URANERZ (AUSTRALIA) PTY. LTD.

FINAL REPORT ON EXPLORATION

CARRIED OUT ON

EXPLORATION LICENCE 980,

HUCKITTA AREA, NORTHERN TERRITORY

BY

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SUMMARY

Exploration Licence 980, located in the Huckitta area north-east of Alice Springs, covers a portion of the north-eastern margin of the Archaean Arunta block. The Archaean granites, gneisses and metamorphics have been intruded by Lower Proterozoic granites and are overlain by a sequence of Upper Proterozoic to Devonian sandstones and dolomites. A preliminary reconnaissance survey proved part of the basement to be mineralized, though assays showed a heavy thorium bias.

Helicopter spectrometric surveys examined the Archaean, its contacts with the granites, the basement contact with the sediments and the Proterozoic/Paleozoic boundary within the sediments. The Devonian Dulcie sandstone was also examined because of its stratigraphic equivalence to the Undandita sandstone at present being investigated by this company in the vicinity of Alice Springs. This was followed by a detailed geological and scintillometric ground examination and a stream sediment survey.

Small anomalous areas were delineated within the Archaean metasediments and Marshall Granite. These were of limited extent and showed a heavy thorium bias in assay. An anomalous bed at the base of the Upper Paleozoic to Lower Cambrian, Grants Bluff Formation was outlined and examined in detail. The strongest anomaly within this bed was drilled as, although the surface assays showed a high thorium bias, it was hoped this was due to superficial leaching of the uranium. The hole was abandoned due to unexpected deformation of the rock and drilling difficulties.

In view of the lack of encouragement from the results of the work which had been done, and with no evidence of the existence of more promising targets, further detailed investigation of the area was considered to be unwarranted. The decision was made not to apply for renewal of the exploration licence and the Mines Branch in Darwin was advised accordingly.

STATEMENT OF EXPENDITURE - 11TH JUNE 1974 TO 10TH JUNE 1975

Salaries and Wages	$6,126.27
Drilling Contractor	1,071.72
Field operating costs, including consumables, rents, vehicle operating and repairs, freight, airfares etc.	8,660.61
Depreciation of vehicles and geophysical instruments, consultants fees, management and distribution of Head Office costs	4,501.95
Total	$20,360.55

INTRODUCTION

In mid August 1973, following a detailed study of available literature and published geological maps, an aerial reconnaissance spectrometer survey extending over a period of two days was carried out along the margin of the Archaean Arunta Block NE of Alice Springs. This survey recorded anomalous radioactivity in a number of areas which were then briefly examined on the ground.

On 20th September, 1973 an application for an exploration licence was lodged with the Mines Branch, Darwin and EL 980 was subsequently granted on 11th June, 1974 for a period of one year.

This mineral tenement, which covers an area of approximately 600 square kilometres, is located about 290 miles NE of Alice Springs within the Huckitta 1:250,000 Sheet area (SF 53-11).

Investigations in the tenement area examined in detail those places of interest indicated by the preliminary aerial and ground reconnaissance and extended to other areas not fully covered in that programme. The field work was undertaken in four phases, involving an initial regional survey by helicopter followed up by more detailed helicopter coverage of prospective targets, with later detailed ground investigations of selected areas and finally sub-surface testing by drilling at one locality. The field programme was completed in December 1974 and data obtained from the various phases of the investigations were evaluated in January and February 1975. The Mines Branch in Darwin was advised that the Company did not intend to apply for renewal of the exploration licence in March, 1975.

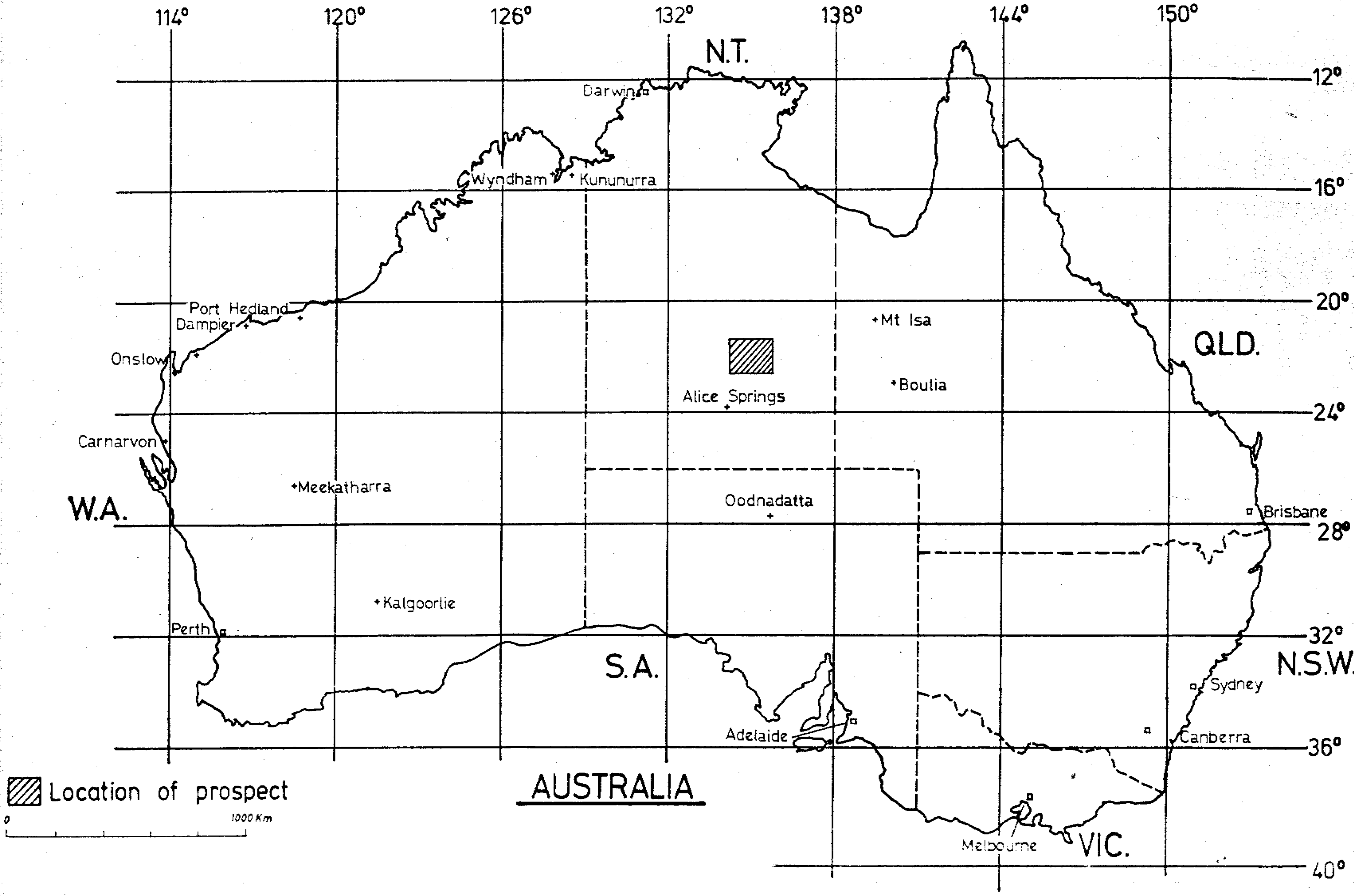
GENERAL INFORMATION

LOCATION

Exploration Licence 980 lies approximately 290km north-east of Alice Springs, within the latitudes 22°35'S and 22°45'S and longitudes 135°15'E and 135°35'E. The general location is shown on the map on the following page.

COMMUNICATIONS AND ACCESS

Alice Springs is the major road, rail and air centre for the area, and the exploration base of this company in the Northern Territory. Access from Alice Springs is gained by the sealed Stuart Highway (70km), the graded Plenty River Highway (210km) and thence by seasonal bush tracks into the area (approx. 29km). The camp site was located at Elkera No. 2 Bore (135°30'E 22°38'S) in the centre of the lease, where water is available. The nearest graded airstrip is at Red Tank Homestead (135°26'E 22°55'S) on the Plenty River Highway and is serviced weekly by Connellan Airways using light aircraft. Four wheel drive vehicles are essential for work in this area, and the use of the helicopter in the initial regional phase of the work, and in the stream sediment sampling programme, speeded up the work over the rough terrain considerably.


