ASSESSMENT OF EXPLORATION

AUTHORITY TO PROSPECT 2568

HARTS RANGE AREA

NORTHERN TERRITORY

ARCADIA MINERALS LTD

BY

P.G. MILLER

CHIEF GEOLOGIST

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ASSESSMENT OF EXPLORATION

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PLAN

K 71-35 GEOLOGICAL SKETCH MAP Scale 1" = 2.5 Miles
This map was prepared by F. N. Hanlon, B.Sc., M.Aust.I.M.M.
SUMMARY

Upon request, exploration data has been examined, a field inspection made and appraisal prepared of Authority to Prospect 2558, an area of 150 square miles located in the Harts Range of the Northern Territory. The Authority to Prospect is underlain by crystalline metasediments and meta-igneous rocks of the Arunta Complex in which ultrabasic, basic and acidic intrusive rocks occur. Previous mining activity in the area was confined to the production of mica from pegmatites, and reported occurrences of radioactive minerals within the pegmatites indicated the possibility of viable occurrences of these within the area, and the Authority to Prospect was taken up on this premise. On acquisition the area was covered by low level closely spaced airborne magnetometer and differential gamma ray spectrometer methods and later by ground traversing. No significant occurrences of radioactive minerals were indicated.

Ultrabasic rocks were discovered which, from surface indications appeared to be relatively large intrusions of an olivine-rich variety. The outcrops are very silicified and the precise rock type, size of the intrusions and their mode of occurrence cannot be ascertained at this stage.

The economic potential of the area appears to be confined mainly to the possibility of nickel and copper sulphide, platinoids and chromite within the ultrabasic rocks, although minor base-metal and rare earth deposits may occur within the elevated and dissected 50 square mile area in the western portion of the Authority to Prospect. Exploration of the ultrabasic rocks is recommended with an estimated expenditure of $20,000 for Phase I of an exploration programme. Additional exploration for base metals and rare earth is not strongly recommended, but if contemplated it is estimated that an expenditure of $12,000 would be involved in a relatively detailed geochemical stream sampling programme.

Elsewhere within the Authority to Prospect the economic mineral potential is low and further work is not recommended.
INTRODUCTION

Upon request by Arcadia Minerals Limited (D.W.E. 7067 of 18.1.71) an appraisal has been made of mineral exploration carried out to date in Authority to Prospect 2568 in the Harts Range area of the Northern Territory (Lone Pine Prospect). Reports prepared by Hall Ralph & Associates and by Q. Howland of Arcadia Minerals have been studied and a field inspection carried out between 9.3.71 and 16.3.71 by the author and L.W. Stewart, Senior Supervising Geologist of William Johnson & Associates Pty. Ltd. Discussions were also held with personnel from the Geological Survey of South Australia and with the Resident Geologist of the Alice Springs branch of the Northern Territory Administration on unpublished stratigraphic and economic aspects of the area.

The purposes of the field inspection were to examine in the field various facets of the geology which had been brought out in the previous exploration, and to assess how local conditions could possibly affect future exploration requirements. The whole area of the Authority to Prospect was briefly examined but more particular attention was paid to the ultrabasic rock occurrences which had been detected late in the 1970 field season in the north eastern portion of the Authority to Prospect. Samples of the ultrabasic rock were taken and submitted for analysis and petrological examination, the results of which are included in the report.

LOCATION, ACCESS AND TOPOGRAPHY

Authority to Prospect 2568 with an area of approximately 150 square miles includes the eastern portion of the Harts Range and the plains to the east of the Range. It is located approximately 100 to 110 miles north-east of Alice Springs. Access is by good graded beef roads from the Stuart Highway via Mt. Riddock Station, or by a shorter route via Clareville Homestead. The latter although considerably shorter is trafficable only to four wheel drive vehicles in patches and the longer route is preferable. Topography is variable throughout the Authority to Prospect. The western portion is occupied by the Harts Range which consists of sharp strike ridges and deeply incised gullies. The higher peaks and ridges rise to a maximum elevation of up to 800 feet above the surrounding claims.
In this portion vehicle movement is very restricted. The eastern portion has relatively flat plain topography with isolated ridges and peaks with a maximum elevation of up to 100 feet above plain level, and in this area movement although confined to four wheel drive vehicles is relatively easy.

