CRA EXPLORATION PTY LIMITED

EL 2353 WARREGO, N.T.

FINAL REPORT

PERIOD ENDING 22nd APRIL, 1981.

submitted by: A.A. Snelling

accepted by : W.H. Johnston

date : June, 1981

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CRAE Library Melbourne

CONTENTS

1. SUMMARY

Areas of higher total count radioactivity outlined by earlier BMR regional surveys were traversed by helicopter on widely spaced lines to ascertain whether they contained uranium responses. All anomalies were mainly due to potassium and/or thorium. However, two contained small uranium peaks due to small patches of a very thin hematitic mudstone unit. These were sampled, but uranium assays received were not significant.

2. INTRODUCTION

During 1979 a detailed airborne magnetic and radiometric survey was carried out over EL 1877 Short Range near Tennant Creek to cover an area of high (total count) radiation near the contact between granitic rocks and overlying Carpentarian sandstones (Snelling and Jenke, 1980). A significant uranium response was outlined within this high total count anomaly, originally surveyed by the BMR in 1956 and 1960.

Consequently an application was lodged on October 9th, 1979, for the area immediately west and south of our EL 1877 Short Range (see Plan NTd 1139) to cover additional areas of higher radioactivity outlined by the BMR (see Plan NTd 1674). Title to a reduced area, as shown on Plan NTd 1674, was granted on June 24th, 1980 by the N.T. Government. This report gives details of all work undertaken in the EL during tenure of the title.

3. CONCLUSIONS

Most of the BMR radiometric total count anomalies investigated are mainly due to potassium with or without thorium. Two anomalies contained small uranium peaks within broader potassium and thorium responses. These are associated with a very thin hematitic mudstone unit which occurs in small isolated pockets resting on other strata. This sedimentary ironstone has clearly accumulated excess uranium, but not in quantities to be of any further significance.

4. GEOLOGY

The geology of the Tennant Creek area has been described in detail by Mendum and Tonkin (1976), and by Dodson and Gardener (1978), and that pertaining to this EL is shown in Plan NTd 1559.

The oldest rocks in the EL area are greywackes, sandstones, shales and minor siltstones, grit bands,

cherts and pebble beds of the Lower Proterozoic Warramunga Group. This rock group has been difficult to sub-divide because of the complexity of structures, the scarcity and isolation of outcrops, and the scarcity of marker beds. Mendum and Tonkin (1976) have attempted a complex sub-division of the whole Warramunga sequence, dividing the succession into ten units based on the proportions of siltstone, greywacke and shale, and locally, the presence of hematitic shale, conglomerate and volcanolithic material. The Warramunga Group is considered to be a eugeosynclinal or turbidite sequence because it consists of monotonous greywackes, shales, and siltstones, with volcanics. Dating of intrusive granites suggests that the Warramunga Group rocks are at least 1800 m.y. old and therefore definitely Lower Proterozoic.

There is very little outcrop of Warramunga Group rocks within the EL area (see Plan NTd 1559). The lithologies present have been mapped as belonging to units:-

Pw_3 Shale, greywacke, minor grit bands

Pw_4 Greywacke, sandstone, minor siltstone, chert and pebble beds.

Potash granite, probably of Carpentarian age, intrudes the Warramunga Group sediments in the central portion of the EL area. This granite, termed the Warrego Granite by Mendum and Tonkin (1976), lies at the northwestern end of a granite belt which cuts across the Tennant Creek area in a NW-SE direction. The Warrego

Granite comprises three major granite types - massive, widely-jointed, coarse-grained muscovite granite (Pgw), fine-grained muscovite-hornblende granite (Pgy), and massive, pink to red, medium to coarse-grained aplitic granite (Pgx). Quartz veins striking roughly north-south cut the granite. Minor quartz porphyry dykes and elongated bodies intrude the margins of the granite and the adjacent sediments.

The Hayward Creek Formation of the Tomkinson Creek Beds unconformably overlies the Warramunga Group sediments to the north and west of the EL area, and is generally considered to be of Carpentarian age. The slight angular unconformity between the Hayward Creek Formation and the Warramunga sediments is well exposed in the EL area and to the west. The Hayward Creek Formation is the main basal unit of the Tomkinson Creek Beds and consists of 3000-6000 m of pebbly lithic and clean quartz sandstones, often cross-bedded and ripple-marked.