114°
120°
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28°
32°
36°
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N.T.
QLD.
W.A.
S.A.
N.S.W.
VIC.
Darwin
Wyndham
Kununurra
Port Hedland
Dampier
Onslow
Carnarvon
Meekatharra
Kalgoorlie
Perth
Mt Isa
Boulia
Alice Springs
Oodnadatta
Brisbane
Sydney
Canberra
Adelaide
Melbourne
AUSTRALIA
Location of prospect
0
1000 Km

TOPOGRAPHY

The average elevation within the lease is 255m. The most prominent features are the sharp ridges of quartzite and quartz reefs rising to 45m above the surrounding plains and trending NW/SE, the rounded hilly outcrop of the Marshall Granite and the south-easterly flowing Marshall River system.

VEGETATION

Vegetation is sparse, except for spinifex, which grows abundantly over most of the area. Eucalypts line the courses of the major streams. Mallee and Mulga scrub grow on the sand plains.

WATER RESOURCES

Although some large water holes hold water for several months after good rains, there are no permanent supplies of surface water. Pastoral supplies are therefore dependent on bore water. The bores in the lease are drilled into the fractured Cambrian cherts and clays and produce good water throughout the year, but have to be cleaned or re-bored every 15 - 20 years as the fine yellow "puggy" clays block up the pipes.

MAGNETIC DECLINATION

5°E changing annually by 0.01°E.

PREVIOUS AND CURRENT SURVEYS AND ACTIVITIES

Most of the geological work done by the Bureau of Mineral Resources on the Huckitta Sheet area has been, since 1949, initially in the search for metals and later for petroleum. During the preceding 50 years numerous reconnaissances were made to observe regional geology, and inspections were made in the Jervois area where copper and lead ore were discovered in 1929.

The Huckitta area was topographically surveyed and the results published on a 1:250,000 scale in 1960 and again, with revisions, in 1969 (Ref: SF 53-11). A compilation of geological mapping, giving good coverage and reliability, was published by the BMR at 1:250,000 scale in 1963. In 1964 the BMR carried out an airborne magnetic intensity survey over this area as part of a general survey over the Georgina Basin. The results were published in 1967 at 1:250,000 scale.

EXPLORATION AND MINING

At Jervois, copper and lead have been worked sporadically since 1929. The mine has been examined by both Consolidated Goldfields (Australia) Ltd., and Conzinc Riotinto without further development. Recent difficulties with the treatment plant and lawsuits between the owners have made the production increasingly sporadic.

Molybdenum and wolfram have recently been mined on a small scale by the Johansen family, who also discovered Jervois. The mineral concentrate is being exported to Japan. The Plenty River Mica field, which lies to the south of EL 980, was heavily exploited until the cheaper Indian product closed the market early in the 1960's.

Seismic surveys for oil by Smith Australian Oil Co. Pty. Ltd. since 1960 indicated no potential oil bearing situations. Central Pacific, until recently, investigated a fluospar deposit in the Jinka granite area.

GENERAL GEOLOGY

STRATIGRAPHY/LITHOLOGY

The area lies to the north-east of the Archaean Arunta block where the basement is overlain by Upper Proterozoic to Devonian sediments which form the southern margin of the Georgina Basin. The Archaean granites, gneisses and metamorphics are intruded by Lower Proterozoic granites, the Dneiper and Marshall granites, without obvious faulting, or chilled margins, although the Dneiper granite is seen to grade marginally into these gneisses. The undifferentiated metamorphics dip at angles exceeding 50° and are strongly folded. The Dneiper granite is mapped as a quartz feldspar mica and the Marshall granite as a quartz feldspar granite. Upper Proterozoic rocks overlie the granites.

The basal unit, the Mount Cornish Formation, is a tillite but it is restricted in outcrop and is succeeded with slight disconformity by the Mopunga Group of Upper Proterozoic to lower Cambrian age. The Elyuah, Grants Bluff and Mount Baldwin Formations constitute this group and are arkoses, quartzites and dolomites. The Middle Cambrian Arthur Creek beds, of siltstones and dolomites, overlie this conformably. The Upper Cambrian Arrithrunga Formation of dolomites and sandstones is overlain by Upper Cambrian/Lower Ordovician Tomahawk beds of dolomites. The succeeding Middle Ordovician Nora formation of dolomites and sandstones is overlain by the Devonian Dulcie sandstone.

STRUCTURE AND TECTONICS

The Archaean rocks have been highly metamorphosed and strongly folded by at least two orogenies, giving a suggested regional strike to the west and north-west. The granite bodies may have been implaced along fracture zones in the Archaean. The intrusions of the granites do not appear to have rotated the alignment of the included gneiss fragments.

The subsequent sedimentation began in late Upper Proterozoic time in down warps in the basement, and persisted without major tectonic break to mid-Ordovician as a margin of the Georgina basin. The greatest depth of sediments, and possible basin low, was in the Huckitta Homestead area to the north-east of the lease. Most of the Nora Formation was eroded, but not folded, before the Dulcie sandstone was laid down. A major

Paleozoic orogeny took place in post Devonian time, giving the present pattern of folding and faulting with a WNW strike and cross strike faulting.

ECONOMIC GEOLOGY

In the Jervois area, 70km east of EL 980, discontinuous copper mineralization occurs within a belt about 10km long and averaging about 600m wide. Secondary copper ores in the area persist to about 30m, but primary mineralization below this depth has not been proved economic. The copper occurs predominantly in skarn lenses in garnetiferous granulite phases in the Precambrian metamorphics, which have been folded into a syncline plunging NNE beneath Upper Proterozoic sediments. The copper lodes are associated with shearing. There are also minor lead lodes which are confined to calcic bands in the metamorphics.

The wolfram and molybdenum mined at Moly Hill, to the east of Mount Sainthill is found in similar skarn deposits where the Jinka granite is against calcic garnetiferous metasediments of the basement.

In the Plenty River Mica field, the mica lies in shoots in pegmatites in the Archaean metamorphics. Their dominant trend is west, but with subsidiary trends to the north-west and north-east. Some of the pegmatites are discordant, but most are concordant with the Archaean metamorphics. It is suggested that the mica recrystallized during the period of stress which caused the downwarp of the Amadeus basin.

PROSPECTIVE TARGETS

The preliminary aerial reconnaissance survey of 1973, which was on a broad regional scale, served to draw attention to the relatively hot Archaean and Proterozoic granites as potential hosts for uranium in vein-type deposits.

The presence of these radioactive granites was also considered to enhance the prospects for the discovery of uranium concentrations in some of the overlying Proterozoic and Palaeozoic sediments which, in the main, consisted of epicontinental sandstones, arkoses and dolomites, and which, in part, were derived by erosion of the underlying radioactive granites.

These represented the principal targets in the search for uranium in this area.

INVESTIGATIONS AND RESULTS

LOGISTICS

The survey was made from the Alice Springs base, and the field base was set up at Elkera No. 2 Bore (135°30'E, 22°38'S) which served for the second helicopter survey and later ground follow-up and drilling. The initial helicopter survey, and later out-camps, were based at Marshall Bore.

The initial survey was a regional reconnaissance with only brief ground follow-up work. In September and early October a more detailed helicopter survey and ground follow-up took place and a stream sediment sampling project was also completed. A very detailed geological and radiometric examination of the Grants Bluff Formation was carried out in late October and early November. From late November to early December one diamond drillhole was drilled.

PERSONNEL

The first phase of exploration was carried out by G.D. Iliff and J. Johnson. The second phase of more detailed work was carried out by K.M. Ferguson, J.S. Ferguson and F. Dotterrer. The third and fourth phases were carried out by F. Dotterrer, with the UAL drilling team supervised by A. McMaster.

