CRA Exploration Pty Limited

EL 2376 KEEP RIVER, NT

FINAL REPORT

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Date : December, 1983

Copy to: N.T. Dept of Mines and Energy
CRAE Library

Locality Auvergne SD 52-15
Lesuine 4767

Report No
12364

CR84/1A

CONTENTS

1.0 SUMMARY

Two diamond drill holes were completed to test a shallow IP response and nearby residual gravity anomaly in Carboniferous sediments of the Bonaparte Gulf Basin. The sources of the IP and gravity responses are considered to be lithologic . No shale or carbonate hosted lead-zinc mineralisation was intersected.

2.0 CONCLUSIONS

A flat-lying sequence of carbonaceous fluviatile to paralic clastics were intersected. At depth these pass gradationally to marine argillites of the Lower Carboniferous Millisans Beds. The sediments, though variably pyritic, disclosed no anomalous basemetal mineralisation.

The shallow IP response, of limited width is possibly caused by carbonaceous, clay rich pyritic mudstones towards the base of the Border Creek Formation at a depth of approximately 40m.

The residual gravity anomaly, is not fully explained by a density contrast of 0.26 g/cc at a depth of 200m. However, a combination of local stratigraphic thickening of argillites, in a primary depositional basin and subsequent horsting are postulated to be the cause.

3.0 INTRODUCTION

An Exploration Licence was applied for on 28th November 1979, granted in modified form on 24th June 1980 and subsequently reduced to an area of 188.16 square km for the third year of tenure commencing 24th June 1982 (Plan NTd 2088).

Work carried out during the first three years of tenure is summarised in the following section. This report details the results of drill testing virtually coincident IP and residual gravity anomalies interpreted as possible expressions of Mississippi Valley -type or shale hosted lead-zinc deposits on the northwestern flank of the Burt Range Syncline in the Bonaparte Gulf Basin.

4.0 PREVIOUS WORK BY CRAE

1980-81

During the first year of tenure exploration was directed towards a search for diamonds. Geomorphological studies had suggested that the Ord River may have once flowed between the Pincombe Ridge and Weaber Ranges into the present Keep River Estuary. Three percussion holes across the postulated course of the river encountered no significant gravel beds and the concept was abandoned. (Plan NTd 3221).

A review of literature suggested that the area had potential for both shale hosted and Mississippi Valley style zinc deposits. The latter style of mineralisation occurs 13km to the SW at Sorby Hills in Devonian limestones close to the Proterozoic inlier of the Pincombe Ridge. Favourable host lithologies in the area under investigation are Lower Carboniferous carbonaceous silty shales of the Millisans Beds possibly overlying limestones which may be proximal to a north easterly, subsurface, extension of the basement Pincombe Ridge. (Johnston 1981).

1981-82

In the second year of tenure, subsequent to assessment of previous gravity and airborne magnetic data gathered by the BMR and oil exploration companies, a semi-regional gravity survey was undertaken by CRAE. This survey outlined two local gravity responses consistent with the expression of relatively shallow mineralisation (Jenke 1982).

1982-83

During the third year of tenure, a detailed gravity survey of the southern local gravity response was carried out. Modelling, though inconclusive, indicated a shallow areally extensive source of low density contrast or a deeper discrete body of higher contrast, with a maximum depth less than 300m, and an excess mass of about 8000 tonnes per metre of strike length.

Subsequent to gravity modelling a dipole-dipole IP survey detected a chargeable, resistive source close to the axis of the gravity response. A ground magnetometer survey carried out on the three IP lines showed no significant response.

A recommendation to drill the IP response on line 5000mN at 5050mE and the residual gravity response at 4850mE was made (Jenke 1983 - Appendix I; Plan NTd 1997).

5.0 GEOLOGY

In the southeastern portion of the EL, Upper Carboniferous quartzites, minor siltstones and basal conglomerates of the Border Creek Formation crop out in the Weaber Ranges. (Plan NTd 3221). Further west in these ranges, the Border Creek Formation unconformably overlies fluvio-paralic sediments of the Point Spring Sandstone which inturn conformably overlies the Burvill Beds, both of the Lower Carboniferous. South of the EL, in the vicinity of Spirit Hill and Millisans Hills, the pyritic and calcareous black silty shales of the Millisans Beds crop out and appear to be transitional with the overlying paralic sediments of the Burvill Beds. Full stratigraphic details may be found in the BMR Bulletin No.97 (Veevers and Roberts, 1968).

Within the detailed area of investigation dealt with in this report, outcrop is limited to minor inliers of presumed Border Creek Formation with the majority of the area covered by Cainozoic sands, laterite and black soil.

6.0 DRILLING

Diamond drilling was carried out by White Drilling Pty Ltd of Darwin. An EDSON 6000 was used. The two vertical holes were geologically and geophysically logged at the time of drilling. A drilling-water bore, located at grid co-ordinates 4950mE 5000mN, was drilled to a depth of 26m. A flow rate in excess of 1500 gals/hr was obtained in permeable quartz sandstones of the lower 11m. Drill logs for all three holes are appended (Appendix 1).

6.1 Drilling Results

Drill hole DD83KR4 was collared at grid co-ordinates 5050mE 5000mN and completed a total depth of 54.2m to test the shallow IP anomaly on the shoulder of the local gravity response (Plan NTd 3222).

Lithologies intersected and stratigraphic correlations follow:-

Interval (m)	Thickness (m)	Lithology	Formation
0.0 - 3.0	3 (precollar)	Loose sand, laterite	CAINOZOIC
3.0 - 39.2	36.2	Coarse grained to granular poorly sorted quartz sandstone, minor pebble beds	UPPER CARBONIFEROUS
39.2 - 41.7	2.5	Maroon siltstones overlying unoxidized carbonaceous shales	BORDER CREEK FORMATION
41.7 - 50.6	8.9	Friable clay and silt rich poorly sorted quartz sandstone	
50.6 - 54.2	3.6	Coarse grained quartz sandstone with pebble beds	

Diamond drill hole DD83KR5 completed at a total depth of 300.46m, was collared at grid co-ordinates 4850mE, 5000mN to test the gravity response.

A lithologic summary and stratigraphic correlations follow:-

Interval	Thickness	Lithology	Age/Formation
0.0 - 41.6	41.6	Oxidised poorly sorted coarse grained quartz sandstone, minor pebble beds	UPPER CARBONIFEROUS
41.6 - 43.9	2.3	Pyritic carbonaceous shale - mudstone, unoxidized	BORDER CREEK FORMATION
43.9 - 52.7	8.8	Pyritic, carbonaceous interbedded shales siltstone and quartz sandstone, conglomeratic at base.	
		~~	DISCONFORMITY

Interval	Thickness	Lithology	Age/Formation
52.7 - 164.60	111.9	Barren coarse grained quartz sandstone. Base of oxidation 130.7m. Minor interbedded shale and siltstone towards the base. Disseminated pyrite below 130.7m.	POINT SPRING SANDSTONE
164.6 - 204.4	39.8	Banded to massive, grey variably calcareous quartz sandstone, minor argillaceous interbeds. Pyritic, and carbonaceous in part. Current bedded.	BURVILL BEDS
204.4 - 234.8	30.4	Laminated, pyritic grey shales with minor interbedded siltstone and fine clastics.	
234.8 - 263.5	28.7	Lithologically similar to interval 164.6m - 204.4m	MILLIGANS BEDS
263.5 - 300.5	37.0	Lithologically similar to interval 204.4m - 234.8m Shales appear glauconitic in part, and are weakly pyritic.	

