft. Rare specks of gold were also reported within the dump rocks.

The present investigation was begun by O. Fruzzetti in June 1971 and continued by J. Morlock. Drill core for all drill holes was logged by J. Morlock.

## GENERAL GEOLOGY

The Strangways Range area is located within the Precambrian Arunta Complex. In the area including the Phlogopite Mine, the country rocks consist of quartzite, schists and acidic gneisses; these contain varying amounts of quartz, hematite, garnet, amphibole, biotite and feldspar. In turn, these country rocks have been invaded by basic and acidic intrusives.

In the northern portion of the Strangways Range area the dip of the meta-sediments is predominantly north, while the dip is generally south in the southern area. In addition, the area has been subjected to imbricate and complex folding.

The basic rocks are generally of gabbroic composition, and usually occur as dykes which strike north-south. Some of these dykes, which are called micro-gabbro in this report, have been referred to as diabase by previous workers. In other cases, as at the Phlogopite Mine, the basic and ultrabasic intrusives are conformable with the country rocks. These basic rocks are largely metamorphosed.

The area has also been intruded by virtually unmetamorphosed pegmatitic dykes which tend to strike northwest-southeast.

## ECONOMIC GEOLOGY

### DIAMOND DRILLING

Three diamond drill holes, totalling 1413 feet, were drilled from June to October, 1971. Drilling was carried out by S. Berger, using an EDECO MK 6/3 diamond drill.

Drillhole D.D.H.1 was sited approximately 350 feet south-west of Number 2 workings, and passes beneath them. Bearing is 70° magnetic, depression is 45°, length of hole is 735 feet. This hole intersects the contact between the intrusive and country rocks at approximately 350 feet vertical depth, but passes beneath the intrusive itself. No significant mineralization was encountered.

Drillhole D.D.H.2 was sited approximately 150 feet south-west of Number 1 workings and passes beneath them. Bearing is 53° magnetic, depression is 60°, length of hole is 401 feet. From 153 to about 300 feet, the hole passes through the zone of contact between the ultrabasic intrusive and the country rock; this occurs at approximately 160 to 200 feet vertical depth. The rocks vary from garnetiferous phlogopite-rich

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quartz rock to small amounts of gabbroic rock. Between 301 and 307 feet down-hole depth a band of pyroxene-rich rock was intersected. Below this, the hole again encountered altered country rocks. No significant mineralization appears to be present.

Drillhole D.D.H.3 was sited approximately 858 feet north-west of Number 1 workings, midway between two pegmatite dykes in the northern portion of the intrusive. Drilling was begun on the contact between the country rock and the intrusive; bearing is 70° magnetic, depression is 55° and length of hole is 277 feet. From 10 to 24 feet down-hole depth a brownish argillaceous carbonate rock was intersected, followed to 82 feet by a grey, dominantly dolomitic carbonate rock. From 82 to 116 feet, the rock is of gabbroic composition and below 116 feet the rock encountered was largely altered country rock. Zinc values of 2.25% were found in the two-foot interval from 26 to 28 feet. 1.05% zinc was also found in a surface grab sample, at the site of D.D.H.3, in a rock similar to that between 10 and 24 feet in D.D.H.3. Apart from this, no significant mineralization was noted in the core.

## ASSAY RESULTS

A list of assays is included in Appendix 2. A total of 82 split core and surface samples were assayed for the elements shown. Analyses were performed by the N.T. Administration East Point Laboratory in Darwin, supplemented by a number of determinations by Australian Mineral Development Laboratories, Adelaide.

As previously discussed, the only significant values were those for zinc; a peak value of 2.25% zinc was recorded between 26 and 28 feet down-hole in D.D.H.3. A surface grab-sample of a similar carbonate rock near the collar of D.D.H.3 contained just over 1% zinc.

## CONCLUSIONS AND RECOMMENDATIONS

The Phlogopite Mine is in a basic to ultrabasic intrusive which strikes about 340° magnetic, generally parallel to the foliation of the country rock. The intrusive does not appear to extend below a depth of about 200 feet, at least not in the vicinity of D.D.H.1 and D.D.H.2. It dips steeply west-south-west. At the contact with the intrusive, the country rock, quartzose gneiss, is highly garnetiferous and the intrusive is fine to medium grained.

The western portion of the intrusive consists mainly of pyroxene-feldspar gabbro, with segregations of magnetite-rich rock. The central portion of the intrusive is largely peridotite containing varying amounts of olivine (with magnesite as a surface expression). Towards the eastern edge of the intrusive, the dominant rock type is augite pyroxenite; most of the phlogopite was obtained from this rock.

Anthophyllite rock occurs in the vicinity of faults cutting the intrusive.

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The olivine and pyroxene-rich portions of the intrusive have been partly altered to serpentine, with magnesite veins containing nodules of steatite and secondary quartz; these veins follow west-southwest dipping joints.

Formation of phlogopite appears to be related to nearby pegmatite dykes, probably by the action of magmatic waters on the original olivine-pyroxene rocks. These magmatic waters are thought to have been rich in alkalies and to have contained excess carbon dioxide. The same processes may also have been responsible for the formation of garnet-rich rocks and carbonate rocks in the contact zones of the intrusive. The main outcrops of carbonate rock are located close to a pegmatite dyke, which cuts off the intrusive at its northern end. The composition of this carbonate rock in hand specimen is approximately 60% brownish-grey dolomite plus an indeterminate amount of silica, 10% grey dolomite, and 10% calcite. Euhedral magnetite, pyrolusite, psilomelane and (?) smithsonite are present in small amounts. In general, the rock is micro to cryptocrystalline. This rock may be economically significant as a concentrator of metals, notably zinc, in the form of carbonates. Minor amounts of malachite and chrysocolla have also been seen in exposures of this rock. Consideration was given at one stage of the investigation to the possibility that this rock type might indicate a genetic link with the Strangways Range carbonatite occurrence, some 20 miles to the north-east, but this suggestion is not supported by the trace element determinations undertaken by Australian Mineral Development Laboratories, and particularly by the generally low values for Ba, Sr, Nb and rare earths.

## ACKNOWLEDGEMENTS

Arrangements for supplementary assays at Australian Mineral Development Laboratories were made by the Bureau of Mineral Resources, whose assistance is gratefully acknowledged.