CONTRACTORS

The helciopter was contracted both times from Jayrow Helicopters Ltd. of Melbourne. Keith Kelly was the pilot.

INSTRUMENTS/EQUIPMENT

1 Bell 47J Alpine helicopter.
3 long wheel base Toyotas,
2 trailers.
1 Jacro 200 diamond drill.
1 water truck.

1 GAM-2 four channel differential spectrometer.
3 Saphymo SRAT SPP2 scintillometers.
1 McPhar TV5 spectrometer.
1 McPhar TV5 spectrometer down-hole logger.

Complete coverage by 1:86,600 aerial photography.

HELICOPTER SURVEYS

Both airborne radiometric surveys within EL 980 were carried out by a Bell 47J Alpine helicopter, using a GAM-2 spectrometer with a 127 x 102mm cylindrical NaI sensor at approximately 30m altitude. Eight and a half days were spent on these surveys, total flying time being 37 hours 46 minutes.

During the surveys, one geologist navigated and noted geology and flight plan on the aerial photography, while the other monitored the instrument and noted the position of the helicopter on the chart. Any anomalies were immediately ground checked and sampled. Flight paths were pre-planned, originally on 1:250,000 geological maps, but later on 1:86,600 aerial photographs, and the charts were re-examined after each flight and assessed.

The contacts of the granites and Archaean were flown 50m, on either side, with at least one traverse across the granite masses. The Marshall granite and its Archaean contacts were covered by E/W flight lines approximately 500m apart; the eastern margin of the granite being covered by an additional four N/S lines 100m apart to further delineate areas of above background readings. To the north and east of the area, the contacts of the Archaean and the Proterozoic Marshall and Jinka granites were flown. Basement and sediment contacts were flown with one line on the basement, and a further one or two lines 200 and 400 metres within the sediment. The Proterozoic/Paleozoic boundary was also flown. The area of the Dulcie sandstone was flown and a horizon of micaceous sandstone and siltstones was covered in more detail. Any anomalies or kicks recorded were immediately ground checked and sampled.

Kicks to three times background were recorded on the eastern margin of the Marshall Granite and in the Archaean to the east (Map 1). A very slight rise above background was recorded on the Dneiper Granite/Grants Bluff boundary to the north-west of the area. All readings showed thorium bias.

CARBORNE SURVEY

Carborne readings were continuously taken throughout the area on the floor of a Toyota landcruiser with a SRAT SPP2 scintillometer set at 150cps fast to obtain general background readings.

Six, approximately east west traverses, were taken 400m apart, over the Archaean to the east of the main mass of the Marshall granite, with one geologist navigating and calling the distances travelled, and the other noting the distances and minimum/maximum readings. These readings were assessed and plotted. No anomalous zones were encountered.

RADIOMETRIC FOOT SURVEY

Footborne traverses were carried out during all initial ground geological surveying, using a Saphymo SRAT SPP2 scintillometer strapped at waist height and set at 150cps fast. Traverses were planned on the aerial photographs, along or across geological boundaries, or on compass bearings from known points. Spot "highs" were checked by the McPhar TV5 spectrometer.

The Archaean wedge to the east of the Marshall granite and the edge of the granite itself were surveyed on E/W lines 200m apart and overlain by lines approximately 25m apart, over the outcropping ridges where the aerial anomalies were found. The Archaean gave background readings of 200cps. An anomalous biotite band to the east of the Marshall Granite gave readings from 250cps to 500cps, rising to 2,000cps very rarely. Small bosses of granite intruding the basement gave rises of 800-450cps. A small quartz vein 9m x 3m gave readings up to 2,400cps. All samples taken from the Archaean gave a definite thorium bias when measured with the spectrometer.

On the eastern margin of the Marshall granite, a grid of five lines was set up over the aerial anomaly, parallel to the contact, with readings taken every 50m. The background readings for the granite were about 250cps, but in the patchy anomalous zones it rose from 1,000cps to spots of 2,000cps for a length of 12m, approximately paralleling the contact and 100m within it. Small patches of deep red heavily weathered granite, up to 1m x 3m, gave readings up to 1,800cps. The centre of the granite mass, and the margins, where there are numerous Archaean inclusions, showed lower readings of 150-175cps. All anomalous samples showed a thorium bias when tested by the spectrometer.

The anomalous bed at the base of the Grants Bluff Formation, after the initial reconnaissance survey, was later covered by more detailed examination (Map 1). Continuous and spot SRAT readings were taken at 10m intervals along its outcrop. Throughout it gave 160-320cps, in comparison with the 60-70cps average for the remainder of the Grants Bluff Formation. Four zones of higher than average radiation were delineated at 1,340m, 1,800m, 2,380m and 4,830m (Map 2), and were sampled.

These peaks were then re-surveyed at 1m intervals, both along and across strike.

Position	Extent of Radiation over 200 c/s	Peak Radiation
1,800m	14m and 12m (separated peaks)	250 c/s and 270 c/s
1,340m	6m	220 c/s
2,380m	30m	300 c/s
4,530m	26m	280 c/s

In addition, the peak in each area was monitored with the TV5 spectrometer.

Position	T_3	T_2	T_1
1,340m	50 c/m	460 c/m	960 c/m
1,800m	120 c/m	650 c/m	1,300 c/m
2,380m	130 c/m	1,100 c/m	1,900 c/m
4,530m	190 c/m	580 c/m	1,160 c/m

Accordingly, the peak at 2,380m was selected as a drill target. A drill site was located 70m up dip in order to intersect target at 32m.

Traverses over the type section of the Dulcie sandstone revealed the bulk of the sandstone to be radiometrically inert, with levels between 30 and 45cps. Only in the region of the micaceous silty horizon were higher readings obtained. At the type section, within this horizon, and for some distance above and below it, levels were between 60 and 70cps. No strongly anomalous zones were encountered in this horizon during ground checks associated with the airborne spectrometer survey.

GEOLOGICAL MAPPING

In order to familiarize ourselves with this area, traverses were mapped across stratigraphic sections. The target boundaries were also examined, irrespective of airborne radiometric results. Any airborne kicks were immediately followed up by detailed mapping. Scintillometers were worn at all times, and any rocks giving anomalous results were sampled.

The Archaean basement (Aa) forms topographically the lower lying ground; the more mafic members, the schists and gneisses, deeply weather into low hills, whereas the quartz and quartzite reefs form obvious ridges, and these divisions can be easily mapped from the photographs. The gneisses and schists show complex folding with granitized and metasomatised portions, whereas the more basic members appear more fractured and massive. The area of interest to the east of the Marshall granite, consists of basic metasediments interfolded with gneiss and intruded by small bosses of Proterozoic granite. The magnetite biotite horizon, rich in thorium and uranium (220ppm U_3O_8 2,400Th) was found to form a series of lenses and pods, up to 16m long and 1m thick, trending at 200°. It is margined by a granitic horizon which cuts it out, and is itself cut out by other rock types. The discontinuous and arcuate trend of this member is probably due to the intense folding and dislocation of the units within the Archaean. This area was initially surveyed on a grid of east/west lines 200m apart and further covered by lines 25m apart running along the ridges.

The Proterozoic granites, the Marshall granite (Pgm) and Dneiper granite (Pgd) intrude the basement without obvious faulting or chilled margins. The Dneiper granite marginally grades into the Archaean and contains many fragments of the basement, making its boundaries arbitrary in many places. The intrusion of the granite does not appear to have rotated the alignment of the included gneiss. Areas mapped as quartz mica granite contain a surprisingly high percentage of these fragments which do not weather as deeply as the granite. The Marshall granite (Pgm) masses form obvious relief over the Archaean gneiss it intrudes. The margins of the mass include fragments of gneiss, but in general it is a blocky pink quartz feldspar granite with very minor mafics. The lower lying centre of the granite contains a higher proportion of Archaean (?roof pendants) and a small basic mass with rare sulphides (pyrrhotite?). Attempts at subdividing the granite by means of grain size, or mineral content, were not possible as there is so much variation locally within the mass. Generally the western margin appears coarser than the eastern, and shows development of interstitial epidote and slickensliding along the joint faces. No pegmatites were found. The anomalous areas on the eastern margin of the main granite mass were seen to approximately parallel the complex contact with the gneisses and be patchy and discontinuous. The area was surveyed along five grid lines approximately paralleling the contact (Map 1). Traverses were also made across the mass of granite from east to west. The Dneiper granite and its contacts were also examined.