Water supplies in the area are limited and there is no known bore producing potable water within the Authority to Prospect. For the purposes of this survey water was obtained from bores to the south-west of the reserved area.

**PREVIOUS INVESTIGATIONS**

Prior to the current mineral exploration on behalf of Arcadia Minerals Limited geological and geophysical investigations in the region which includes the Authority to Prospect were carried out under the auspices of the Bureau of Mineral Resources and included regional mapping incorporating a study of the mica bearing pegmatites, regional aeromagnetic and reconnaissance gravity surveys and a study of the radioactivity in the Harts Range. These were carried out between 1955 and 1959 and a list of the more pertinent publications is as follows -

**Joklik, G.F.** 1955  

**Daly J**  
**Dyson D.F.** 1956  

**Vale K.R.** 1965  

**Wells R**  
**Wilsom J.S.** 1966  
Exploration on behalf of Arcadia Minerals Limited, and confined essentially to within the boundaries of the Authority to Prospect, was commenced in April 1970 with a geological reconnaissance and photo-geological study of the area carried out by Hall Relph and Associates - official consultants to Arcadia Minerals in the Northern Territory. Results and conclusions from these surveys are incorporated in reports per J. Whiting of Hall Relph and Associates dated 21.5.70 and 29.6.70. The conclusions drawn relate mainly to lithology and stratigraphy of the area, presumably to be used as control for later interpretation of airborne geophysical methods. Following the photo-geological study the entire Authority to Prospect was covered with airborne geophysical methods employing Fluxgate Magnetometer and Differential Gamma Ray Spectrometer systems. The survey was carried out and compile by Geophysical Resources Development Company with a flight line spacing of 1/5 mile at an altitude of 300 feet M.T.G. Contour plans of total magnetic intensity and total gamma ray count have been made available, but no written interpretation or uranium thorium and potassium levels of the total count have been sighted by the author.

Between September and November 1970 ground surveys were carried out by D. Howland of Arcadia Minerals Limited. These comprised inspections of all mines in the area, ground magnetometer and scintillometer surveys to confirm and correlate with the airborne surveys, and rock sampling in specific localities. Details are contained in period reports for this interval and in a compilation of all assay and petrological data of samples collected. It was during the latter phase of this survey that the ultrabasic rocks in the north-eastern portion of the Authority to Prospect were detected in rock analyses and confirmed by later petrological examination.
GEOLOGICAL ENVIRONMENT

The regional geology of the area is well described in various publications and reports and will not be elaborated in detail here. Insufficient time was available during the field inspection to confirm the stratigraphical sequence, and furthermore it is not considered warranted at this stage.

The area is underlain by a sequence of metasedimentary and possibly meta-igneous rock of the Arunta Complex lying on the eastern and north-eastern flank of the Hukitta Dome, a domal structure with a granodioritic core. Foliation throughout most of the area dips to the east, with strikes varying from north-west to north under the influence of the domal structure, the centre of which is located several miles west of the Authority to Prospect. The fracture pattern throughout the area is consistent with that to be expected on the flank of a domal structure and radial faults of varying displacement occur throughout the area although apparently more frequent in the western limits.

Rock types consist of alternating bands of muscovite-feldspar-quartz gneisses with some garnet, and biotite-quartz gneisses also with garnet. Thin bands of meta-quartzites and amphibolites occur throughout the sequence, the latter probably representing the metamorphosed equivalent of both basic igneous rocks and magnesic sediments. In the south-eastern portion of the reserve impure dolomitic marbles occur in one locality in association with calc-silicate rocks. What may be remnant algal structures also occur in calc-silicate rocks adjacent to the carbonate rocks.