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## REFERENCES


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# APPENDIX I

# DRILL LOGS

# PHLOGOPITE MINE D.D.H. 1

Location : 350 feet west-south-west of No. 2 Workings Phlogopite Mine.
Bearing : 70° magnetic.
Depression : 45°.
Logged by : J.S. Morlock.
Note : All angles measured relative to core axis.

| Depth | Core Size |
|---|---|
| 0' - 154' | BX |
| 154' - 485' | AX |
| 485' - 735' | EX |

| Depth | Core Recovered | Remarks |
|---|---|---|
| 0' - 40' | 12' | GARNETIFEROUS QUARTZ GNEISS: Gneissosity approx. 55° t.c.a. |
| 40' - 49' | 8½' | QUARTZ DIORITE: Medium to coarse grained. Approx. 60% dark minerals including hornblende and magnetite. 10-12% quartz. HCl test negative; Alizarin Red test, very weak positive. |
| 49' - 56' | 6' | GARNETIFEROUS QUARTZ GNEISS: As for 0'-40'. 10-20% cordierite. |
| 56' - 58' | 2' | QUARTZ DIORITE: Medium to coarse grained. Approx. 12% quartz. As for 40'-49'. HCl and Alizarin Red tests negative. |
| 58' - 65½' | 7' | GARNETIFEROUS QUARTZ GNEISS: As for 49'-56'; 75% quartz, 25% brownish-red garnet. |
| 65½' - 67' | 1½' | QUARTZ DIORITE: Medium to coarse grained. As for 40'-49'. HCl and Alizarin Red tests negative. |
| 67' - 240' | 171' | GARNETIFEROUS QUARTZ GNEISS: Substantially, as for 58'-65½' but also with variable amounts of biotite, chlorite. About 50% quartz, 30% brown-red garnet. Gneissosity approx. 55° t.c.a. Garnet contents increases with depth. Variable cordierite. |
| 240' - 248' | 8' | DIORITE: Contacts sharp, approx. 53° t.c.a. Approx. 5% quartz. Rare pyrite as interstitial clots. Minor magnetite. |

| Depth | Core Recovered | Remarks |
|---|---|---|
| 248' - 426' | 175' | GARNETIFEROUS QUARTZ BIOTITE GNEISS: Granitic. Medium grained. Varying amounts of orthoclase feldspar and red garnet. Gneissosity approx. 50° t.c.a. |
| 426' - 431½' | 5½' | BIOTITE GARNET GNEISS: As above but richer in biotite (phlogopite ?). Veins and clots of clay pseudomorphous after feldspar. |
| 431½' - 436' | 4½' | DIORITE: Medium grained. Rare pyrite. 5-10% quartz. No visible pyroxene. Contacts approx. 53° t.c.a. Both light and dark feldspar grains. HCl and Alizarin Red tests negative. |
| 436' - 441' | 5' | GARNETIFEROUS QUARTZ GNEISS: As for 67'-240'. |
| 441' - 444' | 3' | QUARTZ GNEISS: Clots of garnet-biotite to ½" diam. Garnet contents less than above. |
| 444' - 486' | 40' | GARNETIFEROUS QUARTZ GNEISS: As for 436'-441'. Gneissosity approx. 55° t.c.a. Garnet (red-brown) as clots and stringers parallel to gneissosity. |
| 486' - 489' | 3' | DIORITE: Medium to fine grained. 5-10% magnetite. Gradational contacts, Country rock has clots, to ½" diam., of biotite-garnet-hornblende at contacts. |
| 489' - 504' | 15' | CONTACT ROCK: Continuously variable from Quartz Gneiss to Quartz Diorite. Very rare pyrite. In part magnetic. |
| 504' - 508' | 4' | MICRO-GABBRO: Very fine grained. Approx. 10% olivine, 15% pyroxene. Dark minerals total approx. 70%. Magnetic. Sharp contacts approx. 53° t.c.a. |
| 508' - 520½' | 12½' | QUARTZ GNEISS: Biotite-chlorite stringers approx. 53° t.c.a. Somewhat garnetiferous. |
| 520½' - 526½' | 6' | DIORITE: Medium grained. Sharp contacts approx. 55° t.c.a. HCl and Alizarin Red tests negative. |
| 526½' - 544' | 16' | GARNETIFEROUS QUARTZ GNEISS: Clots of garnet and biotite-hornblende-garnet. Gneissosity 55°-58° t.c.a. |
| 544' - 546½' | 2½' | DIORITE: Approx. 5-8% quartz. To 1% pyrite, chalcopyrite. Magnetic. |

| Depth | Core Recovered | Remarks |
|---|---|---|
| 546½' - 564' | 17½' | QUARTZ GNEISS: Somewhat garnetiferous. Gneissosity approx. 50° t.c.a. |
| 564' - 566½' | 2½' | DIORITE: Medium to fine grained. Gradational contacts. 1-2% pyrite, rare chalcopyrite, in stringers and clots. At contacts, red-brown garnets as clots to ¾" diam. |
| 566½' - 613' | 46' | CONTACT ROCK: Variable from Garnetiferous Quartz Gneiss to Quartz Monzonite and Quartz Diorite. Garnets are of variable size but generally ⅛"-¼". |
| 613' - 664' | 51' | GARNETIFEROUS QUARTZ GNEISS: In part metasomatised. |
| 644' - 666' | 2' | DIORITE: Medium grained. As for 564'-566½'. Sharp contacts at approx. 55° t.c.a. |
| 666' - 673' | 7' | QUARTZ GNEISS: Garnetiferous. |
| 673' - 677' | 4' | QUARTZ VEIN: Contains bands of diorite - gabbro (fine to very fine grained). Contacts approx. 55° t.c.a. |
| 677' - 683' | 6' | GARNETIFEROUS QUARTZ GNEISS: Red garnets approx. ⅛" diam. Minor biotite, increasing with depth. |
| 683' - 692' | 9' | CONTACT ROCK: As for 566½'-613', with rare red garnet. |
| 692' - 735' | 43' | QUARTZ GNEISS: Somewhat garnetiferous. |
| 735' -- | -- | End of Hole. |

## PHLOGOPITE MINE D.D.H.2

Location : 150 feet south-west of Number 1 workings.

Bearing : 53° magnetic.

Depression : 60°.

Logged by : J.S. Morlock.

