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# SOUDAN PROJECT, NORTHERN TERRITORY

## **REVIEW OF PREVIOUS EXPLORATION**

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## **1.0 Previous Exploration**

The Soudan area has been explored by six previous explorers; for phosphate and base metals in the 1960's and more recently for diamonds in the 1980's, 1990's and 2000's.

Eight drillholes are known to occur within the tenement. These include one diamond drill hole (RNN001), two aircore holes (RNN002, RNN003) and five drill holes that are unspecified (W1, W38, S-1-70, S-2-70, S-3-70). Despite this drilling, the area has been inadequately tested for phosphate.

A summary of historic tenements and open file reports covering the Soudan Project is listed in <u>**Table 1**</u>, below. A summary of previous exploration works on the Soudan Project is included as <u>**Table 2**</u>: <u>**Previous Exploration on Soudan**</u>

, below. This table collates historic exploration as outlined in open file mineral exploration reports.



Tenement	Granted	Ceased	Company	Number of Reports	Open File Report Numbers
			IMC		
			Development	1	
AP1802	19670814	19680813	Corporation		CR1968-0030
			Pickands		
			Mather & Co.	1	
AP1875	19671229	19701228	International		CR1970-0080

Table 1: Historic Tenements and Reports Covering Soudan Applications

	]		IMC	_	
			Development	5	CR1970-0038, CR1968-0032, CR1970-
AP2161	19681212		Corporation		0036, CR1970-0040, CR1969-0022
			CRA		
			Exploration	2	(immediate east) CR1985-0275,
EL4591	19840903	19900902	Pty Ltd		CR1986-0256
			CRA		
			Exploration	1	
EL7147	19920421	19921218	Pty Ltd		CR1993-0218
			Rio Tinto		
			Exploration	1	
EL22596	20010830	20021030	Pty Ltd		CR2002-0243
			De Beers		
			Australia	2	
			Exploration	2	
EL22980	20020918	20040223	Ltd		CR2003-0424, CR2004-0188
			Elkedra		
			Diamonds	1	
EL23269	20030428	20040204	NL		CR2004-0195

Table 2: Previous Exploration on Soudan

Dates	Company	Commodity	Tenement	Item	Work	Comments
2 4100			Numbers	Number	Completed	
14/08/1967 – 13/08/1968	IMC Development Corporation	Phosphate	AP1802	CR1968- 0030	Photo Interp, Mapping, Radiometry, Gravity Interp Geophysics, Sections, Drilling, Beneficiation	Mapping indicates Wonarah beds within AP1802 extend into the northern part of the Soudan application, however this map ends at the boundary of AP1802 (& doesn't show geology further south within the Soudan application). 28 holes for 3374 feet. Hole W1 within Soudan application.
July 1970	Pickands Mather & Co. International	Phosphate	AP1875	CR1970- 0080	Drilling, Shapiro testing	3 holes for 330 feet [S-1-70 to S-3-70] to follow up IMC's reported P2O5 intersection in IMC No. 1. NSA's returned from drilling. Samples Shapiro tested. Best result approx 1% P2O5.
14/08/1967- 11/12/1968	IMC Development Corporation	Phosphate	AP2161	CR1968- 0032	Drilling	Contains drill logs and assay data for holes W1-W38.
12/12/1968- 11/12/1969	IMC Development Corporation	Phosphate	AP2161	CR1970- 0040	Drilling	139 holes drilled on AP2161 [W39-W138A]. Several have significant P205 assays. Drill logs with assays are in the report.
12/12/1969- 11/12/1970	IMC Development Corporation	Base Metals	AP2161	CR1970- 0036	Assays only	Library cuttings from 51 holes drilled @ Wonarah were assayed for Cu, Co, Ni, Pb, Zn. This report contains base metal assays.
April 1969 - March 1970	IMC Development Corporation	Phosphate	AP2161, also AP	CR1969- 0022, CR1970- 0038	Drilling, Assays	Reports summarise drilling conducted by IMC since 1967. It includes columnar and standard drilling from all drilling undertaken by IMC. P2O5 assays graphed alongside drill traces.
- 26/07/1986	CRA Exploration Pty Ltd	Diamonds	EL4591	CR1986- 0256	Geophysics, Recon Airborne Survey, Heli Mags, Ground Mags, Mag Interp, Drilling, Geochemistry, Drainage sampling, Loam sampling, Soil sampling, Diamond drilling.	<ul> <li>Detailed low level aeromag survey was flown over EL4591 &amp; the Sthn half of EL4592. Anomalous areas Helimag'd and anomalies were traversed with ground mags. 28 features were loam sampled.</li> <li>Photointerp: 35 anomalous geomorph features; 21 of these were ground truthed and 10 were loam sampled.</li> <li>Four vertical DDH to test magnetic anomalies AVD2, 5, &amp; 20 on Avon Downs EL4592 and one [DD86LN4] 40m hole was drilled to test anomaly Sou16 on Soudan EL4591 (to the east of the current application area). All holes had cased, auger precollars. Magnetic anomalies caused by detrital sands and grits.</li> <li>The magnetic anomaly at drill hole DD86LN4, to the East of the current Soudan application area, results from ferruginous fine sandy clays. Petrography of sample 1311523 of this material calcite-veined breccia exhibiting regolithic sedimentary breccia characteristics. Microcrystalline maghaemite occurred as selveges in fracture partings.</li> </ul>