Basic igneous rocks, post-dating regional metamorphism, occur as dykes, sills and plugs, generally in the western portion of the Authority to Prospect with the exception of the basic and ultrabasic assemblage in the north-eastern portion which will be discussed in more detail at a later stage. Some of the plugs are relatively large as evidenced by the occurrence of olivine norite in the south-eastern portion of the reserve which has caused considerable disruption of the enclosing metasediments.
Evidence of hydrothermal or fluid activity is present in the area in the form of pegmatite and quartz vein. The pegmatites consist essentially of quartz, perthitic microcline, plagioclase and muscovite, and are fine-grained granitic, coarse-grained or graphic. They occur as fissure veins, flat lying joint fillings, pipe-like deposits and multiple controlled deposits. The fissure veins are the most common, and have in the past been the most reliable source of commercial muscovite which has been mined in the area.

**PREVIOUS MINING**

The only record of previous mining activity in the area is from the relatively small shallow mines which produced mica from pegmatites. Production from the mines in the Authority to Prospect amounted to a few thousand pounds of mica from each mine of varying grade from 0.08% to 1.1% of saleable mica to the ton of ground mined (the average grade throughout the Harts Range area is estimated by Jaklik 1955 at 0.28% or 6.3 pounds of cut mica to the ton). Accessory tourmaline, beryl, garnet, magnetite, apatite, epidote, samarskite, betafite, monazite, tantalite, chalcopyrite and galena are recorded within the pegmatites, but the occurrences appear to be of academic interest only.

There is no recorded base metal mining in the area. A small dump of relatively high grade copper ore has been located to the north-west of the Mirror Finish Mine near the old abandoned Indiana Homestead but the source has not been located and the ore could be exotic to the area.

**ULTRABASIC ROCKS**

Isolated outcrops of highly altered ultramafic and/or ultrabasic rocks occur in the north-eastern portion of the Authority to Prospect. The outcrops which are apparently within a metasedimentary sequence are found over a strike length of approximately 16,000 feet within approximately 10,000 feet of sequence width. They occur as isolated outcrops of varying size ranging from a few feet in width and length to up to 3,000 feet long and 2,000 feet wide. They outcrop as siliceous cappings rising up to 100 feet above plain level. Relict textures suggest serpentinite and possibly carbonate mesh textures, but the silicification has been so complete as to destroy most remnant minerals. Petrographic study does however suggest an olivine-rich origin, which is confirmed by trace element assemblages where nickel values up to 8,695 ppm have been recorded.
from samples taken by D. Howland in the area in 1970 and very high chromium associated with relatively high nickel which were recorded from samples taken during this investigation. Poor quality chrysoprase occurs in some of the siliceous cappings.

In view of the previous identification of the ultrabasic rocks sampling was kept to a minimum during this survey. As the precise location of the samples taken in 1970 was not known, some sampling was done throughout the occurrences to confirm the ultrabasic origin of some of the material. The results of these are tabulated below -

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Description</th>
<th>Assays (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>Pseudo-gossan</td>
<td>Ni 1030, Cu 274, Co 225, Cr 1020, Nb 2</td>
</tr>
<tr>
<td>91</td>
<td>Actinolite rock Meta-gabbro?</td>
<td>Ni 260, Cu 62, Co 32, Cr 330, Nb 2</td>
</tr>
<tr>
<td>92</td>
<td>Gabbro adjacent to ultrabasic</td>
<td>Ni 350, Cu 87, Co 38, Cr 180, Nb 2</td>
</tr>
<tr>
<td>93</td>
<td>Magnesian schist after ultrabasic</td>
<td>Ni 1430, Cu 11, Co 63, Cr 1050, Nb 4</td>
</tr>
<tr>
<td>94</td>
<td>Talcose-actinolite rock weathered</td>
<td>Ni 420, Cu 140, Co 30, Cr 2740, Nb 2</td>
</tr>
<tr>
<td>95</td>
<td>Silicified ultrabasic</td>
<td>Ni 175, Cu 13, Co 20, Cr 1680, Nb 2</td>
</tr>
<tr>
<td>96</td>
<td>Silicified ultrabasic pseudo-gossan</td>
<td>Ni 940, Cu 23, Co 66, Cr 1500, Nb 2</td>
</tr>
<tr>
<td>97</td>
<td>Chromite lens or vein</td>
<td>Ni 1160, Cu 12, Co 295, Cr 192000, Nb 2</td>
</tr>
<tr>
<td>98</td>
<td>Calc-silicate south eastern occurrence</td>
<td>Ni 18, Cu 7, Co 12, Cr 80, Nb 10</td>
</tr>
<tr>
<td>99</td>
<td>Dolomitic marble south eastern occurrence</td>
<td>Ni 32, Cu 25, Co 26, Cr 50, Nb 4</td>
</tr>
<tr>
<td>100</td>
<td>Silicified marble, some talc</td>
<td>Ni 15, Cu 18, Co 13, Cr 125, Nb 2</td>
</tr>
<tr>
<td>101</td>
<td>Ferruginous marble highly leached</td>
<td>Ni 30, Cu 21, Co 32, Cr 35, Nb 2</td>
</tr>
<tr>
<td>102</td>
<td>Layered calc-silicate rock</td>
<td>Ni 17, Cu 10, Co 30, Cr 74, Nb 2</td>
</tr>
</tbody>
</table>

