RELINQUISHMENT REPORT ON
FLAT TOP HILL
EL 5659
TO 21 MAY 1993
VICTORIA RIVER DOWNS - DALY WATERS
1:250,000 SHEET AREAS
NORTHERN TERRITORY

by

R W A Crowe

Licence Holders:
Ross Wilson Armfield &
Terrence Royle McNair

For: Licence Holders (1)
Department of Mines & Energy, Northern Territory (1)

Signed:

R W A Crowe
Director

CR93/774
SUMMARY

This report summarises the work completed on EL 5659 to 31st May 1993 and contains details of the work completed on relinquished areas to date. The licence has been held as part of an exploration program for opals, based on a reported discovery some 10 years before. Exploration has consisted of prospecting trips involving bulk sampling and panning to yield concentrates that have then been examined for opals. Chemical analyses on some of the bulks was conducted as a check for other minerals of interest but was non conclusive. Geological studies have consisted of Landsat and air-photo studies which have highlighted a number of lineaments which could be of interest if opals can be proved from the area. However to date this has not been possible because it transpires that the target horizon for opals is overlain by a younger unit. This means that the only effective test of the opal potential will have to be by drilling.
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3. Third Year's Activity Report

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1.0 INTRODUCTION

EL 5659 was applied for following a rumor of semi-precious stones that had been discovered in a drilling survey some 10-15 years previously.

2.0 SUMMARY OF WORK TO DATE

2.1 FIRST YEAR

In the first year of the licence, reconnaissance strips were made to the area to assess the similarity to the rumoured description of the area by drillers. In addition, detailed literature searches were made to locate previous information relating to the area and recommendations were made for further reconnaissance work in the licence, and a shallow auger drilling survey. This work highlighted an area of interest around Pussy Cat Bore as the most likely place for follow up work.

The results of the first years activity are contained in the work report which is being released in full (Appendix 1).

2.2 SECOND YEAR

The second year of activity concentrated on assessing the general potential of the area by making comparison to the opal fields at Coober Pedy and several site visits to assess the targets on the ground.

The results of the second years activity are contained in the work report which is being released in full (Appendix 2).

2.3 THIRD YEAR

The third year of activity concentrated on an aerial photographic and satellite-image study and prospecting trips to the area to identify targets.

The results of the third years activity are contained in the work report which is being released in full (Appendix 3).

2.4 FOURTH YEAR

The fourth years work consisted of preparatory work for a drilling survey which was eventually postponed because of bad weather and unavailability of a rig. This survey is now due to occur in the final year.

The results of the fourth years activity are contained in the work report which is being released in full (Appendix 4).

Chemical analyses of some of the bulk samples that were taken, and which were omitted in the main work report are included in Appendix 5.

An up to date map with the results of the air-phot study and the remaining part of the licence is included as Encl. 1.
3.0 CONCLUSION

The work on the relinquished parts of EL 5659 shows that the area is is flat lying and has a preserved sequence of Early Cambrian Antrim Plateau Volcanics unconformably overlain by Middle Cambrian Montejinni Limestone which is in turn unconformably overlain by the Cretaceous Mullaman Beds. The area is also covered in a thin pisolithic laterite. Air phot study of the area has shown up a number of structural features, some of which may have significance for opal occurrence if the presence of the mineral can be demonstrated in the area. To date this has not been done and the rumour of opal discovery remains unconfirmed.
APPENDIX 1

FIRST YEAR'S ACTIVITY REPORT
REPORT ON EXPLORATION ACTIVITIES
FLAT TOP HILL
EL 5659
FOR YEAR TO 21 MAY 1990
VICTORIA RIVER DOWNS - DALY WATERS
1:250,000 SHEET AREAS, NORTHERN TERRITORY

by

R W A Crowe

Licence Holders:
Ross Wilson Armfield,
Desmond John Foynes
& Terrence Royle McNair

For: Licence Holders (2)
Department of Mines & Energy, Northern Territory (1)

Signed:

R W A Crowe
Director
SUMMARY

Based on a ten-year-old driller's report of a precious stone discovery during a routine drilling programme in the Sturt Plateau in the Northern Territory, an Exploration Licence was applied for around the reputed drill site.

Exploration in the first year has consisted mainly of an exhaustive data search to try to locate the relevant drill records. This yielded open-file and other data on previous work that showed the area has demonstrated potential for diamonds, an old rumour of gold and possible potential for opal.

Two prospecting trips were undertaken and have accomplished a good understanding of the area's logistics, regional geology and level of previous activity. Exhaustive prospecting for visible signs of precious and semi-precious stones have been undertaken but have so far not confirmed the original drill intersection report. However, open-file drill information which has since come to hand, suggests an area worthy of detailed sampling work for the forthcoming year.
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APPENDIX 1 REPORTS OF DIAMOND OCCURRENCES FROM REGION
(Selected Extracts From Northern Territory Mines Department Data Search)
1.0 INTRODUCTION

EL 5659 was applied for following a rumour of semi-precious stones that had been discovered in a drilling survey some 10-15 years previously. The application was based on lengthy enquiries from drilling and exploration companies, as to where the reputed work might have taken place and was eventually narrowed down to the area of this licence. Repeated and diligent efforts have been made to exactly locate the drillhole but the relevant records have not so far been found. The licence holders have, therefore, resorted to detailed ground searches and prospecting in order to locate the drillhole. This report summarises the literature searches and enquiries made to date and the subsequent prospecting trips that have been undertaken. It also provides a compilation of the background geological information for the area as a basis for future work.

