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ANDAMOOKA AND COOBER PEDY

REPORT OF RESEARCH ON OPAL MINING IN SOUTH AUSTRALIA

Submitted by
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1970

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Government of South Australia
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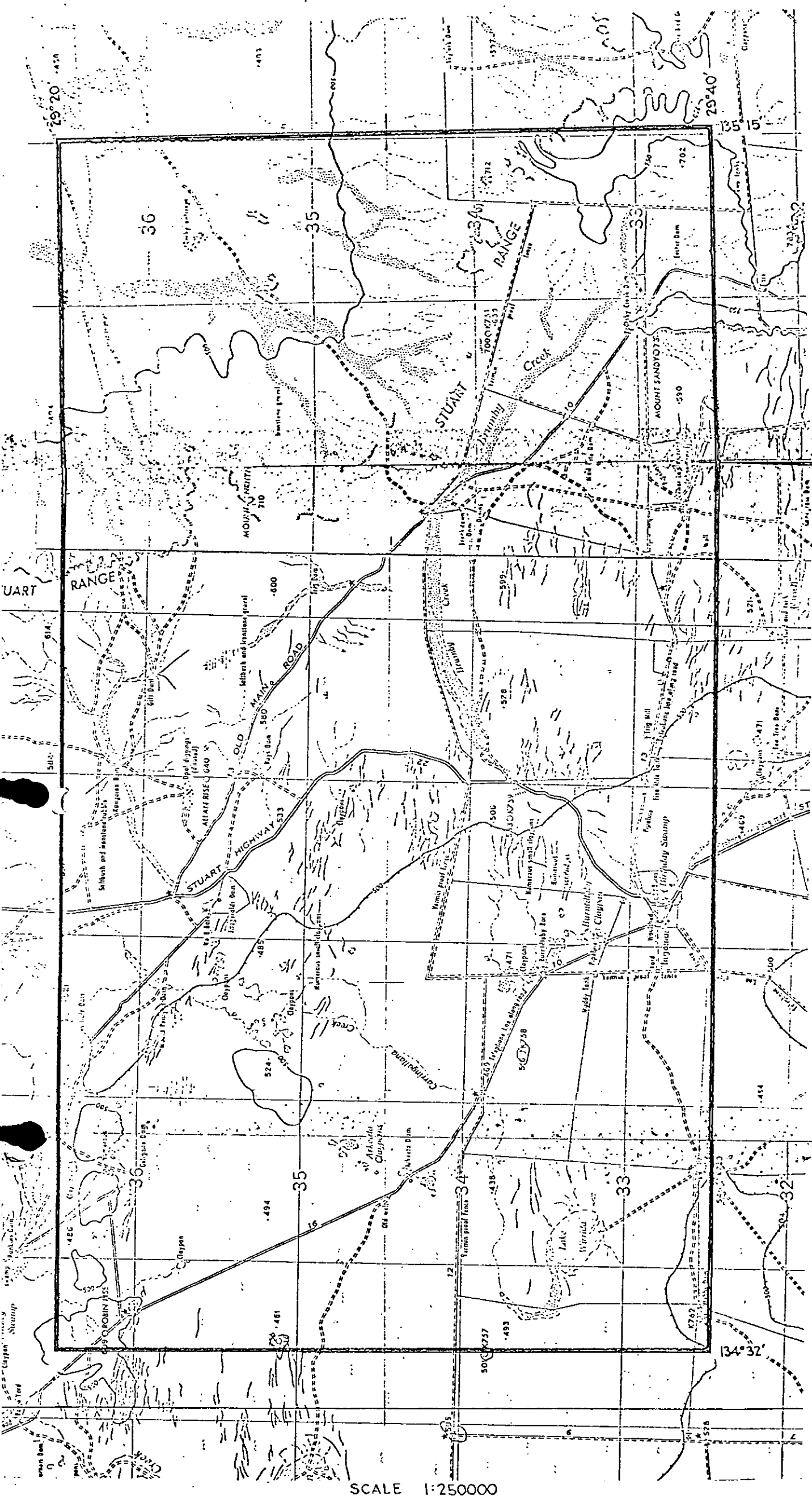