Note : All angles measured relative to core axis.

| Depth | Core Size |
|---|---|
| 0' - 12' | NX Casing |
| 12' - 89' | NX |
| 89' - 250' | AX |
| 250' - 401' | EX |

| Depth | Core Recovered | Remarks |
|---|---|---|
| 0' - 43' | 15' | WEATHERED QUARTZ GNEISS: Somewhat altered. Gneissosity approx. 30° t.c.a. Fractured. |
| 43' - 62' | 10' | GABBRO, MICROGABBRO: Somewhat altered. Approx. 10% magnetite. Secondary calcite plus very rare pyrite. |
| 62' - 87' | 24' | MICROGABBRO, QUARTZ GNEISS: Fault zone. Approx. 30% magnetite. Rock highly fractured, chloritized. Intrusive appears to have entered fault zone during several periods of faulting. |
| 87' - 94' | 7' | QUARTZ GNEISS: Somewhat fractured. Abundant red and yellow garnets. |
| 94' - 146' | 57' | GARNETIFEROUS QUARTZ GNEISS: Red and yellow garnets in bands : rare crystals to ½" diam. Gneissosity approx. 35° t.c.a. |
| 146' - 153' | 7' | CONTACT ROCK: Mixture of gneiss and biotite-garnet rock. Highly quartzose, non magnetic. |
| 153' - 157' | 4' | MICRO-GABBRO: Medium to fine grained. As for 43'-62'. Sharp contacts at 47° t.c.a. Magnetic. |
| 157' - 169' | 12' | CONTACT ROCK: As for 146'-153'. Gneissosity 50° t.c.a. |
| 169' - 173' | 4' | MICRO-GABBRO: Medium to fine grained. Contacts at 48° t.c.a. |
| 173' - 177' | 4' | GARNETIFEROUS QUARTZ GNEISS: As for 94'-146'. |

| Depth | Core Recovered | Remarks |
|---|---|---|
| 177' - 179½' | 2½' | MAGNETITE-GARNET-BIOTITE ROCK: Coarse grained. 50% biotite, some phlogopite, 20% magnetite. Rest is garnet plus rare quartz. |
| 179½' - 181' | 1½' | GARNETIFEROUS QUARTZ GNEISS: As for 94'-146', but gneissosity highly variable. |
| 181' - 182' | 1' | PHLOGOPITE-GARNET ROCK: Coarse grained. No magnetite. |
| 182' - 216½' | 33' | GARNETIFEROUS QUARTZ GNEISS: Approx. 60% quartz plus minor (?) cordierite. 20% phlogopite-biotite. |
| 216½' - 224' | 7½' | QUARTZ GARNET GNEISS: Appears to be fracture zone. Gneissosity 43° t.c.a. |
| 224' - 234' | 10' | CONTACT ROCKS: Medium to coarse grained. Micro-gabbro invading quartzose gneiss. Highly fractured. |
| 234' - 245' | 9' | QUARTZ GARNET GNEISS: Highly fractured. |
| 245' - 250' | 5' | MICRO-GABBRO: Fault zone. Fractures healed by silica. Medium grained. |
| 250' - 260' | 9½' | MICRO-GABBRO: Medium to fine grained. More pyroxene than above. Contacts at 35° t.c.a. |
| 260' - 267' | 7' | GARNETIFEROUS QUARTZ ROCK: Anhedral red garnet to ¼" diam. Some mixing with intrusive material. |
| 267' - 270½' | 3½' | CONTACT ROCK: 30% quartz, 30% red garnet, 25% phlogopite, approx. 15% magnetite. |
| 270½' - 278' | 7½' | CONTACT ROCK: Quartz, garnet, dark green amphibole, phlogopite, rare pyrite as interstitial clots. |
| 278' - 280' | 2' | GABBRO: 30% phlogopite/biotite, 5% pyrite, 20% magnetite. Rest pyroxene, minor olivine, plagioclase, rare chalcopyrite. |
| 280' - 286' | 5½' | CONTACT ROCK: Quartzose. Rare interstitial pyrite. |
| 286' - 291' | 5' | PHLOGOPITE ROCK: Approx. 60% phlogopite. |
| 291' - 294' | 3' | AMPHIBOLITIC ROCK: Dark green amphibole, minor pyroxene. Somewhat altered to talc, chlorite, serpentine. |

| Depth | Core Recovered | Remarks |
|---|---|---|
| 294' - 301½' | 7½' | QUARTZ-GARNET ROCK: Gradational with contact rock. |
| 301½' - 305' | 3½' | PYROXENE ROCK: Coarse-grained. Dark green. Phlogopite clots. |
| 305' - 307' | 2' | PYROXENE-RICH ROCK: Grades, with depth, through contact rock to country rock. |
| 307' - 324½' | 17½' | QUARTZ GARNET ROCK: Red and yellow-brown garnets to ⅛" diam. |
| 324½' - 327½' | 3' | MICRO-GABBRO: Medium grained. |
| 327½' - 380' | 52½' | GARNETIFEROUS QUARTZ ROCK: Gneissosity 50° t.c.a. Red garnet, decreasing with depth. |
| 380' - 381½' | 1½' | CONTACT ROCK: Phlogopite-rich, rare cordierite (?). |
| 381½' - 382' | ½' | GARNET ROCK: Brown garnets in clots to ¼" diameter. |
| 382' - 385' | 3' | GARNETIFEROUS QUARTZ ROCK: As for 327½'-380'. |
| 385' - 387' | 2' | CONTACT ROCK: As for 380'-381½'. 2-5% disseminated pyrite, rare chalcopyrite (?). |
| 387' - 401' | 14' | GARNETIFEROUS QUARTZ ROCK: garnet (red-brown) decreasing with depth. |
| 401' -- | -- | End of Hole. |

## PHLOGOPITE MINE D.D.H. 3

Location : 858 feet north-west of Number 1 workings.
Bearing : 70° magnetic.
Depression : 55°.
Logged by : J.S. Morlock.
Note : All angles measured relative to core axis.

| Depth | Core Size |
|---|---|
| 0' - 22' | NX |
| 22' - 82' | BX |
| 82' - 153' | AX |
| 153' - 277' | EX |

| Depth | Core Recovered | Remarks |
|---|---|---|
| 0' - 3' | 3' | CHLORITE-TALC SCHIST: Weathered, very friable. |
| 3' - 10' | 4' | TREMOLITE-CHLORITE SCHIST: Less friable, weathered. |
| 10' - 24' | 8½' | CARBONATE ROCK: Dense. Brown. Argillaceous, micro to cryptocrystalline. Contains dolomite, (?) smithsonite, magnetite, psilomelane, pyrolusite. |
| 24' - 82' | 38' | CARBONATE ROCK; Grey. Less dense than above. Very minor (?) smithsonite. |
| 82' - 86' | 4' | CONTACT ROCK: Mostly phlogopite and garnet. |
| 86' - 99' | 8' | MICROGABBRO: Medium to fine grained. Contains calcite and dolomite. 2-3% green mineral may be in part malachite. Also, rare chrysocolla. |
| 99' - 110' | 9' | CARBONATE ROCK; As for 10'-24', with rare (?) smithsonite. |
| 110' - 116' | 6' | GABBRO: Contains minor calcite and dolomite. Minor olivine. Minor pyrite. Also contains apatite (positive phosphate test). |
| 116' - 126' | 10' | QUARTZ GNEISS: Minor calcite, muscovite. Gneissosity 40° t.c.a. |
| 126' - 146½' | 20' | CONTACT ROCK: Fine-grained. Quartz, garnet, phlogopite. |

| Depth | Core Recovered | Remarks |
|---|---|---|
| 146½' - 150' | 3½' | GABBRO: As for 110'-116' but dolomite is only carbonate present. Gradational contacts. |
| 150' - 159' | 9' | CONTACT ROCK - QUARTZ GNEISS. |
| 159' - 162' | 3' | MICRO-GABBRO: 10% magnetite, 2-3% pyrite. Gradational contacts. |
| 162' - 170' | 8' | CONTACT ROCK: Fine-grained. |
| 170' - 277' | 105' | QUARTZ-GARNET ROCK: Gneissosity 40° t.c.a. |
| 277' -- | -- | End of Hole. |