2.0 LOCATION AND ACCESS

The exploration licence is located on the boundary between the Victoria River Downs and Daly Waters 1:250,000 sheet areas, along the Buchanan Highway, where the Highway rises up onto the Sturt Plateau. This area is about 20 kilometres east of Top Springs Hotel, the nearest area for services. Top Springs in turn, is a day's drive (500 kilometres) from Kununurra, on the Victoria River Downs Road or about 120 kilometres further by sealed road via Willaroo. It is roughly the same distance by road from Darwin via Catherine. Access from Perth is best by plane to Kununurra and then by road.

Access throughout the licence area is by four-wheel drive vehicle across grass covered plains and laterite surfaces and no problems should be encountered for site works.

Part of the application area was disallowed as it fell within an Aboriginal property, and this area has been excised from the licence (see Figure 1).

3.0 PHYSIOGRAPHY

The exploration licence occurs on the west side of the Sturt Plateau, where it is dissected by head waters of the Armstrong River which is a second-order tributary of the Victoria River Drainage System. The Sturt Plateau is a broad, gently undulating and generally undissected laterite plateau, underlain by clay-rich Cretaceous rocks. It rises to 320 metres above sea level in the Eastern part of the licence, whereas the Western part is only 175 metres above sea level. The scarp area between the East and Western parts has a lower profile of broad plains and undulating hills underlain by limestone. This gives way to the East to the dissected lateritic plateaux, mesas and buttes of the edge of Sturt Plateau (e.g. Flat Top Hill, Bald Knob, Peak Knob). More details of the physiography are given in the explanatory notes for Victoria River Downs and Daley Waters 1:250,000 sheet explanatory notes (Brown, 1969 and Sweet, 1973).
4.0 REGIONAL GEOLOGY

The regional bedrock stratigraphy of the area is simple and is summarised in Table 1.

**TABLE 1**
**STRATIGRAPHY OF EL 5659**

<table>
<thead>
<tr>
<th>NAME</th>
<th>AGE</th>
<th>THICKNESS IN M</th>
<th>ROCK TYPE &amp; FORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laterite</td>
<td>Late Cretaceous to Tertiary</td>
<td>5-20</td>
<td>Micaceous and pisolithic 'hard cap'. Formed in ancient soil horizon.</td>
</tr>
<tr>
<td>UNCONFORMITY</td>
<td></td>
<td></td>
<td>No Deposition</td>
</tr>
<tr>
<td>Mullaman Beds</td>
<td>Early Cretaceous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit C</td>
<td>Albion</td>
<td>&lt; 20m</td>
<td>Micaceous siltstone and grit formed in retreating sea.</td>
</tr>
<tr>
<td>Unit B</td>
<td>Aptian</td>
<td>10m</td>
<td>Marine claystone and siltstone with some beach sandstone.</td>
</tr>
<tr>
<td>Unit A</td>
<td>Aptian</td>
<td>5m</td>
<td>Ferruginous grit and conglomerate. Probably formed by rivers.</td>
</tr>
<tr>
<td>UNCONFORMITY</td>
<td></td>
<td></td>
<td>No Deposition</td>
</tr>
<tr>
<td>Montejinni Limestone</td>
<td>Middle Cambrian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit 3</td>
<td></td>
<td>10-30</td>
<td>Brown fossiliferous limestone minor dolomite formed in quiet sea.</td>
</tr>
<tr>
<td>Unit 2</td>
<td></td>
<td>10-40</td>
<td>Red calcareous mudstone, minor limestone and chert formed in muddy sea.</td>
</tr>
<tr>
<td>Unit 1</td>
<td></td>
<td>0-30</td>
<td>Dark fine-grained limestone minor chert overlain by bedded nearshore limestone.</td>
</tr>
<tr>
<td>UNCONFORMITY</td>
<td></td>
<td></td>
<td>No Deposition</td>
</tr>
<tr>
<td>Antrim Plateau Volcanic</td>
<td>Early Cambrian</td>
<td>&gt; 250m</td>
<td>Massive basalt with minor sandstone and limestone lenses, minor agglomerates. Lavas extruded mainly subaerially.</td>
</tr>
</tbody>
</table>


Structurally the area appears to be very simple with no displacement faults mapped. However, several Northeast-trending en echelon photo-lineaments have been mapped, but they appear to be young features with little displacement. At this stage, it is unlikely they have a control on any mineralisation but they should be kept in mind as work progresses.