Dates	Company	Commodity	Tenement Numbers	Item Number	Work Completed	Comments
3 <sup>rd</sup> September 1984 – 2 <sup>nd</sup> August 1985	CRA Exploration Pty Ltd	Diamonds	EL4591, EL4592, EL4596, EL4597, EL4598, EL4599	CR1985- 0275	Geophysics, Recon Airborne Survey, Heli Mags, Ground Mags, Mag Interp, Radiometrics, Geochemistry, Soil sampling,	Detailed low level aeromag survey was flown. Anomalous areas Helimag'd and anomalies were traversed with ground mags. 122 features were loam sampled – 24 within EL4591. 35 x -2mm loam samples and -80 mesh soil samples were collected from the EL areas80 mesh samples were submitted for multi element assays. Highest U assay 4ppm. 3 samples 1311058R, 1311070R and 1311079R assayed for P2O5 with assays between 0.04 and 0.06%.
21 <sup>st</sup> April 1992 - 18 <sup>th</sup> December 1993.	CRA Exploration Pty Ltd	Diamonds (Note cites P2O5 whole rock analysis)	EL7147	CR1993- 0218	Geophysics, Recon Airborne Survey, Heli Mags, Ground Mags, Mag Interp, Radiometrics, Geochemistry, Soil sampling,	Five rotary percussion holes for 202m [PD92JD1- PD92JD5] were drilled to test mag anomalies. These drill holes all occur to the west of the Soudan application. Whole rock analysis of thin (<3m) claystone unit intersected in drillhole PD92JD5 submitted for P2O5 analysis – 57-60M - 6.85%. Possibly related to extension of the Wonarah phosphate resource on the adjacent Alroy 1:250K sheet. Contains AAPA certificate.
30 <sup>™</sup> August 2001 – 30 <sup>th</sup> Oct 2002	Rio Tinto Exploration Pty Ltd	Phosphate	EL22596 Also EL22594, EL22597, EL22811	CR2002- 0243	Petrology Geochemistry Rock Chips Soil Samples	Reconnaissance, considered favourable for Wonarah style deposits, but downgraded with Wonarah.
18 <sup>th</sup> Sept 2002 – 18 <sup>th</sup> Feb 2004.	De Beers Australia Exploration Ltd	Diamonds	EL22980	CR2004- 0188, CR2003- 0424	Aero magnetic interp. Geophysical surveys, Aeromag surveys, Diamond Drilling.	Three mag anomalies were drill tested using a multipurpose aircore/diamond rig. Two anomalies were explained by a magnetic sub- surface alluvial gravel layer. The third was unexplained. 3 holes drilled for 189m. No record of any assays having been done. Logs indicate all three holes ended in Cambrian sediments. <b>RNN001</b> , the deepest hole, which was drilled to a depth of 116m is available for sampling at NTGS's Darwin facility.
28/04/2003 -	Elkedra Diamonds NL	Diamonds	EL23269	CR2004- 0195	Aeromagnetic interpretation, Aeromagneitc data processing.	Reprocessing and interp of NTGS Barkley Area 2 aeromag survey. No anomalies identified and the area was surrendered.