Density measurements taken on 50cm lengths of core at 2 to 3 intervals above 160m and 1 metre intervals below 160m disclosed values approximately 2.30gm/cc above 164m increasing to 2.56gm/cc below 204m (Plan NTd 3225)

6.2 Discussion of Results

All lithologies are essentially flat lying and devoid of any secondary fracturing or alteration. A 50m+ thick sequence of fluviatile clastics, intersected in both holes, correlates with the Upper Carboniferous Border Creek Formation. This sequence comprises a basal conglomerate overlain by up to 14m of poorly sorted silty sandstones fining upward to grey pyritic mudstones bearing carbonaceous plant remains .

In DD83KR5 the Border Creek Formation disconformably overlies a sequence of Lower Carboniferous fluvioparalic sediments. The upper unit, a moderately sorted coarse grained quartz sandstone, 112m thick, is correlated with the Point Spring Sandstone. The base of oxidation occurs at 130.7m, below which this unit is pyritic and contains numerous carbonaceous plant remains.

The Point Spring Sandstone is conformably underlain, through a gradational contact, by a 40m+ unit of pyritic, current bedded, fossiliferous calcareous sandstones and minor interbedded argillites, tentatively assigned to the Burvill Beds.

Predominantly argillaceous sediments of the lowermost 96m of the hole are arbitrarily assigned to the Millisans Beds. Generally higher rock densities support this lithologic subdivision (Plan NTd 3225). The contact between the Burvill Beds and the Millisans Beds is placed at about 204m, but lithologies change gradationally with depth and the interval 263.5 - 204.4m is suggestive of cyclic deposition. Weakly pyritic laminated shales are glauconitic in the lowermost 20m of the hole.

Thus, carboniferous sediments exhibit an upward gradational change in depositional environment from shallow marine through tranquil deltaic to lagoonal conditions. This sequence is disconformably overlain by terrestrial sediments of the Upper Carboniferous.

All lithologies intersected are essentially undisturbed and flat-lying, devoid of any secondary fracturing or alteration. No anomalous basemetal values were obtained from split core.

6.3 Geophysical Borehole Logging

Both drillholes were logged with a SIE T450 portable logger. The results are presented in Plan Nos NTd 3285, 3286 and 3287.

7.0 REFERENCES

Jenke G.P., 1982	EL 2376 Keep River, NT Annual Report for the Period Ending 23rd June, 1982 CRAE Report No 11763 (unpublished)
Jenke G.P., 1983	EL 2376 Keep River, NT Annual Report for the Period Ending 23rd June, 1983 CRAE Report No 12247 (unpublished)
Johnston W.H., 1981	EL 2376 Keep River, NT Annual Report for the Period Ending 23rd June, 1981 CRAE Report No 10641 (unpublished)
Johnston W.H., 1983	Coal Licence No. 1, Bonaparte, NT Final Report CRAE Report No 12130 (unpublished)
Laws R., 1981	The Petroleum Geology of the Onshore Bonaparte Basin. A.P.E.A. Journal Vol 21 Pt 1
Veevers, J.J. 1968 and Roberts, J.	Upper Palaeozoic Rocks, Bonaparte Gulf Basin of NW Australia BMR Bulletin 97

8.0 KEYWORDS

Lead, zinc, limestone, shale, facies-shallow marine, Palaeozoic, carbonate-hosted, shale-hosted, drill-diamond, geophys-grav, geophys-IP, geophys-mag.

9.0 LOCATION

Auvergne SD52-15
Lesune 4767

10.0 LIST OF PLANS

Plan No.	Title	Scale
NTd 2088	Location Plan EL 2376 Keep River, NT	1:250 000
NTd 3221	Drill Hole Locations and Geology	1:100 000
NTd 1997	Bouguer Gravity Contours	1:50 000
NTd 3222	Residual Gravity Profiles, IP Conductors and Drill Collars	As shown
NTd 3225	Core Densities and Stratigraphic Column for DD83KR5	1:1 000
NTd 3287	DD83KR4 Geophysical Logs	1:200
NTd 3288	DD83KR5 Geophysical Logs 0-160m	1:200
NTd 3289	DD83KR5 Geophysical Logs 150-300m	1:200

11.0 LIST OF APPENDICES

Appendix 1 Drill Logs and Assays

APPENDIX 1

DRILL LOGS AND ASSAYS

C.R.A. EXPLORATION PTY LIMITED

PROJECT KEEP RIVER EL 2376

WATER BORE **DRILL CORE LOG**

CO-ORDINATES 4950mE 5000mN AZIMUTH _____ DRILLERS White Drilling COMMENCED 25.9.83 DEPTH 26m HOLE No. _____

RL COLLAR _____ INCLINATION Vertical DRILL TYPE EDSON 6000 COMPLETED 25.9.83 CASING LEFT PVC to 4m DPO No(s) _____

DEPTH FROM(M)	DEPTH TO(M)	CORE REC. (M)	CORE SIZE	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES WEATH., ALTERATION, FRACTURING VEINING, MINERALIZATION	SAMPLE No.	FROM (M)	TO (M)	REC (M)	ASSAY VALUES Cu	Pb	Zn	Ag	As	Au
0	3·5				Ferruginous; lateritized red sandstone											
3·5	6·5				Poorly sorted coarse grained quartz sandstone											
6·5	10·0				Med coars grained quarts sandstone											
10·0	26·0				white quartz sandstone. Good water at 15m.	Damp sand 11m.										
					26m total dept	Bore flow: 1500+ galls/hr										

SUMMARY AND SPECIAL COMMENTS _____

LOGGED BY S.L. ALLNUTT DATE 25.9.83

SHEET 1 OF 1

C.R.A. EXPLORATION PTY. LIMITED

PROJECT KEEP RIVER EL 2370

DIAMOND DRILL CORE LOG

CO-ORDINATES 5050mE 5000mN | AZIMUTH | DRILLERS WHITE DRILLING | COMMENCED 26.7.83 | DEPTH 54.2m | HOLE No DD83KR4

RL COLLAR 25.00m elev'n | INCLINATION vert 0° | DRILL TYPE Edson "6000" | COMPLETED 27.7.83 | CASING LEFT 6m PVC | DPO No(s)

DEPTH FROM(M)	DEPTH TO(M)	CORE REC. (M)	CORE SIZE	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES WEATH., ALTERATION, FRACTURING VEINING, MINERALIZATION	SAMPLE No.	FROM (M)	TO (M)	REC (M)	ASSAY VALUES Cu	Pb	Zn	Ag	As	Au
0·00	3·07				PRECOLLAR: Loose quartz sand to 2m.											
					5 inch hammer: Laterite 2m to 3m.											
				Fe Fe												
3·07	39·32	35·56	HQ to		Buff to yellow v.coarse grained to granular poorly	oxidised, trace of white mica										
			22·95		sorted quartz sandstone.	on ferruginous veins, 3.9m										
			NQ-EOH		Granular & pebbly interbeds 8.82m & 10.16m, 26.81m with	ocassional fractures										
					waterworn quartzite pebbles up to 7cm across at the	at between 30° to 45° to										
					latter interval. Minor siltstone laths also occur in	LCA with Mn coatings										
					these conglomeratic beds. Sandstones generally better	variably clay rich at 6.61;										
					sorted between 22.32m-39.32m. 15.5m;	22.3m; 22.32 - 39.32 core										
10m					BORDER CREEK FORMATION	more highly fractured.										
						Yellow-red clay bands 10cm -										
						1cm wide at 10.42m $ 11.4m										
						respectively.										
						Bedding indistinct but right										
						angles to LCA.										
						Sandstone heavily ferrug-										
						inised over the basal 20cm.										
20m				Mn Fe												
30m																
40m	39·32	41·70	1·83	NQ	Red oxidised fg siltstone overlying grey silty claystone	55cm core loss in red fissile silstone bedding horizontal. Numerous coal laminae & plant fossils progressively more oxidised over lower 3m. "Leisegang rings" present.										
	41·70	50·60	8·90		Grey, friable clay & silt rich poorly sorted quartz sst fining upward.											
50m																

SUMMARY AND SPECIAL COMMENTS Granular to coarse grained poorly sorted quartz sandstone, minor pebble beds and interbedded red siltstone and carbonaceous claystone at 39.32m extending for 2.4m BORDER CREEK FORMATION.