Sample numbers 90 to 97 inclusive were taken from the north-eastern portion of the reserve and confirm the ultrabasic nature of the siliceous material. Nickel values are not high, but obvious examples of siliceous nickel minerals and chrysoprase were avoided in the sampling.
Sample numbers 98 to 100 and 1101 and 1102 were taken in the south-eastern portion in the area previously reported as containing limestone. The siliceous capping and the presence of talcose minerals suggested a possibility that some of the rocks may have been ultrabasic and/or carbonatite rock. The area also has a similar magnetic pattern to the area in which the ultrabasic rocks occur. However trace element assemblage with low nickel and low niobium apparently disprove this association and confirm the petrographic information that the rocks in this area are metamorphosed limestones or dolomite.

The mode of occurrence of the ultrabasic intrusions is difficult to determine. With the exception of the silicified ultrabasic, there is almost a complete absence of outcrop of other rock types in the area, and no contacts of the ultrabasic with surrounding rocks were observed. In fact the nature of the surrounding rock is unknown, but on regional grounds a metasedimentary sequence similar to that found elsewhere in the region is postulated.

There is little structure remaining in the silicified cappings to suggest the type of ultrabasic intrusion. Petrographic studies on samples collected by Howland of silicified material suggest an olivine rich rock which has been serpen tinised, carbonatised and later silicified. The high olivine content is also reflected in the high nickel assays recorded for these samples as it is considered that in ultrabasic or ultramafic primary rocks most of the nickel is contained within the olivine minerals.

Samples taken by the author were from the margins of the outcropping material and consisted mainly of spoil on rabbit warrens and not outcrop. They have been identified as metamorphosed basic rocks, gabbros and mela-gabbros rather than ultrabasic. This may indicate either a layered complex with the more felsic varieties the product of differentiation or alternatively, assimilation of silica in the country rocks by the ultrabasic magma to produce a rock essentially basic in composition. The latter is favoured because of the apparent greater amount of ultrabasic material in the outcrop, and the lack of an extensive sequence of felsic material which would indicate differentiation of a basic magma.
A vague layering is apparent in the siliceous cappings and is suggestive of relatively flat dips and contortion or circular structures within the intrusions. It may also reflect a weathering profile development associated with the silicification of the ultrabasic. The structures are not visible on the aerial photographs available, and detailed mapping would be required to assess their significance.

It is not possible at this stage to classify the type of ultrabasic intrusion. Whether the bodies are concordant or otherwise is not known and their full extent is uncertain. They appear in some cases to be plug-like but in others to be tabular, and more detailed geological mapping and geophysical work would be required to establish their form.