### AP1802 (Wonarah) CR1968-0030 IMC Development Corporation

A small section of the southern part of AP1802 overlaps with the northern side of the Soudan application.

Exploration on a broader area including AP1802 focussed on phosphate, specifically the delineation of the NW limits of the lower Middle Cambrian phosphorite unit known to occur in the Yelvertoft & Duchess areas to the E & SE.

Photo interpretation was conducted using RC9 aerial photography over the Brunette Downs and Alroy 1:250K map sheet areas & a map of outcrop / photo patterns/soil/rubble types compiled in order find the probable distribution of sub-cropping rock types. Mapping indicates Wonarah beds within AP1802 extend into the northern part of the Soudan application, however this map ends at the boundary of AP1802 (& doesn't show geology further south within the Soudan application).

Radiometric traversing was completed in order to establish strike trends and distribution of subcropping Cambrian units. It was useful for delineating regional contrast between Mesozoic and Cambrian sediments, but ineffective at detecting trends of underlying rock units. The use of a portable scintillometer was a useful aid to local mapping.

BMR gravity data was analysed and a gravity feature map produced to establish a correlation between gravity features and basement configuration of the Cambrian sedimentary basin. SW trending gravity ridges included the Duchess and Alexandria basement arches. A gravity ridge was also shown to pass through the LULU area (AP1788), however this was not explained and it was felt that the correlation between gravity and phosphate deposition was only valid on a regional scale.

Radiometric logging of open bore holes for strat. correlation and detection of anomalous radioactivity associated with phosphorite.

Two drilling programmes totalling 3374 feet were completed to evaluate the phosphate potential of the region and delineate prospective targets for the presence of near-surface phosphorite deposits. [A1-A8, B1-B3, W1-W12, L1-L5]. Drill holes W1-W12 were drilled within AP1802.

W1, which occurs within the Soudan application area, intersected just 0.6% P2O5 over a 2½ ft interval, whereas W2 which occurs to the north of Soudan intersected 17.5 feet at 19.5% P2O5 from 145feet. Drill holes W1-W8 drilled within AP1802 reacted to ammonium molybdate.

Six samples from W2 were subject to beneficiation testing and it was found that the material could be upgraded and that pebble as well as flotation concentrates could be recovered.

Drilling has shown that the Mid-Cambrian phosphorite unit extends as far north as Alexandria Homestead and as far west as Dalmore Downs Homestead. It was not detected in the Brunette Downs area.

Interp from known deposits: Primary exploration targets are the margins and basement highs of the lower Middle Cambrian phosphogenic sea and siltstone-chert lithologies. The principal indicators are structure maps of the top of the phosphatic unit and lithofacies distribution maps.

It is suspected that much of the clastic facies in the Brunette Downs, although Middle Cambrian age is 'phosphate basement' as is probably the case with the Burton Beds in the Alexandria area.

AP1875 CR1970-0080 Pickands Mather & Co. International IMC accidentally drilled a hole in this area (IMC No. 1) and it reportedly contained phosphates. Three widely spaced drill holes totalling 330 feet were drilled to follow up IMC's intersection.

Hole ID	<b>Total Depth</b>	Phosphatic intervals.
S-1-70	125 feet	No analyses of field Shapiro greater than 1% were obtained.
S-2-70	50 feet	Limestone was weakly phosphatic.
S-3-70	155 feet	Limestone. Best value 1% P2O5.