5.0 LICENCE GEOLOGY

The licence geology has not been mapped in detail as the existing 1:250,000 mapping is adequate for reconnaissance exploration. The entire area of interest is underlain by either Montejinni Limestone of Cambrian age or the Cretaceous Mullaman Beds. Both formations have individual units within them (see above) and as work progresses it will probably be worth mapping these in some detail.

6.0 MINERALISATION & EXPLORATION OBJECTIVES

Mineralisation reported from the general area consists of copper and minor lead, as spotty mineralisation in the Antrim Plateau Volcanics which underlie the area. However, the main emphasis of this programme is for precious or semi-precious stones based mainly on the reports of diamonds from the area and in particular on the report of a discovery in a drillhole drilled some 10-15 years ago. The area also has potential for opal in the Cretaceous Mullaman Beds as the formation contains a middle marine unit likely to contain diatomaceous silica. In addition, there is a previous report of gold in the Antrim Plateau Volcanics in a drillhole that was drilled in the mid-western part of the licence. It is intended to follow up each of these objectives with the main emphasis being on precious stones.

However, the first objective of the programme is to try to locate the drillhole that was described as being drilled in the area.

The method has been to try to locate the drill records from the area to see if they tally with the description of the discovery hole. The other method has been by detailed ground searches and surface prospecting.

7.0 WORK UNDERTAKEN DURING THE FIRST YEAR

7.1 Literature Search

A comprehensive literature search has been made of the Mines Department open-file data system in Darwin and also enquiries were made with the Bureau of Mineral Resources in Canberra regarding details of the drilling that they undertook in the area.

Details of the diamond exploration have been obtained from the Mines Department and summary data sheets are listed in Appendix 1 which show the fairly widespread occurrence of small diamonds in the Daley Waters sheet area. This confirms the potential of the area.
7.2 Enquiries to Trace Reported Drilling

Comprehensive enquiries have been made from a number of companies who were reputed to have been interested in the area. Apart from the BMR in Canberra, enquiries have been directed through Ensearch of Dallas in the United States, CRA in Australia and old records of Aquitaines have also been checked. Enquiries have also been directed through the Water Authorities in the Northern Territory, the Department of Lands and the Lands Council.

From all of the above enquiries only one report appears to tally with the descriptions given by the driller of the discovery hole. This is a report by CRA on gold exploration drilling that was done in the western part of the licence (Swensson, 1978). This survey followed up a report of gold in the Antrim Plateau Volcanics that had been found in water drilling, in the late 40’s. The source of this original report is unknown. However, the bore holes appear to tally roughly with the driller’s precious stones report, and this area would appear to have the best indicated potential – for further work.

7.3 Reconnaissance Field Work

Two field trips were made to the area for reconnaissance prospection. The first was made between 2-11 November by two of the licence holders, who established the grid and licence boundaries and familiarised themselves with the area. Some creek sampling was done and visual checks made for precious stones. Regionally, reconnaissance traverses were also made outside the licence to places where drilling had been done.

This trip confirmed that the Exploration Licence area tallied most closely with the driller’s recollection of the drilled site.

A second field trip was made between 29 April - 16 May when the same licence holders revisited the area and conducted more detailed prospection on a pattern grid basis. Several old drillholes were found and sampled. However, so far no precious stones have yet been discovered. Unfortunately, the report of the CRA drilling (Swensson, 1978) was not available at the time of this prospecting trip and it is now felt that future efforts should be concentrated in this area.

Although representative samples of creek sediment and rocks in the area were taken, no analyses were conducted as identification of precious and semi-precious stones relies mainly on visual identification.

8.0 CONCLUSIONS FROM FIRST YEAR’S WORK

The licence holders feel that their search to track down the report of the discovery of precious stones from an exploration drillhole in the Daley Waters area has now led them successfully to the correct site, and that the most likely source of the rumour was the drilling conducted by CRA in the Pussy Cat Bore region and described by Swensson (1978). This drilling intersects both the Cretaceous Mullaman Beds which contains reworked fragments of underlying Montejinni Limestone and the holes bottomed in Antrim Plateau Volcanics. Although the CRA survey did not confirm the presence of gold in the area, no sampling for precious stones was done so further work is clearly warranted.
9.0 RECOMMENDED PROGRAMME FOR YEAR TWO

Now that the most prospective area has been located in the licence, it is intended to conduct further exploration by extensive short hole auger sampling and washing of samples. It is also intended to conduct panning of creek sediments in the area of interest.

REFERENCES


APPENDIX 1

REPORTS OF DIAMOND OCCURRENCES FROM REGION

(Selected Extracts
From Northern Territory Mines Department Data Search)
Exploration for gold within E.L. 5659.
Abstract: Exploration licence was surrendered. Only one small diamond was found.