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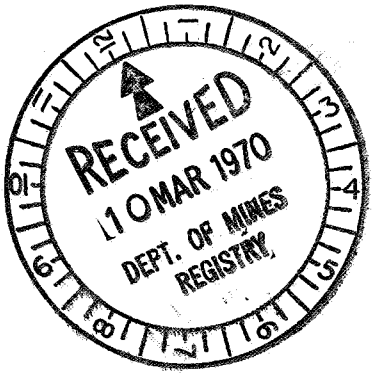

REPORT ON OPAL MINING IN SOUTH AUSTRALIA

MARCH 1970

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SYDNEY. 2000.

INTRODUCTION

This report presents an account of research work, recent geological reconnaissance and recommendations for future geological exploration in the SML areas held in South Australia by Gem Exploration and Minerals Ltd. The report is divided into four sections:

1. Background research
2. Results of recent geological reconnaissance
3. Proposed exploration plan
4. Recommendations.

1. BACKGROUND RESEARCH

1.1 LOCATION & GEOLOGICAL ENVIRONMENT OF OPAL

The major opal fields of Australia are located on the margins of and within the Great Artesian Basin in marine sediments, Lower Cretaceous in age.

During middle to late Tertiary times a laterite profile was developed over most of the Artesian Basin. The profile consists of an iron-rich upper zone underlain by a pallid leached zone which was formed by the leaching action of ground waters under humid, tropical conditions. It is significant that opal deposits are always found within the pallid zone irrespective of the age of the host sediment and also that opal has not been found in rocks younger than mid-Tertiary. It is now accepted beyond doubt that opal is a product of laterite profile formation.

At all opal localities throughout Australia opal is found in similar lithological sequences of nearly horizontally bedded strata within the laterite profile. In every case the host rock is a porous sandstone within the pallid zone which overlies an impermeable claystone bed. In most cases in precious opal-bearing areas the Tertiary sediments are thin or absent, possibly where uplift has occurred since Tertiary times.

1.2 FORMATION OF OPAL

Precious opal is formed in quiescent underground pools by slow precipitation of silica-rich solutions. The precipitation is brought about by the slow evaporation of water trapped above an impermeable clay horizon. Shallow basin-like structures in the overlying sandstone are particularly suitable for the formation of precious opal and where there is fluctuation of the ground water level during formation of the laterite profile, several horizons of opal could develop.

1.3 CONCLUSIONS

Considering the geology of the major opal deposits and the summary of the formation of opal, the following facts emerge:

(i) Opal formation is always related to the formation of the Tertiary laterite profile which extends from South Australia through to N.S.W. and Queensland over the entire Artesian Basin area. Notwithstanding the differences in local lithologies opal is always found under conditions of similar geological environment.

(ii) Precious opal deposits appear to be controlled by a combination of three factors, namely (1) the depth of the overlying Tertiary cover, (2) the presence of an impermeable rock horizon beneath the opal-bearing sandstone layer, and (3) the presence of a basin or downwarp in the sandstone/claystone interface which may or may not be associated with localised faulting.

1.4 OPAL IN SOUTH AUSTRALIA

COOBER PEDY OPAL FIELD

Location

Opal was first discovered in this area in 1915. The field lies along the Stuart Range, a locally prominent escarpment about 150 feet high, which trends in a northwesterly direction forming the drainage divide between the Lake Eyre basin to the east and the sand plains to the west. Coober Pedy lies on the main Adelaide - Alice Springs road, 170 miles north of Kingoonya. A track runs east from Coober Pedy for 110 miles to the Port Augusta - Alice Springs railway at William Creek.

Geology

The workings cover an area of 150 square miles and the opal host rock is a pink to white sandstone, leached during the formation of the Tertiary laterite profile. Depressions in the sandstone/claystone interface caused by minor faulting and downwarping seem to be the chief control of opal horizons in this area. All productive horizons are underlain by a stratigraphic boundary between the host sandstone and an impervious claystone or shale. The Tertiary laterite profile development in the area can be summarised thus:

		Thickness
	Silcrete (grey billy)	12'
	Mottled zone of bleached sediments with iron-stained vertical pipes	25'
Host Rock	Pale pink sandstone of the pallid zone	100'
	Grey Shale	

See Figure 1 for the occurrence of opal at Coober Pedy.