Intervals were tested via Shapiro tests with results up to 1% P2O5. No phosphatic zones were located. No record of lab assays was found.

### AP2161 CR1968-0032 IMC Development Corporation

Contains drill logs and assay data for holes W1-W38 drilled at Wonarah.

### AP2161 CR1970-036, CR1970-0040 IMC Development Corporation

The southern section of AP2161 overlaps a little with the northern side of VALE's Soudan application.

**CR1970:0040:** This report contains paper logs to holes & P2O5 for assays for holes W39-W138A drilled in 1968-1969. Interpretation is not included with the report. The majority of the holes occur to the north of VALE's Soudan application. Coordinates of holes not included on the logs, nor on the map supplied, however the map shows drill collar locations.

CR1970-0036: Some samples from this drilling were submitted for base metal assays (Cu, Co, Pb, Ni, Zn).

# **AP2161** as well as AP1766, 1897, 2159, 2160, 2161 and AP2199 **CR1969-0022, CR1970-0038: IMC Development Corporation**

During 1969, 168 holes for 22,115 feet were drilled. Since the commencement of activities in the region in 1967, phosphorite has been found around the margins of the Precambrian in the Alexandria region. 10 holes intersected phosphorite, with one averaging 15.6% over 20 feet at an upper limit of 160 feet vertical depth. Remaining holes encountered lower grade phosphorite at depths of 100-125 feet.

Prospects at Bowgan, Lulu, Brunette and Avon Downs were relinquished because drilling showed them to be unprospective for phosphate. This report summarises drilling in each of these areas prior to relinquishment.

Reserve figures for Wonarah deposit (at the time) are detailed along with reserve calculation methods.

Beneficiation: Approximately 2,000 lbs of samples were shipped to the US for beneficiation studies. These studies showed that it was possible to obtain a high-grade beneficiated product from the phosphorite in the Wonarah area.

The report contains the following maps/plans:

- Structure Map to top of Phosphatic Unit (Alexandria Region)
- Structure Map with contoured depths to top of Phosphatic Unit (Alexandria Region)
- Columnar sections showing phosphate assays and carbonate content
- Geological Cross Sections (Both Alexandria & Wonarah) with lithological interp.

# EL4591 (Soudan) and also EL4592 (Avon Downs), EL4593 (Shakespeare Creek), EL4594 (Happy Creek)

### CR1986-0256 CRA Exploration Pty Ltd

- Reconnaissance and detailed airborne mag/radiometric surveys
- Ground mag surveys
- Magnetic and radiometric anomaly ledgers
- Ground magnetic stacked profiles
- Geochem sampling (drainage & loam samples)
- Drilling
- Petrography Drilling
- Assay data

Exploration focussed on diamonds. Helicopter supported density drainage gravel sampling was completed over the majority of the tenement area. Single chromites were reported from 5 sites and two chromites from each of 3 other sites. Single microdiamonds were reported four sites and a fifth sample reported two microdiamonds. No kimberlitic indicator minerals were associated with these.

Reconnaissance aeromag and radiometric survey was flown over the whole of the Lake Nash tenement block. Detailed low level survey was flown over EL4591 & the Sthn half of EL4592. Anomalous areas were followed up with Helimags and anomalies warranting further work after helimag data were traversed with ground mags. 28 features were loam sampled.

Photointerp identified 35 anomalous geomorph features. 21 of these were ground truthed and 10 were loam sampled. Four vertical diamond holes were drilled to test magnetic anomalies AVD2, 5,& 20 on Avon Downs EL4592 and one [DD86LN4] 40m hole was drilled to test anomaly Sou16 on Soudan EL4591 (to the east of the current application area). Holes were drilled by tractor-mounted Gemco HT-7 operated by Gaden Drilling of Batchelor. All holes had cased, auger precollars. Magnetic anomalies caused by detrital sands and grits.