Notes:

Text Location: L-D

Microfiche: (y=yes n=no)

Indexed By/Date: SHD 11/12/84
Checked By/Date: SHH 14/12/84

Exploration for diamonds within region.
Report Title: (A) Final report, 11/7/83 to 26/7/84
(B) 1 apia

Author(s):

Publisher: Ashton Mining Limited

Place Publ'n: Brisbane

Date: 1984, Dec

Report Type: Unpublished

Pages of Text: 6p

Plans: diagrams, tables, plan

Drill Core:

Licence No: EL4272

Project Yr(s): 1983-1984

Licensor: AGI Minerals

Joint Venture: Aberfoyle Exploration Pty Limited,
AOG Minerals Limited, Ashton Mining Limited

Operator: Ashton Mining Limited

Maps:

1:1000000: SE53 Newcastle Waters

1: 250000: SE53-1 Daly Waters

1: 100000: 5364 Flat Top Hill

5464 Hidden Valley

5465 Middle Creek

1: 50000:

Prospect Name:

Mine/Well Location:

Lat: , ,

East: , ,

North: , ,

Tectonic Unit: Wiso Basin

Major Terms: Nonmetallic minerals

Minor Terms: geochimistry, stream sediment sampling, assaying,
soil sampling, diamonds, kimberlites, lamproite,
heavy mineral traps

Notes:

Abstract: Exploration licence was relinquished. Only two
small diamonds were found.

Text Location: L-0

Microfiche (y=yes n=no)

Indexed By/Date: SMD 11/12/84

Checked By/Date: SHH 14/12/84

Exploration for diamonds within E56S9 area
Exploration for diamonds within region
Exploration for diamonds within EL 5659 area
Exploration for diamonds within F 5659 area
Exploration for diamonds within E 5659 area
APPENDIX 2
SECOND YEAR'S ACTIVITY REPORT
Date: 4 July 1991  
Ref: R27.91

REPORT ON EXPLORATION ACTIVITIES  
FLAT TOP HILL  
EL 5659  
FOR YEAR TO 21 MAY 1991  
VICTORIA RIVER DOWNS - DALY WATERS  
1:250,000 SHEET AREAS, NORTHERN TERRITORY

by

R W A Crowe

Licence Holders:  
Ross Wilson Armfield &  
Terrence Royle McNair

For: Licence Holders (1)  
Department of Mines & Energy, Northern Territory (1)

Signed:

[Signature]

R W A Crowe  
Director
SUMMARY

Comparative studies with the Cooper Pedy opal fields in South Australia have suggested opal potential exists at Flat Top Hill. Prospecting trips have located opaline silica in the Cretaceous Mullaman Beds and confirmed the need for more thorough exploration for next year.
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PLATE 1 SAMPLES OF OPALINE SILICA RECOVERED FROM PROSPECTING TRIPS

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APPENDIX 1 LICENCE ADMINISTRATION DOCUMENTS
1.0 INTRODUCTION

EL 5659 was applied for following a rumour of semi-precious stones that had been discovered in a drilling survey some 10-15 years previously. In the first year of the licence, reconnaissance strips were made to the area to assess the similarity to the rumoured description of the area by drillers (see Crowe, 1990). In addition, detailed literature searches were made to locate previous information relating to the area and recommendations were made for further reconnaissance work in the licence, and a shallow auger drilling survey. This work highlighted an area of interest around Pussy Cat Bore as the most likely place for follow up work.

This report records the work conducted during the year to 21 May 1991 and contains recommendations for further work.

2.0 LICENCE ADMINISTRATION

Licence EL 5659 was reduced (16 April 1991, see Appendix 1) to 28 graticular blocks and the current area of the licence is shown in Figure 1.

During the year under consideration a slight change of ownership occurred on the licence so that Desmond John Foynes' share was transferred to the remaining two shareholders.

3.0 FIELDWORK CONDUCTED ON THE AREA

3.1 September/October 1990 Field Trip

A field trip was undertaken between 25 September to 15 October 1990 taking in a visit to Cooper Pedy opal fields in South Australia, following the recommendations of consultant geologists from the previous year's work, that the Flat Top Hill area might have potential for opals. A number of rock specimens were collected in Cooper Pedy and studies made of the distribution of opals in the rocks. Following the visit to Cooper Pedy, a field trip was made to the Flat Top Hill licence and reviewed in the light of the new information. This showed that the Cretaceous Pallaman Beds in the area were very similar in lithology and style to the host rocks at Cooper Pedy and this confirmed the interest for opals. General prospecting traverses were made in the Pussy Cat Bore Region which had been outlined as the main target area in the previous year's work. No opal-type stones were found in this area and the field trip was largely unsuccessful.

3.2 May 1991 Field Trip

A further field trip was made to the licence area in May 1991, with ten days spent in the field to conduct more comprehensive sampling of the drainages and area around Pussy Cat Bore. This survey consisted of working to a regular grid and collecting samples from the creeks that drained the rocks occurring in that area. Prior to the field trip, air photographs of the area were purchased and studied so that licence grids could be laid on them.
The systematic work involved visual identification of pebble types in the drainages and other samples collected, and a number of representative rocks were transported back to Perth. Arising out of this work, three specimens with opaline affinities were collected and are being kept in Perth (see Plate 1). One of these appears to be a semi-precious opal and confirms interest in the area, and the probable correctness of the original report that a driller had found opal at Pussy Cat Bore in the 1970's.

