Yearly Report EL 999.
(1976)

OPEN FILE

YEARLY REVIEW OF ACTIVITIES -- PART 1

SPECIAL REPORT ON EXPLORATION LICENCES No. 555, 999, 1000 AND 1167

ELKEDRA, NORTHERN TERRITORY

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1. INTRODUCTION

To assist in the overall assessment of the mineral prospects of the area, a special team comprising three geologists under Mr. M. V. Eipe, M.Sc., with appropriate field support carried out a detailed reconnaissance during June and July, 1976. Special attention was directed towards radio-active minerals with a view to the possible adoption of track-etch techniques in the event that suitable target areas became evident.

1.1. AREAS INVESTIGATED

Reconnaissance traverses were carried out in areas covered by and ajacent to the four E.L.'s noted in the preceding section. The total area covered for this investigation is approximately 324 square miles located approximately 27 miles NE of Anmaroo H.S. and situated on either side of the Newlands Creek (refer PLATE 1) and George Street.

The area is accessible by the Sandover Highway (a graded road) from Mt. Isa and also from Alice Springs. The Sandover Highway is not trafficable during the wet season. Numerous graded tracks provide a good degree of access in the areas investigated.

1.2 Instruments

Three scintillometers (Austral SG2, Ser. Nos. 278, 285 and 293) and two Spectrometers (Austral GDS12, Ser. Nos. 211 and 213) were used in the course of investigations.

1.3 Vehicles

Two four wheel drive Toyota Landcruisers (Reg. Nos. ONC 163 & 164) were used for the period covering this report.

2. GENERAL GEOLOGY

The area investigated occupies the western margins of the Georgina Basin. Here the shallow marine sediments of Cambrian age unconformably overlie the sediments and lavas of the Davenport Geosyncline.

Regionally metamorphosed Archean schists underlie the sediments of the Davenport Geosyncline separated by an unconformity. The Stratigraphic sequences in the area investigated is given below.

Upper Cambrian	TOMAHAWK BEDS	Sandstone, Siltstone, Conglomerate
Middle Cambrian	SANDOVER BEDS	Siltstone, Mudstone, Shale, sandstone, Conglomerate
Lower Proterozoic	HATCHES CREEK GROUP	Sandstone, Siltstone, Acid and basic lavas
Archaean	ARUNTA COMPLEX	Schist

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2.1 Target Lithologies

Regional reconnaissance was carried out by U.G. (1973) along the margines of the Tanami Block, Davenport Geosyncline, Arunta Block and the Amadeus Basin. One of the targets of this investigation was to provide a 'fill in' info for the earlier work and also to test the potential of the Lower Proterozoic and Middle Cambrian sediments as favourable host rocks for uranium.

Arunta Complex

Can be conceived to be the basement rocks in the area investigated. The outcrops tested are located approx. 3 miles SW of Andagera Bore(Lat. 21°30' and long.135°42'). Here the rocks are pale grey coloured schists striking N 75° W and dipping steeply (75° to 80°) to the south. An occacional garnet was observed in the schists. Schistosity is well developed and is parallel to the bedding. A number of quartz hematite veins parallel to the strike of the schists are present in the area. These are older than the Cambrian sediments overlying the schists. Where exposed the schists occupy the basal part of ridges. These ridges arecapped by Cambrian sandstones and siltstones which are separated from the schists by an unconfomity. An idealised cross section across these ridges is given below.

This Lower Cambrian unconformity consists of a conglomerate that is approximately 25 m in thickness. Quartz pepples approximately 2 to 8 cm. in diameter are set in a feldspathic sandstone matrix. This entire conglomerate dips gently to the south with the Archaeans.

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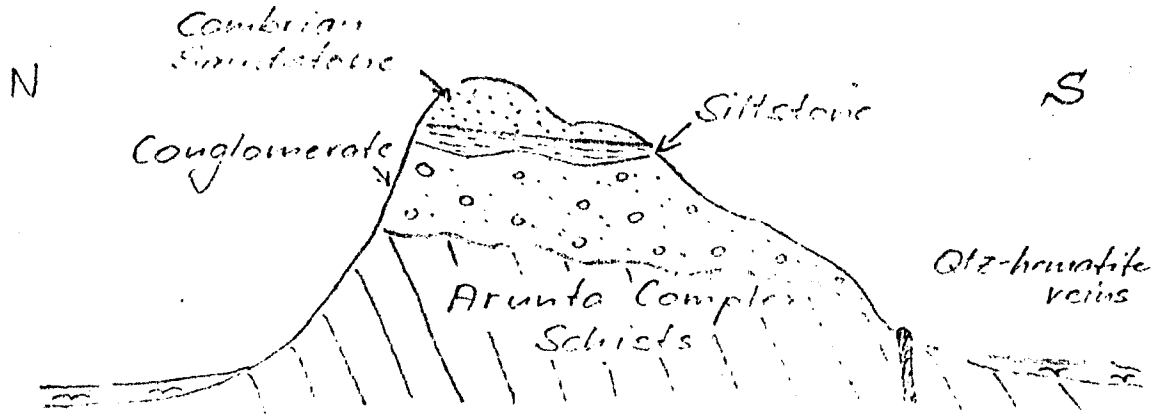
Interstitial clay is abundant in the matrix. Locally ferruginous fillings between the grains were observed.



Hatches Creek Group consists essentially of pale grey and brown coloured quartz sandstone with interbedded acid and basic lavas. The sandstone is generally medium to coarse grained and represents a low energy medium.

Cross bedding is observed locally. Both acid and basic lava flows are present at varying levels within the sequence. The Hatches Creek Group seems to have been subjected to strong folding movements and a series of large scale instrusions by dolerites and granites. A a result the strike and dips vary considerably. It is felt that the general strike of the sediments can be approximated as N 50° W. The dips vary from 5° to 23° and in the vicinity of intrusives dips of up to 58°, have been measured. Both the sediments and the inter-bedded volcanics have been metamorphosed in the vicinity of granite intrusives. At such locations it is difficult to distinguish the group (megascopically) from the Archean schists of the Arunta Complex.

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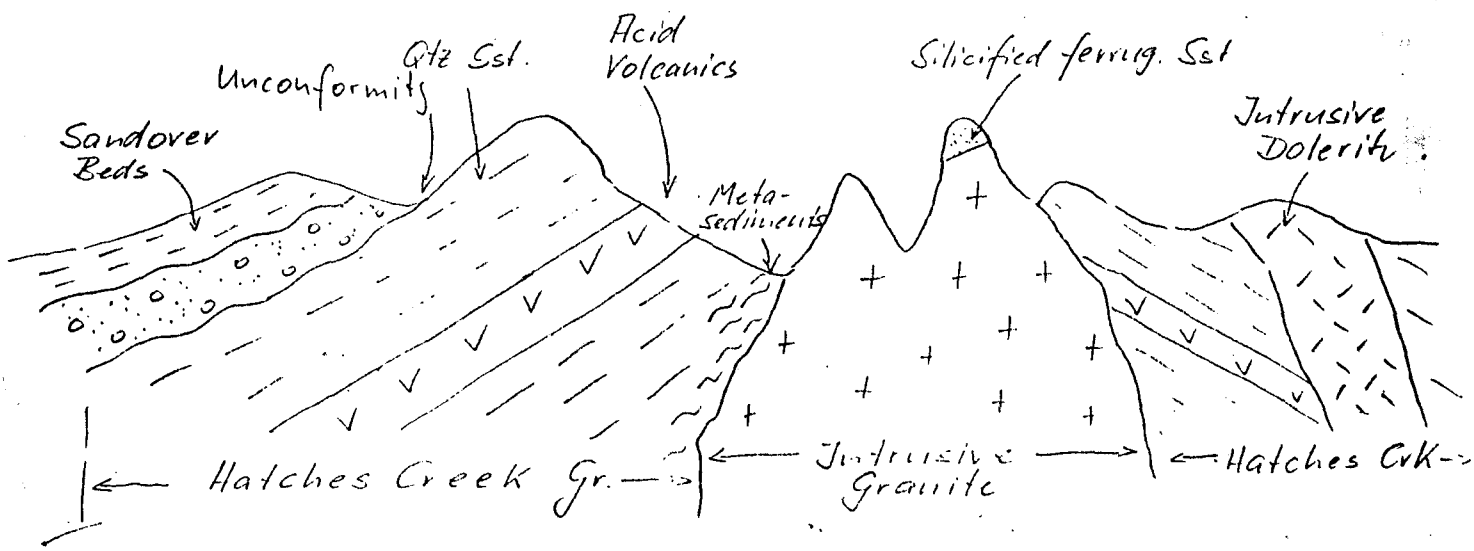
Two types of intrusive granite can be recognised in the area. A coarse grained muscovite granite with an abundance of potash feldspar and tourmaline occurs at approximately 4 miles SSW of Supplejack bore. A number of small and abandoned Wolfram workings are present within this body. At a number of locations a silicified and highly ferruginous sandstone of the Hatches Creek Group was to cap the hills consisting essentially of this granite. A second type of granite which is less potessic was observed to the NW of the main pot ssic mass.

The intrusive dolerite crops out 2 miles west of the Supplejack bore. It is essentially a greenish grey coloured pophyritic rock with phenocrysts of plagioclase set in dark grey matrix rich in mafic constituents. The contact of the dolerite with the sediments of the Hatches Creek Group was not observed.