The Upper Proterozoic to Cambrian sediments lie unconformably on the Archaean and Proterozoic basement. The relief of the basement is locally sufficient to cut out the Mt. Cornish (Puc) and Elyuah (Pue) formations. These form low ridges of coarse pink arkose with prominent blocky jointing. The arkose is poorly sorted with pebbles of quartz, granite and rare green mudstone fragments in a matrix with a high proportion of pink feldspar. These feldspar clasts show very little rounding. The bedding is low angle and rarely conglomeratic. The bedded purple and green shales do not outcrop well. The Grants Bluff Formation (P€g) lies conformably on the Elyuah Formation, forming conspicuous double quartzite ridges. The base and top of this formation are formed by massive white quartzite beds with ripple marked bedding surfaces. The intermediate grey and purple slates and interbedded more fissile quartzite beds do not outcrop well and form low valleys paralleling the scarps. In the northwest of the area the formation directly overlies the granite and Archaean basement.

The anomalous basal bed of the Grants Bluff Formation was examined in detail and is seen to vary between 2-3m in total thickness and be composed of quartz pebble horizons at the top and base, margining a sub arkose. Infrequently there is also a median pebble horizon. The lower horizon is thicker, has larger pebbles and is twice as radioactive as the upper.

	1,300m	1,800m	2,380m	4,530m
Pebble Horizon Thickness	upper 2cm lower 17cm	upper 4cm lower 20cm	upper 35cm lower 40cm	upper 1cm lower 6cm
Bedding Joints	7-10cm	7-10cm	12-16cm	10-14cm
Pebble Size	av. 2cm largest 6cm	av. 2cm largest 5cm	av. 2cm largest 7cm	av. 2cm largest 5cm
Dip	40°	34°	60°	50°
Structure	jointed	2 joint sets	3 joint sets	jointed

In the area of the drillsite the P€g-Pgd unconformity is exposed. The basal bed thickens and thins occasionally as channel fillings and is three times repeated in small left lateral strike slip faults. The eastern margin of the quartz pebble horizon pinches out against the granite. The quartz pebble conglomerate is composed of approximately one third white polycrystalline quartz pebbles and two thirds of fine sandstone matrix with a silica cement. The quartz pebbles range from 0.1 - 7cm in size, but average 2cm. They are subrounded, poorly sorted, roughly graded and, infrequently, elongate pebbles are aligned parallel to bedding. The matrix is quartzose with a 10% K-spar fraction and the grains are well sorted and subrounded. The quartz pebble conglomerate is twice as radioactive as the sub-arkose beds above it, but exceeds, or is equal in radiation to, the formation below it. The Grants Bluff/Elyuah contact is conformable and transitional, with the quartz pebbles grading out in size, number and thickness, from 0.4 - 4m into the Elyuah arkose, which may explain why the upper arkose has the same level of radiation as the quartz pebble conglomerate. There is a similar quartz pebble conglomerate, which is also anomalous, within the Grants Bluff Formation (Map 4). The basal bed of the Grants Bluff often outcrops at some distance from the foot of the main ridge and may have been missed during the airborne survey. Samples were taken from the peak areas and analysis showed a definite thorium bias (U 39ppm Th 277ppm).

The overlying Mount Baldwin Formation (€lb) gives low relief and outcrops as yellowish algal dolomite, dolomitic grit and dolomitic shale.

The type section of the Dulcie sandstone was studied in detail and sampled. The typical sandstone is quartzose, well sorted and medium grained. Much of the sequence is siliceous and hard, while other parts contain much interstitial kaolin and are softer. The sandstone is generally cross bedded and light grey in colour. Within the sequence are rare pebble conglomerates. The sequence is 600m thick in type section. About 360m from the base occurs a light greyish green micaceous silt, sand and mudstone horizon of variable thickness. This is a persistent horizon throughout the outcrop area of the Dulcie sandstone. It occurs at the base of the mesas within the plateau. At the type section it is only 3.3m thick, but in other localities appears to be up to 24 or 30 metres thick. In many localities away from the type section this horizon has been oxidized to a purplish red colour, giving a motley appearance. This horizon is very micaceous and is generally more silty than the bulk of the sandstone.

STREAM SEDIMENT SURVEY

The helicopter route and the sampling points were planned on the aerial photographs prior to the survey to eliminate engine shut-off time. Specific attention was paid to collecting samples from the Marshall Granite and its Archaean contacts to cover the possibility of vein-like and skarn deposits. The downstream spacing, at these points, was less than one kilometre. One geologist collected a 2-3 lb sample from the inside curve of the stream bed (to include heavy minerals), while the other took on sample and background scintillometer readings and noted any outcropping rock type. Fifty nine stream sediment samples were taken in approximately nine hours flying time. At base the samples were sieved to <80 mesh (<0.2mm), and assayed for Cu, Zn, U, Th, Mo and W.

The analyzed results (Map 3, Table 1) showed the conjunction of high uranium and thorium values. The U/Th ratio is similar to that in grab samples taken from anomalous spots within the granite, showing the present erosional process to be mainly mechanical.

STREAM SEDIMENT SURVEY RESULTS

Table 1

Sample	ASSAYS IN PPM U	Th	Cu	Zn	SRAT READINGS CPS b/g	situ	Source
No.802	22	298	30	45	100	100	Pue/Pgd/PЄg
803	32	289	15	25	250	270	Pgm
804	2	30	15	25	125	125	Pgm/Pue
805	17	316	30	30	500	800	Pgm/A
806	11	287	20	25	1000	1250	Pgn/A
807	2	45	20	20	150	180	Pgm/A
808	9	114	15	20	220	300	Pgm/A
809	26	331	25	20	400	700	Pgm
810	46	804	30	30	150	240	Pgm
811	3	86	30	25	180	250	Pgm/A
812	2	82	40	25	250	280	A
813	11	151	20	25	200	240	Pgm/A
814	17	253	10	25	150	190	Pgm/A
815	12	91	15	20	150	170	Pgm/A
816	6	89	80	95	120	180	Pgm/?A
817	ins.spl.		55	60	150	180	Pgm/?A
818	19	280	20	25	200	220	A
819	45	639	30	35	200	244	Pgm/A
820	12	134	15	25	110	180	Pgm/A/Pgd
821	37	640	60	50	160	210	Pgm
822	9	74	15	25	140	180	Pgm
823	11	130	10	25	250	260	Pgm
824	ins.spl.		15	30	160	210	Pgm/A/Pgd/....
825	5	52	15	20	180	180	Pgd
826	2	14	20	35	75	100	Pgd/PЄg
827	6	57	10	30	120	120	Pgd
828	3	27	20	25	75	75	PЄg/Єlb
829	4	17	10	25	100	75	Pgd
830	4	35	20	20	70	70	PЄg
831	5	53	35	40	150	170	PЄg/Pgd
832	6	84	50	50	120	150	PЄg/Pdg/Pue/A
833	10	82	20	40	90	110	Pgd
834	3	29	40	60	100	120	Pgd
835	7	113	15	30	100	150	Pgd/A
836	5	69	10	25	110	120	A
837	10	147	20	35	150	125	Pgd/A
838	10	180	30	50	110	110	Pgd
839	-	22	30	50	100	110	Pgd
840	9	141	15	20	110	170	Pgd/A
841	3	34	20	35	120	120	Pgd/A
842	17	201	20	65	140	210	Pgd
843	9	74	30	75	125	125	Pgd
844	12	135	30	55	150	150	Pgd/A
845	7	44	20	40	100	170	Pgd/A/PЄg
846	5	41	15	40	110	150	Pgd/A/PЄg
847	14	201	30	50	100	120	PЄg/A
848	8	129	10	25	90	150	PЄg/A
849	4	70	40	45	80	90	PЄg/A
850	5	55	20	35	80	95	PЄg/Єlb