4.0 RECOMMENDATIONS FOR FURTHER WORK

Following the success of Year 2 exploration and despite not undertaking the auger sampling, the work has confirmed the prospectivity of the area and work must now be done to properly assess whether opal of sufficient quality occurs in the area. This should be done by a programme of shallow auger sampling as proposed for the previous year and if this is successful, some bulk sampling using earthmoving machinery.

REFERENCES

Crowe, R. W. A., 1990, Report on Exploration Activities Flat Top Hill EL 5659 for Year to 21 May 1990, Victoria River Downs - Daly Waters, 1:250,000 Sheet Areas, Northern Territory, R40.90
APPENDIX 1

LICENCE ADMINISTRATION DOCUMENTS
Mr P Walker  
Ward Keller  
GPO Box 330  
DARWIN NT 0801

Dear Mr Walker

TRANSFER D5358 FROM D J FOYNES TO R W ARMFIELD 15.63% AND  
J McNAIR 15.62%

The abovementioned dealing was registered on 16 October 1990 against Exploration Licence 5358, the title is now held by R W Armfield - 68.75% and T McNair - 31.25%

As a matter of courtesy, parties to a dealing should contact all affected land holders and keep them fully informed of their likely activities in the area. Contact officers names and telephone numbers should be provided wherever possible.

Yours sincerely

Penelope Mangan  
Mining Registrar  
17.10.90

5.11.90  
Title reference added by  
EL 5659.
Department of Mines and Energy  
GPO Box 2901  
DARWIN NT 0801

Attention: Olinda Gomes  
Titles Registration Branch

REFERENCE EXPLORATION LICENCE 5659

Dear Ms Gomes

Thank you for your letter dated 7th of March 1991, requesting nomination of the graticular blocks to be retained in the licence area for the forthcoming year. Enclosed is a map of the area on which is outlined in red the 28 blocks to be retained.

Also enclosed is a cheque for $280 to cover the rent for the forthcoming licence year on these blocks.

Yours sincerely

R Armfield  
16 April 1991

Westpac Banking Corporation  
DISTRICT OPERATIONS CENTRE  
SUBIACO WA  

Pay Department of Mines & Energy N.T.  
the sum of Two Hundred and Eighty Dollars Only  
Not Negotiable  

For and on behalf of Westpac Banking Corporation  
Managing Director  

758056  
16th April 1991  
$ 280.00
APPENDIX 3

THIRD YEAR'S ACTIVITY REPORT
REPORT ON EXPLORATION ACTIVITIES
FLAT TOP HILL
EL 5659
FOR YEAR TO 21 MAY 1992
VICTORIA RIVER DOWNS - DALY WATERS
1:250,000 SHEET AREAS
NORTHERN TERRITORY

by

R W A Crowe

Licence Holders:
Ross Wilson Armfield &
Terrence Royle McNair

For: Licence Holders (1)
Department of Mines & Energy, Northern Territory (1)

Signed:

R W A Crowe
Director
SUMMARY

Work for the 1991-1992 year on EL 5659 has consisted of a landsat and air photo study to identify prospective targets, followed by two field visits and collection of bulk samples for evaluation in Perth.
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SUMMARY

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   3.2 21 April to 12 May 1992 Field Trip

4.0 AIR PHOTOGRAPH AND SATELLITE IMAGE STUDY

5.0 CONCLUSION

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Figure 1 Location of EL 5659

PLATES

Plate 1 Typical low breakaway outcrops of Mullaman Beds: the cover rock in EL 5659
Plate 2 Close-up view of Cretaceous Mullaman Beds. Opal is expected close to the buried contact with Montigimi Limestone.
Plate 3 Creek-sediment collection site
Plate 4 Auger-sample site for bulk collection
Plate 5 Landsat image of prospect area containing EL 5659. The main road is visible in the image which shows the outline of the area shown in Appendix 1.

APPENDICES

APPENDIX 1 Air photograph and Landsat Interpretation
Top Springs Area, Northern Territory by R Russell & Associates
1.0 INTRODUCTION

EL 5659 was applied for following a rumour of semi-precious stones that had been discovered in a drilling survey some 10-15 years previously. In the first year of the licence, reconnaissance strips were made to the area to assess the similarity to the rumoured description of the area by drillers (see Crowe, 1990). In addition, detailed literature searches were made to locate previous information relating to the area and recommendations were made for further reconnaissance work in the licence, and a shallow auger drilling survey. This work highlighted an area of interest around Pussy Cat Bore as the most likely place for follow up work.

The second year of activity concentrated on assessing the general potential of the area by making comparison to the opal fields at Coober Pedy and several site visits to assess the targets on the ground.

This report records the further work conducted on the lease for the year to 21 May 1992 and contains recommendations for further work.