# APPENDIX II

## ASSAY RESULTS

## PHLOGOPITE MINE

### D.D.H. 1
(Split Core)

| INTERVAL | Parts per Million | | | | |
|---|---|---|---|---|---|
| | Cu | Pb | Zn | Co | Ni |
| 40' - 49' | 245 | 30 | 41 | 20 | 40 |
| 56' - 58' | 170 | 40 | 29 | 15 | 70 |
| 65½' - 67' | 125 | 20 | 21 | 20 | 70 |
| 240' - 244' | 40 | 30 | 37 | 10 | 30 |
| 244' - 248' | 160 | 25 | 28 | 15 | 60 |
| 431½' - 436' | 105 | 15 | 31 | 15 | 45 |
| 486' - 489' | 50 | 15 | 29 | 10 | 35 |
| 489' - 496' | 25 | <10 | 15 | <10 | 10 |
| 496' - 504' | 20 | <10 | 21 | <10 | 20 |
| 504' - 508' | 90 | 20 | 32 | 20 | 150 |
| 520½' - 526½' | 70 | 10 | 32 | 10 | 70 |
| 544' - 546½' | 90 | 15 | 24 | 15 | 85 |
| 564' - 566½' | 30 | 15 | 44 | 20 | 60 |
| 570' - 573' | 400 | <10 | 220 | 20 | 35 |
| 581' - 582' | 10 | 10 | 24 | <10 | 35 |
| 664' - 666' | 20 | 25 | | | |

PHLOGOPITE MINE

D.D.H. 2
(Split Core)

| INTERVAL | Parts per Million | | | | |
|---|---|---|---|---|---|
| | Cu | Pb | Zn | Ni | Cr |
| 44' - 62' | 200 | 10 | 25 | 50 | 175 |
| 62' - 72' | 120 | 20 | 53 | 90 | 200 |
| 72' - 77' | 90 | 20 | 37 | 80 | 175 |
| 77' - 82' | 40 | 10 | 32 | 60 | 225 |
| 82' - 87' | 40 | 10 | 50 | 70 | 250 |
| 153' - 157' | 30 | <10 | 20 | 30 | 300 |
| 169' - 173' | 60 | <10 | 23 | 40 | 325 |
| 177' - 179½' | 5 | 30 | 13 | 10 | 25 |
| 224' - 229' | 30 | 60 | 73 | 60 | 250 |
| 229' - 234' | 50 | 80 | 30 | 30 | 400 |
| 245' - 250' | 50 | 30 | 70 | 50 | 175 |
| 250' - 255' | 30 | 20 | 55 | 40 | 150 |
| 255' - 260' | 70 | 30 | 27 | 50 | 350 |
| 267' - 270½' | 270 | 120 | 45 | 10 | 13 |
| 270½' - 273' | 50 | 230 | 38 | 10 | 15 |
| 273' - 275' | 50 | 320 | 41 | 10 | 15 |
| 275' - 277' | 460 | 100 | 66 | 10 | 20 |
| 277' - 279' | 1100 | 120 | 63 | 30 | 15 |
| 279' - 281½' | 1850 | 110 | 71 | 60 | 18 |
| 286' - 291' | 200 | 320 | 200 | 30 | 72 |
| 291' - 294' | 10 | 340 | 85 | <10 | 22 |
| 301½' - 305' | 20 | 350 | 93 | 10 | 10 |
| 305' - 307' | 330 | 120 | 76 | 20 | <10 |
| 324½' - 327½' | 70 | 40 | 51 | 40 | 115 |
| 385' - 387' | 150 | <10 | 32 | 60 | - |

(NOTE: All Au analyses were below 0.1 dwt/ton).

## PHLOGOPITE MINE

### D.D.H. 3.
(Split Core)

| INTERVAL | Parts per Million Cu | Pb | Zn | Ni | Cr | P |
|---|---|---|---|---|---|---|
| 10' - 14' | 20 | 50 | 200 | <10 | <10 | 260 |
| 14' - 18' | 10 | 130 | 350 | <10 | <10 | 390 |
| 18' - 24' | 50 | 390 | 780 | <10 | <10 | 130 |
| 24' - 44' | 360 | 380 | 5400 | 15 | <10 | 130 |
| 44' - 64' | 30 | 170 | 1700 | <10 | <10 | 50 |
| 64' - 82' | 270 | 280 | 780 | 10 | <10 | <50 |
| 86' - 93' | 1115 | 380 | 370 | 16 | 90 | 290 |
| 93' - 99' | 350 | 250 | 530 | 45 | 140 | 250 |
| 99' - 105' | 1000 | 1900 | 1700 | 12 | 15 | 550 |
| 105' - 110' | 620 | 840 | 650 | <10 | 25 | 450 |
| 110' - 116' | 160 | 140 | 140 | 50 | 140 | 375 |
| 146½' - 150' | 80 | 30 | 53 | 46 | 90 | 500 |
| 159' - 162' | 90 | <10 | 58 | 30 | 90 | 700 |

| INTERVAL | Percentage of: Pb | Zn |
|---|---|---|
| 24' - 26' | 0.16 | 1.30 |
| 26' - 28' | 0.04 | 2.25 |
| 28' - 30' | 0.05 | 0.28 |
| 30' - 32' | 0.14 | 1.08 |
| 32' - 34' | 0.11 | 0.07 |
| 34' - 36' | 0.07 | 0.03 |
| 36' - 38' | 0.08 | 0.10 |
| 38' - 40' | 0.05 | 0.23 |
| 40' - 42' | 0.02 | 0.20 |
| 42' - 44' | 0.05 | 0.20 |
| 44' - 46' | 0.06 | 0.28 |
| 46' - 48' | 0.02 | 0.12 |
| 48' - 50' | 0.03 | 0.11 |
| 50' - 52' | 0.01 | 0.09 |
| 52' - 54' | 0.01 | 0.15 |
| 54' - 56' | 0.06 | 0.13 |
| 56' - 58' | 0.02 | 0.20 |
| 58' - 60' | 0.08 | 0.28 |
| 60' - 62' | 0.04 | 0.18 |
| 62' - 64' | 0.05 | 0.18 |