ANDAMOOKA OPAL FIELD

Location

The Andamooka opal field is located 8 miles west of the northwest edge of Lake Torrens, about 80 miles northeast of Pimba, the nearest railhead, and 191 miles by road from Port Augusta.

Geology

The opal horizon at Andamooka is a conglomerate band within the Cretaceous sandstone. The field is controlled by a broad basin-like structure with localised faulting also controlling some opal-bearing horizons. The impermeable base controlling the depth of opal formation is in this case bands of clay. The lithology of the field can be summarised thus:

		Thickness
Recent	Recent sands & kaolinised sediments	5'
	Unconformity	
	Kaolinised marine Cretaceous sediments	7'
	Conglomerate with precious opal	3"
	Sandy clay	14' 9"
	Conglomerate up to 18 in. thick	1' 6"
Mesozoic	Clay	6"
	Conglomerate with precious opal	1'
	"Bottom gouge" clay	1' 6"
	White Kaolin clay	9'
	Conglomerate	6"
	Gypsiferous sand	1'

		Thickness
	Iron stained conglomerate	1' 6"
	"Sharpstone" conglomerate	3"
	White kaolinised clay	2' 11"
	Gypsum vein	1"
Mesozoic	Pink and grey sandstone with boulders and occasional precious opal	1'
	White kaolinised sandy clay	30'
	Black siliceous hematitic sandstone	Variable

Unconformity

Proterozoic

See Figure 1 for the occurrence of opal at Andamooka.

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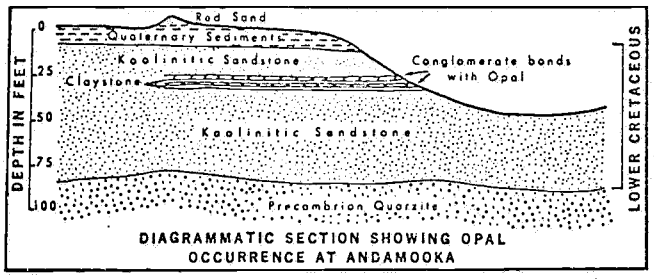
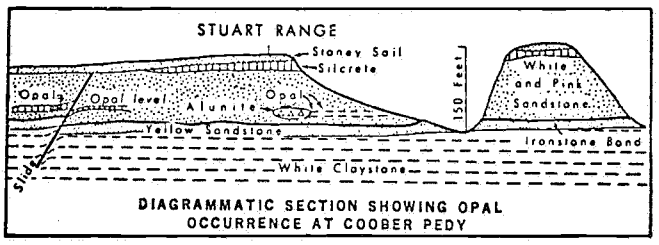


SECTION SHOWING OCCURRENCE OF OPAL AT ANDAMOOKA



SECTION SHOWING OCCURRENCE OF OPAL AT COOBER PEDY

FIGURE 1

2. RESULTS OF RECENT GEOLOGICAL RECONNAISSANCE

Recent geological studies in the Coober Pedy area including detailed study of several of the major producing areas has brought forward the following considerations:

At the 2-Mile which is possibly the most classic example of opal formation and mining practice, the precious opal level is above and within an iron-stained claystone which lies between two slightly different kaolinitic sandstones. The opal level is generally horizontal but vertical opal-and potch-filled cracks are common. These are termed "verticals" and much of the good opal is produced from these. At Olympic there are several producing mines. In one of these the opal is overlain by a hard alunite band and in another there is no alunite above the opal level. The laterite profile is particularly well developed in this area and further study could help in the understanding of the opal-forming process.

The Pendant Field is within the S.M.L. held by Gem Exploration. This field is different to the others examined as the opal is alluvial in nature probably representing part of an eroded laterite formation. All occurrences are within three feet of the surface.