The unconformity between the Archean schists and the Lower Proterozoic sediments was not encountered in any of the traverses. An idealised cross section showing the relationship of the various units within the Hatches Creek Group is shown below.



Sandover Beds are a group of shallow marine sediments resting unconformably on the Hatches Creek Group and the Arunta Schists. The unconformity with the Hatches Creek Group is well developed in the vicinity of the turquoise mine located at Lat. 21°35' and long. 135°26'. Here well rounded quartz pepples approximately 5 cm to 12 cm across are set in a fine grained sandstone matrix. The unconformity is approximately 20 m in thickness and dips 8° to the South.

A well defined sequence of the Sandover Beds was observed in the several cuts within the mine and the entire sequence has been mapped and is presented in PLATE 2 appended to this report.

Total thickness of sediments present in the mine area is approximately (dip corrections not applied) 20.8 m. Though the entire sequence can be classified into 11 different units for mining purposes it is felt that for all practical purposes a three fold division would suffice. These horizons are summarised below.

Horizon 'A' (Approx. 9.5 m thick)	Pale grey and white coloured siltstone with lenses of chert occurring at two distinct levels (one near the top of the horizon and one near the bottom of the horizon).
Horizon 'B' (Approx. 9 m thick)	Pale brown and dark reddish brown coloured mudstone. The latter is usually massive and has greenish black coloured fracture fillings that are orientated oblique to bedding. The pale brown coloured horizon usually has a series of chert lenses towards its top.

Horizon 'C' (Approx. 2.5 m thick)	Yellowish black and brown coloured mudstone which is normally the turquoise bearing units.

Horizon 'C' is underlain by the conglomerate which marks the unconformity with the Hatches Creek Group.

A coarse grained potash granite outcrops in the mine area. The Sandover beds seem to have been deposited over this granite parts of which could have stood out as inselbergs. Horizon 'C' in places ajoining the granite seems to have slid away from it while still in a plastic stage of development. This is evidenced by the intraformational breccia present in one of the cuts near the northern most part of the mine.

Chert horizons in the upper divisions seem to be of biogenic origin. A large number oval shaped chert modules with concentric growth rings are present both above and below the chert horizon.

3. INVESTIGATIONS AND RESULTS

3.1 Radiometrics

Arunta Complex

Ground scintillometer traverses were carried out over all the outcropping schists. Background count rates varied from 40 to 60 cps. Occasionally higher count rates of up to 80 cps were observed.

The unconfomity with the overlying Cambrian sediments registered a steady count rate of 40 cps.

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Hatches Creek Group

Ground scintillometer traverses were carried out to check airborne radiometric anomalies detected by BMR (Davenport Region - 1958). The following anomalies were investigated. Background count rate for the sediments of the group is 20 cps.

Anomaly 73 was located in a sheared and silicified sandstone intersected by numberous quartz veinlets. Count rate of up to 500 cps were observed in an area approximately 5 square metres in size. A detailed investigation of the surrounding area failed to reveal any other anomalies. Sandstone in the anomalous area strike 355° and dips 8° to the west. It was also confirmed through detailed chip sampling that the radioactivity was attributed to the sandstone and not to any of the quartz veinlets intersecting it.

Anomaly 74, 75 and 76 were located within a slightly warped sandstone intruded by a quartz vein. The sandstone horizon directly responsible for the higher count rate was exposed by pitting. Thickness of the radioactive horizon was measured as 0.3 m; count rates exceeding 1000 cps were measured over samples collected from this horizon. The radioactive horizon strikes 300° and dip 25° - 30° to the east. The sandstone horizon was checked along strike over distances of up tp 30 m and was found to be anomalous. A thick scree covers most of this horizon.

Anomaly 77, 78 and 79 coincided with outcropping masses of granite in an otherwise alluvial covered area.

Apart from checking these airborne anomalies scintillometer traverses were also carried out over the inter-

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bedded acid and basic volcanics, intrusive granites and along the contacts of the granites with the sediments. Background count rates for the various units are tabulated below.

Interbedded acid volcanics	70 to 80 cps
" basic "	30 to 35 cps
Intrusive granites	60 to 80 cps
Sediments at the contact with the granites	40 to 65 cps

No other anomalous areas of any significance were encountered in these traverses.

Sandover Beds

The only major anomalous areas encountered was in the northern part of the turquoise mine. Count rates varying from 200 cps to 500 cps were registered over 20 m in the sediments immediately overlying the granite. The area was gridded at a line spacing of spacing of 3 m and count rates were recorded at every 1 m. Details of the anomalous area are shown in PLATE 3 appended to this report. To evaluate this anomalous area in detail an adjacent cut in the mine was mapped and count rates recorded for the different lithological units exposed in the cut. During the course of this mapping it became evident that the Sandover Bads were deposited over the older granite. However, the contact with the granite could not be traced as that particular part of the cut was covered by rubble. The horizon that was responsible for the higher count rates was established as an intraformational breccia rich in phosphate and lying adjacent to the granite. PLATE 4 shows the details of the southern face of the cut mapped and the various lithological units showing the count rates.

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Having located the lithological unit that was responsible for the higher count rates a comprehensive stratigraphic section of the 11 lithological units in the mine was mapped from the different cuts available. Average count rates for each of these units mapped was measured against the exposed faces and recorded in PLATE 2.

Background count rates for the Sandover Beds vary from 35 to 45.

Unconformity at the base of the Sandover Beds (with the Hatches Creek Group) was investigated in detail. Background count rates of up to 40 cps were registered over the entire horizon exposed NE of the mine area. No anomalous areas of any significance were encountered.

3.2 Sampling

3.2.1 Rock Chip Sampling

A total of 51 samples were collected from the different formations outcropping in the area. Locations of these samples are shown in PLATE 1, PLATE 2, PLATE 3 and PLATE 4. Details of these samples are recorded below.

Arunta Complex

40 cps	ELK 1	-	Conglomerate separating Arunta Complex from the Sandover Beds
80 cps	ELK 2 & 3	-	Schist

Hatches Creek Group

Samples ELK 6 & ELK 7 were collected from anomalous areas detected by the BMR airborne survey.

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Samples ELK 14 to 17 A (both numbers inclusive) were collected by a private prospector. The remaining samples were collected from areas of higher count rates and favourable geological situations encountered during reconnaissance traverses. Details of the samples collected are given below:

40 cps	ELK 4	Quartz sandstone near BMR anomaly 73
500 cps	ELK 6	Fine grained silicified sst from BMR anomaly 73
1000 cps	ELK 7	Fine to medium grained feldspathic sst. from BMR anomaly 74
70 cps	ELK 8	Basic interbedded volcanics
80 cps	ELK 9	Acid " "
100 cps	ELK 10	" " "
100 cps	ELK 11	Recrystallised volcanics
120 cps	ELK 12	Acid interbedded volcanics
70 cps	ELK 13	Gossan in quartz vein
	ELK 14	Quartz hematite veins sampled by Polney
	ELK 15	
	ELK 16	
	ELK 17	
	ELK 17A	Malachite and chalcocite bearing sample
80 cps	ELK 18	Recrystallised volcanics
70 cps	ELK 19	" "
40 cps	ELK 20	Gossan in quartz vein
70 cps	ELK 21	Rhyolite? - interbedded volcanics
70 cps	ELK 22	Recrystallised volcanics
60 cps	ELK 23	Muscovite granite
60 cps	ELK 24	Hornfels

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60 cps ELK 25 Granite - Tourmaline & Muscovite

40 cps ELK 26 Ferruginous sandstone capping granite

60 cps ELK 27 Muscovite granite with Wolfram

40 cps ELK 28 Silicified sandstone

Sandover Beds

Only one chip sample ELK 5 was collected during the course of reconnaissance traverses. The location of this sample is shown in PLATE 1 appended to this report. All the other samples were collected from the turquoise mine area. Details of these are shown in PLATE 2, PLATE 3 and PLATE 4 appended to this report. A summary of the samples collected is given below:

60 cps ELK 5 Yellowish grey siltstone

100 cps ELK 29 Pale grey coloured siltstone

100 cps ELK 30A Brown coloured siltstone

250 cps ELK 30B "" " "

150 cps ELK 31A Yellowish black coloured intraformational breccia

250 cps ELK 31B " " " " "

150 cps ELK 32 " " " " "

150 cps ELK 33 Pale brown coloured mudstone

70 cps ELK 34 Siltstone

300 cps ELK 35 Grey siltstone

150 cps ELK 36 Intraformational breccia

200 cps ELK 37 Mudstone - horizon 'C'

300 cps ELK 38 Reddish brown mudstone horizon 'B'

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400 cps ELK 39 Reddish brown mudstone horizon 'B'

400 cps ELK 40 " " " "

ELK 41 - ELK 51 Refer PLATE 2

From the total of 51 samples collected 31 samples were despatched to Geochemical and Mineralogical Laboratories for chemical analysis of U, Th, Cu, Pb, Zn, Co, V, Mo, W and P_2O_5. Results of the analysis received are tabulated in TABLE 1 appended to this report.