The magnetic anomaly at drill hole DD86LN4, to the East of the current Soudan application area, results from ferruginous fine sandy clays. Petrography of sample 1311523 of this material calcite-veined breccia exhibiting regolithic sedimentary breccia characteristics. Microcrystalline maghaemite occurred as selveges in fracture partings.

Sample said to have been subject to geochem however geochem results not located for this sample.

### EL4591 (Soudan), EL4592 (Avon Downs), EL4596, EL4597, EL4598, EL4599 CR1985-0275 CRA Exploration Pty Ltd

- Reconnaissance and detailed airborne mag/radiometric surveys
- Ground mag surveys
- Magnetic and radiometric anomaly ledgers
- Ground magnetic stacked profiles
- Geochem sampling (drainage & loam samples)

Exploration focussed on diamonds. Helicopter supported density drainage gravel sampling was completed over the majority of the tenement area. Single chromites were reported from 4 samples and two chromites from a fifth sample. A single chromite grain of +0.4mm was reported in sample 1083297 from EL4591.

Reconnaissance aeromag and radiometric survey was flown over the whole of the Lake Nash tenement block. Detailed low level survey was flown over all 6 tenements. Anomalous areas were followed up with Helimags and anomalies warranting further work (140 anomalies) data were traversed with ground mags.

24 of these occurred within Soudan tenement EL4591 to the east of the current Soudan application. In total, 122 of these 140 features were loam sampled. Results pending.

29 x U-channel radiometric anomalies selected from detailed airborne survey were ground truthed.

Photointerp identified 71 anomalous geomorph features. 46 of these were ground truthed and 35 were loam sampled. Results pending.

35 x -2mm loam samples and -80 mesh soil samples were collected from the EL areas. -80 mesh samples were submitted for multi element assays. Highest U assay 4ppm. 3 samples 1311058R, 1311070R and 1311079R assayed for P2O5 with assays between 0.04 and 0.06%.

### EL7147 (Joildung) CR1993-0218 CRA Exploration Pty Ltd

The eastern side of historic tenement EK7147 overlaps with the western side of the Soudan application.

Exploration focussed on Diamonds.

Exploration undertaken included detailed aeromag & radiometric survey. This work indicated the presence of 43 magnetic anomalies and 0 radiometric anomalies requiring follow up. The list of magnetic anomalies was refined using aquired helimag data & modelling to cut the list down to 21 anomalies that were loam sampled.

Loam samples comprised of a 20-25kg -2m samle of surface material from each site. A single chromite was reported from sample 3317141 (anomaly BC27) and sample 3317147 (anomaly JD15) contained a microdiamond.

No radiometric anomalies warranted further work.

**Five rotary percussion holes for 202m** [PD92JD1-PD92JD5] were drilled to test anomalies in the more accessible northern part of the tenement. These drill holes all occur to the west of the Soudan application. Anomalies BC8/9 & BC10 are sourced from ferruginous karsitic infill whist JD1 is caused by Antrim Plateau Basalt equivalent volcanics overlain by weakly phosphatic Cambrian carbonates.

Outcrop within EL7147 is restricted to the Northern part of the tenement where undulating hills of laterised and silicified limestone, siltstone, dolomite and chert rubble have been assigned to the Middle Cambrian Gum Ridge Formation (formerly Wonarah Beds). The base of the formation as intersected in drillhole PD92JD5 (CRAE 1992) consists of a three metre thick phosphoritic cellophane claystone horizon unconformably overlying Lower Cambrian basalt (cf Helen Springs Volcanics and Antrim Plateau Basalt). The thickness of the Gum Ridge Formation at this locality is in the order of 50m.

Whole rock analysis of thin (<3m) claystone unit intersected in drillhole PD92JD5 submitted for P2O5 analysis – 6.85%. Possibly related to extension of the Wonarah phosphate resource on the adjacent Alroy 1:250K sheet.

Note: although drill holes are located to the west of the Soudan application this information may assist with P2O5 exploration.

No original assays were located in the report.