3. PROPOSED EXPLORATION PLAN

Opal could exist at any place within the Tertiary laterite profile of the Artesian Basin. However, areas for exploration can be narrowed down to those in which the Tertiary cover is thin or absent, and the Cretaceous rocks outcrop at or near the surface.

The following exploration plan has been based on geological work previously carried out in the area by the Mines Department and on a recent geological survey carried out by Aminco and Associates.

3.1 Geological Mapping

A considerable amount of mapping can be done using aerial photograph interpretation. It is fairly certain that the opal search can be restricted to the area of the main divide and this can be plotted from aerial photographs. Areas of extensive sand cover can be abandoned as far as the search for opal is concerned, as it is impracticable to work within these areas at any stage. This is an extension of the mapping programme carried out by the Mines Department which was initially based on aerial photograph interpretation.

It would be particularly beneficial in these areas to be able to make use of coloured aerial photographs but these are not available at the present time.

3.2 Resistivity Surveys

Exploration methods such as electrical resistivity surveys can be used to map the discontinuity between the opal-bearing sandstone and the underlying impermeable strata. Recent investigations by the South Australian Mines Department at Larkins Folly near Coober Pedy indicate that this boundary can be mapped by correlation methods based on resistivity measurements.

As the accuracy of the resistivity method is an unknown quantity and the results of the Mines Department survey were not checked by drilling, further work must be carried out to delineate the usefulness of this exploration method.

3.3 Drilling

Drilling is an essential adjunct to an exploration programme. Initially drilling should be carried out to check the results of the resistivity survey of Larkins Folly. Vertical and horizontal drilling will be employed to search for precious opal layers in areas considered as potential fields following geological investigation.

3.4 Bulldozer Costeaning

Whilst other exploration methods narrow the prospective areas down and detect the presence of probable opal-bearing horizons because of the spasmodic and erratic nature of precious opal layers or 'verticals' the ultimate tool in the search must be bulldozing. In this way several carefully-positioned costeans can rapidly locate any precious opal within an area and help bring a claim into full production.

3.5 Base Metal Exploration

Exploration work will be carried out to determine whether there is any base metal mineralisation in the areas held under S.M.L. by Gem Exploration. There are reported copper shows within both areas held by Gem Exploration.

4. RECOMMENDATIONS

4.1 A drilling programme should be carried out over Larkins Folly to attempt to correlate the Mines Department geophysical survey results with the rocktypes.

The results of the electrical resistivity survey carried out at Larkins Folly indicated an interface at varying depths below the surface. This interface was interpreted as being the sandstone, claystone boundary which is the potch-bearing level. No drilling was done to check this. For the method to have any meaning and to be of any use in other areas the original test site must be drilled and the accuracy of the method checked. If the geophysical results are confirmed by drilling this method could prove useful in other areas. However, determining the potch-bearing level is not an indication of the presence of precious opal and this restricts the usefulness of this exploration method. Its value, therefore, appears to be that large areas of country can be explored relatively quickly and inexpensively to determine whether a potch layer is present. It is expected that where surveys indicate the absence of a potch layer interface, the area can be discarded as a potential for precious opal. Once the potch layer is located further explor-atory work using auger drilling and costeaning is necessary.

4.2 The Pendant Field, where the opal horizon is close to the surface, can be readily explored using a bulldozer for shallow costeaning. This is a proven field which because of its shallow opal layer would readily lend itself to being worked in this manner. It is probable that workable claims can be brought into production in this area within a relatively short period of time.

It is recommended that a D9 Bulldozer and a 36" auger drill are used to implement the above exploration programme.

4.3 Further geological investigation must be done to find whether there is any definite order in the occurrence of precious opal instead of potch. It must be emphasised at this stage that although it is scientifically possible to find the level and the band of potch, it is considered that the occurrence of precious opal within these bands is irregular and unpredictable.

4.4 It is anticipated that by the use of airphoto interpretation, drilling and geophysics the S.M.L. area can be reduced to a few promising areas which can then be examined in detail with a reasonable prospect of finding precious opal.

JILL CHRISTIE