Ultrabasic rocks of this type have not previously been recorded within the Arunta Complex and consequently there is no indication of the economic potential of the bodies. The siliceous cappings bear a superficial resemblance to siliceous cappings occurring over ultrabasic rocks in the Musgrave Block in South Australia. The occurrences in South Australia have been tested by diamond drilling and found to consist of serpentinised and carbonatised dunites and peridotites which have been subjected to regional metamorphism [approximate age 1600 million years] and potassium metasomatism. They are considered [pers. comm. South Australian Geological Survey] to be conformable, and not of the alpine type, although significant sulphide mineralisation has not been located to date within the South Australian occurrences.

The occurrences in the Northern Territory differ in that they appear to be much lower in iron, and there is no strong development of primary or secondary magnetite which occurs abundantly in the South Australian occurrences. This is reflected also in their low response to magnetic methods where airborne surveys indicate very low order anomalies overlying the ultrabasic rocks and ground surveys show only isolated values of up to 4000 gamma above background.

Chromite segregations are much more evident in the Northern Territory occurrences and in one locality there appears to have been minor prospect pitting on a chromite lens. The chromite was tested for platinum but no significant amounts were recorded. The plug-like circular structures and relict carbonate texture are vaguely suggestive of a kimberlite-carbonatite association although the distinctive kimberlite textures and mineral assemblages were not observed. The niobium content of approximately 2 ppm is also considerably lower than the 70 ppm to 240 ppm recorded in kimberlites elsewhere in the world.
Carbonatites have been recorded in the Arunta Complex and this association cannot at this stage be discounted, but much more extensive sampling would be required to confirm or disprove their origin.

Relatively high copper at 274 ppm was recorded in a weathered variety resembling gossan, although no relict sulphide mineral textures were observed. This is higher than normal for weathered ultrabasic rocks and may be of significance.

**ASSESSMENT**

Authority to Prospect 2568 is underlain by a sequence of metasedimentary rocks of probable Lower Proterozoic age although metamorphism is obviously of a much younger age. The metamorphic grade is relatively high and the rocks are considered to be of the upper amphibolite-granulite metamorphic facies.

Within the sequence, igneous intrusive rocks occur both as metamorphosed and unmetamorphosed varieties.

- Metabasic rocks occur throughout the sequence represented now by amphibolites although distinction between these and metasedimentary rocks of basic composition is difficult.
- Basic rocks occur in plugs, sills and dykes of post metamorphic age, mainly confined to the western portion of the Authority to Prospect, where there are relatively large plug and sill-like intrusions of olivine-norite.
- Ultrabasic rocks occur in the north-eastern portion of the reserve, but the mode and the extent of the occurrences is not known.
- Granodiorite occurs to the west of the Authority to Prospect although none has been located to date within. Pegmatite bodies are abundant in the mid-western portion confined mainly to the Irindina and Brady Gneiss horizons where they have been a previous source of mica.

There is no detailed geological map of the area. Photo-geological studies have been undertaken but have been aimed at delineating stratigraphy with minor emphasis on smaller scale structural features which could be extracted from such a study.
Exploration to date has been largely on a regional basis and has comprised mainly airborne geophysical methods with only limited follow up ground examination. The Authority to Prospect was apparently taken up as an area containing possible radioactive mineral deposits, and to this purpose the low level spectrometric surveys have given adequate coverage especially when combined with the ground traversing.

No markedly anomalous areas are obvious in the total count contour plan. Areas of above background have been investigated by ground surveys and apart from isolated spot readings no significant highly anomalous areas have been located. Results of individual levels for uranium, thorium and potassium have not been sighted but it is presumed that these do not significantly alter the results of the total count, and as a consequence the area must be considered to have been adequately explored for radioactive minerals without success.

The base metal potential of the area has not really been appraised. Apart from minor prospecting carried out during the ground magnetometer and scintillometer traverses there has been no systematic survey in this regard. It could be assumed that the area has been prospected in the past and all obvious surface indications located. However because of varying trends in past exploration within the region it may be that base metals have not been the object of previous prospectors, although this is considered unlikely in view of the proximity to the Jervois Range base metal occurrences.