Earliest Middle Cambrian interbedded chert, siltstone, limestone, and minor sandstone and mudstone of the Gum Ridge Formation unconformably overlie all earlier rocks - Warramunga and Hayward Creek sediments, and the granite - in the western portion of the EL and further to the west. The formation is probably about 25 m thick, but the cherts and siltstones are richly fossiliferous and the limestones are often biostromal.

Tertiary silcrete (quartz grains in a siliceous matrix) forms a prominent 3 to 8 m thick capping on granite in the central portion of the EL. Scattered patches of thin Cainozoic laterites are developed on all pre-Cainozoic sediments. Fine red Cainozoic sands cover much of the area reducing the availability of outcrop information.

5. GEOPHYSICAL INVESTIGATIONS AND GEOCHEMICAL SAMPLING

During August 1980 a helicopter-borne spectrometer was used to investigate the BMR radiometric anomalies in the EL area. The equipment used consisted of a Geometrics DGRS 1002 spectrometer, a MARS-6 six channel recorder and a 7.4 litre NaI crystal detector, all mounted in a Bell 206 Jet Ranger helicopter.

Broadly spaced lines were flown over the areas of interest (see Plan NTd 1674) to ascertain if the sources of the higher (total count) radiation incorporated any uranium. When appropriate the helicopter was put down to allow ground investigations of anomalies and geochemical sampling.

(a) Area 6

This is the BMR class "C" radiometric anomaly located at 133°43', 19°19'S (see Plan NTd 1674) over outcrop of Warramunga sediments (see Plan NTd 1559). Traverses across the area revealed that thorium and potassium were the sources of the total count response. Only minor increases in uranium were noted, but these were confined to the areas of high thorium and potassium.

No samples were taken.

(b) Area 7

This is the BMR class "C" radiometric anomaly located at 133°44'E, 19°23'S (see Plan NTd 1674) over outcrop of Tertiary silcrete capping granite (see Plan NTd 1559). Traverses across the outcrops showed that thorium and potassium produced the total count response. No samples were taken.

(c) Area 8

This is the large BMR class "B" total count anomaly located at 133°39'E, 19°22'S (see Plan NTd 1674) over outcropping Warramunga sediments in the northern half of the anomaly and mainly scattered outcrops of granite and minor quartz porphyry surrounded by Cainozoic sand in the southern half of the anomaly area (see Plan NTd 1559). Traverses across the southern end of the anomaly area showed that potassium with a minor increase in thorium produced the total count response - most probably a reflection of the outcropping and sub-cropping granite.

A small uranium peak on the eastern side of the northern portion of anomaly area 8 (marked by a * symbol on Plan NTd 1674) was investigated on the ground. The source of the radiation was traced to a thin (approximately 0.5 m or less) almost flat-lying bed of hematitic mudstone (sedimentary ironstone) in a mudstone breccia sequence on a spur between creeks draining to the south. The outcrop was traversed with the Scintrex BGS-4 scintillometer and readings taken

at selected spots with the Geometrics GR-410 spectrometer. Best spectrometer reading was:-

Total Count = 1753 cpm

K = 1119 cpm eK = 2.17%

U = 910 cpm eU =41.4 ppm

Th = 198 cpm eTh =24.8 ppm

A rock chip sample - number 882508 (see Appendix I) - representing 10 chips over 1 m, was collected from a spot high of 400 cps on the BGS-4 scintillometer (background 130 cps). Spectrometer readings from the same spot high were:-

Total Count = 1122 cpm

K = 617 cpm eK - 0.80%

U = 619 cpm eU = 29.9 ppm

Th = 84 cpm eTh = 10.5 ppm

The rock chip sample returned a geochemical assay of 56 ppm U and less than 4 ppm Th (see Appendix I), indicating uranium/daughter and thorium/daughter disequilibrium.