Table 1 (cont'd)

Sample	U	Th	Cu	Zn	b/g	situ	Source
No.851	3	69	25	40	95	110	PЄg/Pgd
852	8	84	20	35	50	80	PЄg/Єlb/Єma
853	1	40	20	30	65	75	PЄg/Єlb/Єma
854	ins.spl.		50	70	95	110	Pgd
855	5	41	15	35	100	100	PЄg/Pgd/Єlb
856	4	30	10	20	75	85	PЄg/Pgd/Єlb
857	2	11	15	80	75	90	A/PЄg/Pue/Єlb
858	3	7	15	20	95	75	A/PЄg/Pue/Єlb
859	7	80	25	45	100	100	PЄg
860	2	29	45	55	90	90	PЄg/Єlb

All samples were assayed for Mo and W and found to be BLD

A comparison of the U/Th ratio in the stream sediment samples (approx. 1/16) and in the heavy mineral assay (max. 1/8.7) shows the uranium and thorium not to be bound purely in the heavy mineral portion of the sample.

The assay values for Cu, Zn, W, Mo (Table 1) suggest that skarn deposits similar to those found to the east of the area, at Moly Hill and Jervois, are not present in this area.

GRAB SAMPLING/ASSAYING

Forty one grab samples were taken of all rock types, both representative and anomalous. The anomalous bands in the Archaean and granite were channel sampled across the trend. Seven grab samples were taken from the base of the Grants Bluff Formation (Table 2).

The results for both the Archaean and Lower Proterozoic samples show a definite thorium bias. The seven grab samples from the base of the Grants Bluff Formation gave varying U/Th ratios, perhaps due to preferential leaching of the uranium; the thorium values always exceeding twice the uranium values. Heavy mineral analysis of two of the samples showed low heavy mineral content. However, a large portion of the uranium and thorium appears to be found in the heavy minerals. This is also indicated in the rock and heavy mineral assays.

				Heavy Mineral Concentrate		
	U	Th	Th/U	U	Th	Th/U
G602	39	103	2.6	147	386	2.63
G603	39	277	7.1	310	2691	8.7
G604	33	79	2.4			
G606	12	32	2.7			
G607	2	20	10			
G608	35	74	2.1			
G609	7	26	3.7			

HUCKITTA AREA - REPRESENTATIVE SAMPLES

Table 2

Formation	SRAT b/g	cps situ	Assay U	ppm Th	Lithology
Dulcie Sandstone	40	70	0	4	white sandstone
Dulcie Sandstone	40	100	1	9	green siltstone
Grants Bluff	160	320	39	103	basal conglomerate
" "	160	650	39	277	" "
" "	160	1000	33	79	" "
" "	160	160	12	32	yellow sandstone
" "	160	160	35	74	" "
" "	160	160	7	26	" "
" "	160	160	2	20	" "
Ooraba Arkose	180	200	7	39	arkosic grit
Mt. Cornish	180	180	6	18	brown siltstone
" "	100	130	2	12	brown sandstone
Dneiper Granite	130	200	4	26	grey/pink granite
Marshall Granite	200	700	10	15	granite rubble
" "	200	23000	100	1670	" "
Arunta Complex	300	400	10	95	quartzite
" "	250	300	5	32	gneiss
" "	250	3000	220	2400	magnetic gneiss

DRILLING

One shallow diamond drillhole was planned, using the company's Jacro 200 rig, to intersect the radioactive zone below water table; with a planned 32m of very fine sandstones, 4.5m of quartz pebble conglomerate and 2m of granite. Total drilling time was 12 days, with four days for location. A total of 58.5m was drilled, 21.3m of NQ core and 37.2m of BQ. The speed of the drilling was severely restricted by the nearly vertical dip and fissility of the shale, which caused small wedges of rock to block the core barrel. The target bed had not been reached when the hole was abandoned, due to a broken water pump and because the drill was due back in Alice Springs.

Since the beds above and below the drill site dip at 40-50°, the greatly increased bedding dip seen in the core and the increased depth to the target is probably due to local small scale faulting or incompetence of the shales within the quartzites. The hole was logged using the McPhar TV5 spectrometer down hole logger and no significant variation was noted.

MICROSCOPY

Two specimens of the Dulcie sandstone were examined by Delta Petrological Services. Specimen 2x/G161 proved to be a fine to medium grained, moderately sorted carbonate cemented sandstone, whereas 2x/162 was a calcareous silty sandstone. For details see Appendix 1.

One specimen of Grants Bluff Formation was examined by Dr. B.G. Jones of Wollongong University and was proved to be a siliceous submature subarkose (Appendix 1).

SUMMARY AND DISCUSSION OF RESULTS

All anomalies found within both the basement and overlying sediments are characterized by the heavy thorium bias of the assays and spectrometer readings.

Anomalies in the Archaean and Proterozoic basement are too limited in extent. The similarity of the stream sediment samples and the grab samples infers that the thorium bias is not due to selective leaching of the uranium but reflects the true U/Th proportions in the rock. Although the thorium assay is higher, the relatively high percentage of uranium in the granites suggests it would make a good source.

The anomalous bed at the base of the Grants Bluff Formation has the regional extent but shows little variation in radioactivity. Such variation as does occur is controlled by the thickness of the bed and the size of the pebble. The possibility of selective leaching of uranium was considered but drilling indicated this to be unlikely since no deep weathering was observed within the hanging wall rocks, above ground water table.

The Dulcie sandstone was examined because of its probably stratigraphic equivalence with the Undandita sandstone whose mineralized beds are at present being examined by this company near Alice Springs. The Dulcie sandstone beds, except for the marginally radioactive micaceous band, proved radiometrically inert.

ASSESSMENT

This area may be generally described as a thorium province, with sufficient uranium to be useful as a source, but nowhere is it sufficiently concentrated to be economically interesting. The Archaean basement shows a high thorium bias, as do the intruding granites. The high thorium content of the granites is either due to their formation by the partial remelting of the basement or to a fractionating process occurring within the granite on emplacement. The present outcrop may only be a very high level of the granite intrusion, as is inferred by the large number of roof pendant inclusions, and richer in thorium than the mass as a whole. The absence of skarn type deposits similar to those found round the Lower Proterozoic granites to the east of the area must be due to a regional compositional difference in the basement as the granites themselves are mineralogically similar. This was borne out by the stream sediment sampling programme which showed no significant anomalies.

The sediments, except for the basal bed of the Grants Bluff Formation, show less response than do the granites. The zones of high readings within this formation may be surface indication of richer zones which have suffered less uranium leaching, but this has proved unlikely. Further exploration of this basal bed does not appear to be warranted in view of its thinness and the lack of channels or other uranium localizing features within it.

B I B L I O G R A P H Y

Smith, K.G.	1964 :	BMR Report No. 67. Progress Report on the geology of the Huckitta Sheet.
Smith, K.G.	1963 :	BMR Explanatory Notes on the Huckitta Geological Sheet 1:250,000.
Wells, A.T. Forman, D.J. Ranford, L.C. and Cook, P.J.	1970 :	BMR Bulletin 100. Geology of the Amadeus Basin, Central Australia.

APPENDIX 1

PETROLOGICAL REPORT BY DR. B.G. JONES AND DELTA PETROLOGICAL SERVICES REPORT NO. 2096.

A petrological description of a pebbly sandstone sample from the ?Upper Proterozoic to lowest Cambrian Grant Bluff Formation in the Mopunga Range area, Huckitta Sheet, N.T.

by

Brian G. Jones,
Department of Geology,
University of Wollongong.

February 1975

DEPARTMENT OF GEOLOGY

SAMPLE No. **UNIT** Grant Bluff Formation

Rock Name: Pebbly and granular very fine sandstone: siliceous submature subarkose.