With the exception of very minor sulphide minerals recorded in amphibolitic rocks and in the olivine-norite, no evidence of base metal mineralisation was recorded in the brief reconnaissance survey carried out in March of this year, and with the exception of the copper ore found near the old abandoned Indiana Homestead which is considered to be exotic, no significant occurrences were recorded during the 1970 ground surveys.

The base metal potential does not appear to be high, although the occurrence of basic igneous rocks in association with later hydrothermal activity could have provided favourable conditions for the formation of small copper sulphide bodies and to a lesser extent, lead and zinc. This aspect may be worthy of limited exploration. Similarly, occurrences of rare earth minerals are reported to the north of the Authority to Prospect within and associated with pegmatites and although none have been located in the pegmatitic bodies examined here, some limited exploration may be warranted.
The ultrabasic bodies are of unknown potential as occurrences of this rock type have not been previously reported in the region. The ultrabasic rocks could provide hosts for nickel and copper sulphide minerals and also for chromite and platinoid minerals. Exploration to date on these bodies has been very limited.

CONCLUSIONS

The Authority to Prospect has been adequately explored for radioactive minerals without success and it is considered that the area does not warrant further exploration in this regard.

It is probable that there are still significant reserves of mica in the area, but in view of the unsatisfactory price position and the intense competition from overseas sources they are not an attractive economic proposition.

Base metals and rare earth elements may occur within the region although indications are not particularly favourable for the occurrence of large ore bodies. A low cost exploration programme may be warranted however, before the area is discarded.

The ultrabasic occurrences, which are the first reported within rocks of the Arunta Complex require further exploration to determine their potential as host rocks for nickel and copper sulphide minerals and also for chromium and platinoids. Reconnaissance traversing outside of the Authority to Prospect would also be desirable to locate additional occurrences which could lie in unleased territory.

RECOMMENDATIONS

Future exploration within the Authority to Prospect will depend upon the policy of Arcadia Minerals Ltd. Relatively high option considerations may have a bearing on a future expenditure on exploration and these factors are beyond our resolution. Without consideration of them, our recommendations, based on the work done prior to our involvement and from our assessment of the area would be as follows.
The primary object for future exploration should be the ultrabasic rock occurrences in the north-eastern portion of the Authority to Prospect. Secondary consideration would be exploration of the elevated bedrock masses in the western portion. The outlook for the latter is not promising and cannot be strongly recommended but may be desirable if complete coverage of the Authority to Prospect is considered necessary.

Phase I of the exploration of the ultrabasic rocks would require controlled ground magnetometer traversing, geological mapping and rock sampling of the known occurrences and reconnaissance to locate additional occurrences within and outside of the area of the Authority to Prospect. Because of the poorly outcropping and extensively altered nature of the ultrabasic rocks sub-surface information would be required at an early stage to obtain samples for positive identification of the type of ultrabasic rock beneath the siliceous capping. This would more likely be regarded as a Phase II operation and could possibly involve the use of electrical geophysical methods to locate metallic conductors. The Phase I programme could be modified at any stage to include these if considered warranted.

To test the western elevated area geochemical sampling involving both active stream sediments and heavy mineral concentrates would be required as a Phase I to delineate area for more detailed examination.

Estimated expenditure is tabulated below. The two projects have been costed separately but some overlap would be possible if both were undertaken with a reduction in total cost.
Ultrabasic Exploration

Surveyed Grid (Contract Rates) Baseline with croSSLines at 1000' intervals.

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<tr>
<th>Description</th>
<th>Cost</th>
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<tr>
<td>60 Line Miles at $65 per line mile</td>
<td>3,900</td>
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<tr>
<td>Mobilisation charges from Adelaide</td>
<td>800</td>
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<td><strong>Total</strong></td>
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Magnetometer Traversing (Contract Rates)

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<td>60 Line Miles @ $30 per mile</td>
<td>1,800</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>8,180</strong></td>
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Geological Mapping etc.