## PHLOGOPITE MINE

(Surface Samples)

| LOCATION | Parts per Million | | | | |
|---|---|---|---|---|---|
| | Cu | Pb | Zn | Ni | Cr |
| 0+7, D.D.H. 3 line | 180 | 3200 | 10500 | 10 | <10 |
| 1+20, D.D.H. 3 line | 70 | 230 | 410 | 40 | 225 |
| 1+30, D.D.H. 3 line | 300 | 1600 | 61 | <10 | <10 |
| S.E. limb of intrusive, magnetite rock | 7 | 10 | 13 | <10 | <10 |
| S.E. limb of intrusive, magnetite rock | 8 | 30 | 27 | <10 | <10 |
| S.E. limb of intrusive, magnetite rock | 20 | 40 | 180 | <10 | 10 |
| S.E. limb of intrusive, pyroxene rock | 10 | 100 | 24 | <10 | <10 |
| No. 1 workings, pyroxene-olivine rock | 16 | 25 | 230 | <10 | <10 |

(NOTE: All Au analyses were below 0.1 dwt/ton).

* Assays carried out by the Water Resources Branch Laboratory, East Point, Darwin.

D.D.H. 3

SUPPLEMENTARY ANALYSES

by Australian Mineral Development Laboratories

| INTERVAL | Ba | Sr | Nb | Zr | La | Y | Ti | P |
|---|---|---|---|---|---|---|---|---|
| 10' - 14' | 100 | 95 | 10 | 50 | <50 | 50 | 500 | 200 |
| 14' - 18' | 80 | 60 | 5 | 40 | <50 | 10 | 250 | 500 |
| 18' - 24' | 30 | 45 | <5 | 30 | <50 | <5 | 120 | 200 |
| 24' - 44' | 140 | 60 | <5 | 30 | <50 | 10 | 1750 | 100 |
| 44' - 64' | 30 | 80 | <5 | 10 | <50 | <5 | 100 | <100 |
| 64' - 82' | 120 | 65 | <5 | 10 | <50 | 5 | 600 | <100 |
| 99' - 105' | 180 | 50 | <5 | 20 | <50 | 5 | 1700 | 500 |
| 105' - 110' | 40 | 55 | <5 | 70 | <50 | 15 | 1800 | 400 |
| 24' - 26' | 140 | 85 | <5 | 30 | <50 | <5 | 350 | 200 |
| 26' - 28' | 60 | 65 | <5 | 10 | <50 | <5 | 50 | 100 |
| 28' - 30' | 60 | 110 | <5 | 40 | <50 | <5 | 100 | <100 |
| 30' - 32' | 60 | 65 | <5 | 20 | <50 | <5 | 150 | <100 |
| 32' - 34' | <20 | <5 | 5 | 20 | <50 | <5 | 50 | 200 |
| 34' - 36' | 220 | 35 | <5 | 270 | <50 | 50 | 7600 | <100 |
| 36' - 38' | 120 | 90 | <5 | 60 | <50 | 10 | 1600 | 100 |
| 38' - 40' | 400 | 80 | 5 | 20 | <50 | 5 | 900 | 200 |
| 40' - 42' | 450 | 90 | <5 | 50 | 100 | 20 | 600 | 200 |
| 42' - 44' | 100 | 15 | 25 | 110 | <50 | 25 | 6700 | 400 |
| 44' - 46' | 300 | 45 | 15 | 40 | <50 | 25 | 1900 | 200 |
| 46' - 48' | 300 | 5 | <5 | <10 | <50 | 5 | 400 | 300 |
| 48' - 50' | 220 | 15 | <5 | 20 | <50 | 5 | 200 | 200 |
| 50' - 52' | 180 | 5 | <5 | 10 | <50 | 5 | 400 | 200 |
| 52' - 54' | 100 | 90 | <5 | 10 | <50 | 5 | <50 | <100 |
| 54' - 56' | 160 | 30 | <5 | 30 | <50 | 5 | 70 | 200 |
| 56' - 58' | 80 | 65 | <5 | <10 | <50 | <5 | 50 | <100 |
| 58' - 60' | 60 | 75 | <5 | 10 | <50 | <5 | <50 | 100 |
| 60' - 62' | 200 | 80 | <5 | 30 | <50 | 5 | 600 | 200 |
| 62' - 64' | 100 | 95 | 5 | 20 | <50 | 5 | 1700 | 200 |

D.D.H. 3

SUPPLEMENTARY ANALYSES

by Australian Mineral Development Laboratories

| INTERVAL | ppm Cu | ppm Pb | ppm Zn | ppm Cr | ppm Co | ppm Ni |
|---|---|---|---|---|---|---|
| 10' - 14' | 35 | 60 | 410 | 70 | <5 | 10 |
| 14' - 18' | 20 | 120 | 400 | 25 | <5 | <5 |
| 18' - 24' | 45 | 370 | 880 | 30 | <5 | <5 |
| 24' - 44' | 330 | 340 | 5300 | 100 | 10 | 10 |
| 44' - 64' | 30 | 150 | 1500 | 15 | 5 | 5 |
| 64' - 82' | 270 | 300 | 1000 | 90 | 5 | 15 |
| 99' - 105' | 920 | 2000 | 2000 | 180 | 10 | 15 |
| 105' - 110' | 620 | 900 | 1150 | 160 | 10 | 20 |
| 24' - 26' | 1400 | 1550 | 13,000 | 35 | 15 | 10 |
| 26' - 28' | 290 | 350 | 23,000 | 110 | 15 | 5 |
| 28' - 30' | 410 | 430 | 2500 | 60 | 10 | 10 |
| 30' - 32' | 1500 | 1300 | 33,000 | 70 | 10 | 5 |
| 32' - 34' | 1500 | 950 | 940 | 70 | 5 | 10 |
| 34' - 36' | 2000 | 1050 | 5100 | 380 | <5 | 20 |
| 36' - 38' | 600 | 110 | 1700 | 220 | <5 | 10 |
| 38' - 40' | 340 | 390 | 2700 | 35 | 15 | 20 |
| 40' - 42' | 170 | 110 | 2500 | 40 | 10 | 20 |
| 42' - 44' | 500 | 540 | 2200 | 110 | 10 | 30 |
| 44' - 46' | 310 | 500 | 2700 | 35 | 10 | 20 |
| 46' - 48' | 220 | 95 | 1400 | 120 | 10 | 25 |
| 48' - 50' | 340 | 200 | 1400 | 170 | 10 | 20 |
| 50' - 52' | 250 | 120 | 1050 | 290 | <5 | 20 |
| 52' - 54' | 30 | 35 | 1050 | 40 | <5 | 5 |
| 54' - 56' | 720 | 570 | 2000 | 120 | 10 | 10 |
| 56' - 58' | 35 | 140 | 1850 | 10 | 10 | <5 |
| 58' - 60' | 40 | 800 | 3000 | 10 | 10 | 15 |
| 60' - 62' | 140 | 300 | 1750 | 60 | 20 | 20 |
| 62' - 64' | 390 | 450 | 2300 | 30 | 10 | 10 |