3.2.2 Ground Water Sampling

In view of the higher count rates observed within the older units of the Sandover Beds (exposed in the Mine) it was found highly desirable to investigate the underlying conglomerate which marks the unconformity with the Hatches Creek Group. Elsewhere, in BMR drill holes Anmaroo No. 1 and Anmaroo No. 2 this conglomerate was found to directly overlie the Arunta Schists of Archaean age. Hence a programme of water sampling was conducted from all the 8 bores available in the area. All except the Ilbumeric Bore were pumping at the time of sample collection. Details of these samples are given below.

cps	Bore	Lithology
35	Honeymoon	Sandover Beds
36	Hagens	Tomahawk Beds
36	McRob	Sandover Beds
30	Ilbumeric	Hatches Creek

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cps	Bore (cont.)	Lithology
35	Fitz	Hatches Creek
35	Supplejack	Hatches Creek
35	Newland	Sandover Beds
29	Trew	Sandover Beds

Analytical results obtained from these samples are shown in TABLE II appended to this report.

4. CONCLUSION

Radiometric investigations and the geological setting favour the Arunta Complex as a source rock for uranium rather than a host rock. Analysis of samples ELK 2 and 3 indicate a higher thorium content in the schists then otherwise would be expected. However, the possibility of small but rich lodes within the schists in the vicinity of younger granite cannot be ruled out. On the area investigated it is considered that there is little chance for the occurrence of a viable uranium deposit within the Arunta Complex.

Anomalous areas detected by the BMR airborne survey within the Hatches Creek Group indicate a high thorium content. These sandstone samples ELK 6 + 7 on chemical analysis yielded 0.27% and 0.34% P_2O_5. Phosphate has been known as a fixing agent for uranium within sandstones. Phospate is also one of the constituents that is associated with thorium and rare earths. In view of the analitical results the latter case seems to be applicable in this area. It is also considered that the phosphate in these sandstone horizons within the Hatches Creek Group is a syngenetic association. Thus it is possible to have radiocative horizons within these sediments which in the case of sample ELK 7 was 0.3 m thick. Analysis of the interbedded acid volcanics (as in the case of samples ELK 10, 12, 18 and 21) rules out the possibility that these horizons could

have provided a source for the uranium in the sandstones. A silicified ferruginous sandstone (ELK 26) in the vicinity of the granitic intrusion also shows the lack of uranium in the area. From geological observations and analytical results it is concluded that in the area investigated there is little chance of establishing a viable uranium deposit within the Hatches Creek Group.

The Sandover Beds more than the Hatches Creek Group exhibit a high percentage of phosphate and the associated thorium assemblage. However, it is interesting to note that positive relationships exist between the count rates uranium and vanadium contents. In view of the high thorium and phosphate levels it is considered that the Sandover Beds are unlikely to hold a viable uranium deposit in the area investigated.

Analyses of water samples collected from the bores in the area indicate very high thorium levels and confirm the field observations.

5. RECOMMENDATIONS

From the experience gained in the area it is recommended that only future exploration programmes designed for the Hatches Creek Group and/the Sandover Beds should primarily attempt to define the thorium and phosphate levels in these sediments prior to testing these horizons.

GEOCHEMICAL SAMPLE SHEET

Project A 8e | Area N.T. | Airphoto Run | Analysis by GEOMIN

Map ELKEDRA | Scale 1:250,000 | Airphoto No. | Dispatched

Sample No.	Grid Ref. North	Grid Ref. East	Sample Type	Depth from	Depth to	U	Th	Cu	Pb	Zn	Co	V	Mo	W	% P_2O_5	Remarks
ELK 2						3	22	18	18	70		40	2			
3						3	15	60	32	36		36	0.5			
6						96	920	130	250	36		96	9		0.07	
7						130	127	28	32	24		100	14		0.34	
10						4	39	22	20	50		32	64			
12						4	28	80	18	46		36	24			
13						12	29	94	30	270		104	4	10		
14								12	30	3						
15						1	2	1050	18	6		52	2	30		
16								1650	30	36						
17								330	20	220	220					
17A								>1%	32	12						
18						1	21	30	20	32		24	16			
20						1	4	200	12	6		16	44			
21						3	51	10	16	6		12	22			
26						1	13	18	20	4		16	44		0.062	
27						1	16	28	18	6		12	15	50		
28						3	21	66	20	16		43	13			
29						100	98	100	40	30		56	29		0.63	
30A						70	119	150	28	56		44	33		0.97	
30B						203	2610	230	36	78		100	3		1.35	
31A						305	2386	140	68	52		116	9		1.22	
31B						275	2466	140	72	44		112	9		0.89	
32						152	784	170	32	80		76	21		3.39	
33						172	1034	170	34	68		72	17		2.90	
34						55	273	130	24	44		48	3		2.04	
35						263	5625	150	190	40		112	6		1.66	
36						13	30	450	30	330		104	6		6.76	
37						36	11	370	40	530		112	7		24.63	
38						83	31	340	30	660		124	8		18.42	
39						80	7	700	30	960		160	13		25.63	

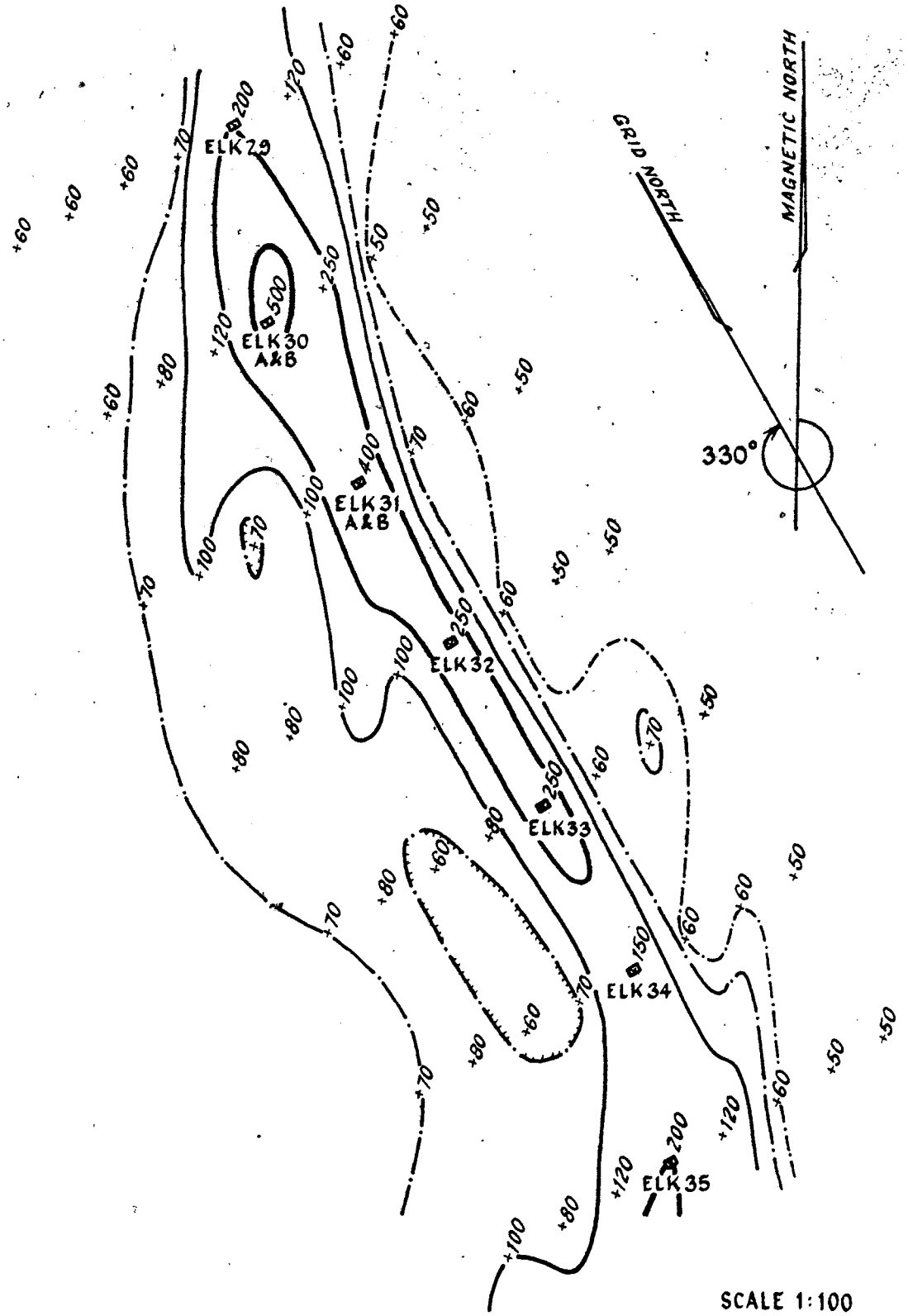
GEOCHEMICAL SAMPLE SHEET

Project A8c. Area N.T. Airphoto Run _____ Analysis by _____

Map ELKEDRA Scale 1:250,000 Airphoto No. _____ Dispatched _____

BORE

Sample No.	Grid Ref. North	Grid Ref. East	Sample Type	Depth from	Depth to	U	Th	Cu	Pb	Zn	Remarks
						Analysis in ppb/~~ppm~~/~~%~~					WATER SAMPLES
HONEYMOON						10	553	20	120	80	
HAGENS						7	553	10	130	240	
McROB						30	277	20	130	380	
ILBUMRIC						55	2212	30	100	500	Bore not pumping at the time of sampling
FITZ						120	1106	20	340	50	
SUPPLEJACK						15	330	10	60	110	
NEWLAND						20	553	20	140	330	
TREW						3	277	10	100	90	



SCALE 1:100

0 10 20 30 40 50 metres

□ ELK33 Rock chip sample location and number

×250 Radiometric reading (cps)