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<th>Cost</th>
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<td>1 Geologist, 6 weeks @ $560 per week</td>
<td>3,360</td>
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<tr>
<td>1 Field Assistant, 6 weeks @ $140 per week</td>
<td>840</td>
</tr>
<tr>
<td>Vehicle Hire plus Insurance (Alice Springs)</td>
<td></td>
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<tr>
<td>6 weeks @ $80 per week</td>
<td>480</td>
</tr>
<tr>
<td>Vehicle Mileage, 3000 miles @ 15 cents per mile</td>
<td>450</td>
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<tr>
<td>Fuel etc.,</td>
<td>150</td>
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<tr>
<td>Caravan Hire, 6 weeks @ $40 per week</td>
<td>240</td>
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<tr>
<td>Messing, etc.</td>
<td>340</td>
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<tr>
<td>Mobilisation from Adelaide (Air Fares + Accommodation)</td>
<td>320</td>
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<tr>
<td>Assaying and petrographic work</td>
<td>1,000</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>8,180</strong></td>
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Reporting and Assessment

<table>
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<tr>
<th>Description</th>
<th>Cost</th>
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<tr>
<td>1 Geologist, 10 days @ $80 per day</td>
<td>800</td>
</tr>
<tr>
<td>Drafting</td>
<td>150</td>
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<td><strong>Total</strong></td>
<td><strong>950</strong></td>
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Supervision

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<tr>
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<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field: 1 Supervising Geologist</td>
<td></td>
</tr>
<tr>
<td>10 days @ $130 per day</td>
<td>1,300</td>
</tr>
<tr>
<td>Mobilisation from Perth</td>
<td>300</td>
</tr>
<tr>
<td>Office: 1 Supervising Geologist</td>
<td></td>
</tr>
<tr>
<td>5 days @ $130 per day</td>
<td>650</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,250</strong></td>
</tr>
</tbody>
</table>

* + 10% contingencies                                       | 1,790 |

**TOTAL**                                                   | **$19,670** |

Say $20,000
Geochemical Sampling Western Area

50 Square Miles with sample density 25 per square mile plus
250 heavy mineral concentrates.

Map Preparation of topographic control for sampling
1 Geologist, 5 days @ $80 per day
Drafting, etc. 

Sampling
2 Field Assistants, 25 days @ $20 per day each
Vehicle hire plus insurance (Alice Springs)
Vehicle mileage 2000 miles @ 15 cents per mile
Fuel, etc.
Messing, etc.
Caravan Hire
Mobilisation from Adelaide
Field Supervision, 1 Geologist 5 days @ $80 per day

Assaying
1500 samples @ $4 per sample

Compilation & Reporting
1 Geologist, 10 days @ $80 per day
Drafting, etc.

Supervision
1 Supervising Geologist, 5 days @ $130 per day

* plus 10% Contingencies

TOTAL $ 11,950

Say $ 12,000
Subsequent exploration requirements are difficult to assess and cost. The availability of geophysical and drilling contractors in the Northern Territory is not known to us at this stage, and additional research would be required as it would be desirable to use locally based organisations to avoid excessive mobilisation charges.

P.G. MILLER
CHIEF GEOLOGIST

16/4/71
1. Area containing ultrabasic rocks
   "Primary Exploration Area"

2. Area amenable to stream sediment sampling
   "Secondary Exploration Area"

ARCADIA MINERALS LTD.
ATP 2568 - NORTHERN TERRITORY
"GEOLOGICAL SKETCH MAP"
(After F.N. HANLON)

SCALE IN MILES
0 1 2 3 4 5 miles

REPORT ON NORTHERN TERRITORY
FIELD TRIP 14 OCTOBER - 14 NOVEMBER

In the 1930's Mr Dale found a carnitite vein within a pegmatite, somewhere near Lone Pine. He brought a specimen back to Sydney and did not revisit the area till 1970 (the specimen which has been identified as uranium is now in the possession of Ken Smith of Geoman).

Mr Dale contacted Don Emerson in September 1971 with regard to the uranium and suggested that if he was sent out to the general area he would possibly be able to find the vein of uranium.

My purpose was to drive Mr Dale along all known roads in the vicinity of Lone Pine so as to pinpoint landmarks and so familiarise himself with the country. From this it was hoped he could remember where the uranium was located. See Map 1.