Hand Specimen: Yellowish brown hard siliceous very fine grained sandstone with about 40% by volume of subrounded to rounded quartz pebbles and granules, up to 2½ cm size.

Texture: Massive, no bedding or grain orientation visible. Pebbles randomly dispersed throughout the matrix.

Grain size: Maximum: 26 mm Average: Pebbles 13 mm, Granules 2.8 mm, Sand o.11 mm

Sorting: Poor overall, moderate to good within the 3 size fractions.

Grain shape: Angular to well rounded, average rounded. Roundness increases with increasing size of grains.

Packing: Poor overall; good in fine fraction

Porosity: Very low

Point count analysis of sand sized fraction only

Composition	Vol.%	Av. size (mm)	Roundness	Comments
Quartz	67	0.11	Ang-rnd.	mainly single grains
K-feldspar	17	0.12	Sang-rnd	7% very vacuolized & brown
Plagioclase	-			
Rock fragments	1	0.15	Srnd	
metaquartzite	1	equigranular		
Q-musc.schist	-			
other M.R.F.	-			
siltstone	-			
chert	-			
limestone	-			
fine Q sst.	-			
Accessory Minerals	3	Zircon - common subhedral to well rounded grains Sphene - rare		
muscovite	tr	small fresh flakes		
biotite	-			
chlorite	-			
epidote	tr			
garnet	-			
magnet/ ilmenite	2	many small subrounded opaque grains		
glauconite	-			
tourmaline	tr	mainly greenish pleochroic variety		
ferromags.	tr			

SAMPLE No. Grant Bluff Formation

Composition	Vol. %	Comments
Matrix	3	
clay and sericite	3	very fine, brownish, indeterminable
hemat./ limonite	?	brown colouration probably due to the presence of widely disseminated limonite
carbon	-	
Cement	9	
micrite	-	
microspar and spar	-	
Q.overgrowths	tr	few overgrowths seen, may be reworked
silicification	9	sample silicified with very fine grained intergranular quartz

Comments: This sample consists of a silicified trimodal sandstone. The pebbles and granules are composed almost entirely of quartz rich fragments. Many of the pebbles and granules consist of clear coarsely crystalline composite quartz aggregates with the individual quartz crystals having straight grain boundaries, straight extinction and quite abundant vacuoles. Such clasts represent reworked vein quartz. Some of the clasts are finer grained with variable grain sizes, elongate grains, straight to crenulated grain boundaries, strained extinction and some weathered orthoclase grains. They probably represent reworked metaquartzite. A few of the clasts are granitic with quartz grains, large fresh microcline grains and quartz-feldspar intergrowths. They may represent clasts reworked from the Marshall Granite to the south.

The abundance of quartz grains and clasts and the predominance of stable accessory minerals indicates that the sediment was subjected to considerable weathering and/or mechanical reworking before being finally deposited.

The period of silicification cannot be determined from the information at hand. It may be a diagenetic feature or possibly it is related to the period of Tertiary silicification and silcrete formation.

DELTA PETROLOGICAL SERVICES

SPECIALISTS IN PETROLOGY, MINERALOGY, MINERAGRAPHY, BEACH SANDS.

G.D. BARTRAM. B.Sc., Ph.D.
R.C. MORRIS. B.Sc.
R.K. REYNOLDS.

THIN SECTIONS POLISHED MOUNTS

37 CARRINGTON STREET,
CLAREMONT 6010 W.A.
PHONE 86 2152.

10th June, 1974

URANERZ (AUSTRALIA) PTY. LTD.
27 Oxford Street
LEEDERVILLE W.A. 6007

REPORT NO. 2096

2 Petrological Descriptions of samples - Nos. 2x/G161 and 2x/G162.

Reference : Order No. 1021

G. D. Bartram
for R. C. Morris

2x/G161 : Fine-Medium Grained, Moderately Sorted, Carbonate Cemented, Sandstone

Hand Specimen

A faintly bedded, fairly compact though slightly friable, grey white sandstone, composed of well rounded fine quartz grains and generally coarser lithic grains with abundant calcite cement.

Thin Section (Format as requested)

1. Composition

(a and b) Fragments and Grains. About 50 per cent quartz, mainly as single entities, rarely composites; 25 per cent lithic fragments (chert, shale, or mudstone, siltstone and fine sandstone); 25 per cent clastic carbonate and possible shell fragments (minor). Accessory microcline, tourmaline, iron ores, leucoxene, plagioclase.

(c) Matrix. 10-15 per cent.
Most of the clastic fragments have a narrow continuous rim of finely crystalline calcite, while the cement is relatively coarsely crystalline. The distinction between clastic carbonate and matrix is

2x/G161 : (Continued)

not always clear.

11. Texture

(a) Grain size. 0.1 to $1\frac{1}{2}$mm, with quartz averaging about 0.3mm and the rock fragments about 0.75mm.

(b) Rounding. - Well rounded except in the finest grains

(c) Sorting - Poor- moderate

(d) Porosity - Inherently low due to carbonate matrix, but weathering has slightly modified this.

(e) Intergrowth - Negligible, except between carbonate clasts and matrix where boundaries are often indistinct.

111. Alteration/Weathering

Weathering has reduced the strength of the bond between the coarser clasts and the matrix resulting in plucking out some of these fragments on the sawn surface. Apart from this feature, there are a few small areas of pale yellowish green clay-like material, which may be weathering of clastic fragments or an introduced stain. The feldspar fragments are completely fresh.

2x/G162 : Calcareous Silty-Sandstone

Hand Specimen

A very friable, slightly fissile, fine grained greenish-grey-white rock. The weak fissility is due to a poorly defined bedding.

Thin Section

Due to the fine grain size and varied character of the sample we are using a descriptive format rather than the detailed format of the previous specimen.

A poorly bedded specimen marked by variations in the carbonate content and differing grain size.

In general the rock consists of about 40 per cent of fine clastic quartz ranging from around 0.03 to 0.25mm, and averaging about 0.06mm (i.e. close to the boundary between sand and silt), with very minor microcline and plagioclase, and accessory glauconite, tourmaline, zircon, micas, clays and iron ores. The remainder is carbonate, generally showing some evidence of recrystallisation. As such, it is difficult to determine how much is clastic and how much is introduced, though it is probable that a high proportion is original sedimentary material.

2x/G162 : (Continued)

Rounding is apparent only on the larger clastic grains (and the glauconite) but the generally irregular smaller grains also show some rounding due to chemical attack by the carbonate.

The rock is very porous due to poor bonding between carbonate and clasts, and is also probably moderately permeable.

General Remarks :

We would place these two samples into the "ortho-quartzite-carbonate" facies or association (if two samples can be called an association!).

The first sample contains well rounded quartz grains but also a high proportion of soft sedimentary material (also well rounded), indicating some degree of immaturity.

The second sample is finer grained, with a much higher content of carbonate and contains minor glauconite but is probably related to the sandstone. The absence of pyrite in this sample suggests that the glauconite could be derived from earlier sediments.

Thus a simple picture based on limited evidence suggests a near shore marine environment, sedimentary source rocks and reef structures. The rims of fine carbonate on the clastic fragments in the first sample could have formed during deposition (as opposed to diagenesis).