60
70
100
200
500
} cps

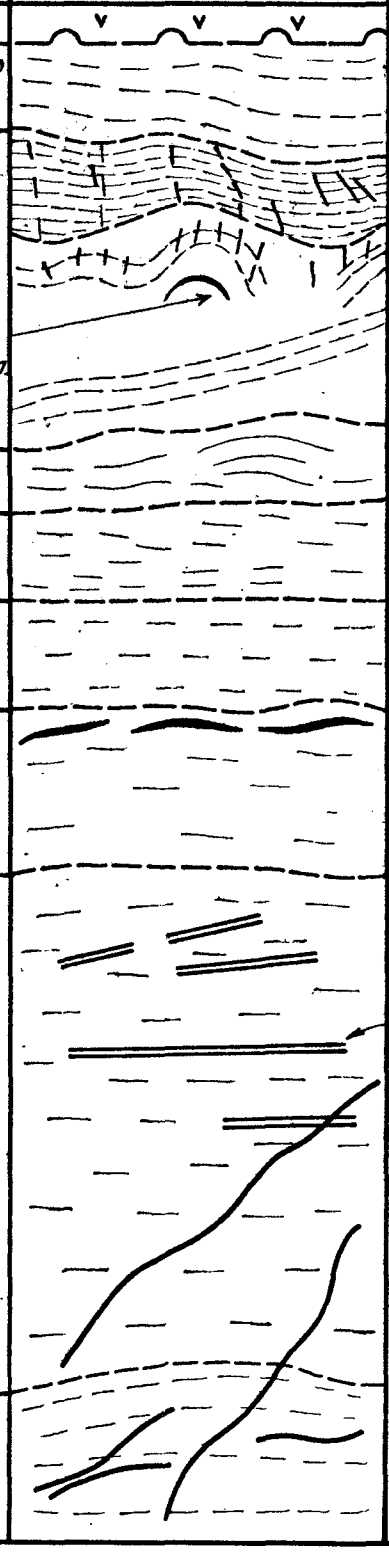
Radiometric Low

1976 PROJECT A8

Fig. N°

ANMAROO, N.T.
TURQUOISE MINE, NORTHERN CUT AREA
RADIOMETRIC PLAN AND ROCK CHIP SAMPLE LOCATIONS

Prepared by: V. Mohan	Drawn by: D. McR. Barty
Date: Aug '76	Drawing N° A4-187	Project N° NTA-4

ROCK SAMPLE Nº	cps	STRUCTURE	GRAPHIC LOG	LITHOLOGY
				Regolith
ELK 41	60	Bedding joints are well developed. Beds approx. 5-7cm.		Weathered, fine siltstone - white, yellow staining appears in pods.
ELK 42	92	Bedding joints well developed		White siltstone, more massive than the upper unit. Podding
ELK 43	80	Bedding joints well developed		White siltstone, massive, podding structures yellow.
ELK 44	100	More intensely folded beds		Yellow stained siltstone marker bed
ELK 45	140	Quartz, biogenic quartz veins, show dragging and brecciation. Bedding defined.		Grey green siltstone. White surface phosphate staining.
ELK 46	82	Slight dragging		Pale grey siltstone. Yellowish brown staining. White modules shale are scattered within the horizon.
ELK 47	78	Bedding quite prominent		Grey siltstone, possibly phosphate. Massive bands.
ELK 48	40	Occasional bedding joints, slight warping in the bottom layers		Pale grey coloured siltstone. usually massive.
ELK 49	80	Warping within the silica bands, especially in the upper layers		Pale brown coloured siltstone Dark grey coloured bands of silica up to 15 cm thick Massive at bottom layers.
ELK 50	68	Extensive fracturing - oblique to the bedding.		Light coloured bands. Dark brown coloured mudstone. Massive and thick unit. Individual beds are approx. 80 cm thick. Vein cross fractures filled with yellowish black mudstone and cutting across the beds. Upper contact is sharp.
ELK 51	74	Fracturing, as above		Yellowish black and brown coloured horizon which is normally the host for Turquoise cut by fracture fillings as above.

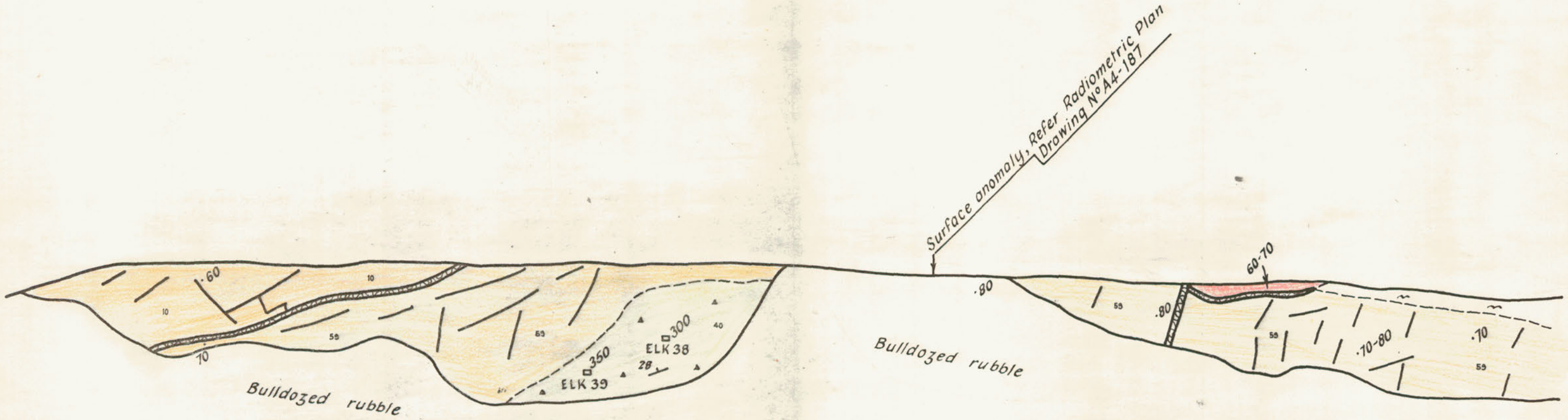
ANMAROO, N.T.
TURQUOISE MINE

CAMBRIAN SEQUENCE

Fig. Nº

← 150°

330° →



ELK 38 □ Rock chip sample location and number

·10 Radiometric reading (cps)

▲ ▲ Brecciation

Fracture zone

Shearing, fractured bedding

~ Alluvium

10 Reddish brown siltstone

55 Yellowish brown siltstone

40 White siltstone. Silicification mainly as secondary silica. Limonite and yellowish brown phosphate rock.

14 Red mudstone

SCALE 1: 100

0 5 metres

1976 PROJECT A8

Fig. N° 3

ANMAROO, N.T.
TURQUOISE MINE
NORTHERN CUT
SOUTHERN FACE PROFILE

Prepared by V. Mohan, July '76

Drawing N° A3-97, Project N° NTA-3

YEARLY REVIEW OF ACTIVITIES -- PART 2

EXPLORATION LICENCE No. 999

FOR THE YEAR ENDED 9th SEPTEMBER, 1976

General prospecting was carried out through the year with the use of Aboriginal people of the area. A scout drilling programme was carried out using a proline drill. A specific turquoise and uranium exploration was carried out and a report is enclosed forming Part 1. Marketing research of turquoise was carried out in Europe and the U.S.A. and new techniques in treating soft and low-grade material were studied.

Access roads to the area were maintained and a dam was sunk to supply fresh water.

This equipment was available from International Turquoise:

D7 Cat Dozer
Whitlock 60A Backhoe
Proline Drill
Compressor and Jack Hammers
Atlas Copco Junior Wagon Drill
Hydraulic Rock Buster
Toyota Land Cruisers (2)
Permanent Workshop
Wowic Portable Accommodation
Caravan

Summary of Expenditure

For the Year Ended 9th September, 1976

Wages	$ 4,500
Fuel and Freight	1,100
Travelling and Motor expenses	320
Stores and Supplies	570
Lease Fees and expenses	1,400
Consultants	3,800
Repair and Maintenance	740
Insurance	650
	13,080 ✓

Yearly Report (1976)

EL 555.

Yearly Report (1976) EL 555

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SPECIAL REPORT ON EXPLORATION LICENCES No. 555, 999, 1000 AND 1167

ELKEDRA, NORTHERN TERRITORY

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The area investigated occupies the western margins of the Georgina Basin. Here the shallow marine sediments of Cambrian age unconformably overlie the sediments and lavas of the Davenport Geosyncline.

Regionally metamorphosed Archean schists underlie the sediments of the Davenport Geosyncline separated by an unconformity. The Stratigraphic sequences in the area investigated is given below.

Upper Cambrian	TOMAHAWK BEDS	Sandstone, Siltstone, Conglomerate
Middle Cambrian	SANDOVER BEDS	Siltstone, Mudstone, Shale, sandstone, Conglomerate
Lower Proterozoic	HATCHES CREEK GROUP	Sandstone, Siltstone, Acid and basic lavas
Archaean	ARUNTA COMPLEX	Schist

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2.1 Target Lithologies

Regional reconnaissance was carried out by U.G. (1973) along the margines of the Tanami Block, Davenport Geosyncline, Arunta Block and the Amadeus Basin. One of the targets of this investigation was to provide a 'fill in' info for the earlier work and also to test the potential of the Lower Proterozoic and Middle Cambrian sediments as favourable host rocks for uranium.