The outcrop generally gave variable counts on the BGS-4 scintillometer between 200 and 400 cps. Two further GR-410 spectrometer readings were taken over the outcrop south of the rock chip sample site:-

(i) Total Count = 776 cpm

K = 458 cpm eK = 0.80%

U = 395 cpm eU = 17.5 ppm

Th = 87 cpm eTh = 10.9 ppm

(ii) Total Count = 991 cpm

K = 592 cpm eK = 1.07%

U = 505 cpm eU = 23.3 ppm

Th = 100 cpm eTh = 12.5 ppm

Background GR-410 spectrometer readings were also taken:-

(i) over surrounding quartzites

Total Count	=	337 cpm			
K	=	151 cpm	eK	=	0.07%
U	=	111 cpm	eU	=	2.6 ppm
Th	=	94 cpm	eTh	=	11.8 ppm

(ii) over "bulldust" with some radioactive float

Total Count	=	446 cpm			
K	=	223 cpm	eK	=	0.48%
U	=	156 cpm	eU	=	5.3 ppm
Th	=	86 cpm	eTh	=	10.8 ppm

(d) Area 9

This is the large BMR class "B" total count radiometric anomaly located at 133°34'E, 19°20'S (see Plan NTd 1674) over what appeared to be just a large patch of Cainozoic black soil surrounded by fine red sand. Traverses across the area detected a small uranium peak on the flank of an area of broad higher thorium levels with an associated increase in potassium. Ground investigation traced the uranium anomaly to a sub-cropping hematitic mudstone unit similar to that in area 8 (see above). A 2 m area of sub-crop was sampled (number 882509 - see Appendix I). Maximum count on the Scintrex BGS-4 scintillometer was 250 cps against a background of 150 cps. A Geometrics GR-410 spectrometer reading was taken at the sample site:-

Total Count = 722 cpm

K = 398 cpm eK = 0.64%

U = 345 cpm eU = 14 ppm

Th = 124 cpm eTh = 15.5 ppm

The sample returned a geochemical assay of 47 ppm U and less than 4 ppm Th (see Appendix I), again indicating uranium/daughter and thorium/daughter disequilibrium. A further spectrometer reading was taken nearby:-

Total Count = 586 cpm

K = 351 cpm eK = 0.75%

U = 241 cpm eU = 7.7 ppm

Th = 148 cpm eTh = 18.5 ppm

A 50 m diameter circular feature with a negative profile just north of area 9 was inspected. A sample (number 882510 - see Appendix I) was collected from an anthill for concentrate inspection.

(e) Area 10

This is the BMR class "C" anomaly located at 133°32'E, 19°10'S (see Plan NTd 1674) over outcrop of Tomkinson Creek Beds (Morphett Creek Formation - feldspathic sandstone, siltstone and shale). Three east-west lines were flown across the area. The dominant response was recorded in the potassium channel over outcrop. Only minor increases were noted in the thorium channel and uranium remained at background levels. No samples were collected.

(f) Area 12

This is a BMR class "C" anomaly located at 133°31'E, 19°27'S (see Plan NTd 1674) over a Cainozoic black soil "claypan". Traverses over the area were made before landing for a ground inspection. A grab sample of a pink, highly weathered rock, which appeared to be the

source of anomalous radioactivity, was collected for petrographic identification.

Spectrometer readings taken at the site are:-

Total Count	=	420 cpm			
K	=	198 cpm	eK	=	0.38%
U	=	132 cpm	eU	=	2.2 ppm
Th	=	139 cpm	eTh	=	17.4 ppm

The response was mainly from thorium. The petrographic report on the sample collected (number 882515) appears as Appendix II.

A.A. SNELLING

6. REFERENCES

Dodson, R.G. &	1978	Tennant Creek, Northern Territory. Sheet SE/53-14 Internat.Index. Bur.Miner.Resour.Geol. Geophys.Aust.1:250 000 Geological Series - Explanatory Notes
Mendum, J.R. & Tonkin, P.C.	1976	Geology of the Tennant Creek 1:250 000 Sheet Area, Northern Territory. Bur.Miner. Resour.Geol.Geophys.Aust. Record 1976/68 (BMR Microform MF 96)
Snelling, A.A. Jenke, G.P.	1980	EL 1877 Short Range, N.T. Annual Report Period Ending 14.5.80. CRAE Report 10144

7. KEYWORDS

Uranium, Tennant Creek SE/53-14 1:250 000 map sheet, Proterozoic-Lr, sandstone, shale, granite, Proterozoic-Md, unconformity, Cambrian, airborne, geophys-rad, geochem-rock, assays-geochem.