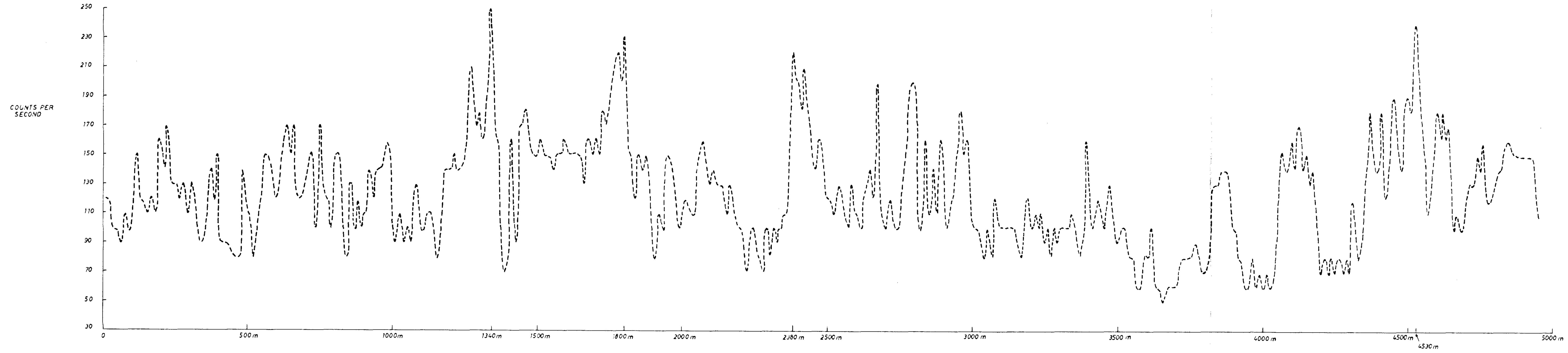
URANERZ AUSTRALIA PTY. LTD.

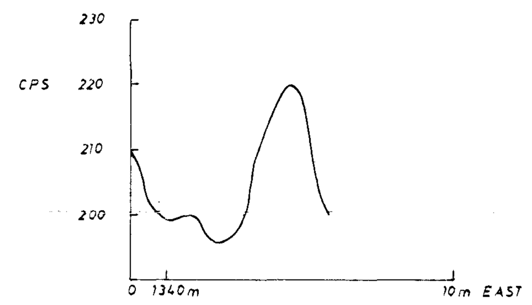
HUCKITTA EL 980

RADIOMETRIC AND GEOLOGICAL SURVEY

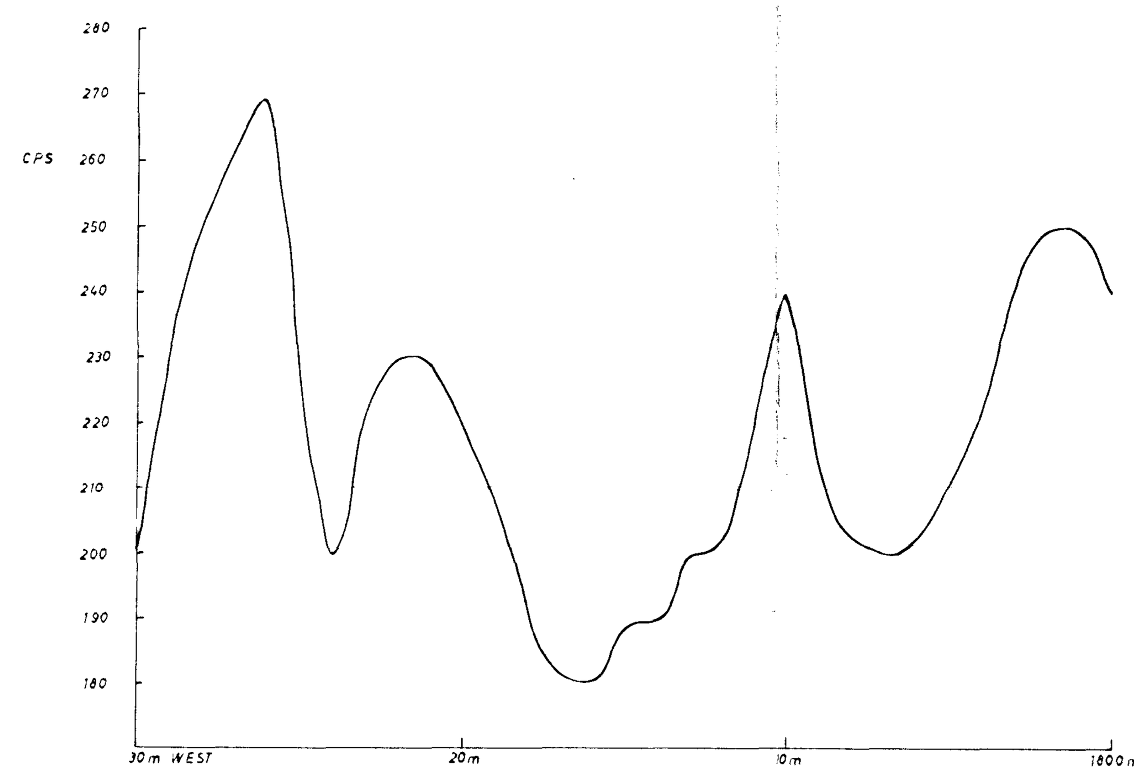
COMPILED: FE J	DATE: OCT. 74	TENEMENT:	MAP No: 1
DRAWN: EA	DATE: OCT 74	PLAN No: NT-1175-2x	REPORT No: FR 35
LAST REVISION:		SCALE: 1:50000	PROJECT No: 2x
T.C. TO BONN:		REF:	

QUATERNARY	Qs	Sand, soil and alluvium	LOWER PROTEROZOIC	Ꝑgd	Dneiper Granite
TERTIARY	Tr	Arltunga Beds		Ꝑgm	Marshall Granit
UPPER CAMBRIAN	€ua	Eurowie Sandstone	ARCHEAN	Ad	Basic Intrusives
MIDDLE CAMBRIAN	€ma	Arthur Creek Beds		Aa	Undifferentiated Archean
LOWER CAMBRIAN to UPPER PROTEROZOIC	€lb	Mt. Baldwin Formation			
	Ꝑ€g	Grant Bluff Formation			
	Ꝑue	Elyuah Formation			