2.0 LICENCE ADMINISTRATION

Exploration Licence 5659 for the year under review consisted of 28 graticular blocks as shown in Figure 1.

In accordance with the regulations controlling Exploration Licences in the Northern Territory the area of the licence has now been reduced to 14 graticular blocks around the main zone of interest. A map showing this area will be received from the Mines Department, once the current report has been reviewed.

3.0 FIELDWORK CONDUCTED ON THE AREA

3.1 20 September to 8 October 1991 Field Trip

A field trip was undertaken between 20 September to 8 October 1991 by one of the licence owners travelling from Perth. The purpose of the trip was to reconnoiter suitable sample sites, collect some surface samples by shovel, and pan-off concentrates for examination in Perth. A second purpose of the trip was to reconnoiter all areas that were due for drop-off in the following Autumn. No precious stones were found either within the area being retained, or the area being dropped off.

3.2 21 April to 12 May 1992 Field Trip

A second field trip was made to the licence area during late April to early May 1992, by both licence holders. The purpose of this trip was to collect bulk samples for evaluation in Perth. Following the identification of target areas from an air photograph study conducted by an independent consultant (see below), targets were sampled with an auger and bulk composites made up. These composites have now been transported back to Perth and from them heavy mineral concentrates will be prepared, and the samples examined for any precious or semi-precious stones. No results from this evaluation are yet available.
Plate 1  Typical low breakaway outcrops of Mullaman Beds; the cover rock in EL 5659

Plate 2  Close-up view of Cretaceous Mullaman Beds. Opal is expected close to the buried contact with Montiginni Limestone.
Plate 3
Creek-sediment collection site

Plate 4 (below)
Auger-sample site for bulk composite
4.0 AIR PHOTOGRAPH AND SATELLITE IMAGE STUDY

An air photograph and Landsat interpretation was commissioned for the Top Springs area from R Russell & Associates and a copy is appended (Appendix 1). The study identified a number of targets for opal and other precious stones, but the details of these locations have been withheld from the consultants report for strategic reasons at present. Details will be released when the various targets have all been followed up.

5.0 CONCLUSION

Although the various field trips conducted on EL 5659 have as yet failed to discover any precious or semi-precious stones on the licence area which might confirm the original rumour of a discovery in that area, the studies have confirmed the general prospectivity of the licences and it is the intention of the licence holders to continue their exploration effort. The next round of exploration will involve deeper drilling which should access the targets beneath the surface Mullaman Beds. This appears to be acting as cover for all of the targets in the area meaning that they are effectively blind. Therefore, the lack of confirmation from the surface and auger sampling conducted so far may not necessarily have written off the targets.

REFERENCES

Crowe, R W A, 1991, Report on Exploration Activities Flat Top Hill EL 5659 for Year to 21 May 1991, Victoria River Downs - Daly Waters, 1:250,000 Sheet Areas, Northern Territory, R27.91

Crowe, R W A, 1990, Report on Exploration Activities Flat Top Hill EL 5659 for Year to 21 May 1990, Victoria River Downs - Daly Waters, 1:250,000 Sheet Areas, Northern Territory, R40.90
APPENDIX 1

Air photograph and Landsat interpretation
Top Springs Area, Northern Territory
by
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10th April 1992  

Attn: Ross Armfield  

Re: Air Photograph and Landsat Interpretation,  
Top Springs Area, Northern Territory.

1 THE MAPS

I have completed the air photo and Landsat interpretations of the  
Top Springs area and the photo-maps are enclosed.

1.1 Landsat Image and Interpretation

Our image is a 1:250,000 MSS photo dating from 16th July '83.  
The quality is very good. I have marked the Top Springs  
exploration area on the photo. The image is useful for giving a  
regional picture of the area which is not possible to get from  
the air photos and hard to get from the maps. The Landsat map is  
included at the rear of these notes as Enclosure 1.

The most important points from the map are as follows:

i) Palaeo drainage on the old land surface. The Tertiary land  
surface to the east of the Exploration area once carried an  
extensive dendritic drainage system which is now completely  
silted up. The trunk stream flows westward about 50km to  
the south of Top Springs. The westward end of this channel  
lies just off the edge of the Landsat and the 1:250,000 maps.  
From the 1:2.5 million maps the channel appears to  
end at a breakaway on the edge of the Cretaceous rocks near  
Mt. Williams. I recommend a) locating the eroding channel  
(phase 1 exploration) and b) sampling the gravels (phase 2).  
These gravels are a great opportunity for sampling a huge  
area: the heavy mineral concentrate from the gravels will  
give a sort of summary of any mineralisation in the vast  
palaeo-catchment to the east. The rocks are quite young so  
I guess the prospects are not that good (the rocks probably  
cover the orebodies). Nevertheless, the diamond pipes at  
Ellendale (for example) are about the same age as the  
surface (Miocene). If any of these are in the area, we  
should pick them up in the palaeochannel.