LOGGED BY S.L. Allnutt DATE 26.7.83

SHEET 1 OF 2

C.R.A. EXPLORATION PTY. LIMITED

PROJECT KEEP RIVER

DIAMOND **DRILL CORE LOG**

CO-ORDINATES 5050E 5000N AZIMUTH _____ DRILLERS White Drilling COMMENCED 26.7.83 DEPTH 54.2m HOLE No DD83KR4

RL COLLAR 25.00m Elev INCLINATION vertical DRILL TYPE Edson "6000" COMPLETED 27.7.83 CASING LEFT 62m DPO No(s) _____

DEPTH FROM(M)	DEPTH TO(M)	CORE REC. (M)	CORE SIZE	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES WEATH., ALTERATION, FRACTURING VEINING, MINERALIZATION	SAMPLE No.	FROM (M)	TO (M)	REC (M)	ASSAY VALUES Cu	Pb	Zn	Ag	As	Au
50·60	54·2	3·60	NQ		Buff-cream coarse grained quartz sandstone, occassional waterworn pebble/granular quartzite unit-with a matrix supported fabric.	H_2O loss at 50.3cm -cavity? oxidised.										
				E.O.H.												

SUMMARY AND SPECIAL COMMENTS BORDER CREEK FORMATION - CLOSE TO BASE

LOGGED BY S.L. Allnutt DATE 27.7.83

SHEET 2 OF 3

C.R.A. EXPLORATION PTY. LIMITED

PROJECT KEEP RIVER EL 2376

DIAMOND **DRILL CORE LOG**

CO-ORDINATES 4850E 5000N | AZIMUTH | DRILLERS White Drilling | COMMENCED 28.7.83 | DEPTH 300.46m | HOLE No. DD83KR5

RL COLLAR 26.41m elevation | INCLINATION vertical | DRILL TYPE Edson "6000" | COMPLETED 3.8.83 | CASING LEFT steel to 12m PVC to 24.7m | DPO No(s)

DEPTH FROM(M)	DEPTH TO(M)	CORE REC. (M)	CORE SIZE	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES WEATH., ALTERATION, FRACTURING VEINING, MINERALIZATION	SAMPLE No.	FROM (M)	TO (M)	REC (M)	ASSAY VALUES Cu	Pb	Zn	Ag	As	Au
0·00	41·6	41·6	6" OH		Precollar: 6" Hammer to 12m; 5"Hammer to 24.67m											
					Om-24.67m: White to yellow quartz, coarse grained	Water Table at 12m.										
				Fe	sandstone	Good water flow @ 19m, in										
					laterite 3 to 4m	excess of 2000 gals/hr										
					BORDER CREEK FORMATION:	oxidised to 41.63m										
					Yellow to buff very coarse grained to granular, barren	Bedding indistinct but										
					quartz sandstone. Poorly sorted, occassional waterworn	lithologic contacts horizon-										
					pebble beds and isolated clasts.	al sandstones all porous &										
						permeable.										
			5" OH													
			HQ		24.67m-41.59m HQ.	HQ coring 24.67m to 50.7m										
					Occassional pebbles of waterworn quartzite.											
				Fe	Conglomerate, clast up to cobble size minor current											
41·6	43·9	2·3	HQ		bedded sandstone	41.59-41.63m Maroon to red										
					Grey to mauve shale minor quartz rich fine grained silty	siltstone.										
				Py	sandstone interbeds. Carbonaceous: not oxidised.	41.63-43.9 grey shale, with										
43·9	52·7	8·8	HQ	Py	Interbedded shale siltstone and sandstone laminates	disseminated & "occassional"										
				Py	grading downward to coarse grained silt clay rich	blebs of pyrite.										
				Py	carbonaceous in part sandstone. Conglomeratic at base	Bedding horizontal.										
					Minor ripple cross laminations & loading features at											
				Py	shale - sandstone contacts. Not oxidised.	Veneer of pyrite at 49.45m										
				Py		& 49.84m.										

10m 20m 30m 40m 50m

SUMMARY AND SPECIAL COMMENTS BORDER CREEK FORMATION - coarse grained quartz sandstones, minor pebble & conglomerate lenses with basal gre-mauve shale and silty sandstone

LOGGED BY S.L. Allnutt DATE 28.7.83

SHEET 1 OF 6

C R A. EXPLORATION PTY. LIMITED

DIAMOND DRILL CORE LOG

PROJECT KEEP RIVER EL 2376

CO-ORDINATES 4850E 5000N AZIMUTH _____ DRILLERS White Drilling COMMENCED 28.7.83 DEPTH 300.46m HOLE No. DD83KR 5

RL COLLAR 26.41m elevation INCLINATION vertical DRILL TYPE Edson "6000" COMPLETED 3.8.83 CASING LEFT steel to 12m PVC to 24.7m PPO No(s) _____

DEPTH FROM(M)	DEPTH TO(M)	CORE REC. (M)	CORE SIZE	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES WEATH., ALTERATION, FRACTURING VEINING, MINERALIZATION	SAMPLE No.	FROM (M)	TO (M)	REC (M)	ASSAY VALUES Cu	Pb	Zn	Ag	As	Au
			NQ			NQ 50.7m to E.O.H.										
					Conglomeratic - matrix supported fabric	oxidised below 51.06m.										
52.7	164.60	111.9			Unconformity: 6cm clay bed at 52.2m.	BASE OF BORDER CREEK FORM.										
					POINT SPRING SANDSTONE	-ATION 52.67m.										
					Moderately sorted yellow variably very coarse to coarse											
					grained quartz sandstone, occassional pebbles and	oxidised to 130.7m.										
					clay bands. The latter occurring more frequently in the											
					lower 44 metres.											
					waterworn quartzite pebbles.											
					minor 1cm clay band.											
						fractures 30° to LCA.										
					Grain size changes; to coarse-medium grained quartz sandstone.											
					Minor clay bands up to 7cm thick @ 78.77m'79.82m;79.82m; 80.25m; 80.35m.											
					Grain size fine-medium grained between 89.3m-93m.											
						Highly fractured mauve s.st 90.4-93.3m.											
						leisegang rings developed										
						ferruginous stringers										
						occur at 4 to 10cm intervals										
						from 95m to base of oxida-										
						tion usually aligned @ 80°-										
						90° to LCA.										

60m 70m 80m 90m 100m

SUMMARY AND SPECIAL COMMENTS UNCONFORMABLE contact between overlying BORDER CREEK FORMATION and coarse grained clastics of the POINT SPRING SANDSTONE occurs at 52.67m.