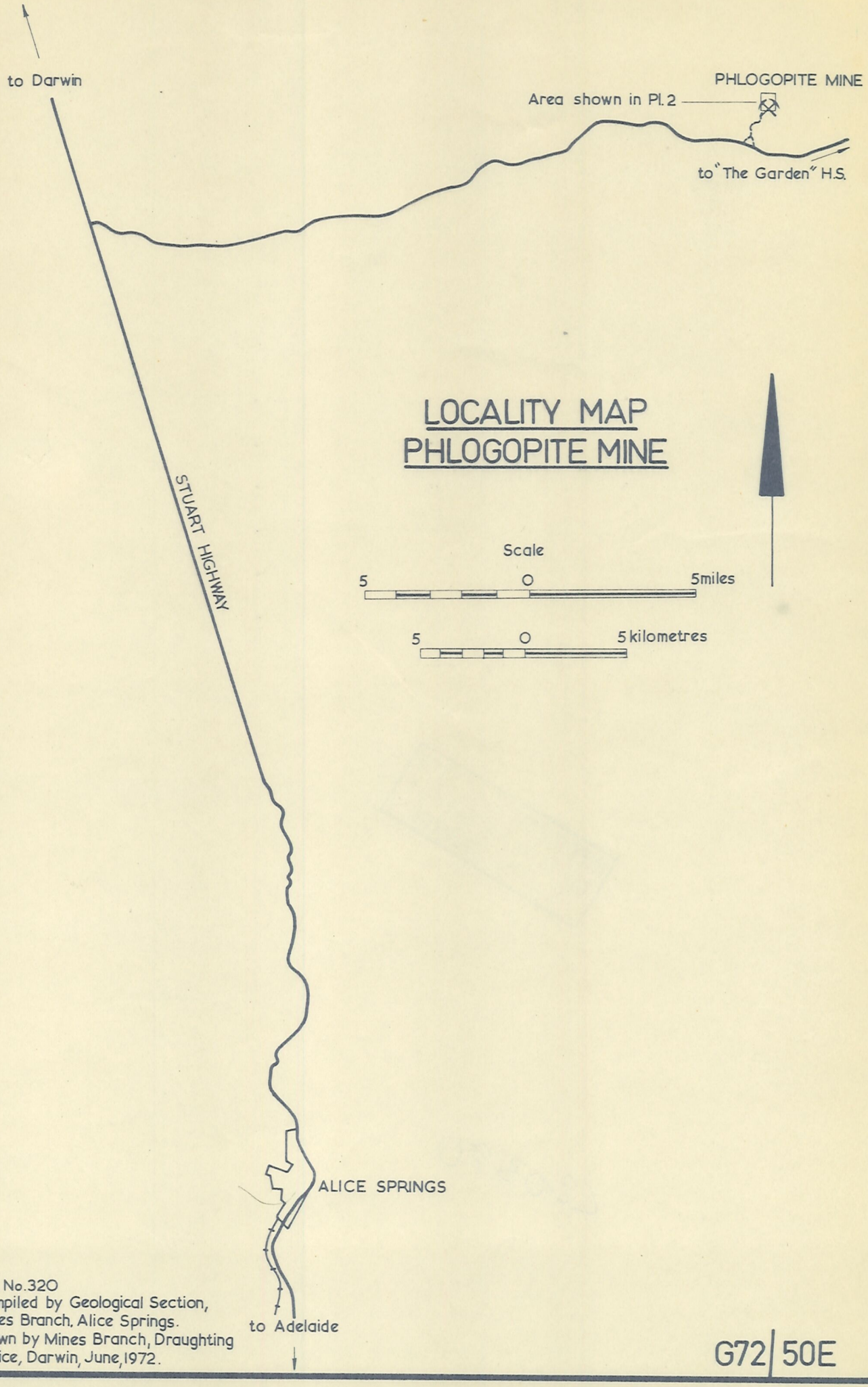
Gold, Palladium and Platinum Assays
on selected core intervals

by Australian Mineral Development Laboratories.

parts per million

| Sample Mark | Gold Au | Palladium Pd | Platinum Pt |
|---|---|---|---|
| DDH1 504-508 | <0.02 | <0.005 | <0.005 |
| DDH2 153-157 | <0.02 | <0.005 | <0.005 |
| DDH2 169-173 | 0.03 | <0.005 | <0.005 |
| DDH2 301'6"-305 | <0.02 | <0.005 | <0.005 |
| DDH3 90-94 | <0.02 | <0.005 | <0.005 |
| DDH3 110-116 | 1.5 | <0.005 | <0.005 |