At the end of three weeks Mr Dale had still not recognised any major landmarks and was no closer to finding the uranium body.

In the last week, I therefore carried out:
(1) More sampling of the ultrabasics found in the previous survey under the heading Location 1 and 2
and
(2) Carried out some limited regional prospecting, samples sent to Sydney coming from Locality 3.

1. (a) **Locality 1** is situated on the eastern margin of the main ultrabasic hill found in 1970. These results show that the nickel content is highly variable 500ppm-3,200ppm (see assay sheet K71-1771) but that the ultrabasic character of the intrusion is maintained to this margin.

(b) **Locality 2** is situated on the northern margin of the most easterly ultrabasic on Arcadia's leases. Once again the nickel content is variable but in this case low. (see assay sheet K71-1806) This margin may therefore represent a gabbroic portion of the intrusion with the ultrabasic differentiate represented in the centre of the intrusion.

2. **Locality 3** is situated 4 miles NW of the main ultrabasic hill found in 1970. The outcrop is 100' wide, 400' long and is ellipsoidal in shape, the longer axis directed NW-SE. The hill protrudes 30' above plain level. The main rock type is silicified limonite with small veins of chalcedony and chrysoprase cross cutting the main body.
This is to Certify that we did analyse the undermentioned:

APPLICANT: ARCADIA MINERALS,
G.P.O. BOX 4883,
SYDNEY N.S.W. 2001
ATTENTION: MR. D.W. EMMERSON

SUBJECT: FOUR (4) ROCK SAMPLES DESIGNATED LONE PINE N.T. LOCALITY 2 were received in our Registered Laboratory on 11.11.71 for the purpose of analysing.

ANALYSIS: Each of the four (4) rock samples were split into two (2) pieces, one half for return to client and the other prepared and analysed as required by Atomic Absorption Spectroscopy.

RESULTS: Results of our determinations are as under:

<table>
<thead>
<tr>
<th>SAMPLE NO.</th>
<th>Cu</th>
<th>Ni</th>
<th>Co</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35</td>
<td>250</td>
<td>50</td>
<td>360</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>885</td>
<td>35</td>
<td>450</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>385</td>
<td>25</td>
<td>1090</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>500</td>
<td>50</td>
<td>725</td>
</tr>
<tr>
<td>L.O.D.</td>
<td>2 ppm</td>
<td>5 ppm</td>
<td>10 ppm</td>
<td>45 ppm</td>
</tr>
</tbody>
</table>

SYDNEY
18th November, 1971.
This is to Certify that we did analyse the undermentioned:

APPLICANT: ARCADIA MINERALS,
BOX 4883, G.P.O.,
SYDNEY, N.S.W.
ATTENTION MR. D. W. EMMERSON

SUBJECT: FIVE (5) ROCK SAMPLES DESIGNATED 'LONE PINE' LOCATION 2 were received in our Registered Laboratory on 7.11.71 for the purpose of analysing.

ANALYSIS: Each of the five (5) rock samples were split into two (2) pieces one half for return to client and the other prepared and analysed as required by Atomic Absorption Spectroscopy.

RESULTS: Results of our determinations are as under:

<table>
<thead>
<tr>
<th>SAMPLE NO.</th>
<th>Copper ppm</th>
<th>Nickel ppm</th>
<th>Cobalt ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>115</td>
<td>325</td>
<td>85</td>
</tr>
<tr>
<td>2</td>
<td>230</td>
<td>50</td>
<td>55</td>
</tr>
<tr>
<td>3</td>
<td>75</td>
<td>0.32%</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>55</td>
<td>850</td>
<td>135</td>
</tr>
<tr>
<td>5</td>
<td>55</td>
<td>675</td>
<td>85</td>
</tr>
<tr>
<td>L.O.D.</td>
<td>2</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

SYDNEY
16th November, 1971.

This Laboratory is Registered by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its terms of registration.

For CARGO SUPERINTENDENTS CO. (A/SIA.) PTY. LTD.

Chief Chemist.