LOGGED BY S.L. ALLNUTT DATE 29.7.83

SHEET 2 OF 6

C.R.A. EXPLORATION PTY. LIMITED

PROJECT KEEP RIVER EL 2376

DIAMOND DRILL CORE LOG

CO-ORDINATES 4850E 5000N | AZIMUTH | DRILLERS White Drilling | COMMENCED 28.7.83 | DEPTH 300.46m | HOLE No. DD83KR5

RL COLLAR 26.41m elevation | INCLINATION vertical | DRILL TYPE Edson "6000" | COMPLETED 3.8.83 | CASING LEFT steel to 12m PVC to 24.7m | PO No(s)

DEPTH FROM(M)	DEPTH TO(M)	CORE REC (M)	CORE SIZE	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES WEATH., ALTERATION, FRACTURING VEINING, MINERALIZATION	SAMPLE No.	FROM (M)	TO (M)	REC (M)	ASSAY VALUES Cu	Pb	Zn	Ag	As	Au
				Fe												
				Fe												
				Fe												
				Fe												
				Fe												
				Fe												
				Fe												
				Fe												
110m				Fe												
						Leisegang rings.										
120m					Minor clay interbeds 120.3m; 122.3m; 122.5m; 123.9m;											
					129m.											
						Bedding 90° to LCA.										
						Minor vertical fractures.										
130m						BASE OF OXIDATION 130.7m.										
				ρ	Grey carbonaceous variably pyritic coarse grained	- sharp contact.										
				Py ρ	quartz sandstone. The darker grey carbonaceous	Pyritic ubiquitous as										
				ρ	clay rich laminates exhibit wavey bedding and have	disseminations and occassional										
				Py	plant imprint on partings. Minor coarse-med grain s.st	blebs to 164.6m minor coal										
				ρ	"rolls" occur in finer grained sediments, imparting a	laminae at 132m.										
				Py ρ	contorted nature to bedding.											
				ρ												
				Py												
140m				ρ												
				Py												
				ρ												
				Py												
				ρ												
					20cm clay/shale bed.											
				Py												
				Py												
150m																

SUMMARY AND SPECIAL COMMENTS: POINT SPRING SANDSTONE, base of oxidation at 130.7m. Fresh rock is grey carbonaceous variably pyritic quartz sandstone

LOGGED BY S.L. ALLNUTT DATE 30.7.83

SHEET 3 OF 6

C.R.A. EXPLORATION PTY. LIMITED

PROJECT KEEP RIVER EL 2376

DIAMOND DRILL CORE LOG

CO-ORDINATES 4850E 5000N | AZIMUTH | DRILLERS White Drilling | COMMENCED 28.7.83 | DEPTH 300.46m | HOLE No. DD83KR5

RL COLLAR 26.41m elevation | INCLINATION vertical | DRILL TYPE Edson "6000" | COMPLETED 3.8.83 | CASING LEFT PVC to 24.7m steel to 12m | MPO No(s)

DEPTH FROM(M)	DEPTH TO(M)	CORE REC. (M)	CORE SIZE	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES WEATH., ALTERATION, FRACTURING VEINING, MINERALIZATION	SAMPLE No.	FROM (M)	TO (M)	REC (M)	ASSAY VALUES Cu	Pb	Zn	Ag	As	Au
				Py	cross bedded siltstones and small scour structures											
					present. Laminated grey shale, minor sand	bedding horizontal, weakly,										
					Minor ripples and scour channels.	contorted disseminated pyrite.										
				Py		minor clay rich carbonaceous										
					Graded bedding, over 5 to 10cm intervals.	stringers.										
				Py												
				Py	Minor graded bedding over 5cm-10cm intervals coarse											
160m					grained-fine grained sandstone, minor siltstone.											
				Py												
				Py												
164.6	182.6	18.0			BASE OF POINT SPRING SANDSTONE 164.6m											
					BURVILL BEDS? conformable & gradational contact	Py blebs 165.2; 165.5, 166.15m										
				Py												
				Py	banded light-dark grey occassionally massive fine	168.8m $\frac{1}{2}cm^2$ bleb black coal										
				Py	grained, in part calcareous, sandstone with interbedded	in silty-sandstone.										
				Py	laminated siltstone and shale. Disseminated pyrite	calcareous silty sandstone										
170m				Py	ubiquitous. Argillaceous component exhibits contorted-	med grained evidence of bio-										
				Py	wavey bedding with "eyes" of sandstone.	turbation. 168.5m for 25cm.										
						massive slugs of pyrite up										
				Py		to 1cm x 2cm.										
					calcareous interval sandstone	vertical fractures.										
				Py		Bedding horizontal.										
						Carbonate occurs in matrix-										
				Py		cement.										
				Py												
						fractures 30° to LCA minor										
180m						clay & calcite developed at										
						intersections and on f.planes										
				Py												
182.6	192.6	10.0		Py	Similar to unit above, bedding more contorted, shales	Disseminated pyrite thru'out										
					more dominant minor interbedded calcareous sandstones.	Bedding horizontal.										
				Py	The light grey variably calcareous & siliceous siltstone	Carbonate in matrix common.										
					sandstone occur as elongate lenses within dark grey											
					argillites.											
				Py	laminated siliceous siltstone.											
				Py		incipient intraformation										
						brecciation. Minor current										
190m						bedding in sandstones.										
192.6	195.7	3.1			laminated grey-black shales, silt content increasing in	bedding horizontal: dissemin-										
				Py	lower 50cm. Bedding in part wavey & convoluted.	pyrite.										
195.7	204.4	8.7			Similar to interval 164.6-182.64m. Banded light-dark	disseminated pyrite.										
					grey appearance. Upper 4.5m is dominantly fine grained	calcareous, fossiliferous top										
					siliceous sandstone minor shale, intermittently	60cm. vertical calcite filled										
					calcareous.	fractures at 195.86m.										
200m																

SUMMARY AND SPECIAL COMMENTS: Conformables contact & gradational at 164.6m between coarse grained pyritic and carbonaceous quartz sandstones of the POINT SPRING SANDSTONE & underlying rhythmically 'bedded' shales siltstones & sandstones, varibly pyritic & calcareous, of the BURVILL BEDS.

LOGGED BY S.L. ALLNUTT DATE 31.7.83

SHEET 4 OF 6

C.R.A. EXPLORATION PTY. LIMITED

DIAMOND **DRILL CORE LOG**

PROJECT KEEP RIVER EL 2376

CO-ORDINATES 4850E 5000N AZIMUTH — DRILLERS White Drilling COMMENCED 28.7.83 DEPTH 300.46m HOLE No. DD83KR5

RL COLLAR 26.41m elevation INCLINATION vertical DRILL TYPE Edson "6000" COMPLETED 3.8.83 CASING LEFT steel to 12m PVC to 24.2m DRO No(s)

DEPTH FROM(M)	DEPTH TO(M)	CORE REC. (M)	CORE SIZE	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES WEATH., ALTERATION, FRACTURING VEINING, MINERALIZATION	SAMPLE No.	FROM (M)	TO (M)	REC (M)	ASSAY VALUES Cu	Pb	Zn	Ag	As	Au
				Py		flame structures present.										
						"Birdseyes" of light grey										
				Py		siliceous s.st/siltstone in										
				Py		convoluted laminated shales										
204.4	230.2	25.8			← ARBITRARY BASE OF BURVILL BEDS - GRADATIONAL CONTACT											
				Py	with MILLIGANS BEDS											
					Laminated dark grey shale with minor light grey wavey -	Bedding horizontal dissem-										
				Py	convolute interbeds of v.fine sandstone and minor	nated pyrite ubiquitous										
					"lenses" of buff?dolomitic siltstone.	slugs & blebs of pyrite										
210m				Py		common at 216-219m.	"									
				Py												
					low amplitude, current bedding											
				Py		thin calcite laminae										
				Py		parallel bedding @214m;										
				Py		214.7m; 215.46m. 216.4m.										
				Py	Shale content increases in lower 13 metres.											
				Py												
220m																
					221.1m minor chalcedonic fracture infill in contorted	calcite laminae										
				Py	lensoidal buff siltstone "clasts".											
						calcite laminae										
				Py												
						numerous calcite laminae,										
				Py		some exhibit dislocations										
				Py												
							765990	228	231	15	10	75	X	3	X	
230m																
230.2	234.8	4.6		Py	Massive dark grey-green laminated siltstone bearing	Redding horizontal light										
					flecks of carbonaceous debris. High clay content.	grey carbonate rich band	765991	231	234	10	10	20	X	1	X	
					Variably calcareous. CALCILUTITE?	2-6cm wide										
				Py		Disseminated pyrite with										
				Py-Py		massive slugs common in	765992	234	235	15	10	30	X	X	X	
				Py		lower 1.3m.	765993	235	237	25	20	65	X	8	X	
234.8	263.5	28.7			Banded, to massive inpart, variably calcareous and											
					carbonaceous quartz sandstone, minor wavey interbedded	plant fossil 237.1m.	765994	237	240	25	20	60	X	3	X	
					laminated shales/siltstone. Equivalent to 164.6-182.63m											
240m					unit.											
					Evidence of channel scours in coarse grain clastic beds	coal laminae 241.94m.	765995	240	243	20	25	45	X	2	X	
				Py												
				Py		pyrite slugs 242.5-242.9m										
						" " 243.2-243.5m										
						245.3 gastropods bioturba-										
				Py		tion-snail burrows etc extend										
				Py		vertically up to 15cm										
				Py		Abundant slugs Py:-247.3-										
250m						247.85m. Bedding at 80° to										
						CA for 75cm.										