Arunta Complex

Can be conceived to be the basement rocks in the area investigated. The outcrops tested are located approx. 3 miles SW of Andagera Bore(Lat. 21°30' and long.135°42'). Here the rocks are pale grey coloured schists striking N 75° W and dipping steeply (75° to 80°) to the south. An occacional garnet was observed in the schists. Schistosity is well developed and is parallel to the bedding. A number of quartz hematite veins parallel to the strike of the schists are present in the area. These are older than the Cambrian sediments overlying the schists. Where exposed the schists occupy the basal part of ridges. These ridges arecapped by Cambrian sandstones and siltstones which are separated from the schists by an unconfomity. An idealised cross section across these ridges is given below.

This Lower Cambrian unconformity consists of a conglomerate that is approximately 25 m in thickness. Quartz pepples approximately 2 to 8 cm. in diameter are set in a feldspathic sandstone matrix. This entire conglomerate dips gently to the south with the Archaeans.

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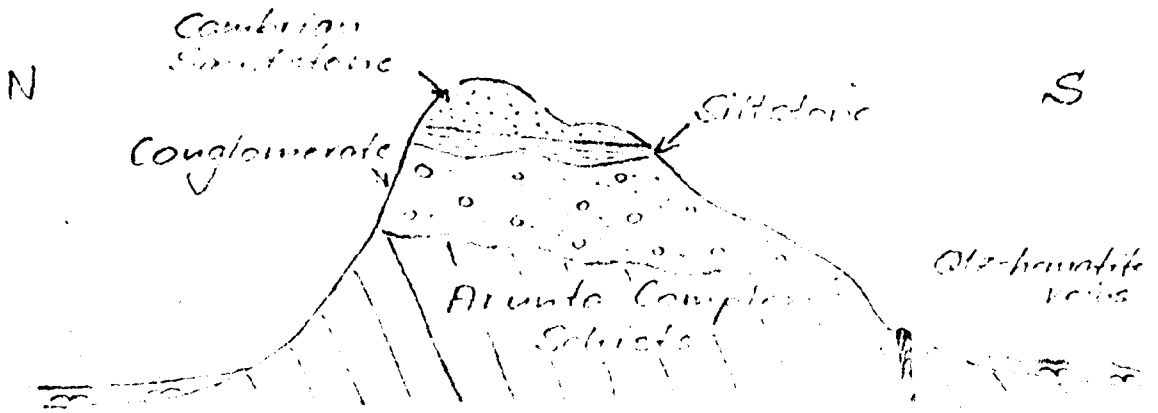
Interstitial clay is abundant in the matrix. Locally ferruginous fillings between the grains were observed.



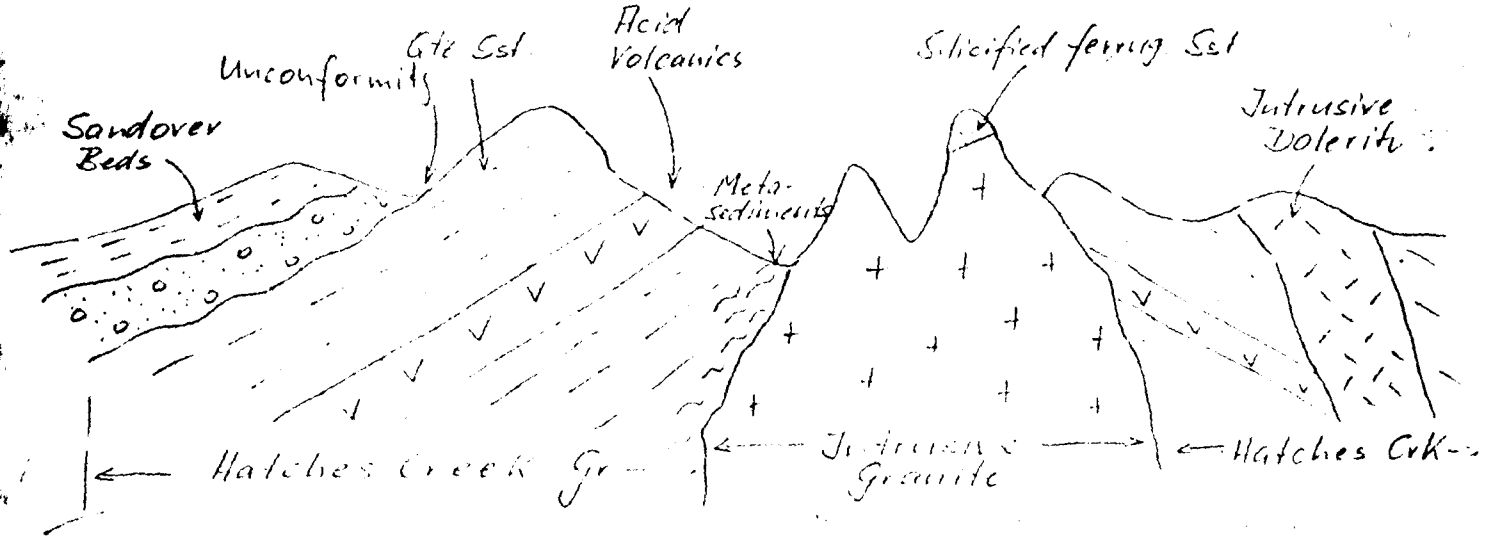
Hatches Creek Group consists essentially of pale grey and brown coloured quartz sandstone with interbedded acid and basic lavas. The sandstone is generally medium to coarse grained and represents a low energy medium.

Cross bedding is observed locally. Both acid and basic lava flows are present at varying levels within the sequence. The Hatches Creek Group seems to have been subjected to strong folding movements and a series of large scale instrusions by dolerites and granites. A a result the strike and dips vary considerably. It is felt that the general strike of the sediments can be approximated as N 50° W. The dips vary from 5° to 23° and in the vicinity of intrusives dips of up to 58°. have been measured. Both the sediments and the inter-bedded volcanics have been metamorphosed in the vicinity of granite intrusives. At such locations it is difficult to distinguish the group (megascopically) from the Archean schists of the Arunta Complex.

Two types of intrusive granite can be recognised in the area. A coarse grained muscovite granite with an abundance of potash feldspar and tourmaline occurs at approximately 4 miles SSW of Supplejack bore. A number of small and abandoned Wolfram workings are present within this body. At a number of locations a silicified and highly ferruginous sandstone of the Hatches Creek Group was to cap the hills consisting essentially of this granite. A second type of granite which is less potessic was observed to the NW of the main pot ssic mass.

The intrusive dolerite crops out 2 miles west of the Supplejack bore. It is essentially a greenish grey coloured pophyritic rock with phenocrysts of plagioclase set in dark grey matrix rich in mafic constituents. The contact of the dolerite with the sediments of the Hatches Creek Group was not observed.

The unconformity between the Archean schists and the Lower Proterozoic sediments was not encountered in any of the traverses. An idealised cross section showing the relationship of the various units within the Hatches Creek Group is shown below.



Sandover Beds are a group of shallow marine sediments resting unconformably on the Hatches Creek Group and the Arunta Schists. The unconformity with the Hatches Creek Group is well developed in the vicinity of the turquoise mine located at Lat. 21°35' and long. 135°26'. Here well rounded quartz pepples approximately 5 cm to 12 cm across are set in a fine grained sandstone matrix. The unconformity is approximately 20 m in thickness and dips 8° to the South.

A well defined sequence of the Sandover Beds was observed in the several cuts within the mine and the entire sequence has been mapped and is presented in PLATE 2 appended to this report.

Total thickness of sediments present in the mine area is approximately (dip corrections not applied) 20.8 m. Though the entire sequence can be classified into 11 different units for mining purposes it is felt that for all practical purposes a three fold division would suffice. These horizons are summarised below.

Horizon 'A' (Approx. 9.5 m thick)	Pale grey and white coloured siltstone with lenses of chert occurring at two distinct levels (one near the top of the horizon and one near the bottom of the horizon).
Horizon 'B' (Approx. 9 m thick)	Pale brown and dark reddish brown coloured mudstone. The latter is usually massive and has greenish black coloured fracture fillings that are orientated oblique to bedding. The pale brown coloured horizon usually has a series of chert lenses towards its top.

Horizon 'C' (Approx. 2.5 m thick)	Yellowish black and brown coloured mudstone which is normally the turquoise bearing units.

Horizon 'C' is underlain by the conglomerate which marks the unconformity with the Hatches Creek Group.

A coarse grained potash granite outcrops in the mine area. The Sandover beds seem to have been deposited over this granite parts of which could have stood out as inselbergs. Horizon 'C' in places ajoining the granite seems to have slid away from it while still in a plastic stage of development. This is evidenced by the intraformational breccia present in one of the cuts near the northern most part of the mine.

Chert horizons in the upper divisions seem to be of biogenic origin. A large number oval shaped chert modules with concentric growth rings are present both above and below the chert horizon.

3. INVESTIGATIONS AND RESULTS

3.1 Radiometrics

Arunta Complex

Ground scintillometer traverses were carried out over all the outcropping schists. Background count rates varied from 40 to 60 cps. Occasionally higher count rates of up to 80 cps were observed.

The unconfomity with the overlying Cambrian sediments registered a steady count rate of 40 cps.