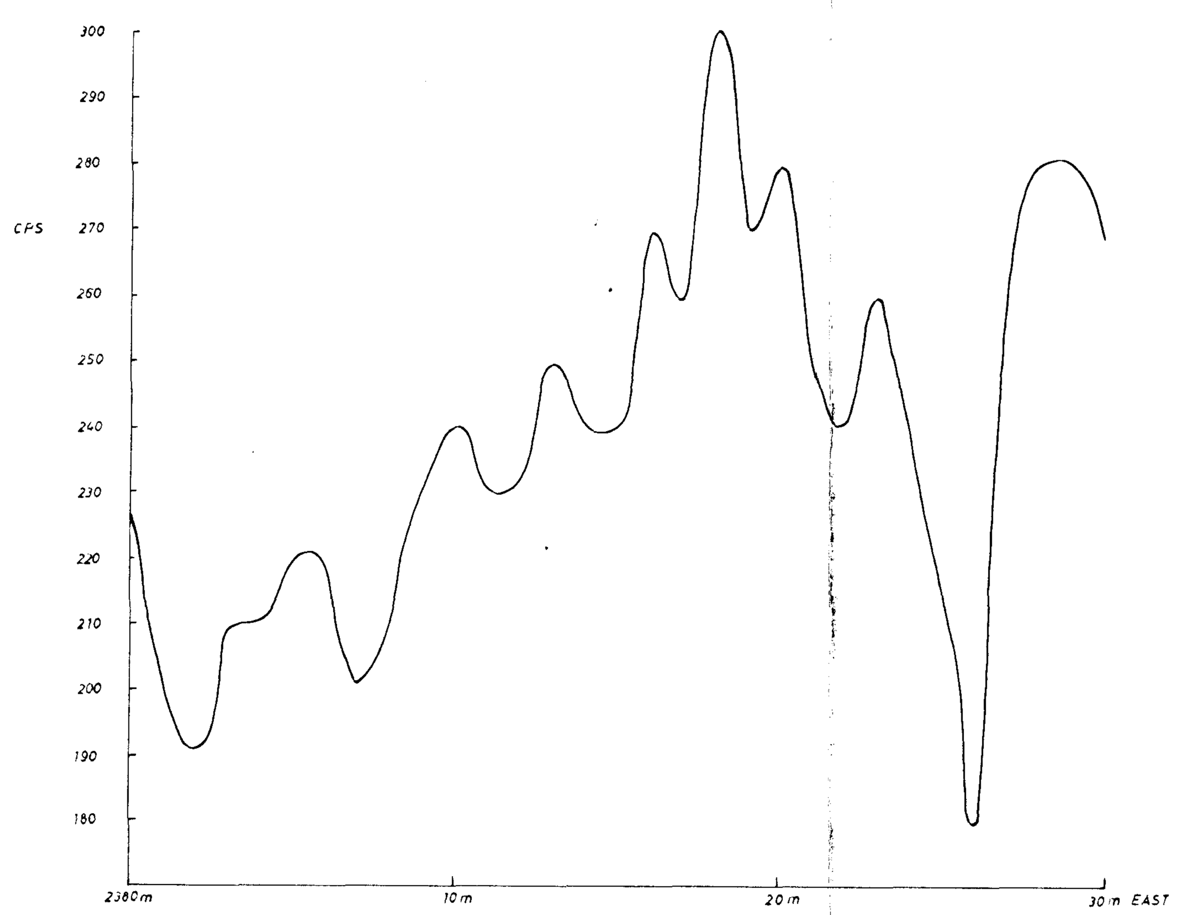




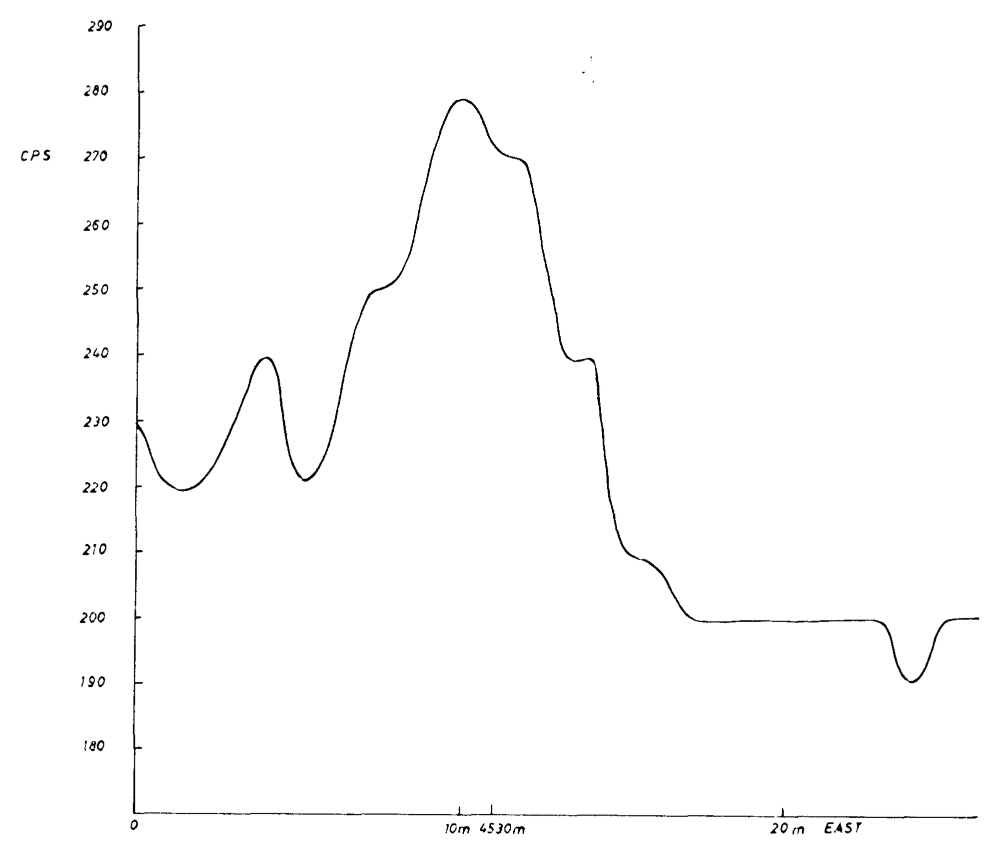
DETAIL OF 1340m AREA



DETAIL OF 1800m AREA



DETAIL OF 2380m AREA



DETAIL OF 4530m AREA

URANERZ AUSTRALIA PTY. LTD.

HUCKITTA EL 980

SRAT SCINTILLOMETER TRAVERSES OVER BASAL CONGLOMERATE BED OF GRANTS BLUFF FORMATION

COMPILED: DO	DATE: NOV 74	TENEMENT: EL 980	MAP No: 2
DRAWN: EA	DATE: DEC 74	PLAN No: NT-1193-2x	REPORT No: FR 35
LAST REVISION:		SCALE: AS SHOWN	PROJECT No: 2x
T.C. TO BONN:		REF:	

● Sample Point.

U12 Uranium parts per million.

T15 Thorium parts per million.

All samples were also assayed for molybdenum and tungsten but all results for these two minerals were below the level of detection.

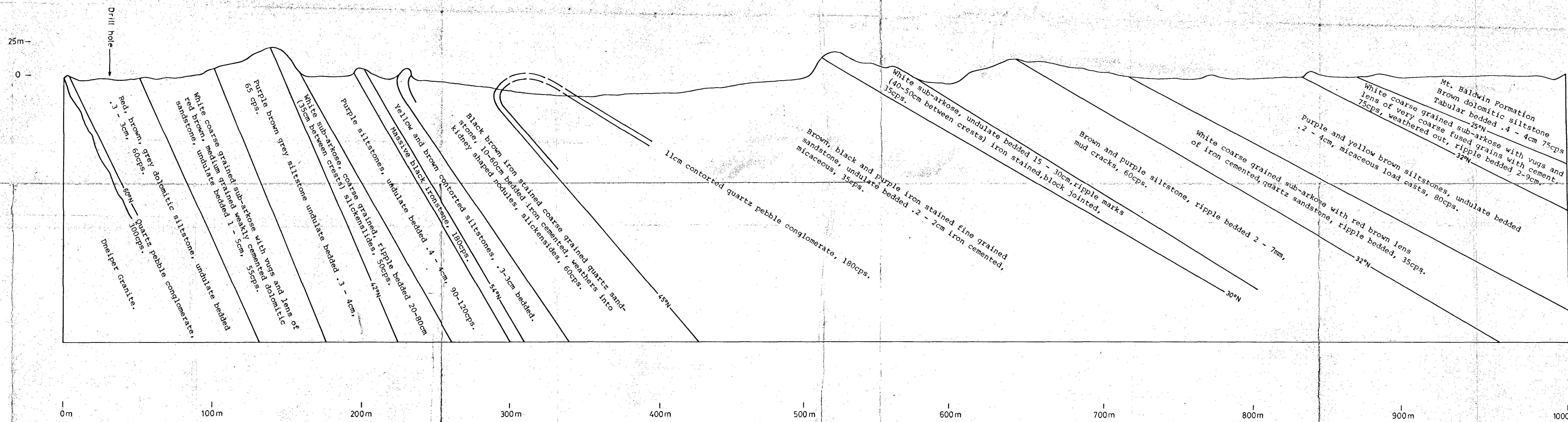
C - COPPER Z - ZINC

URANERZ AUSTRALIA PTY. LTD.

HUCKITTA EL980

STREAM SEDIMENT SURVEY ASSAY RESULTS

COMPILED: IL	DATE: NOV 74	TENEMENT:	MAP No: 3
DRAWN: EA	DATE: DEC 74	PLAN No: NT-2009-2x	REPORT No: FR 35
LAST REVISION:		SCALE: 1:50000	PROJECT No: 2x
T.C. TO BONN:		REF:	



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HUCKITTA AREA

GRANTS BLUFF FORMATION CROSS SECTION
(location see map 1)

COMPILED: DO	DATE: JAN 75	TENEMENT: EL 980	MAP No: 4
DRAWN: EA	DATE: FEB 75	PLAN No: NT-133-2x	REPORT No: FR 35
LAST REVISION:		SCALE: AS SHOWN	PROJECT No: 2x
T.C. TO BONN:		REF:	