8. LOCATION

Tennant Creek SE/53-14 1:250 000 map sheet

9. LIST OF PLANS

Plan No.	Title	Scale
NTd 1139	Exploration Licence Application Warrego ELA 2353 Northern Territory	1:100 000
NTd 1559	Warrego EL 2353 Geology	1:100 000
NTd 1674	Warrego EL 2353 Geophysical Investigations	1:100 000

PETROGRAPHIC REPORT ON A ROCK SAMPLE

Lowder Geoscience
Ore Petrology and Exploration Research

PETROGRAPHIC EXAMINATION OF

SAMPLE NO . 882515

Report No.: 80/129 18th September, 1980

For: C.R.A. Exploration Pty. Ltd.

Petrography by: Dr Jane Barron

G. G. LOWDER
Consulting Petrologist

Sample No. 882515

Rock Type Weathered, poorly sorted quartz arenite with limonitic-stained argillaceous matrix.

Hand Specimen As in the case of 882505 this rock is very substantially weathered. It is patchy red- to yellow-brown in colour and is medium grained and rather friable. Irregular joint surfaces are coated with a black alteration product. Staining for K-feldspar indicated that this mineral is absent.

Thin Section The rock is even more altered than 882505, but it is substantially different. It is possibly a sediment with the texture of a poorly sorted arenite. The average grain size of the subrounded to angular detritus is about 0.4 mm across. The sandy detritus forms about 25% of the whole rock and is dominantly quartz with minor lithic material and numerous rounded accessory zircon grains with a few grains of detrital blue to yellow, less well rounded tourmaline. A few rare scattered detrital opaque oxide grains are also present. All this material is widely scattered throughout an abundant matrix of red-brown to yellow-brown, limonitic stained, fine grained ?clay, probably largely a product of weathering.

The rock is primarily a poorly sorted quartz-rich arenite with an abundant, largely argillaceous matrix. It has been severely affected by weathering which has produced a limonitic-stained fine grained argillaceous matrix.

APPENDIX I

GEOCHEMICAL SAMPLING LEDGER

FORM 16.

[redacted] PTY. LIMITED

GEOCHEMICAL DRAINAGE SAMPLING LEDGER

AREA WARREGO E.L. 2353 SAMPLE Nos. 882508 – 882515 COLLECTED BY CS, G.J. SHEET No.

MAP OR PHOTO REFERENCE Tennant Creek 1:250,000 ANALYSED BY TECHEM, D.P.O's 20675/76 DATE 24/8/80.

Map or photo No.	No. Sample	Sediment: Gravel	Sand	Silt/mud	Organic	Channel: Flow	Width	Alluvial	Colluvial	pH	Metal content, p.p.m.: Pb	Zn	Cu	Ni	Au	Cr	Mn	Ag	Sn	W	U	Th	Geological observations
	882508	Rock CHPS/1M Subcrop.									70	435	406	—	<0.02	—	6040	<0.5	—	—	56	<4	Anomaly 8: radiometric anomaly traced to thin sedimentary ironstone (hematitic mudstone) in mudstone breccia sequence. Sample is of 10 chips over 1m of spot high of 400cps on BGS 4. (background 130cps). Rock varies from 200–400cps over outcrop.
	882509	Rock chips over 2m.									68	75	127	—	<0.02	—	630	<0.5	—	—	47	<4	Anomaly 9: radiometric anomaly traced to similar unit as that of 882508. Sample over 2m subcrop at maximum count of 250cps on BGS 4. Background is 150cps.
	882510	ANT HILL Sample.																					Circular feature 50m dia, negative profile close to Anomaly 9. Sample from anthill taken for concentrate inspection. White clay of feature (acts as soak) contrasts to surrounding red loam soils.
	822511	ANT HILL Sample.	+40#			Pink Purple Br					40	14	16	98	<0.02	895	150	<0.5	<5	44	—	—	Anomaly 5: BMR mag. Samples taken at approx. 400mN on mag traverse 1. from anthill.
	822512		+60 –40#			Dark "					52	22	20	96	<0.02	573	180	<0.5	<5	31	—	—	
	822513		+80 –60#			"					49	26	26	78	<0.02	642	210	<0.5	<5	39	—	—	
	822514		–80#			Anth Br					55	21	14	60	<0.02	278	250	<0.5	<5	15	—	—	
	822515	GRAB Rock sample.																					Anomaly 12: Radiometric. Great sample of pink intrusive, highly rea. which appears to be source of anomaly. Sample taken for petrographic ID. Silly.