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Hatches Creek Group

Ground scintillometer traverses were carried out to check airborne radiometric anomalies detected by BMR (Davenport Region - 1958). The following anomalies were investigated. Background count rate for the sediments of the group is 20 cps.

Anomaly 73 was located in a sheared and silicified sandstone intersected by numberous quartz veinlets. Count rate of up to 500 cps were observed in an area approximately 5 square metres in size. A detailed investigation of the surrounding area failed to reveal any other anomalies. Sandstone in the anomalous area strike 355° and dips 8° to the west. It was also confirmed through detailed chip sampling that the radioactivity was attributed to the sandstone and not to any of the quartz veinlets intersecting it.

Anomaly 74, 75 and 76 were located within a slightly warped sandstone intruded by a quartz vein. The sandstone horizon directly responsible for the higher count rate was exposed by pitting. Thickness of the radioactive horizon was measured as 0.3 m; count rates exceeding 1000 cps were measured over samples collected from this horizon. The radioactive horizon strikes 300° and dip 25° - 30° to the east. The sandstone horizon was checked along strike over distances of up tp 30 m and was found to be anomalous. A thick scree covers most of this horizon.

Anomaly 77, 78 and 79 coincided with outcropping masses of granite in an otherwise alluvial covered area.

Apart from checking these airborne anomalies scintillometer traverses were also carried out over the inter-

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bedded acid and basic volcanics, intrusive granites and along the contacts of the granites with the sediments. Background count rates for the various units are tabulated below.

Interbedded acid volcanics	70 to 80 cps
" basic "	30 to 35 cps
Intrusive granites	60 to 80 cps
Sediments at the contact with the granites	40 to 65 cps

No other anomalous areas of any significance were encountered in these traverses.

Sandover Beds

The only major anomalous areas encountered was in the northern part of the turquoise mine. Count rates varying from 200 cps to 500 cps were registered over 20 m in the sediments immediately overlying the granite. The area was gridded at a line spacing of spacing of 3 m and count rates were recorded at every 1 m. Details of the anomalous area are shown in PLATE 3 appended to this report. To evaluate this anomalous area in detail an adjacent cut in the mine was mapped and count rates recorded for the different lithological units exposed in the cut. During the course of this mapping it became evident that the Sandover Bads were deposited over the older granite. However, the contact with the granite could not be traced as that particular part of the cut was covered by rubble. The horizon that was responsible for the higher count rates was established as an intraformational breccia rich in phosphate and lying adjacent to the granite. PLATE 4 shows the details of the southern face of the cut mapped and the various lithological units showing the count rates.

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Having located the lithological unit that was responsible for the higher count rates a comprehensive stratigraphic section of the 11 lithological units in the mine was mapped from the different cuts available. Average count rates for each of these units mapped was measured against the exposed faces and recorded in PLATE 2.

Background count rates for the Sandover Beds vary from 35 to 45.

Unconformity at the base of the Sandover Beds (with the Hatches Creek Group) was investigated in detail. Background count rates of up to 40 cps were registered over the entire horizon exposed NE of the mine area. No anomalous areas of any significance were encountered.

3.2 Sampling

3.2.1 Rock Chip Sampling

A total of 51 samples were collected from the different formations outcropping in the area. Locations of these samples are shown in PLATE 1, PLATE 2, PLATE 3 and PLATE 4. Details of these samples are recorded below.

Arunta Complex

40 cps	ELK 1	-	Conglomerate separating Arunta Complex from the Sandover Beds
80 cps	ELK 2 & 3	-	Schist

Hatches Creek Group

Samples ELK 6 & ELK 7 were collected from anomalous areas detected by the BMR airborne survey.

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Samples ELK 14 to 17 A (both numbers inclusive) were collected by a private prospector. The remaining samples were collected from areas of higher count rates and favourable geological situations encountered during reconnaissance traverses. Details of the samples collected are given below:

40 cps	FLK 4	Quartz sandstone near BMR anomaly 73
500 cps	ELK 6	Fine grained silicified sst from BMR anomaly 73
1000 cps	ELK 7	Fine to medium grained feldspathic sst. from BMR anomaly 74
70 cps	ELK 8	Basic interbedded volcanics
80 cps	ELK 9	Acid " "
100 cps	ELK 10	" " "
100 cps	ELK 11	Recrystallised volcanics
120 cps	ELK 12	Acid interbedded volcanics
70 cps	ELK 13	Gossan in quartz vein
	ELK 14	Quartz hematite veins sampled by Polney
	ELK 15	
	ELK 16	
	ELK 17	
	ELK 17A	Malachite and chalcocite bearing sample
80 cps	ELK 18	Recrystallised volcanics
70 cps	ELK 19	" "
40 cps	ELK 20	Gossan in quartz vein
70 cps	ELK 21	Rhyolite? - interbedded volcanics
70 cps	ELK 22	Recrystallised volcanics
60 cps	ELK 23	Muscovite granite
60 cps	ELK 24	Hornfels

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60 cps ELK 25 Granite - Tourmaline & Muscovite

40 cps ELK 26 Ferruginous sandstone capping granite

60 cps ELK 27 Muscovite granite with Wolfram

40 cps ELK 28 Silicified sandstone

Sandover Beds

Only one chip sample ELK 5 was collected during the course of reconnaissance traverses. The location of this sample is shown in PLATE 1 appended to this report. All the other samples were collected from the turquoise mine area. Details of these are shown in PLATE 2, PLATE 3 and PLATE 4 appended to this report. A summary of the samples collected is given below:

60 cps ELK 5 Yellowish grey siltstone

100 cps ELK 29 Pale grey coloured siltstone

100 cps ELK 30A Brown coloured siltstone

250 cps ELK 30B "" " "

150 cps ELK 31A Yellowish black coloured intraformational breccia

250 cps ELK 31B " " " " "

150 cps ELK 32 " " " " "

150 cps ELK 33 Pale brown coloured mudstone

70 cps ELK 34 Siltstone

300 cps ELK 35 Grey siltstone

150 cps ELK 36 Intraformational breccia

200 cps ELK 37 Mudstone - horizon 'C'

300 cps ELK 38 Reddish brown mudstone horizon 'B'

-/..

400 cps ELK 39	Reddish brown mudstone horizon 'B'
400 cps ELK 40	" " " "
ELK 41 - ELK 51	Refer PLATE 2

From the total of 51 samples collected 31 samples were despatched to Geochemical and Mineralogical Laboratories for chemical analysis of U, Th, Cu, Pb, Zn, Co, V, Mo, W and P_2O_5. Results of the analysis received are tabulated in TABLE 1 appended to this report.

3.2.2 Ground Water Sampling

In view of the higher count rates observed within the older units of the Sandover Beds (exposed in the Mine) it was found highly desirable to investigate the underlying conglomerate which marks the unconformity with the Hatches Creek Group. Elsewhere, in BMR drill holes Anmaroo No. 1 and Anmaroo No. 2 this conglomerate was found to directly overlie the Arunta Schists of Archaean age. Hence a programme of water sampling was conducted from all the 8 bores available in the area. All except the Ilbumeric Bore were pumping at the time of sample collection. Details of these samples are given below.

cps	Bore	Lithology
35	Honeymoon	Sandover Beds
36	Hagens	Tomahawk Beds
36	McRob	Sandover Beds
30	Ilbumeric	Hatches Creek

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cps	Bore (cont.)	Lithology
35	Fitz	Hatches Creek
35	Supplejack	Hatches Creek
35	Newland	Sandover Beds
29	Trew	Sandover Beds

Analytical results obtained from these samples are shown in TABLE II appended to this report.

4. CONCLUSION

Radiometric investigations and the geological setting favour the Arunta Complex as a source rock for uranium rather than a host rock. Analysis of samples ELK 2 and 3 indicate a higher thorium content in the schists then otherwise would be expected. However, the possibility of small but rich lodes within the schists in the vicinity of younger granite cannot be ruled out. On the area investigated it is considered that there is little chance for the occurrence of a viable uranium deposit within the Arunta Complex.

Anomalous areas detected by the BMR airborne survey within the Hatches Creek Group indicate a high thorium content. These sandstone samples ELK 6 + 7 on chemical analysis yielded 0.27% and 0.34% P_2O_5. Phosphate has been known as a fixing agent for uranium within sandstones. Phospate is also one of the constituents that is associated with thorium and rare earths. In view of the analitical results the latter case seems to be applicable in this area. It is also considered that the phosphate in these sandstone horizons within the Hatches Creek Group is a syngenetic association. Thus it is possible to have radiocative horizons within these sediments which in the case of sample ELK 7 was 0.3 m thick. Analysis of the interbedded acid volcanics (as in the case of samples ELK 10, 12, 18 and 21) rules out the possibility that these horizons could

have provided a source for the uranium in the sandstones. A silicified ferruginous sandstone (ELK 26) in the vicinity of the granitic intrusion also shows the lack of uranium in the area. From geological observations and analytical results it is concluded that in the area investigated there is little chance of establishing a viable uranium deposit within the Hatches Creek Group.

The Sandover Beds more than the Hatches Creek Group exhibit a high percentage of phosphate and the associated thorium assemblage. However, it is interesting to note that positive relationships exist between the count rates uranium and vanadium contents. In view of the high thorium and phosphate levels it is considered that the Sandover Beds are unlikely to hold a viable uranium deposit in the area investigated.

Analyses of water samples collected from the bores in the area indicate very high thorium levels and confirm the field observations.