ii) West-northwest Faulting and Arching. A major northwest  
trending fault crosses the Landsat image 45km north of the  
Top Springs area. Movement on the fault is probably  
Proterozoic (older than 600my): the fault zone is buried
even by the Cambrian rocks. However, recent (post 30my) arching has occurred along the fault to give the unusual erosional patterns along the trend of the fault. If any diamond bearing intrusions occur in this area, they have probably been directed up the fault. The surface arch would therefore be the place to start looking for heavy mineral indicator minerals (HMI's). A couple of the creeks that cross the arch may be worth sampling as shown on the map.

iii) Recent Arching has occurred to the east of the Armstrong Fault (name given here) in the project area and on a parallel trend to the southeast. In fact, erosion along the scarp of the Tertiary Land Surface shows that general uplift has occurred to the south of the exploration area (notice how fresh the erosion along the southern scarp is compared to the scarp to the north which is relatively 'dead'). This arching is probably not significant in our mineral search.

iv) The Deep Weathered Zones along the exposed Cretaceous outcrop in the exploration area show as light areas against a blue background. It is these patches that we think are most prospective for opals (see air photo section). On this basis, four other good areas for opals can be mapped from the Landsat (Areas A, B, C and D).

1.2 Air Photographs

The central part of the map is interpreted in stereo. I have included the mono interpretation (no stereo overlap) on the left and right edges of the map so the mapping here is less accurate. The photos are of good quality. The scale at 1:50,000 is a little small for our purposes although I realize we were lucky to get our hands on them in the first place. It's no problem to see everything, its just a problem getting it onto the map!

I have gridded the map with a 2km square grid. I am not sure of the north-south/east-west accuracy of the grid lines. Navigation will be difficult especially in the western parts of the area. Locating yourselves accurately on the ground relative to the map will be a problem and I hope the grid helps a bit.

2 THE GEOLOGY

Structurally the area is dominated by the big northeast trending fault (termed the "Armstrong Fault" here) and the rugged Cretaceous rocks surrounding it. The fault line has been eroded out by the headwaters of the Armstrong River. The Cretaceous rocks erosionally pinch out towards the west where the Cambrian sequence is exposed. A modern erosion wave is working back eastward up the Armstrong catchment.

I have resisted the temptation to clutter the map with too much stratigraphic information but important aspects of the Cretaceous are as follows:
i) The Cretaceous is cut flat in the east by an older land surface (probably the 'Wave Hill' land surface, about Miocene age; + 22 my old). This surface is probably the key to the formation of the opals in the area. The long term leaching of the silica from the surface rocks and the precipitation in lower horizons where the water table has been at a more or less constant level would favour the formation of opals.

ii) The 'Tertiary' deposits in the area are actually weathered products of the Cretaceous (Mullaman Beds) and are not really a depositional unit in their own right. The 'rubbly ironstone' described in the 'Notes to Accompany Daly Waters Sheet' is a pretty accurate description of what is seen on the photographs especially around the Armstrong Fault zone.

iii) The upper parts of the Cretaceous (Mullaman Beds) are resistant to erosion and appear to be quite siliceous. These are probably the rocks you have brought back and appear on the photograph you took. They look good for opal: porcellinized and with a fair amount of silica. It just depends on how mobile the silica has been in the past. Apart from silica, iron, glauconite and other mobile minerals have probably also leached out to form the thick saprolite layers we see below the Tertiary weathering cap. Therefore, it does not necessarily follow that opal occurs in this precipitate zone. I guess these Cretaceous rocks are shallow marine siltstones and sandstones.

iv) The lower part of the Cretaceous appears to be more fine grained and erodes more easily. It is possible that these rocks could be marginal marine deposits related to the advancing Cretaceous sea. I suspect that our best chances for opals may be in two environments: at the base of the Tertiary weathering profile and along the contact between the 'upper' and 'lower' beds. At Govt. Bore 14 (location 'D'), the upper Cretaceous has been removed by erosion exposing a bleached horizon which may represent some sort of bedding plane or stratigraphic contact along which the opal gels have been formed. Other areas where this scenario is repeated are listed from A to G. (See paragraph 3).

v) Soil from the eroding Cretaceous blurs the contact with the Cambrian so the mapped contact between the two units is very approximate.
APPENDIX 4

FOURTH YEAR'S ACTIVITY REPORT
REPORT ON EXPLORATION ACTIVITIES
FLAT TOP HILL
EL 5659
FOR YEAR TO 21 MAY 1993
VICTORIA RIVER DOWNS - DALY WATERS
1:250,000 SHEET AREAS
NORTHERN TERRITORY

by

R W A Crowe

Licence Holders:
Ross Wilson Armfield &
Terrence Royle McNair

For: Licence Holders (1)
Department of Mines & Energy, Northern Territory (1)

Signed:

R W A Crowe
Director
SUMMARY

Work for the 1992-1993 year on EL 5659 has consisted of two field trips to firm up targets for drilling. Our planned drilling campaign was not commenced due to wet weather in the area and an exemption has been sought for this part of the work.
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SUMMARY

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4.0 CONCLUSION

REFERENCES
1.0 INTRODUCTION

EL 5659 was applied for following a rumor of semi-precious stones that had been discovered in a drilling survey some 10-15 years previously. In the first year of the licence, reconnaissance strips were made to the area to assess the similarity to the rumoured description of the area by drillers (see Crowe, 1990). In addition, detailed literature searches were made to locate previous information relating to the area and recommendations were made for further reconnaissance work in the licence, and a shallow auger drilling survey. This work highlighted an area of interest around Pussy Cat Bore as the most likely place for follow up work.