19° 15'

Warrego
67·76 Sq. Miles
(175·49 Sq. Km.)

133° 40'

133° 45'

19° 22'

133° 50'

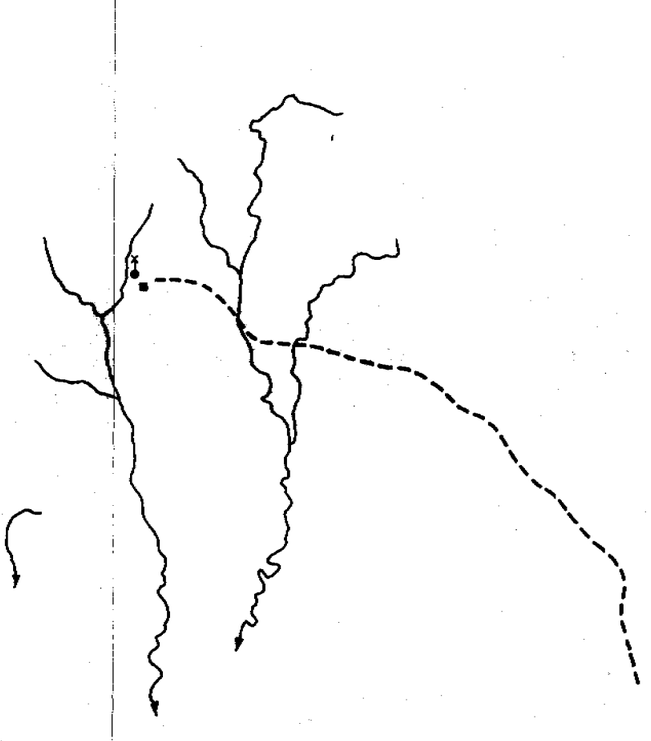
MR 318

19°25'

Scale 1:100,000

2 0 2 4 6 8 10 Km.