SUMMARY AND SPECIAL COMMENTS Gradational boundary between BURRVILL BEDS conformably overlying MILLIGANS BEDS at 204.4m.

LOGGED BY S.L. ALLNUTT DATE 2.8.83

SHEET 5 OF 6

C.R.A. EXPLORATION PTY. LIMITED

DIAMOND DRILL CORE LOG

PROJECT KEEP RIVER EL 2376

CO-ORDINATES 4850E 5000N | AZIMUTH | DRILLERS White Drilling | COMMENCED 28.7.83 | DEPTH 300.46m | HOLE No. DD83KR5

RL COLLAR 26.41m elevation | INCLINATION vertical | DRILL TYPE Edson "6000" | COMPLETED 3.8.83 | CASING LEFT steel to 12m PVC to 24.7m | PO No(s)

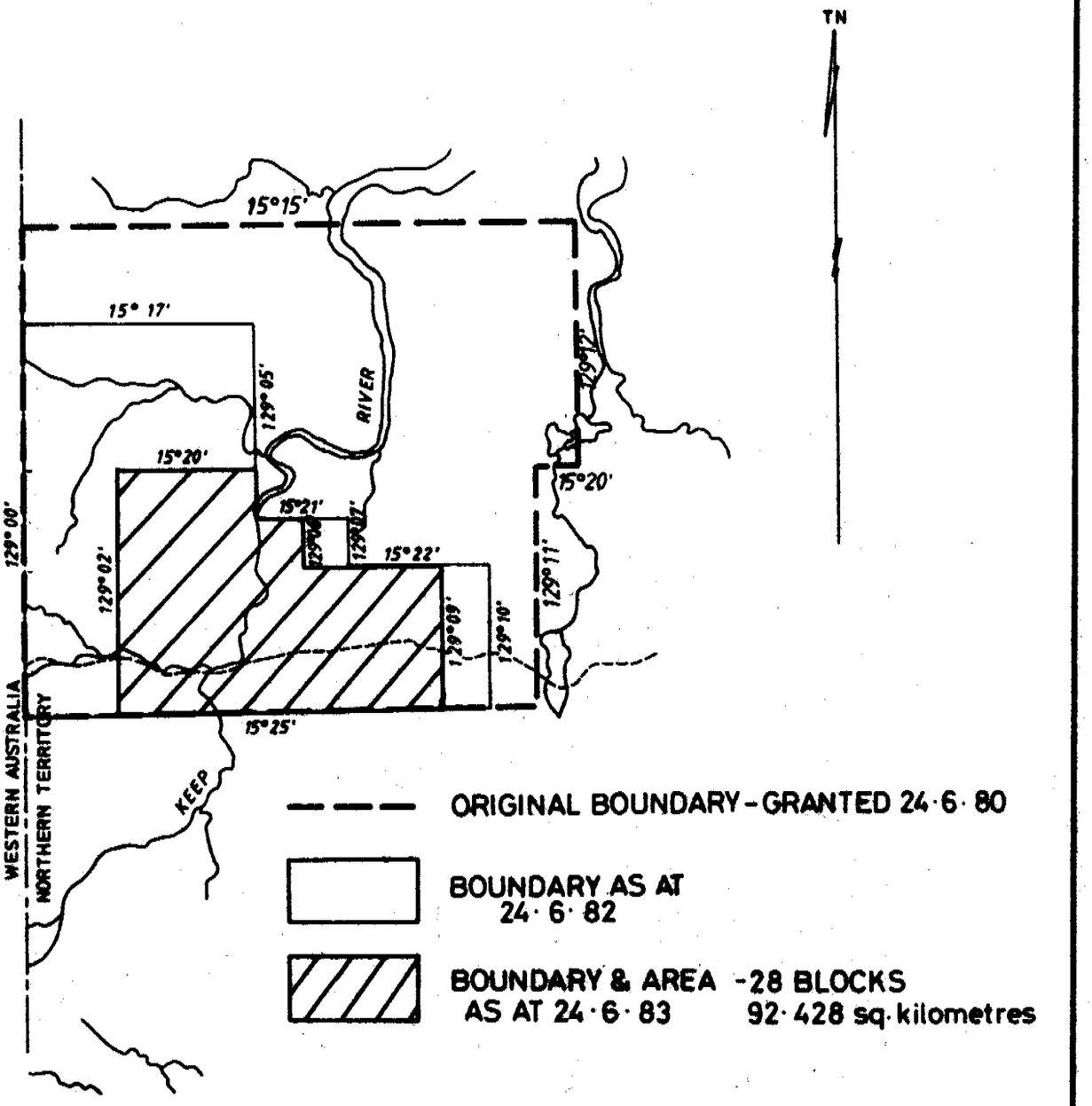
DEPTH FROM(M)	DEPTH TO(M)	CORE REC (M)	CORE SIZE	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES WEATH., ALTERATION, FRACTURING VEINING, MINERALIZATION	SAMPLE No.	FROM (M)	TO (M)	REC (M)	ASSAY VALUES Cu	Pb	Zn	Ag	As	Au
				Py		Minor fault planes 251.7m										
				Py	Argillaceous interbeds more frequent in lower 9m.											
				Py												
260m				Py		259.4m buff?dolomitic"halo"										
						around blebs of pyrite-up to										
						1cm x 3cm.										
				Py												
263·5	300·5	37·0			Gradational boundary over upper 2m as the argillaceous	Carbonaceous leaf imprints										
					content increases.	on shale partings @ 263.8m.										
					Equivalent, of the interval 204.4 to 230.2m	Minor fault @ 264.6m 10°toCA										
					Dark grey laminated shales and carbonaceous sl.sts with	bedding predominantly										
					minor interbedded calcareous ssts 2 to 8cm wide	horizontal.										
					Minor buff? dolomitic sl.st lenses interbedded.	Unit only weakly pyritic and										
270m				Py		then restricted to the										
						coarser grained interbeds/										
						laminates.										
						coal laminae 271.4m										
						x cutting calcite laminae										
						274.5m.										
				Py												
280m						bedding 60°toCA279.8-280.1m										
						channel/scour fill.										
						shales easily fractures btwn										
						281-288m with a "polish" on										
						partings. Cross fractured										
						40°toCA 284m to 287m.										
					Shales develop a greenish hue to EOH ? glauconitic	bedding 55°toCA283.26m-284.1m										
290m				Py		Trace Py in coarsergrained										
						calcareous & qtz rich inter										
						beds. Minor elliptical clasts										
						of slst and shale within										
						glauconitic shales.										
					sl.st and minor interbeds of fine grained quartz sst											
					more frequent in lower 4m.	calcite laminae along part-										
						ings in shale.										
300m					E.O.H. 300.46											

SUMMARY AND GEOLOGICAL SPECIAL COMMENTS

MILLIGANS BEDS laminated-wavey interbedded carbonaceous shales and siltstones - with minor variably calcaeous fine grained sandstones beds.