The second year of activity concentrated on assessing the general potential of the area by making comparison to the opal fields at Coober Pedy and several site visits to assess the targets on the ground.

The third year of activity concentrated on an aerial photographic study and prospecting trips to the area to identify targets. This report records work done during the fourth year of the licence.

2.0 LICENCE ADMINISTRATION

Exploration Licence 5659 for the year under review consisted of 14 graticular blocks as shown in the previous years report.

In accordance with the regulations controlling Exploration Licences in the Northern Territory the area of the licence has now been reduced to 7 graticular blocks around the main zone of interest. A map showing this area will be received from the Mines Department, once the current report has been reviewed.

3.0 FIELDWORK CONDUCTED ON THE AREA

3.1 25 June to 8 July 1992 Field Trip

A field trip was undertaken in late June and early July 1992 to follow up targets that were identified by the previous years aerial photographic study. The second purpose of the trip was to reconnoitre all areas that were due for drop off in the following Autumn. Faulting was identified on the ground as indicated by the air photograph study confirming interest in the areas for the possibility of opal occurrence.

3.2 10 March to 25 March 1993 Field Trip

A second trip was made to the licence area in March 1993. The purpose of this trip was to test drill sites with a hand held shallow auger and to locate a suitable drill rig for drilling the targets later in the year. Progress with the auger proved difficult in the Mullamen Beds as this rock type proved harder than anticipated. It was concluded that a motorized tungsten-tipped auger would be necessary to effectively test these rocks.

The second part of the trip was spent visiting drilling contractors in the Kimberleys as it was felt that the best drilling machines would be located there and could be more cheaply mobilized from that area than from Alice Springs or Perth. A drill program was planned to commence during April or May.
4.0 CONCLUSION

Work during the year was only partially successful as the drilling program that was planned before the end of the reporting year had to be postponed due to unseasonal heavy rain in the north west of Australia. The applicants have therefore lodged an application for exemption for expenditure for this part of the work on the basis that they will attempt to do the work during the next year.

REFERENCES

Crowe, R W A, 1991, Report on Exploration Activities Flat Top Hill EL 5659 for Year to 21 May 1991, Victoria River Downs - Daly Waters, 1:250,000 Sheet Areas, Northern Territory, R27.91

Crowe, R W A, 1990, Report on Exploration Activities Flat Top Hill EL 5659 for Year to 21 May 1990, Victoria River Downs - Daly Waters, 1:250,000 Sheet Areas, Northern Territory, R40.90
APPENDIX 5

CHEMICAL ANALYSES OF BULK SAMPLES REPORT

Location of samples is shown on Enclosure 1.
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**DETECTION** 5 4 4 2 0.02 5

**UNITS** ppm ppm ppm ppm ppm ppm

**METHOD** GA101 GA101 GA101 GA101 GG329 GA101

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Results in ppm unless otherwise specified.
T = element present; but concentration too low to measure.
X = element concentration is below detection limit.
- = element not determined.
However the air photos's have clearly indentified a number of fault lines which are believed are areas of water and hopefully silica enrichment. The principle targets for drilling are all within a one kilometre radius of the No. 14 Govt Bore.

The greatest problem with exploration in this area is that the Mullaman Beds are covered by clayey overburden and in fact are only exposed in a few areas which are not at this stage the subject of exploration activities.

Should the drilling programme be successful then a suitable geophysics technique will probably be used to minimise the environmental impact of exploration.

Regarding, the relinquished areas it is the licencees opinion that these areas are quite prospective and have been released (relinquished) only because of the obligation to do so. The areas for relinquishment were selected on the basis of the air photo and satellite image study conducted in the previous year. This report has already been submitted.

Many of these areas also showed promising potential but were not followed up because of time and financial constraints but may be taken up again at some future date.

I trust this covers the information you require.

Yours sincerely

[Signature]
R W A Crowe
Director
Dear Sir/Madam

RE: REPORTS ON EL5659

I am writing in reply to your letter regarding the above and have been asked by the licence holders to reply as follows;

1) Analytical reports of bulk composite samples which should have been previously submitted are appended as requested. A photocopy map showing the location of the sample sites is also enclosed. The owners apologise for this omission.

2) All target areas indentified in air photo and satellite image where followed up. They included one area which looked circular and distinctly round, turned out to be old road base supply area. This occured in four areas targeted and this material is obviously used as surrounding road foundation.

Two other areas identified turned out to be concentrated areas of ironstone rubble (generally in occurence with porcelainite, chert and occasionally opalite).