Plate 1




# LOCALITY MAP
# PHLOGOPITE MINE

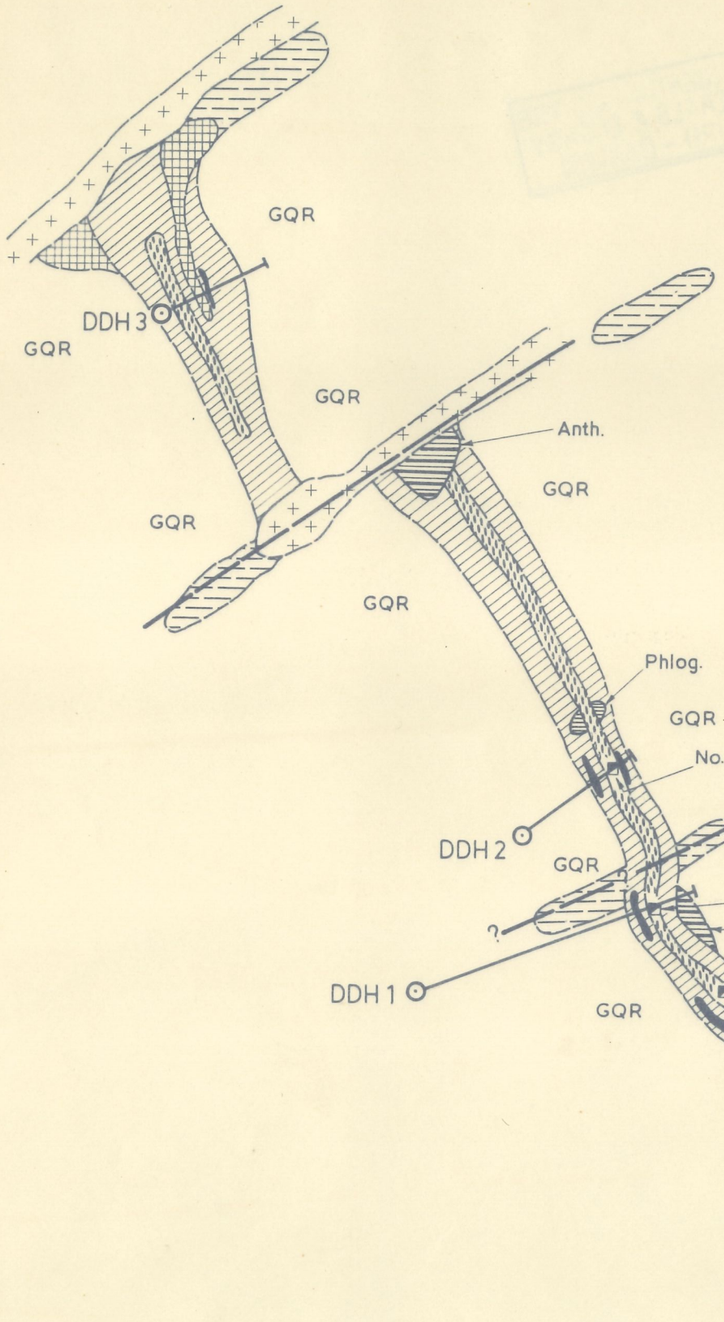
Scale

5 0 5miles

5 0 5 kilometres

G.S. No. 320
Compiled by Geological Section, Mines Branch, Alice Springs.
Drawn by Mines Branch, Draughting Office, Darwin, June, 1972.

G72/50E





# GEOLOGY OF THE PHLOGOPITE MINE

## INTRUSIVE

(After Jensen 1943 with alterations)

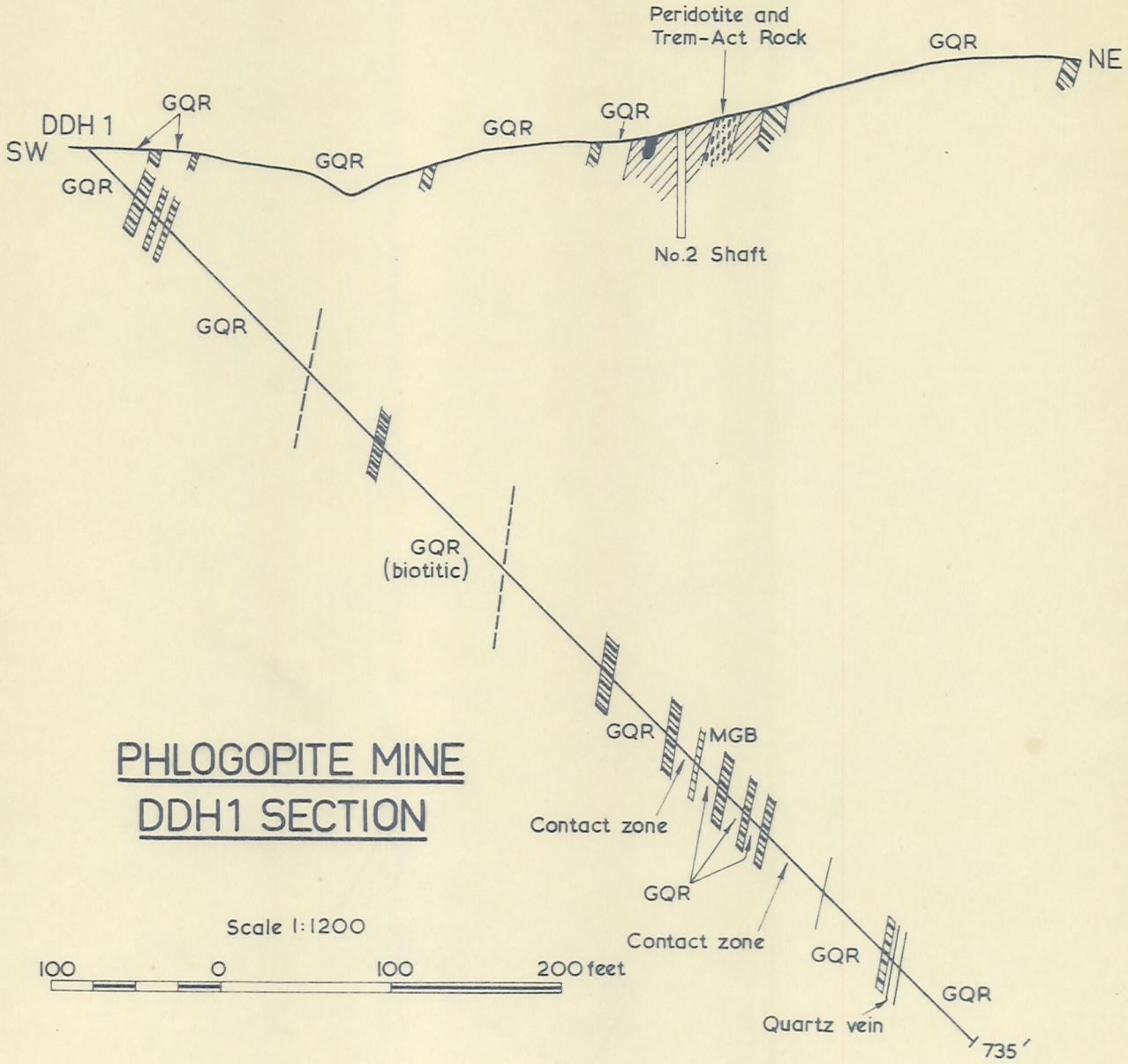
Scale

200 0 200 400 feet

REFERENCE

| | |
|---|---|
| Pegmatite | Fault, position approximate |
| Peridotite | Fault, inferred |
| Anth. Anthophillite Rock | DDH 1 Diamond drill hole, showing number |
| Carbonate Rock | Geological contact, position accurate |
| Pyroxene Gabbro | Geological contact, position approximate |
| Phlog. Phlogopite-rich Rock | Mine shaft |
| Feldspathic Schist | |
| GQR Garnetiferous Quartz Rock | |
| Magnetite-rich Rock | |

Compiled by Geological Section, Mines Branch, Alice Springs (G.S. No.320)
Drawn by Mines Branch Draughting Office, Darwin, June, 1972.