LOGGED BY S.L. ALLNUTT DATE 23.8.83

SHEET 6 OF 6



1:250,000 SHEET AREA

0 5 10 15 20 kilometres

CRA EXPLORATION PTY LIMITED

LOCATION PLAN
EL 2376
KEEP RIVER
NORTHERN TERRITORY

REFERENCE SD 52-15 AUVERGNE	
SCALE 1:250,000	DATE OCTOBER 1983
AUTHOR GPJ	REPORT 12364
DRAWN SRJ	PLAN No NTd 2088

CR 84/1

KEEP RIVER 1

Skull Creek

(Abandoned)

KEEL RIVER

TN

129° 00'

WESTERN AUSTRALIA

KUNUNURRA 55 km

BC 6 - T.D. 103·0 m.
SHALY COAL 77·3 - 77·8 m.
85·8 - 86·2 m.

BC 10 - T.D. 103·0 m.
BASE OF OXIDATION 15m.
BARREN

BC 9 - T.D. 97·0 m.
BASE OF OXIDATION 15m.
BARREN

BC 23 - T.D. 16·0 m.
CAINOZOIC SEDIMENTS

ORIGINAL BOUNDARY OF EL 2376

DD83KR5 DD83KR4

RD80KR1

RD80KR3 RD80KR2

Czs

Czb

Cub

Clb

Duk

1st. REDUCTION
23rd. JUNE 1982

2nd. REDUCTION
23rd. JUNE 1983

LEGEND

Quaternary		Qc	Coastal deposites: mud, silt, evaporites
		Czs	Sand, soil, colluvium
		Czb	Black soil
Upper Carboniferous	BONAPART LIMESTONE FORMATION	Cub	Limestone, minor shale, conglomerate, sandstone
Lower Carboniferous	BURT RANGE FORMATION	Clb	Limestone, minor shale and sandstone
Upper Devonian	KELLYS KNOB SANDSTONE MEMBER	Duk	Quartz sandstone, pebbly in part
	RAGGED RANGE CONGLOMERATE MEMBER	Dur	Conglomerate sandstone

LEGEND

- Fence
- Track
- Bore
- Dam
- KEEP RIVER 1
- CRAE DRILL HOLE LOCATION
- No 2 Bore — WATER BORES (PERMIAN)
- GEOLOGICAL BOUNDARY
- FAULT
- PREVAILING STRIKE & DIP OF STRATA
- DIP 5°- 15°

NOTE

BC 10	*BONAPART COAL PERCUSSION HOLES*
RD80KR1	*1980 PERCUSSION DRILL HOLES*
DD83KR4	*1983 DIAMOND DRILL HOLES*

0 1 2 3 4 5 6 7 KILOMETRES

CRA EXPLORATION PTY LIMITED

KEEP RIVER-EL2376

DRILL HOLE LOCATIONS AND GEOLOGY

REFERENCE SD52-15 AUVERGNE	
SCALE 1:100,000	DATE OCTOBER 1983
AUTHOR SLA	REPORT 12364
DRAWN SRJ	PLAN No. NTd 3221

CR 84/1

500 000mE

520000mE

8315000mN

8300000mN

RD81 BC5
507800mE
8314750mN

RD81 BC5
507300mE
8314750mN

RD81 BC9
508700mE
8312500mN
Ion line BN1-80-021

OUTSIDE BOUNDRY DONATES EL BOUNDARY JUNE 1980

BOUNDARY JUNE 1982

102

104

106

108

110

RD81 BC 23
513950mE
8303700mN

5800mN

5000mN

4200mN

DD83KR4

DD83KR5

3500mE

6500mE

102

104

106

108

IP anomaly

DETAILED GRAVITY TRAVERSE

RD 80 KR 3
502200mE
8296500mN

RD 80 KR 2
504000mE
8296500mN

RD 80 KR 1
506500mE
8297200mN

INSIDE BOUNDARY DONATES EL BOUNDARY 1982

OUTSIDE BOUNDARY DONATES EL BOUNDARY JUNE 1980

NOTE:

STATION SPACING	Various (80, 160, and 200m)
SURVEYING	Quasco Northern Surveys Pty Ltd
METER READINGS	Geoex Pty Ltd., CRAE
DATA REDUCTION	CRAE
REFERENCE STATION	Permanent mark RLH7 109/12 near AMG 508100mE, 8303550mN Assumed absolute value 92 15 milligals Absolute value 978 392 15 milligals
LATITUDE CORRECTION	0·00041553 milligals per metre north-south relative to AMG 500000mE 8286400mN
ELEVATION CORRECTION	0·21650 milligals/metre
CONTOUR INTERVAL	0·5 milligals
BOUGER DENSITY	2·2 tm^{-3}