5. RECOMMENDATIONS

From the experience gained in the area it is recommended that only future exploration programmes designed for the Hatches Creek Group and/the Sandover Beds should primarily attempt to define the thorium and phosphate levels in these sediments prior to testing these horizons.

GEOCHEMICAL SAMPLE SHEET

Project A 3e Area N.T. Airphoto Run _____ Analysis by GEOMIN

Map ELKEDRA Scale 1:250,000 Airphoto No. _____ Dispatched _____

Sample No.	Grid Ref. North	Grid Ref. East	Sample Type	Depth from	Depth to	U	Th	Cu	Pb	Zn	Co	V	Mo	W	% P_2O_5	Remarks
LK 2						3	22	18	18	70		40	2			
3						3	15	60	32	36		36	0.5			
6						96	920	130	250	36		96	9		0.27	
7						130	127	28	32	24		100	14		0.34	
10						4	39	22	20	50		32	64			
12						4	28	80	13	46		36	24			
13						12	29	94	30	270		104	4	10		
14								12	30	3						
15						1	2	1050	18	6		52	2	30		
16								1650	30	36						
17								330	20	220	220					
17A								>1%	32	12						
18						1	21	30	20	32		24	16			
20						1	4	200	12	6		16	44			
21						3	51	10	16	6		12	22			
26						1	13	13	20	4		16	44		Cu-bl	
27						1	16	24	18	6		12	15	50		
28						3	21	66	30	16		48	13			
29						100	78	120	40	30		56	29		0.63	
30A						70	119	150	28	56		44	33		0.97	
30B						208	2610	230	36	78		100	3		1.35	
31A						305	2386	140	68	52		116	9		1.22	
31B						275	2466	140	72	44		112	9		0.89	
32						152	734	170	32	86		76	21		3.39	
33						172	1034	170	34	68		72	17		2.96	
34						55	278	130	24	44		48	3		1.54	
35						263	5628	150	190	40		112	6		1.62	
36						18	80	450	80	330		104	6		6.70	
37						86	11	370	40	530		112	7		24.62	
38						83	31	340	30	660		124	8		19.42	
39						30	7	700	30	960		160	13		25.62	

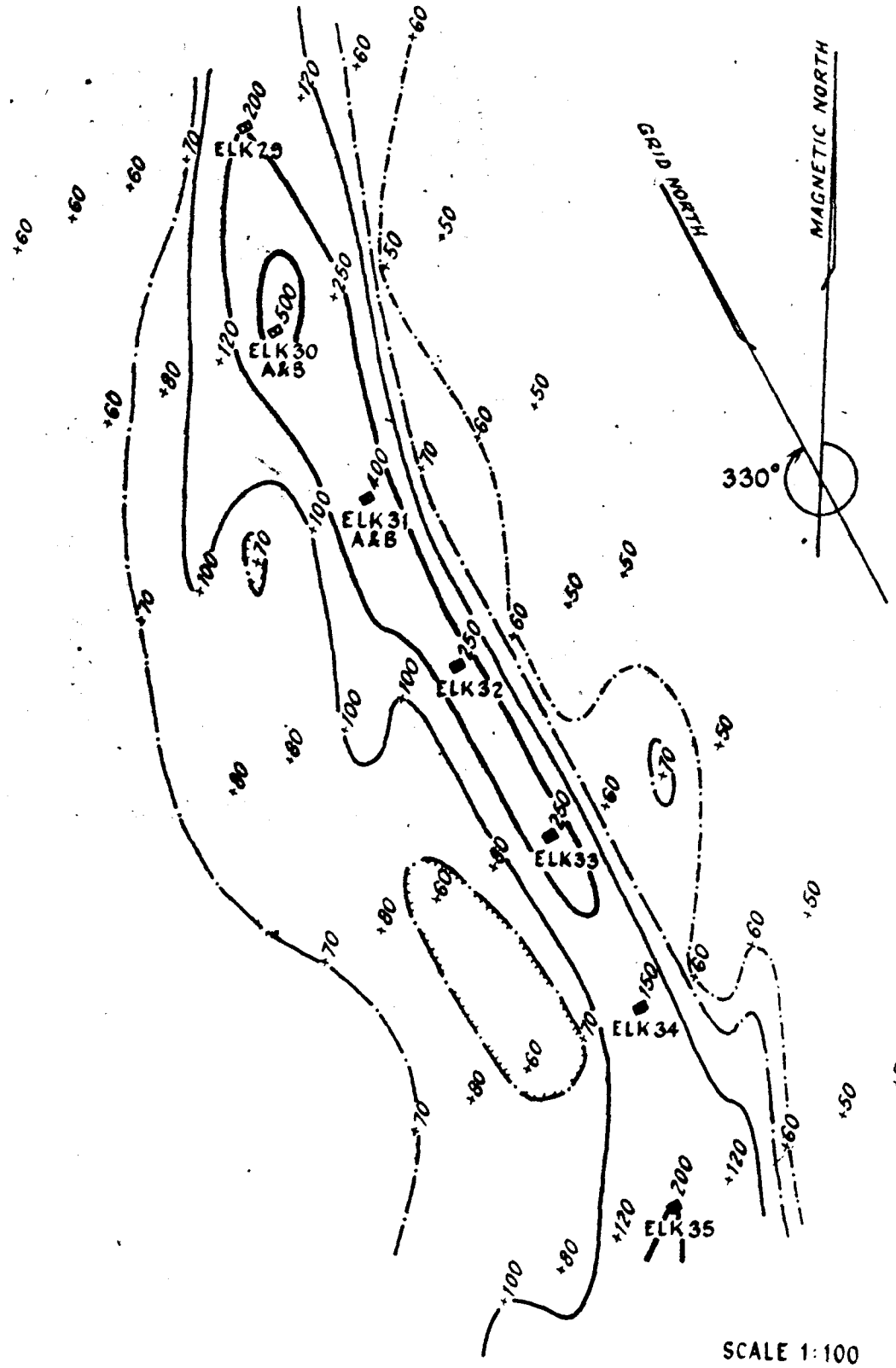
GEOCHEMICAL SAMPLE SHEET

Project A 8c. Area N.T. Airphoto Run _____ Analysis by _____

Map ELKEDRA Scale 1:250,000 Airphoto No. _____ Dispatched _____

BORE

Sample No.	Grid Ref. North	Grid Ref. East	Sample Type	Depth from	Depth to	U	Th	Cu	Pb	Zn	Remarks WATER SAMPLES
HONEYMOON						10	553	20	120	80	
HAGENS						7	553	10	180	240	
McRUB						30	277	20	130	380	
ILBUMRIC						55	2212	30	100	50	Bore not pumping at the time of sampling
FITZ						120	1106	20	340	50	
SUPPLEJACK						15	830	10	60	110	
NEWLAND						20	553	20	140	330	
TREW						3	277	10	100	90	



SCALE 1:100

0 10 20 30 40 50 metres

ELK33 Rock chip sample location and number

×250 Radiometric reading (cps)