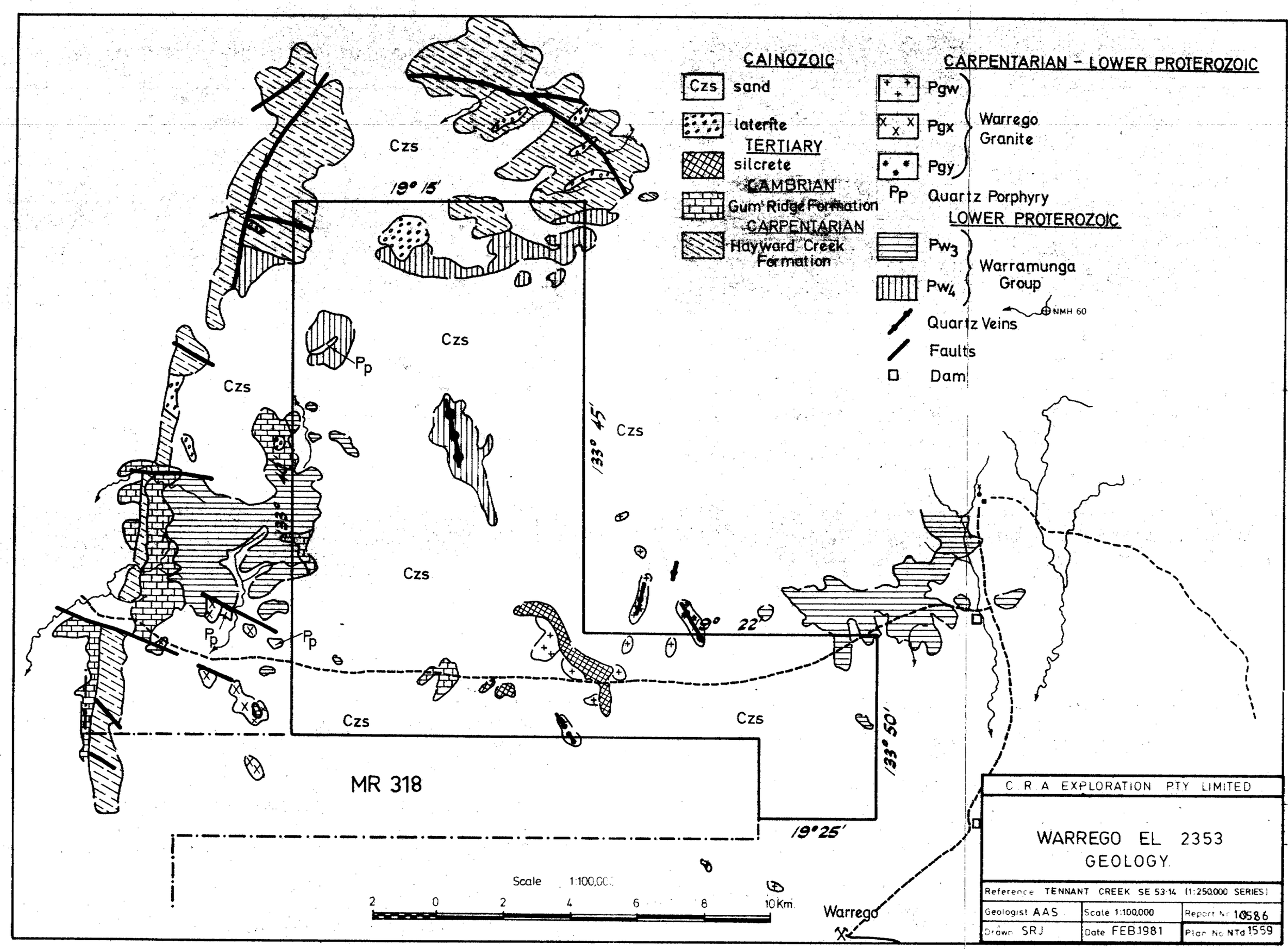
NMH 60



C. R. A. EXPLORATION PTY LIMITED

EXPLORATION LICENCE APPLCN.
WARREGO ELA 2353
NORTHERN TERRITORY

Reference TENNANT CREEK SE 53-14 (1:250,000 SERIES)		
Geologist W.J.F.	Scale 1:100,000	Report No 10586
Drawn W.S.P.	Date 8 · 11 · 79	Plan No. NTd 1139


CAINOZOIC
Czs sand
laterite
TERTIARY
silcrete
CAMBRIAN
Gum Ridge Formation
CARPENTARIAN
Hayward Creek Formation
CARPENTARIAN - LOWER PROTEROZOIC
Pgw
Pgx
Pgy
Warrego Granite
Pp Quartz Porphyry
LOWER PROTEROZOIC
Pw3
Pw4
Warramunga Group
NMH 60
Quartz Veins
Faults
Dam
Czs
Pp
19° 15'
133° 45'
133° 50'
19° 22'
19°25'
MR 318
Scale 1:100,000
2 0 2 4 6 8 10 Km.
Warrego
C R A EXPLORATION PTY LIMITED
WARREGO EL 2353
GEOLOGY.
Reference TENNANT CREEK SE 53-14 (1:250,000 SERIES)
Geologist AAS
Scale 1:100,000
Report No 10586
Drawn SRJ
Date FEB.1981
Plan No NTd 1559

10

9

8

6

7

11

12

19° 15'

133° 40'

133° 45'

19° 22'

133° 50'

19° 25'

MR 318

WARREGO MINE

LEGEND

RADIOMETRICS

B.M.R. "B" Class Total Count Anomalies

B.M.R. "C" Class Total Count Anomalies

6-12 Anomalies Investigated

MAGNETICS

Total Magnetic Intensity Contours (gammas) (contour interval is 50 gammas)

Reference:

B.M.R. Tennant Creek – N.W. Geophysical Sheet G 237-11, June, 1962.

C. R. A. EXPLORATION PTY LIMITED

WARREGO - EL 2353

GEOPHYSICAL INVESTIGATIONS

Reference Tennant Creek SE 53 - 14		
Geologist A.A.S.	Scale 1:100,000	Report No 10585
Drawn S.R.J.	Date MARCH 81	Plan No. NTd 1674