# PHLOGOPITE MINE
# DDH1 SECTION

Scale 1:1200

100 0 100 200 feet

REFERENCE

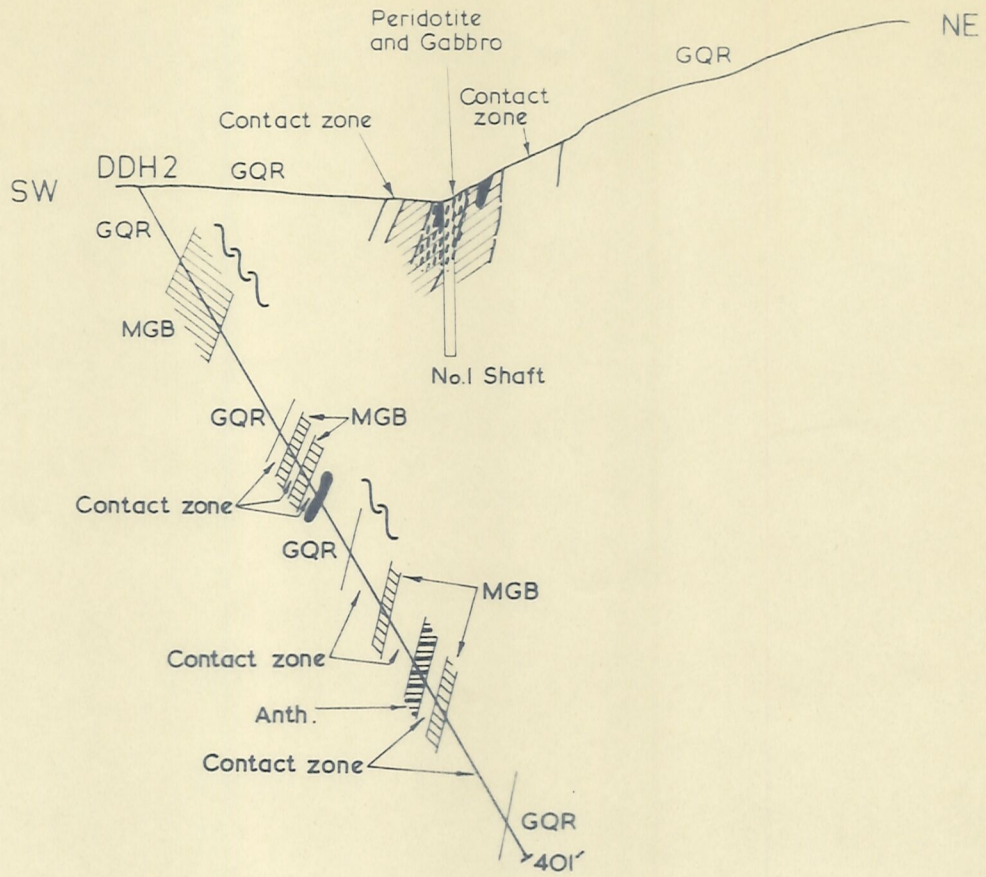
| | |
|---|---|
| GQR | Garnetiferous Quartz Rock |
| | Peridotite |
| | Pyroxene Gabbro |
| | Micro-gabbro MG-B |
| | Diorite |
| Trem-Act | Tremolite-actimolite Rock |
| | Magnetite-rich Rock |

"Contact zone"-Mixture of basic intrusive and garnet-quartz rock

Dip of Schistosity

Compiled by Geological Section, Mines Branch, Alice Springs (G.S. No.320)
Drawn by Mines Branch Draughting Office, Darwin, June, 1972.

G72/52E




# PHLOGOPITE MINE
# DDH 2 SECTION

Scale 1:1200

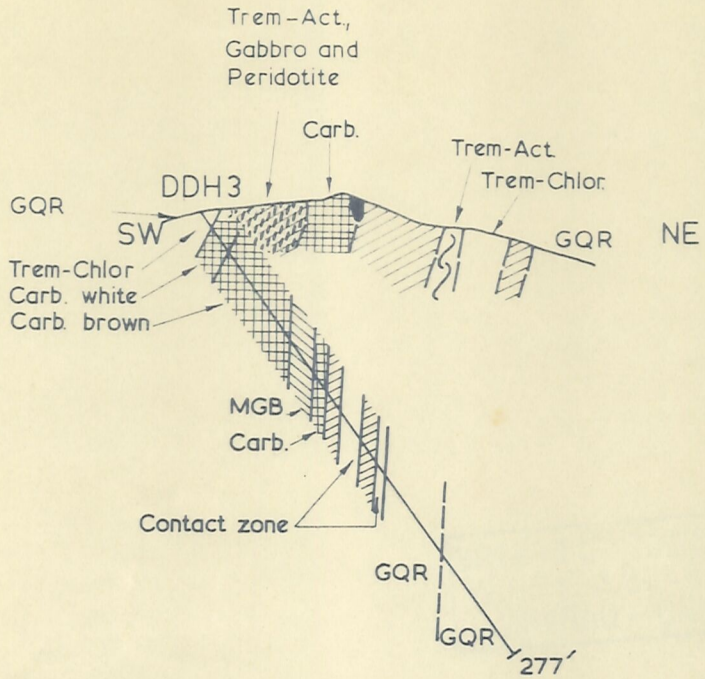
100 0 100 200 feet

REFERENCE

| | |
|---|---|
| GQR | Garnetiferous Quartz Rock |
| | Peridotite |
| | Pyroxene Gabbro |
| MGB | Micro-gabbro |
| Anth. | Anthophillite-rich Rock |
| | Magnetite-rich Rock |
| "Contact zone" | Mixture of basic intrusive and garnetiferous quartz rock. |
| | Shear zone |

Compiled by Geological Section, Mines Branch, Alice Springs.(G.S.No.320)
Drawn by Mines Branch Draughting Office, Darwin, June, 1972.

G72/53E




# PHLOGOPITE MINE
# DDH 3 SECTION

Scale 1:1200

100 0 100 200 feet

REFERENCE

| | |
|---|---|
| GQR | Garnetiferous Quartz Rock |
| | Peridotite |
| | Pyroxene Gabbro |
| Carb. | Carbonate Rock |
| MGB | Micro-gabbro |
| Trem Act. | Tremolite-actimolite Rock |
| Trem-Chlor. | Tremolite-chlorite Rock |
| | Magnetite rich Rock |
| "Contact zone" | Mixture of basic intrusive and garnetiferous quartz rock |
| | Dip of schistosity |
| | Shear zone |

Compiled by Geological Section, Mines Branch, Alice Springs.(G.S.No.320)
Drawn by Mines Branch Draughting Office, Darwin, June, 1972.

G72/54E