60
70
100
200
500
} cps

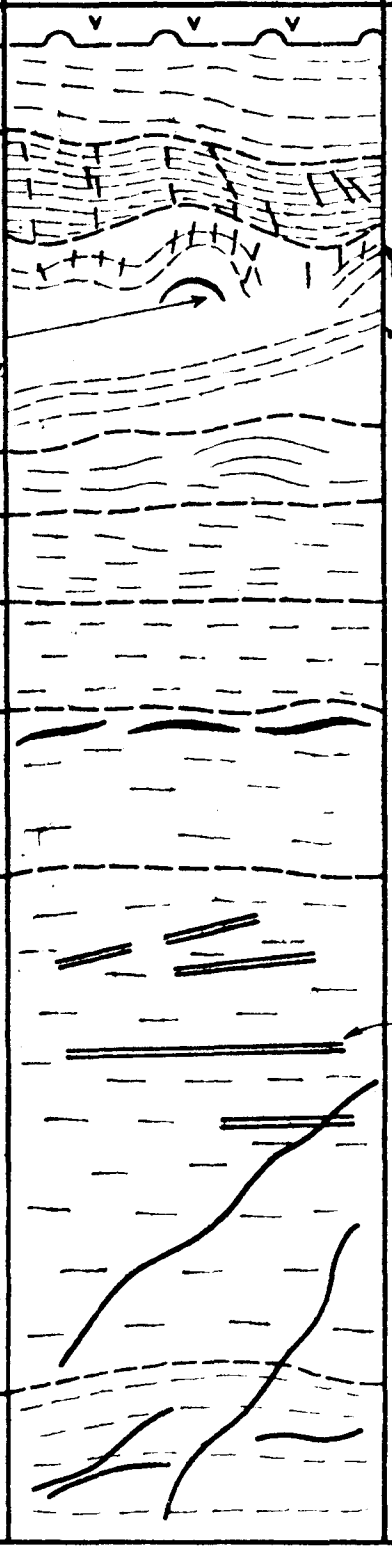
Radiometric Low

1976 PROJECT A8

Fig. N° 1

ANMAROO, N.T.
TURQUOISE MINE, NORTHERN CUT AREA
RADIOMETRIC PLAN AND
ROCK CHIP SAMPLE LOCATIONS

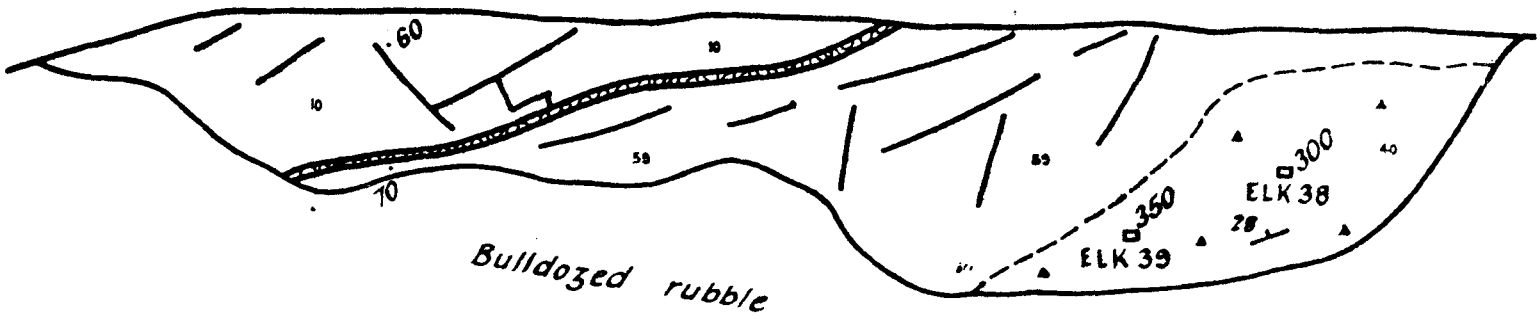
Prepared by: V. Mohan	Drawn by D. McR. Barty
Date: Aug '76	Drawing N° A4-187 / Project N° NTA-4

ROCK SAMPLE N°	cps	STRUCTURE	GRAPHIC LOG	LITHOLOGY
				Regolith
ELK 41	60	Bedding joints are well developed. Beds approx. 5-7cm.		Weathered, fine siltstone - white, yellow staining appears in pods.
ELK 42	92	Bedding joints well developed		White siltstone, more massive than the upper unit. Podding
ELK 43	80	Bedding joints well developed		White siltstone, massive, podding structures yellow.
ELK 44	100	More intensely folded beds		Yellow stained siltstone marker bed
ELK 45	140	Quartz, biogenic quartz veins, show dragging and brecciation Bedding defined.		Grey green siltstone. White surface phosphate staining.
ELK 46	82	Slight dragging		Pale grey siltstone. Yellowish brown staining. White modules shale are scattered within the horizon.
ELK 47	78	Bedding quite prominent		Grey siltstone, possibly phosphate. Massive bands.
ELK 48	40	Occasional bedding joints, slight warping in the bottom layers		Pale grey coloured siltstone. usually massive.
ELK 49	80	Warping within the silica bands, especially in the upper layers		Pale brown coloured siltstone Dark grey coloured bands of silica up to 15 cm thick Massive at bottom layers.
ELK 50	68	Extensive fracturing - oblique to the bedding.		Light coloured bands. Dark brown coloured mudstone. Massive and thick unit. Individual beds are approx. 80 cm thick. Vein cross fractures filled with yellowish black mudstone and cutting across the beds. Upper contact is sharp.
ELK 51	74	Fracturing, as above		Yellowish black and brown coloured horizon which is normally the host for Turquoise cut by fracture fillings as above.

ANMAROO, N.T.
TURQUOISE MINE

CAMBRIAN SEQUENCE

← 150°



ELK 38 Rock chip sample location and number

·10 Radiometric reading (cps)

Brecciation

Fracture zone

Shearing, fractured bedding

~ Alluviu

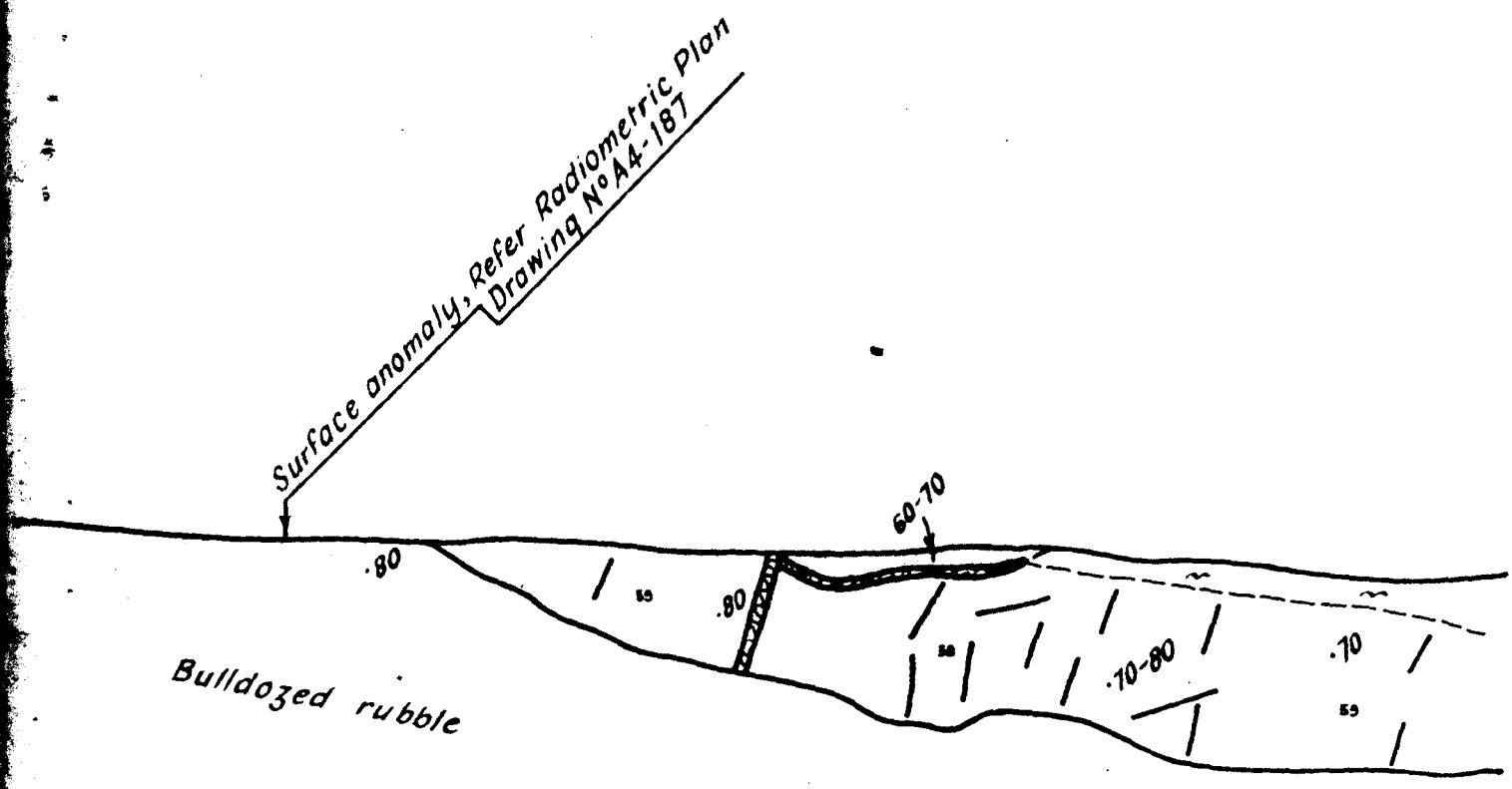
10 Reddis

59 Yellowis

40 White s mainly Limonit phosphc

14 Red mu

330° →



SCALE 1:100

0 5 metres

1976 PROJECT A8

Fig. No

brown siltstone

brown siltstone

iltstone. Silicification
as secondary silica.
and yellowish brown
ire rock.

dstone

ANMAROO, N.T.
TURQUOISE MINE
NORTHERN CUT
SOUTHERN FACE PROFILE

Prepared by V. Mahan, July/76

Drawing No A3-97, Project No NTA-3

JOHN CUMMING—LARAPINTA TURQUOISE MINE

INTERNATIONAL TURQUOISE PTY. LIMITED

319 PARRAMATTA ROAD, AUBURN, N.S.W. 2144 AUSTRALIA PHONE: (02) 648 2932 CABLES: JASCUM, SYDNEY

YEARLY REVIEW OF ACTIVITIES -- PART 2

EXPLORATION LICENCE No. 555

FOR THE YEAR ENDED 13th DECEMBER, 1976

General prospecting was carried out through the year with the use of Aboriginal people of the area. A scout drilling programme was carried out using a proline drill. A specific turquoise and uranium exploration was carried out and a report is enclosed forming Part 1. Marketing research of turquoise was carried out in Europe and the U.S.A. and new techniques in treating soft and low-grade material were studied. Participation in the Australian National Display in Moscow was further market evaluation information.

Access roads to the area were maintained and a dam was sunk to supply fresh water.

Equipment on Site:

- D7 Cat Dozer
- Whitlock 60A Backhoe
- Proline Drill
- Compressor and Jack Hammers
- Atlas Copco Junior Wagon Drill
- Hydraulic Rock Buster
- Toyota Land Cruisers (2)
- Permanent Workshop
- Wowic Portable Accommodation
- Caravan

Summary of Expenditure

For the Year Ended 13th December, 1976

Wages	$ 12,500
Fuel and Freight	1,450
Travelling and Motor expenses	3,200
Stores and Supplies	2,200
Lease Fees and expenses	700
Consultants	5,500
Repair and Maintenance	1,750
Insurance	1,400
	28700