GN TN MN

Grid Convergence 0·1°

Grid/Magnetic Angle 3·5°

0 1 2 3 4 5 6 KILOMETRES

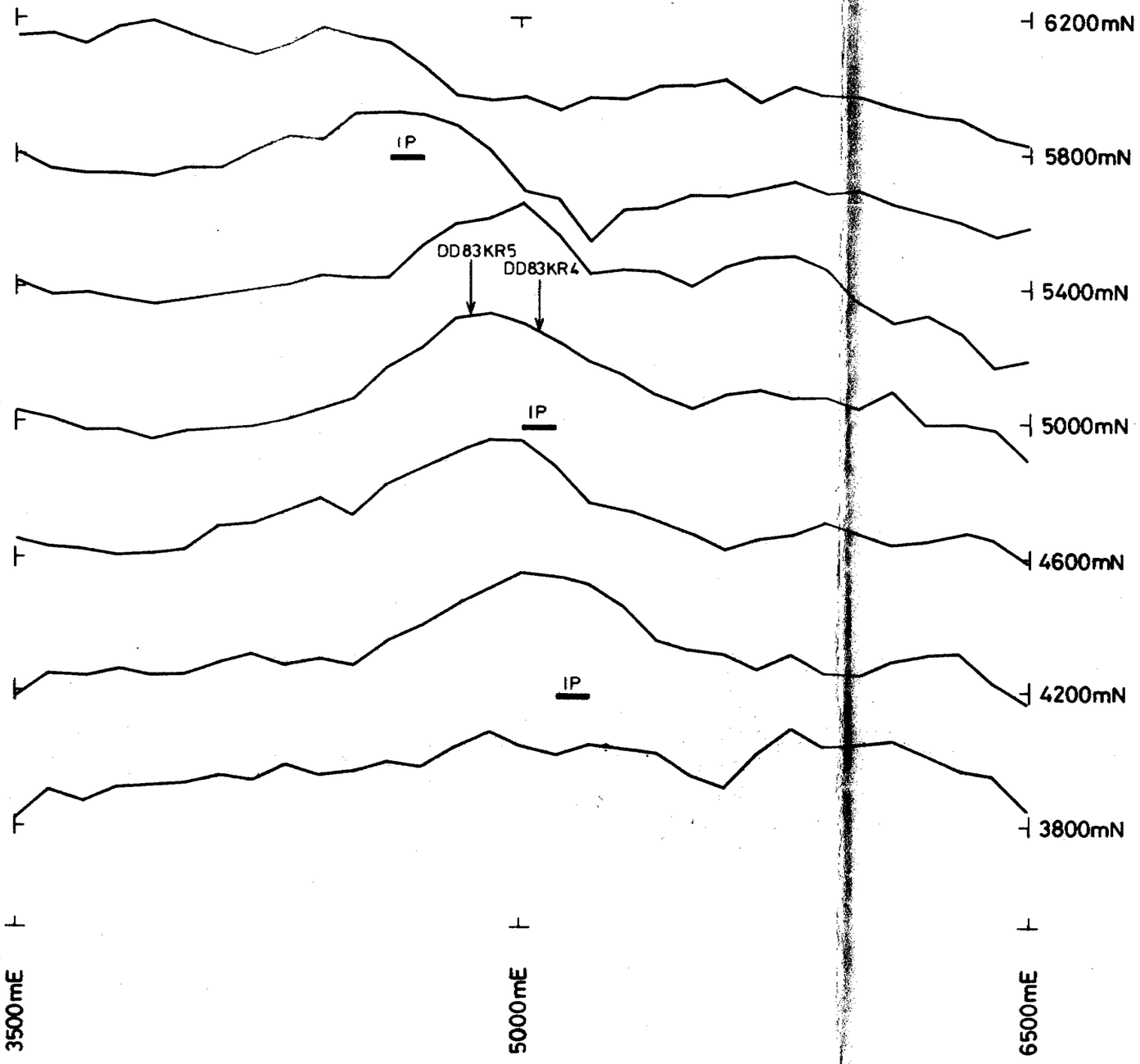
CRA EXPLORATION PTY LIMITED

KEEP RIVER EL 2376

BOUGER GRAVITY CONTOURS

REFERENCE AUVERGNE SD 52-15	
SCALE 1:50,000	DATE OCTOBER 1982
AUTHOR GPJ	REPORT 12364
DRAWN SRJ	PLAN No 1167 1997

CR 84/1



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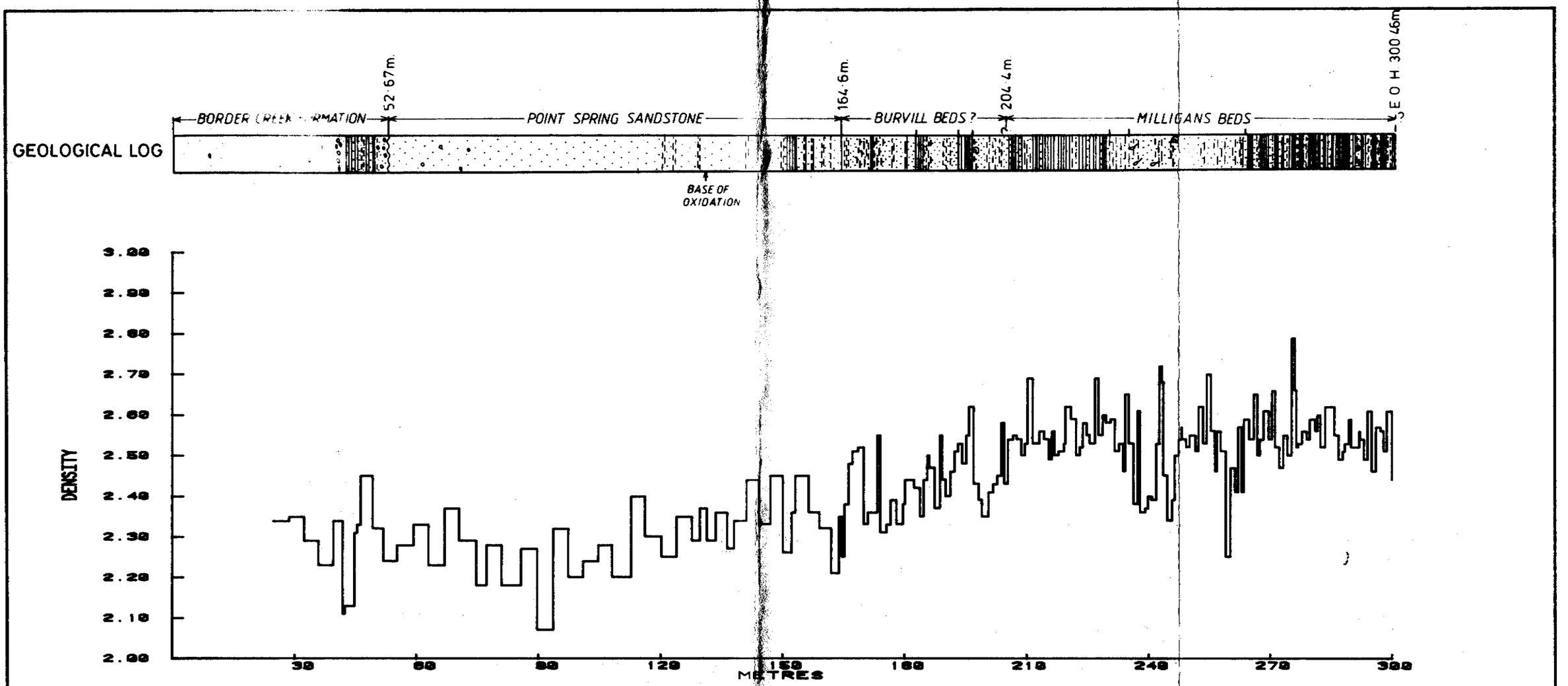
C R A EXPLORATION PTY LIMITED

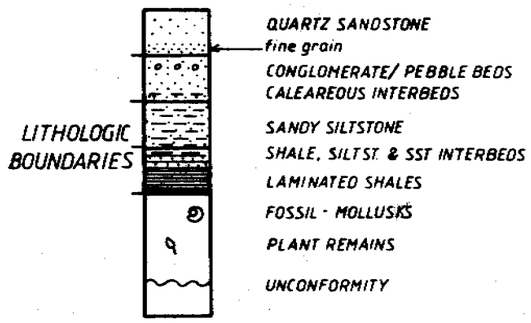
KEEP RIVER EL 2376

RESIDUAL GRAVITY PROFILES,
IP CONDUCTORS & DRILL COLLARS

REFERENCE *AUVERGNE SD 52-15*	
SCALE *AS SHOWN*	DATE *OCTOBER 1983*
AUTHOR *SLA/GPJ*	REPORT *12364*
DRAWN *SRJ*	PLAN No *NTD 3222*