EL22596 (Frew River North) and also EL22594 (Frew River South), EL22597 (Frew River West), EL22811 (Barkly 4) CR2002-0243 Rio Tinto Exploration Pty Ltd Tenement EL22594 overlaps the northern portion of Annitowa 1. The remainder of the tenements covered by this report are outside of the Annitowa application area and extend to the north and west of the Annitowa tenement applications.

Focus on phosphate exploration. Area considered favourable for Wonarah style phosphate deposits. Tenements cover Mid Cambrian sediments, and occur south of the Wonarah phosphate deposit hosted by the Upper Gum Ridge Formation. In the southern part of the tenement area basement ridges of the Palaeoproterozoic Davenport Block are interpreted from aeromags. Basement highs are flanked by onlapping dolomitic rocks equivalent to Thorntonia Limestone (sequence 1). Overlying sequence 1 carbonates and older basement is dolostone, mudstone and phosphorite of the lower middle Cambrian Upper Gum Ridge formation and mudstone siltstone and dolostone of the middle Cambrian Wonarah beds. The phosphorite time horizon (basal sequence two) is interpreted to be shallow throughout the tenement area but outcropping phosphatic units have only been identified in Frew River North (EL22596).

Limited reconnaissance was undertaken in 2002. This comprised of collecting 8 rock chip samples, petrographic analysis of one of these samples and the collection of 6 orientation soil samples from over subcrop. None of these coincide with the area covered by the Annitowa 1 application.

Reconaissance undertaken Q4 2002. 1 sample of dolomitic limestone (+ve response to ammonium molybdate testing) was submitted for petrographic analysis.

8 rock chips samples were collected and assayed. 6 from Arruwurra (EL22596 – Frew River North) and 2 from EL22597 – Frew River west.

6 orientation soil samples were collected from over subcropping phosphatic Upper Gum Ridge Formation, however the -80# fraction sampled was contaminated with Aeolian material and was ineffective.

### EL22980 (Ranken Project) CR2003-0424, CR2004-0188 De Beers Australia Exploration Limited

**CR2003-0424:** Contains digital dtm and mag geophysical survey data and images, digital drill hole logs, and down hole mag sus data.

CR2004-0188: Contains strip logs

The South Western corner of EL22980 overlaps the NE quarter of VALE's Soudan Application.

Exploration on EL22980 focused on diamonds. Works undertaken included interpretation of NTGS Barkly geophysical survey data, an aeromag survey infilling the 400m spaced govt data to 200m line spacing, and detailed airborne surveys over three anomalies of interest. All three anomalies were drill tested [RNN001, RNN002 and RNN006] using a multipurpose aircore/diamond rig (total 189m drilled). Drill holes, access tracks and drill pads were rehabilitated, however hole plugs were left in place.

Two anomalies were explained by a magnetic sub-surface alluvial gravel layer. The third was unexplained.

The tenement was relinquished on 18<sup>th</sup> February 2004 as the area was considered unprospective for diamondiferous diatremes.

All three drill holes drilled fall within the Northern portion of VALE's Soudan application. Strip logs are included in the report, however precollar depths are not stated.

RNN001 was drilled to 116m. The majority of the hole intersected Cambrian siltstone and limestone. RNN002 was drilled to 42m. Cambrian siltstone was found between 28-42m. RNN006 was drilled to 31m and terminated in Cambrian siltstone.

There is no record of any assays having been undertaken on hole cuttings or core.

Although the holes are stated to be diamond holes it is possible that the shallower holes were aircore only (ie precollars only). A quick review of NTGS records indicate that RNN001 is housed at NTGS's Farrell Crescent core storage area and that it is available for sampling. There is no record, however of drill holes RNN002 or RNN006 being held in storage.

### EL23269 (Dingo Hole) Elkedra Diamonds NL CR2004-0195

Exploration focussed on diamonds. The only work undertaken was the reprocessing and interpretation of NTGS Barkley Area 2 aeromag survey. No magnetic anomalies were identified and the area was surrendered.

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