LEGEND



CR 84/1

C R A EXPLORATION PTY LIMITED

KEEP RIVER-EL 2376

CORE DENSITIES AND STRATIGRAPHIC COLUMN FOR DD83 KR5

REFERENCE SD 52-15 AUVERGNE	
SCALE 1:1000	DATE OCTOBER 1983
AUTHOR SLA/GPJ	REPORT 12364
DRAWN SRJ	PLAN No NTd 3225

CRA EXPLORATION PTY. LIMITED

KEEP RIVER - EL2376

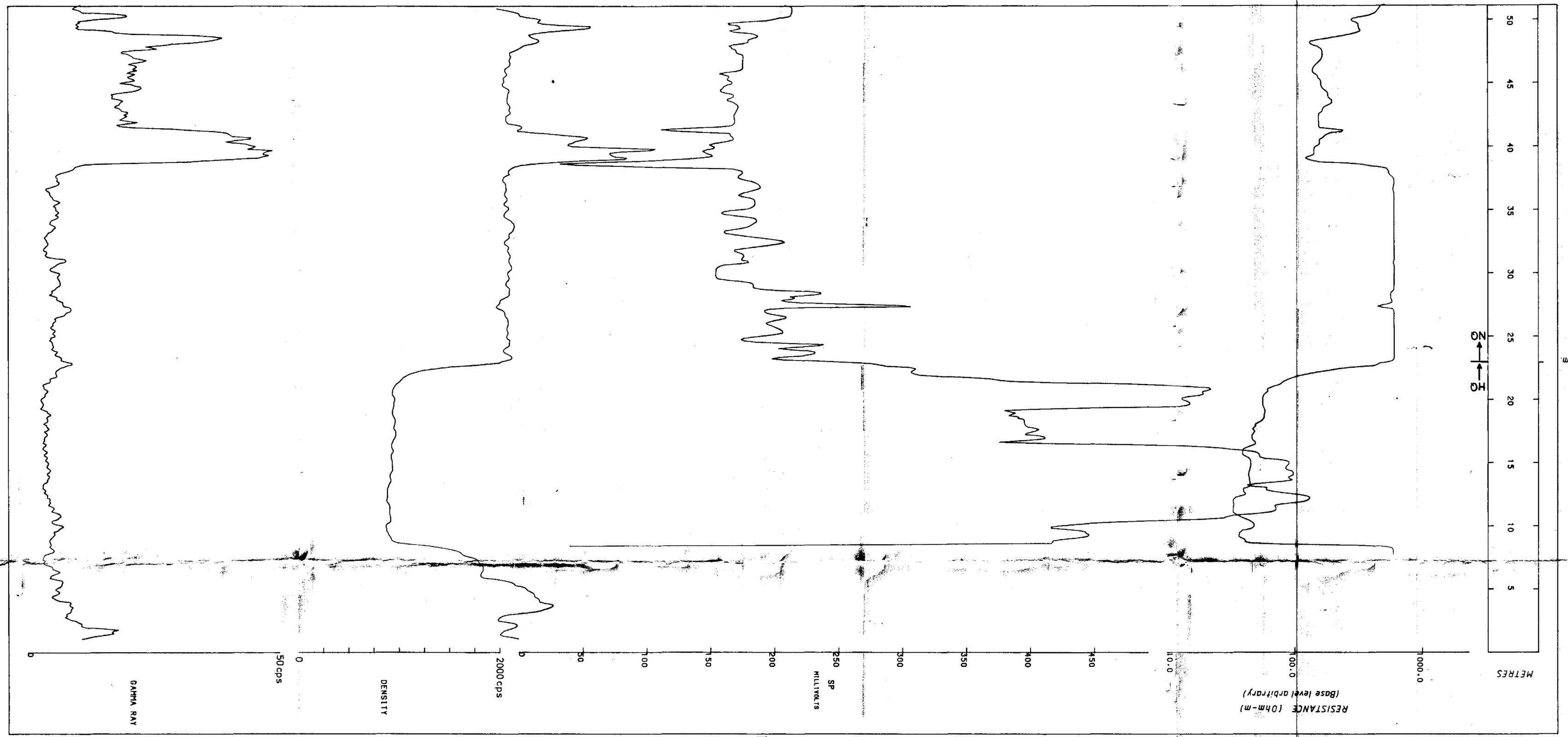
DD83 KR4

GEOPHYSICAL LOGS

REFERANCE AUVERGNE SD52-15

SCALE 1:200	DATE DECEMBER 1983
AUTHOR GPJ	REPORT 12366
DRAWN SRJ	PLAN No. MD 2287

LODGER
SIE T450

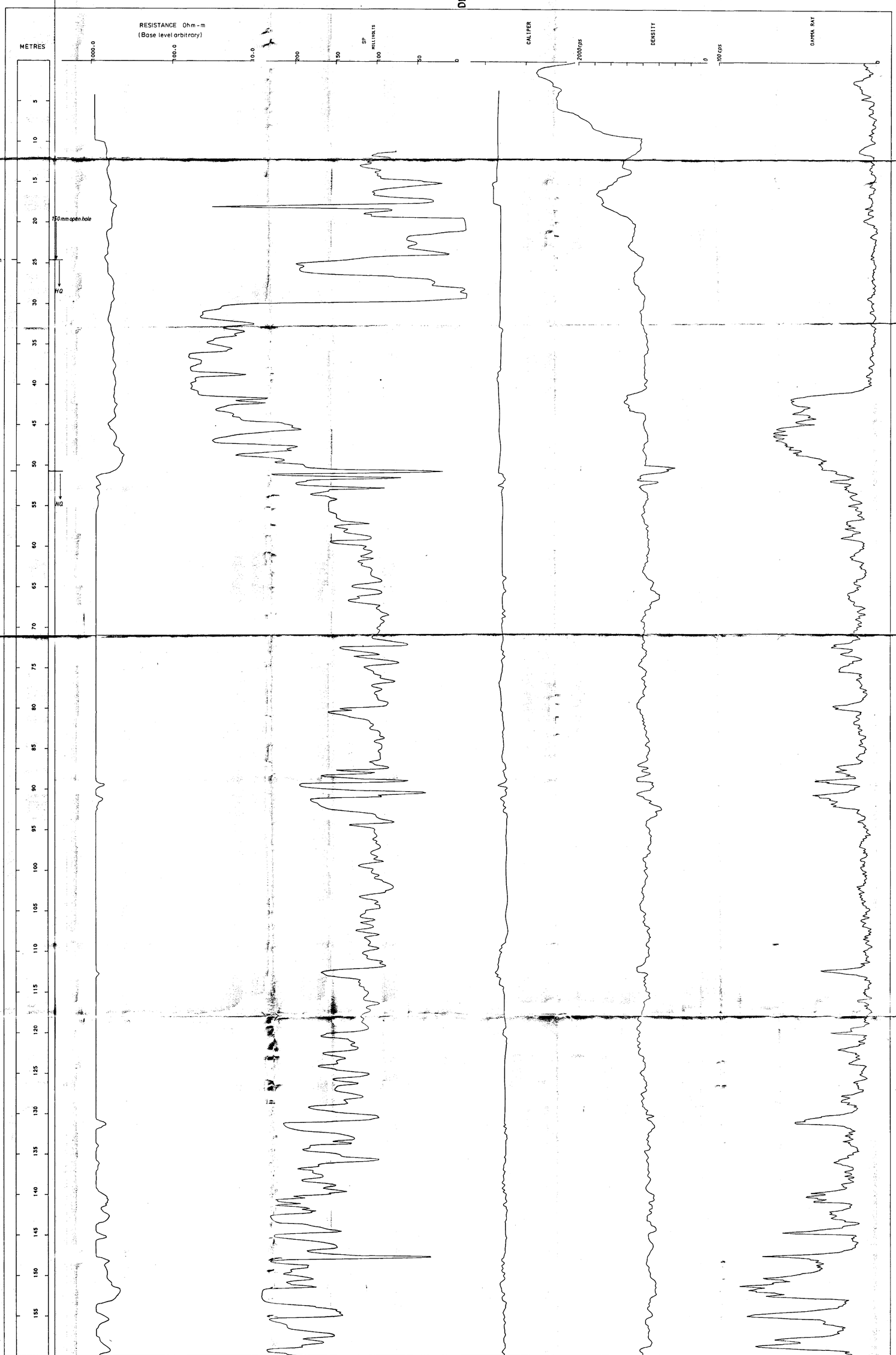


DD83KR4

DD83KR4

DD83KR5

DD83KR5



LOGGER:
SIE T450

CRA EXPLORATION PTY LIMITED	
KEEP RIVER-EL2376	
DD83 KR5	
GEOPHYSICAL LOGS 0-160m	
REFERENCE AUVERGNE SD52-15	
SCALE 1:200	DATE DECEMBER 1983
AUTHOR GPJ	REPORT 12364
DRAWN SRJ	PLAN No. NTG 3288

CR 84/1

DD83 KR5

DD83KR5

RESISTANCE Ohm-m
Base level arbitrary

METRES

1000.0 100.0

SP MILLIVOLTS 200 50 100 50 0

CALIPER

2000 cps DENSITY 0

100 cps 0

POSSIBLE BASE LEVEL SHIFT

155 160 165 170 175 180 185 190 195 200 205 210 215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295

LOGGER
SIE T450

CRA EXPLORATION PTY. LIMITED	
KEEP RIVER-EL 2376	
DD 83 KR5	
GEOPHYSICAL LOGS 150-300m	
REFERENCE AUVERGNE SD52-15	
SCALE 1:200	DATE DECEMBER 1983
AUTHOR GPJ	REPORT 12364
DRAWN SRJ	PLAN No. NTg 3289

CR84/1